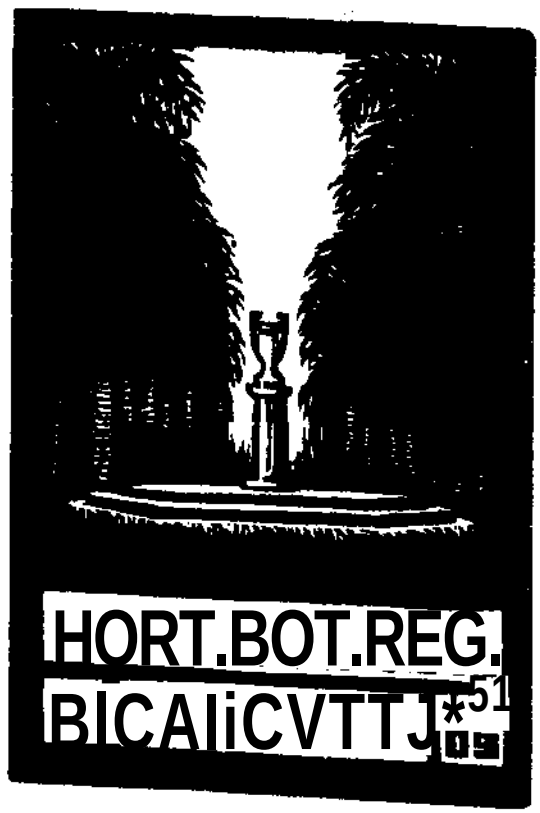

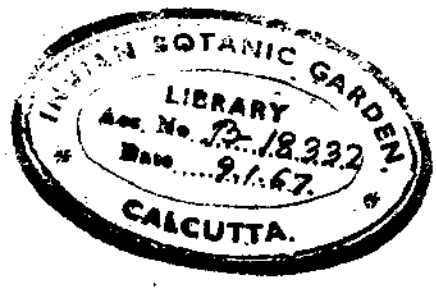

ANNUAL REPORT

OF THE

GOVERNMENT EXPERIMENTAL FARM

POONA,

For the year ending 31st March 1893.

ANNUAL REPORT OF THE GOVERNMENT EXPERIMENTAL FARM, POONA, FOR THE YEAR ENDING 31ST MARCH 1893.

I have the honour to submit herewith the Annual Report of the Poona Farm for the year 1892-93.

Season.

2. The regular monsoon did not burst until about the 30th of June. Over nine inches of rain fell previously as ante-monsoon showers. This facilitated early sowing, flushed grass into vigorous growth, and dispelled fears of scarcity which previously existed. The irrigation canals of the district partially failed during April and May, and fodder and food-grains approached famine-prices.

3. The character of the season was unusual. The rainfall was much above the average. Rain fell unseasonably. The heavy rainfall during October proved disastrous to cereals ripening at the time, particularly to bdjri, which is the staple of the Poona District and of the light land of the Deccan. The grain sprouted in the ear and the straw rotted. Many cultivators lost heavily although they took the unusual precaution of stooking the crops in the fields and hooding the stooks to protect the grain. On the farm the heavy down-pour of July flooded two of the fields, so that they were inaccessible for weeks, spoiled a very promising crop of fodder jowári, rotted several plots of lucerne (as it did many of the fields of the district), and washed away first sowings necessitating a second seeding.

4. The following table compares the rainfall of the season with that of 1891 and with the average of the preceding seven years ;—

Bqinfall Return.

\frvnfVia XVIUIldla.		1891.		1892.		Average of seven years (1885—91).
		Rainy days.	Inches.	Rainy days.	Inches.	
May ...	1st fortnight ...	2	0-60	1	0-05	1*89
	2nd ,, ...	...	...	3	1'23	
June ...	1st ,, ...	...	...	8	4-62	4·3 - 5
	2nd ,, ...	3	0-50	8	3'15	
July ...	1st ,, ...	9	1-84	13	11-06	6·31 8
	2nd ,, ...	13	7-43	12	1-36	
August ...	**1st** ,, ...	12	1-43	9	1'16	2-88
	2nd ,, ...	9	1-34	9	1-83	
September ...	1st ,, ...	4	0-87	11	2-87	7·13
	2nd ,, ...	2	0-78	7	2-52	
October ...	1st ,, ...	5	3-41	4	1-57	D £i
	2nd ,, ...	...	...	10	13-24	
November ...	1st ,, ...	...	...	1	**0-41**	218
	2nd ,, ...	...	...	...	...	
December ...	1st ,, ...	...	...	...	...	0-58
	2nd ,, ...	...	...	...	...	
	Totel ...	59	18-20	96	45-07	32-59

5. The following table sho^s the areas under different crops during th§ year under report:—

Statement showing the Area under Cultivation, 1892-93.

Crops.	Area. A. g.	
"Shálu" Jowári	2 22	A variety of Sorghum vulgare, usually grown in the "cold weather," hence its name.
Bájri	0 32	
Maize	0 25	
Potatoes	1 23	
Sugarcane	0 12	
Wheat	0 12	
Gram	4 15	
Lucerne	1 17	
Guinea grass	3 7	
Eye	2 22	
Various fodders	26 23	
Vegetables	1 3	
Fruit trees	0 30	
Cape gooseberry, &c.	0 30	
Total ...	**46 33**	Of which 9 acres *22* gunthas were twice cropped.

Experiments.

6. Only a small portion of the Poona Farm is suited for manure and other comparative experiments; The only area which can be utilised consists of two small fields situate within the limits of the old Botanical Gardens, which at one time were the property of the Agri.-Horticultural Society of Western India. The whole of the garden land is good although somewhat irregular in character. It is, however, (with the exception of the two fields referred to) overshadowed by road-side and fruit trees, and this makes it unsuited for experimental work the results of which are gauged by the weigh-bridge. On the other hand, although the most of the farm consists of uneven light land, there is fair scope for ... like th... carried out during ... under report and ... desir... e.

Fodder Experiments.

7. These experiments were instituted to find out whether well-known fodders, which are not indigenous to India, or if indigenous are cultivated in other districts, could be substituted economically for those commonly grown in the Deccan. The conclusions so far are that exotic ... for the most part proved themselves failures, that some of the ... sorghums under liberal cultivation yield heavily and are as fodder crops difficult to improve upon, and that one variety (the Sundhia of Gujarat) on account of its special value as a fodder crop should be more widely cultivated than is at present.

8. The outturn weights per acre of the fodders grown are by no means a true guide ... Nutritive values vary (but how far without analysis we ... with which a given weight of each ... of domestic stock.

cattle ... compared were soiled green to highly fed milk ... than with those which had not. ... ordinary stock of the country there would have ... no ... difference in value would have at once been eliminated ... certain extent, because all fodders with coarse stalks have ... value as those with less fibrous ... varieties can be, to some extent, controlled by sowing the seed ... between ... This causes nearly all fodder plants to producing thin stalks and ... ordina-

rily increases the outturn also. Thick seeding will, however, only give good results if the soil is either naturally rich or well stocked with manure and if (failing a good rainfall) irrigation water is available. I have no figures to prove the relative value of thin and thick seeding, that is a point for future enquiry ; but practical observation inclines me to believe that very thick seeding is advantageous. I must however make an exception of two crops (maize and Reana luxurians). Both require more space between plants than any of the millets or Sorghums. If the maize and Reana plants are crowded the crops become stunted.

10. I put in tabular form below yields per acre, the values of outturn, and the cost of cultivation of various fodders of the cereal family. Leguminous fodders were also tested and results of these I will refer to further on. The figures given below are not so much for comparison *inter se* as to show results of liberal farming on ordinary soil:—

Crop.	Outturn in lbs. per acre.	Cost of cultivation.	Value of produce.	Rate in lbs. per lie. (Poona).	Remarks.
	Lbs.	Rs. a. p.	Rs. a. p.		
Guinea grass ...	35,028	109 12 2	233 8 2	150	Crop cut ten times during year. Grown on poor light land. Much better results got from other plantations, but as these were established during the year, results therefrom for a whole year cannot be now given.
Nilva Jowári, Sorghum vulgare.	17,787	45 1 1	71 2 4	250	This crop followed country peas which failed. The tillage expenses and manure for both crops charged against the Nilva.
Maize	17,850	29 7 4	59 7 11	300	This fodder is coarser than the millets and worth less.
Sundhia Jowári Sorghum cernuus.	18,690	44 2 0	74 12 0	250	The best fodder millet in cultivation.
Reana luxurians...	21,246	54 4 4	84 15 9	250	This result; was from two "cuts." A duplicate plot was cut five times. It was proved that only the first two "cuts" paid. The last three were produced at a loss.

11. I have already said that the outturn figures do not fairly represent the feeding value of fodder crops. Below I tabulate the order of superiority of the various cereal fodders as to feeding value. In arranging the order I have been guided not so much by the actual nutrient value as by the preference shown by cattle for one fodder over another and by the relative wastage in feeding one kind of fodder as compared with another. I note remarks against each kind of fodder crop which may assist growers :—

Order of superiority.	Remarks.
1 fit.—Guinea grass ...	A very fine fodder; yields well; no waste in feeding; greedily eaten by all description of live stock; grows best on ridges, which should be two feet apart. Plants should be eighteen inches apart in the rows. Apply manure heavily and give plenty of water. Guinea-grass grows well in damp situations and under shade. Propagated either from seeds or "sets"; the latter, best.

Order of superiority.	Eemarks.
2nd.—Sundhia Jowiri (Sorghum cernuus).	Stalks very tall and very thin. No waste in feeding. Cultivated largely as a fodder crop in Gujarát. Grain head very poor. Seed should be sown by drill, first length-wise and then across field This secures even distribution. Seed rate 50 to 60 lbs. per acre' Sow in June or for hot weather irrigated crop in February to March. Ram crop in flower and ready for cutting as fodder 60 days after sowing. Crop rather more subject to rust, in cloudy weather and to lodge in wet weather than ordinary jowdri
3rd.—Shalu Jow&ri (Sorghum vulgare.)	A cold weather crop which can be advantageously irrigated Sow seed in rows 11 to 13 inches wide. 25 to 30 lbs. seed per acre fora fodder crop. Stalks sweet, but short and rather coarse This fodder is greedily eaten both green and dry by milch cattle. ' Outturn is however comparatively light.
4th.—Nilva Jowári (Sorghun vulgare.)	Stalks very tall and moderately thin if seed is sown thickly Seerl rate for fodder crop about 50 lbs. per acre. Drill seed in rows 11 to W inches apart in June, This crop grows in the rains nearly as quickly as Sundhia and outturn on rich land very heavy Does not grow well late in the kharif season, when Utavli (another common variety) should be substituted.
5th.—Teosente (Reana luxuriaus.)	Stalks tall, but coarse and fibrous, leaves also coarse, but liked by cattle. Plant tillers freely. Seed should be sown by dropping it by hand into every second furrow made by a plough. The plough in making the next furrow covers the seed 5 lbs per acre sufficient. Single the seedlings, to 15 inches apart' On heavily manured land, the crop is ready to cut in 85 days ' If long stubble is left Reana shoots up vigorously a second time and yields a second cut in 7 weeks. Subsequently the shoots are less vigorous, and the crop fails to produce profitable cut.
6th.—Maize, Zea mays ...	Grows vigorously in rich land. The seed for a fodder crop may be sprinkled by hand, 45 lbs. per acre, in every second furrow made by a plough, crop is ready for cutting as a fodder when male flowers appear, about 65 days after sowing. Stalks tall, but coarse near the root end. Lower leaves get coarse and fibrous when the upper leaves are yet young and growing. Milch cattle reject the coarse stalk.

12. During the year African sugarcane, Sorghum saccharatum (Imphi) was also tried as a fodder crop. Heavy flood water during the rains swept the field and damaged the crop. The experiment, which was inconclusive, will be repeated.

(Imphi).

13. A fodder crop of oats was nearly a failure. The seed was sown under favourable conditions in June. In July heavy rains swamped the field and subsequently the heat forced the crop prematurely into ear. The season was undoubtedly unfavourable, but even if it had been favourable I doubt if the best possible oat crop could compare favourably with a middling crop of fodder jowari. Oats, as a hay crop, are said to have proved successful at the Remount Nursery Farm, Ahmednagar.

(Oats).

14. It is quite possible to show the superiority of Sorghums, millets and plants of the cereal order as fodders. But (excepting Guinea grass) it is impossible to grow them continuously. Consequently systematic rotation must be practised. On an Indian dairy farm the land should be principally under fodder crops, and as the practice of growing any cereal continuously induces unhealthy condition of the crop, the question naturally arises, what rotation crops can most advantageously be rotated with the cereal. This problem has received some attention on the Poona Farm in the year under report, and very satisfactory results have been yet attained, it is the subject of forthcoming inquiry. Crops of the Leguminous order are of course best adapted for rotation. As far as our experiments have yet gone exotics have failed signally.

15. Vetches or tares, almost, if not the best, forage crop of England, gave no promise of ever being a success. The seedlings germinated well but these soon dwarfed into plants, which it was difficult to recognise as ordinary vetches. Only a few

Vetches (Vicia sativa).

flowers were produced and these did not fertilize or at least they produced no seed.

Sainfoin.

16. Sainfoin, an English clover, which delights in a light limestone soil and has an extraordinary power of resisting drought, did worse, for, although the seed germinated the seedlings Soon died away. This crop was tried twice in the rains and in the cold weather with seed imported twice in tin-lined cases and with each time the same result.

Flat Pea (Lathyrus sylvestris).

17. Professor Wagner's Lathyrus sylvestris, the seed of which was obtained direct from his accredited London agent, has not in India proved itself the " great fodder plant," which it is called by the seed-seller. The seed has been widely advertized and its sale has been pushed in India with considerable success, probably because it is so dear. It is but fair to warn the public what the result of purchasing seed will be. The plant has proved itself on the Poona Farm a miserable failure as it has done elsewhere in India. It is described as an improved form of a weed. The wild plant has a poisonous narcotic principle. It is very probable that the produce of the improved seed may revert to the wild form in India. But it is not at all likely that the poisonous principle will ever endanger the stock of the country !" The plot on the Poona Farm has survived more than a year, but in the hands of an ordinary cultivator it would have been extinct long ago, because the expenses incurred in weeding and watering have already far exceeded any prospective return, which the most enthusiastic cultivator could forecast I must give the plant credit for enormous root development, but unfortunately this growth is in the wrong direction for, nothing that could be called fodder, has yet been gathered.

Country Peas.

Kultlai(Dolicbosunifloms).

18. The indigenous leguminous crops selected for trial as fodder crops ^s year, ^id not prove successful. Country peas grown in the rains mildewed and the yield was insignificant. Kulthi (Dolichos uniflorus) on medium black land in rich condition did not, as a rain crop, give promising results. On poor light land it did much better. A test area taken as average of the light land crop gave a yield equivalent to 7,912 lbs. per acre of green fodder. There is considerable wastage in feeding kulthi to highly ted cattle]; milch buffaloes reject the coarser stems, but eat greedily the leaves and young tender shoots. Kulthi must therefore be classed as only a moderately successful fodder rotation crop. Experiments that are in progress indicate that two other indigenous pulses will prove much more satisfactory. These are Wai (Dolichos lablab) and Chola (Dolichos catiang). Both grow in good land luxuriantly iu the rains and thrive also as rabi crops. Unlike kulthi they do best in deep good soil.

Wai (Dolichos labkb).

Chott (Dolichos catiang).

Lucerne.

19. The season was unfavourable for the lucerne crop of the district. Many of the fields round Poona were submerged by the heavy rains of July and the crops were completely destroyed. Those grown in the bed system fared worst. The ridge and furrow system afforded some protection, because the plants were not directly in contact with the water, and the water drained away more freely. But the ridge system of sowing was no safeguard against a fungoid disease which attacked the roots and destroyed many fields, including a good deal of that grown on this farm. This disease has been observed for a year or two. This year owing probably to the wet season it was more disastrous than usual. The combined effect of a bad season and disease was to raise the value of healthy crops considerably. At one time during the season lucerne could not be bought cheaper than 60 lbs. per rupee.

20. The experience of this year proves that lufcerne in the Poona District is a delicate crop liable to many mishaps. If it is sown at any season except early in the rains or between October and December it is apt to be attacked by aphides or eaten by caterpillars, while the seedlings are still young. If it remains healthy which, during the last two seasons, is the exception rather than the rule there is perhaps no more profitable crop to grow, but if it fails a considerable amount of invested capital is sunk, because the initial outlays in

establishing the crop are heavy. With the exception of one plot all others on the Poona Farm were either damaged by rain or by disease during the year. It is noteworthy to mention that one piece of lucerne, which had become patchy through disease, was filled up by planting Guinea grass. The mixed crop corresponding to the " Rye grass and clover " of England has done exceptionally well, and the lucerne plants are now quite healthy. I tabulate below the result of manure experiments on lucerne. The plots selected were as equal in character as it was possible to get them on the farm. The manures tested were (A) Farm-yard manure, (B) Castor cake, (C) Bones crushed into small pieces, (D) Bones similarly crushed and fermented in a pit for several months with earth and stable urine. As near as possible an equivalent value of each kind of manure was applied per acre. The results are of little value because they were vitiated by the fungoid disease, which appeared (first in the farm-yard manure plot) just when the crop was well established. The figures afford useful comparison with results from a healthy crop which I will note further on Copper sulphate applied in solution with lime had no appreciable effect in checking the disease. The farm-yard manure plot was affected earlier and to a greater extent by disease than any of the others.

	Weight in Lbs. per acre.	Cost of cultivation per acre.	Value of produce per acre.	Remarks.
	Lbs.	Rs. a. p.	Rs. a. p.	
1st Plot	26,860	133 4 4	223 13 4	Sown in June 1892, cut first time in September 3rd to 16th, 1892 ninth cut finished 15th March 1893, attacked by fungoid disease. Manured with 5 tons per acre farm-yard manure before sowing and 7 tons per acre every second time after cutting.
2nd Plot	29,824	143 3 8	248 8 4	Sown in June 1892, cut first time 2nd to 8th September, ninth cutting finished on 16th March 1893, crop attacked by fungoid disease. Manured with 7½ cwt. per acre, castor cake before sowing and 3 cwt. per acre after every second cutting.
3rd Plot	27,088	149 13 4	225 11 8	Sown in June 1892. Cut first time 1st to 10th September, ninth finished 17th March 1893? Attacked by fungoid disease. Manured with 10 cwt. crushed bones per acre before sowing and 4 cwt. per acre after every second cutting.
4th Plot	28,012	144 3 4	233 6 8	Sown in June 1892. Cut first time, 1st to 12th September, ninth cutting finished 19th March 1893? Attacked by fungoid disease. Manured before sowing with 5 tons per acre fermented with earth and stable urine bones and 2 cwt. per acre after every second cutting.

21. Below I give the results of general lucerne cultivation, Produce charged at 120 lbs. per rupee :—

	Lbs. per acre during season.	Cost of cultivation ptr acre.	Value of yield per acre.	Remarks.
	Lbs.	Us. a. p.	Rs. a. p.	
Lucerne after sugarcane, which was heavily manured.	83,793	330 6 0	698 4 3	Crop sown early in June 1892, manured with farm-yard manure applied in October, December and February. Total quantity of manure 111 tons per acre. Crop quite healthy. Cut first time, 4th to 23rd September and tenth time between 5th and 31st March 1893. Value of manure applied Ks. I11 per acre.
Lucerne after potatoes.	**30,420**	201 12 10	253 8 1	Crop sown early in June 1892. Twice top-dressed with saltpetre in June and July, two applications together, 5 cwt. per acre. Farm-yard manure applied in August and September, *22* tons per acre. Cost of saltpetre per Acre . . . . . Es. 54 Cost of farm-yard manure per acre... „ 22 Total Cost ... „ 76 Crop badly diseased.
Lucerne after ratoon sugarcane, which was heavily manured.	36,696	184 6 0	305 12 8	Crop sown in July. Land rich from manure applied to previous crop. Lucerne only manured once during season. 8 tons per acre of farm-yard manure applied in January 1893. Crop cut 1st time in October 1892, 9th time 18th March 1893.

Bdjro and bdjri.

22. Bdjro or the giant bdjri of Gujardt was compared ^ with the ordinary deshi or local variety. There is no doubt as to the superiority of the former; but the season was all against the trial, and the returns from each sort are poor. The bajro is decidedly best. Heavy rain fell when the crops were in flower, and fertilization was thereby prevented. Hence the spikes were only partially filled with grain. This is a common occurrence in wet seasons and was the cause of very considerable loss throughout the Presidency. The improved bam can only be recommended for cultivation on good land or land in high condition. It would prove probably inferior to the local variety on the light poor soils ot the Deccan. Its cultivation by the better class of cultivators would be advantageous and the distribution of the seed to those that are likely to be benefited is being undertaken locally on a small scale.

Potatoes.

23. The cultivation of potatoes imported from England was not so successful on the farm as at Khed. The Khed results have already been separately reported. The potatoes grown on the farm were got from Messrs. Carter and Sons, London, and were landed at Bombay a month later than those cultivated at Khed and long after the proper season for planting. The varieties grown on the farm were "Cosmopoliten^Reading giant","Magnum bonum" and Kingoi Russets-. All varieties reached this country in first class condition for planting. They were planted on the 10th to 12th December 1892 and ripened from the 22nd March to 4th April 1893. The "King of Russets" ripened first, the three

other varieties ten days later. The hot weather forced the crop prematurely to maturity with the result that not only was the outturn poor but the tubers did not keep when stored.

The cultivation returns are as under:—

	Seed, Lbs, per Acre.	Outturn, Lb». per Acre.	Cost of cultivation per Acre.	Value of produce per Acre.	HIM ARKS.
	Lbs.	Lbs.	Es. a. p.	Rs. a. p.	
English potatoes after b£jri.	1,310	4,051	217 6 1	173 8 1	The seed cost delivered at Poona, approximately R/;8°?P».tQa. The wt produceis Va W at the current market rate Rs. 96 per ton.

The respective yields per acre were as under:—

Magnum bonum	...	...	5,056 lbs. per acre.
Cosmopolitan	...	...	4,708 „ „
King of Russets	...	...	3,410 „ „
Reading giant	....	...	2,801 „ „

The "Magnums" kept fairly well, the other varieties (particularly fi Russets) were most unsatisfactory in this respect. I attribute this entirely the fact that the potatoes were cultivated unseasonably, and the practical l e f learned is that imported seed, intended for cultivation on the plains, must *xea°?* India not later than the middle of October. It may be well to note here th° special care is required in the storage of all exotic varieties during the hot weather and this will I fear prove a formidable difficulty with the ordinary cult vator. There is a risk of theft if the potatoes are stored in a thatched heap outside or in an out-house, and there is no room in the rayat's dwelling for p r o per storage. During the hot weather in India potatoes should be kept in a cool place and if possible spread to a depth of not more than a foot on a mud floor- well coated with cow-dung. In Gujarat a good practice prevails of buildinō the potato heap on a layer of sand taken off the roadways. This sand is mixe also freely through the potatoes. The heap is turned every ten days and tubere which show signs of going bad, are removed. This method of storage mio-j^ advantageously be imitated elsewhere.

Potatoes propagated from seed.

24. Seedlings raised two years ago from the absolute seed of the potato plant have been making satisfactory progress. The seedlings have now been propagated from sets three times, and although many have been discarded as worthless, we have several hundreds-of tubers of medium size and of good ap, pearance which promise to prove eventually good sorts for general cultivation.

Sugarcane.

25. The experimental cultivation of cane was this year confined to three small plots of ^ acre each. The object of the experiment was to contrast the respective merits of the local Pundia (a tall soft white variety) with two red Cuban canes of more recent introduction. The sugar^borer wiade its ap- pearance in the local variety, when the shoots were about a foot high, and did a good deal of damage, but although the three plots were contiguous, the borer confined itself practically to the local variety probably because it oould eat its way easier into the soft variety than into the harder red canes. Although the crop was watched at night jackals did a lot of damage. This damage was of course more marked on a small area than on a large field. For this reason small plots will never give satisfactory results. The cultivation of sugarcane on a large scale is objected to within cantonment limits and experiments on cane will be discontinued on the Farm. The red canes were distributed among the best oane cultivators at Mundwa and it will be interesting to watch whether these varieties at Mundwa continue to resist the sugar-borer, which each year is becoming more destructive.

Rye.

26. The experiment in the cultivation of rye was undertaken at the request of Colonel Caldeeott, Superintendent, Kirkee Gunpowder Factory. The straw of this coarse cereal is valuable for the manufacture of brown gunpowder and as rye grows well on poor land in Europe there was a hope of its succeeding on the light land of the Deccan. The first consignment of seed had undergone some form of fermentation in the tin-lined case in which it was sent and had lost all germinating power. A second supply of seed packed in various ways was received and all germinated equally well. The tin-lined case offered no advantage over an ordinary sack or a wooden case without tin-lining. If the packages had been carried in transport deep down in the hold of a vessel the result would probably have been different.

The trial failed completely. The plant lost its natural habit of sending up straight shoots which grow ordinarily into tall thin stalks. The plants tillered freely and formed a thick close sward all over the field, but only a few dwarfed shoots formed and although these flowered they produced no grain.

Cape Goosebemj.

27. This useful fruit was tried on approximately a \ acre plot. The seedlings were raised in a seed-bed and transplanted in August when about 6 inches high. The soil was rich loam carefully prepared and manured. The plants stood 18 inches apart in each direction and were planted on ridges. The irrigation water, which must necessarilly be given late in the season, was applied along the furrows. The plants began to fruit in October, but the first fruit was worm-eaten and fell to the ground in large quantities. In December the plantation was in full bearing and continued so during January and February. In March and April the plants showed signs of exhaustion and the fruit was not so large or so good as that produced earlier.

I give below the cultivation returns :—

	Produce per Acre.	Cost of cultivation.	Value of produce.
	Lbs.	Rs. a. p,	Rs. a. p.
Cape Gooseberry	811	98 13 8	95 9 1

It must be noted that the irrigation water was supplied from a well at a much greater cost than that from the canal and if canal water had been available the crop could have been raised at a handsome profit. The fruit is worth 2 annas a lb. and is in considerable request for jam making. A practical trial to determine at what cost Cape gooseberry jam could be made gave the following r&sults. The proportional weight of fruit to crystallized sugar was as 8: 5. The jam could be made and sold at a fair profit in 2-lbs, bottles at 12 annas each.

English Vegetables.

28. The experimental cultivation of English vegetables was not financially successful. The reason is not that they cannot be successfully grown but that their sale on a Government farm at fair market value is difficult. The rates offered by dealers are very different rates from those paid by consumers and the middleman is a well established evil in India.

The seeds were obtained from Messrs. Sutton and Sons, Reading. Those vegetables which succeeded best were undoubtedly of fine quality. The most conspicuous failures were peas and broad beans. The former mildewed and although the plants grew vigorously they did not blossom as they ought to have done. The broad beans flowered, but the flowers diet not fertilize and of course no beans were produced. Turnips and kohlrabi sown early in the rains did well, but second sowings were attacked and eaten up by green fly. On account of insect) attack it is quite impossible to grow cauliflower and cabbage during the rains. They do succeed in the cold weather, but even then there is the same risk. Beet root and lettuce did very well in the rains. Tomatoes of many varieties succeeded admirably during the rains and later. Kidney beans of all sorts were grown with more success than any other vegetable tried.

Wheat.

29. Three varieties (soft red and soft white obtained originally by Messrs. Ralli Brothers from Muzáffarnagar) were grown experimentally to test the stability in wheat of consistency and colour. The experiment has been in progress both on the Bhadgaon and Poona Farms for some years and it has been proved that the natural characters of a variety of wheat are quite stable and that it is quite possible to introduce good varieties into districts where poor varieties are grown without any risk of the new introduction changing in character, provided it suits the soil and climate of the district into which it is introduced. The wheat plots on the farm were attacked with rust to a most unusual extent. The crops when in flower gave promise of yielding well. Three weeks later owing to rust each variety was quite withered. The straw was quite worthless and there was no grain at all. Hust did more harm than usual in the district owing to cloudy weather and unseasonable rain but nowhere could the results have been more disastrous than on our experimental plots. In other countries, particularly in the Australian Colonies, protective measures against rust are in force, but expert enquiry as to remedies has so far failed to show how rust can be prevented. No variety of wheat except perhaps khapli or jod wheat is rust-proof, but some varieties are much less liable to attack than others. Bust attack depends almost entirely upon climatic conditions. It has not been proved that the grain from a diseased crop will when sown as seed produce another diseased crop as is the case with other common fungoid diseases which attack cereals.

Fruit.

30. A fig plantation has been established on land which is commanded by an excellent well and which was reclaimed from waste at considerable cost. The trees are thriving, Guinea grass occupies the space between trees. ^ A number of the best varieties of Bombay mango grafts, including a few Pakrias, have been planted along borders. A large number of Egyptian date seedlings are in a nursery, but they do not bear transplantation.

Ensilage.

31. An ensilage stack was made of coarse grass, which, owing to the wet season, could not be made at the time into hay. It is pretty well established that when good hay can be made there is no economy in making ensilage. There is no doubt that coarse fibrous grass can be made more palatable and probably more nutritive by being ensiled. But the wastage, which invariably results in India, however carefully the process is conducted, is a serious disadvantage. It was the intention to have converted into hay the grasc which was used in making the easilage stack, but rain fell heavily and the grass bundles, which otherwise would have been spoiled, were stacked wet. The stack was built like the body of an ordinary hay-rick. It took two days to raise it to a height of \& feet. It was allowed to heat for three days during which time it subsided considerably. It was then weighted with a layer of earth a foot in depth and was protected from rain by achupper roof. The stack was made in September 1892 and when opened in May 1893 there was found to be about a foot of waste on the top and round the outsides. The stack had sunk to a height of about *o* feet. The ensilage was fed to dry cows and young stock and these cattle continued to eat greedily a fair ration daily until young grass flushed up in June when they refused to eat any more. The ensilage was a nice brown colour and had a sweet aromatic smell. The cattle preferred the ensilage to rather coarse hay with which they had been previously fed.

Accounts.

32. The farm accounts have been kept distinct from dairy and dairy *herd* accounts. Two balance-sheets are appended showing the financial results^of each. The farm balance-sheet shows that the net cost to Government, exclusive of the Superintendent's pay and of cost of new buildings,has risen from Rs. *1g*^ last year to Rs. 1,768 this year. This is partly due to an unfavourable season but is mainly caused by experiments, the value of which cannot be gauged ^ cost, and by considerable expenditure incurred in getting the farm into ? order and the fields into good condition. A large quantity of manure obta-

from the dairy herd has been applied in heavy dressings to almost every field and although the cost of application is included in this year's expenses, the effect will extend beyond one season. A re-appropriation of .Rs. 1,500 from the savings of the Bhadgaon Farm grant for the costruction of wire-fencing and buildings on the Poona Farm is not shown in the balance-sheet.

The Dairy and Dairy Herd.

33. The financial results of management are shown in the appended balance-sheet. The profit for the year is Rs. 1,130. This would have been higher if famine prices had not been current for food bought during three months of the year. No interest is charged on invested capital, which amounts to about Es. 8,000.

34. The herd increased from 93 head last year to 129 head this year as shown in Appendix V. During the year 8 cattle were sold and 10 bought. There are three stud bulls, 51 milch animals and 75 head of young stock. The dairy produce during the year from 51 milk cattle was sold for Rs. 10,981. Cattle food and fooder cost Rs. 7,346. No allowance is made for value of manure produced. If it had been sold it would have realized at least Rs. 2,000, Its application to the fields of the farm has raised the standard of fertility considerably. The up-keep of the young stock has been costly. The cost exceeds the increase in value, and the balance-sheet for the year is consequently unfavourably affected. I must urge the necessity of early orders regarding the establishment of a stock farm. This farm would relieve the Poona Farm of dry cattle and of young stock and reduce the expenditure considerably. At present the young stock are reared under conditions which, are by no means favourable. They are grazed on land rented at a high rate from the Cantonment Committee. The grazing ground is open to trespass of every description and necessarily there is considerable risk of the young stock contracting contagious disease. This year " foot and mouth " disease broke out in the herd. Fortunately the symptoms were diagnosed early, and by at once segregating affected animals the disease was confined to about a dozen. Milk cattle when attacked gave little or no milk and never recovered their normal yields. The grazing land is only leased for a year and it would not pay to erect steading except of the most temporary kind. The cattle have no proper shelter and suffer considerably during the rains. The buildings at the Farm are sufficient only for cows in milk and young calves. In addition to the dairy being a profitable institution, Govern, ment have benefited by the supply of pure dairy products to the Military hospitals and prison. The differece between the lowest tenders by Gavlis and our rates show a saving to Government of over Rs. 2,000 during the year* There can be no comparison between the purity and quality of our dairy products and those of the Gavlis. The Commissariat indents vary considerably from day to day and to work the dairy profitably it is necessary that sales be made to the general public. The rates fixed for dairy produce sold to the general public are fixed purposely higher than the rates charged at the three private dairies, which are profitably worked in Poona. If a pure supply of milk was not available at the Government Farm the residents of Kirkee, who get their supply from the farm, would keep their own milk cows or buffaloes, and for this reason I am convinced that the departmental dairy interferes in no way with native private enterprize. It gives an opportunity for the systematic study of the milk breeds of India, of breeding specially for milk, and of testing the comparative values of foods and fodder. A great impetus has been given to improved dairying throughout the Presidency by the initiative example of the department. I believe that improved machinery to the value of nearly two l&khs have been sold by the agent of the dairy supply company. The troops in garrison at Hyderabad, Deccan, are supplied from a dairy farm established by private enterprize there. About sixty,milk cattle mostly Surat buffaloes were bought in Bombay when the farm was started. The demand steadily increased until the farm was unable to meet it, and it is noteworthy that the increased demand was met by sending from Bombay daily 75 lbs. of butter which had been churned in Bombay from cream separated at Nadiád and railed as cream to Bombay. The far-reaching influence and advantage of improved dairying throughout the Presidency could be detailed at great length. It is sufficient to know that private enterprize will extend the good work for the best of all reasons—It pays.

35. In April of this year we salted and packed butter in earthen-ware jars which were fitted with close-fitting lids. Each jar held about 25 lbs. of butter and seven were filled. Special care was taken to wash the butter thoroughly before it was salted. The best refined table salt was used. Before it was mixed with the butter it was powderd very fine with a roller (an empty bottle does well for the purpose).. 8 oz. of salt were used for 12 lbs. of butter. This is equivalent to approximately 4 per cent, salt, which is heavy salting. The salt was mixed through the butter by thorough working on the butter-worker, a little salt being sprinkled on the butter each time the butter-worker kneaded it. During July the butter as required was removed from the jars, placed on the butter-worker, where the salt was washed almost completely out by means of pure cold water, and the free use of the butter-worker. At no time was the butter touched by the hand. It was sold as fresh butter, and the most expert dairy-man could not have detected that it had not been churned the day before. The butter was made with the object of supplying district officers, in camp, in the fair season, but a sudden demand for fresh butter arose during July and it was met in the manner described.

36. There is little to add to the information contained in my note on the dairy herd published as an appendix to the annual report, 1891-92, of the Department of Land Records and Agriculture. In the light of further experience I have no reasons to modify the information contained therein. I submit below a tabulated statement which gives details of the milk yield of buffaloes and cows in milk during the year. The figures relative to yields of animals, which were not dry at the end of the year, are excluded in this statement, but will be given in next year's report. I may note that nine Sind cows were bought in the neighbourhood of Karáchi soon after the end of the financial year and these promise to excel as milk cattle any that we have yet tried, They were selected for the farm by me at the same time as a consignment of 25 was sent for the Ceylon Government Dairy Farm at the School of Agriculture, Colombo. The Sind cows are docile and are remarkably good milk cattle. Well selected animals have a characteristic type and a "breedy" appearance, which indicates that the zaminddrs of Sind know something of cattle breeding. Ten of the thirty-four purchased were the pick of a herd of 280 cows owned by a rich zaminddr;—

Buffaloes.

Number.	Name.	Breed,	Date of calving,	Number of days in milk.	Maximum yield.	Average yield.	Total yield.	Date of birth of next calf*
			D, m. y.		lbs. Ozs.	Lbs. OZB.	Lbs.	D, m. y.
1	Champá	Jtfrabdd	5 2 92	369	23 12	12 12	4,775	38 5 93
2	Rami	Do.	26 5 91	442	23 12	13 5	5,902	15 12 92
3	Asmán	Surati	26 11 91	312	18 4	14 2	4,411	20 11 92
4	Kesar	Do.	7 .9 91	335	20 8-	12 3	3,763	14 1 93
5	Mohan	i)o.	7 9 91	325	22 0	13 8	4,393	24 11 92
6	Rupá	Do.	7 9 91	327	24 0	11 3	3,667	21 12 92
7	Chandni	Do	7 9 91	336	20 0	11 10	3,973	4 12 92
8	Khándi	Do.	13 6 91	459	24 4	14 8	6,669	20 1 93
9	Awdi	Do.	7 9 91	358	17 12	11 7	4,089	19 12 92
10	Mukhran	Do.	16 6 91	436	19 8	]2 1	5,281	15 1 93
11	MahiUb	Do.	7 9 91	251	14 12	9 7	2,375	22 9 92
12	Bichwá...	Do.	13 6 91	372	23 0	13 15	6,206	4 12 92
13	Chakkar	Do,	13 6 91	439	23 0	12 10	5,566	6 5 93
14	Tikkal	Do.	13 6 91	342	20 12	12 14	4,411	18 7 93
15	Pávli	Do.	13 6 91	333	17 0	9 2	3,044	16 11 92
16	Láli	Do.	31 3 91	381	23 0	15 9	5,931	14 8 92
17	Thaki	Do.	31 3 91	412	21 8	12 10	5,227	10 9 92
18	Kapeli	Do.	31 3 91	382	21 12	11 9	4,432	15 9 93
19	Chandri...	Cross.	17 10 91	293	22 0	11 13	3,474	14 12 92
20	Hirá	Do.	24 11 91	261	16 4	8 12	2,293	21 1 93
21	Dasrath	Do.	24 4 91	496	15 12	9 3	4,556	7 1 93
22	Devli	Deccan	26 11 91	260	22 8	12 6	3,212	20 12 92

Cows.

1	Jamni	Aden...	22 1 92	349	23 4	14 5	4,998	12 7 93
2	Bhagi	Do.	7 10 91	366	10 4	7 3	2,650	5 11 92
3	Gowlan	Gir.	13 5 91	451	15 4	7 9	3,408	7 10 92
4	Pari	Do.	8 8 91	249	19 12	7 0	1,755	31 10 92
6	Sárgi	Do,	13 5 91	471	18 4	10 10	5,024	13 10 92
6	Siti	Do.	13 6 91	404	15 0	10 0	4,055	23 10 92
7	Sundri	Surti.	12 2 92	179	11 12	6 11	1,192	Sold
8	Kashi	Aden Gir cro83.	5 3 92	255	15 8	10 6	2,645	29 7 93
9	Bahuli	Do.	14 8 91	315	13 12	9 13	3,101	16 8 92

The average number of days between two calvings are —

22 buffaloes' average—524 days.
8 cows' average—175 days.

The average period of lactation for the same number was—for buffaloes 364 and for cows 360 days.

37. A record has been kept during the year of the average amount of butter obtained from buffaloes' milk. It has been possible to feed to the milch cattle a moderate quantity of green fodder during the whole year, and consequently there is not now that difference which was previously noted in respect of the average amount of butter fat in milk at different seasons. Formerly in the hot weather buffaloes' milk was much richer than that produced in the rains and afterwards when a good deal of the food is succulent.

During February, March, April and May the average weight of milk required to produce a pound of butter was 11 lbs. 7 ozs.

Similarly for June, July and August the average was 12 lbs. 8 ozs.

Analysis made by the Assistant Agricultural Chemist of the milk samples taken as average of Sind cows and of farm buffaloes gave the following average results :—

SIND COWS.

Analysis of average Samples of Milk from nine Cows. The Cows all calved in May 1893.

Constituents.	Morning Milk.	Evening Milk.	Remarks.
Water	8675	85-91	Average of six analyses made between 10th July and 28th August 1893.
Fat	4-29	5-42	
Casein	3-12	295	
Milk sugar	5-28	5-40	
Ash...	•70	•69	

BUFFALOES.

Analysis of average Samples of Milk from whole Buffalo herd numbering 27 heads.

Constituents.	Morning Milk.	Evening Milk.	Remarks,
Water	82-99	81-92	Average of four analyses made between 10th July and 28th August 1893,
Fat	7-92	8-10	
'Casein	3*98	4-02	
Milk sugar	4-98	5-39	
Ash...	•78	•80	

Statement showing relative proportion by weight of butter fat to milk in the average daily yield of Sind cows and of tliewhotejn^^erd.*

Description of Animals.	Average quantity of Milk per head in one day.		Average quantity of butter, fat per head in one day.		Remarks,
	Lbs.	Ozs.	Lbs.	OZ3.	
Cows (Sind)	13	14	...	9-87	Equivalent to 1 lb. butter from 22'3 lbs. milk.
Buffaloes	9	2	...	14-37	Equivalent to 1 lb. butter from 11 lbs. milk.

Mr. Collins had no time whilst in Poona to analyse Aden, Gir and cross bred-cows' milk, bat the butter fat percentages of Aden cows' and Gir cows' milk as indicated by Soxhlet's apparatus show that these breeds are at least equal to Sind cattle as butter producers.

38. It will be noted that the evening milk is in each case richer in total solids than the morning milk. Water drunk immediately before milking or succulent food eaten then is supposed to produce an increased yield of poor milk. The difference shown by analysis cannot be accounted for in this way. The quality of the evening milk could be lowered by the succulent food and water which is usually given soon before milking, but the morning milk could not possibly be affected in this way. The true explanation has to be looked for otherwise and this is found in the fact that thirteen hours elapse between evening and morning times of milking, whilst only eleven hours elapse between morning and evening times of milking. The longer period seems to allow the animals sufficient time for full milk secretion. The difference in actual yield between morning and evening is shown as under:—

	Morning yield.		Evening yield.	
	Lbs.	ozs.	Lbs.	ozs.
Total yield of 9 Sind cows	72	8	52	13
Total yield of 27 buffaloes	162	6	153	3

Establishment.

39. I can give unqualified praise to Mr. Kelkar, the acting Superintendent of the Farm, who has done very good work both on the Poona Farm and at Bhadgaon. He was transferred to Poona last March. Mr. Káshináth Thamáji has worked hard at Bhadgaon and Poona. He as well as Mr. Kulkarni, the Poona Farm Clerk, have learned to manipulate improved dairy machinery and are each of them expert dairy-men and are perfectly capable of teaching apprentices thoroughly. I cannot help saying that should it be found possible to give the three subordinates mentioned above facilities for attending the agricultural course of lectures at the College of Science with the object of passing the Bombay University Examination for the diploma in agriculture, they would make much more satisfactory students and much better Government servants afterwards than the students who are attached to my classes now. An apprenticeship on a Government Farm should in every case precede a College Training in Scientific Agriculture, and the scholarships awarded at present to agricultural students would in my opinion be more usefully employed in paying apprentices for defined duties on a Government Farm, who if they proved their worth could be afterwards encouraged to go through the College agricultural course.

J, W. MOLLISON,

Superintendent of Farms, Bombay Presidency,

7th October 1893.

APPENDIX I.

Balance Sheet of the Poona Farm, 1892-93.

Receipts.	Rs. a. p.	Amount. Rs. a. p.	Expenditure,	Rs. a. p.	Amount. Rs. a. p.
To Sale-proceeds from Farm produce of 1892-93—			By rent of land		122 0 0
Grains	10 12 0		Assistant Superintendent's pay		1,208 3 9
Fodder crops	80S 15 2		Establishment pay		537 7 3
Sugarcane	30 2 3		Horse allowance		240 0 0
Vegetables	65 14 3		Travelling allowances		26 0 0
Miscellaneous receipts	45 7 1		By ordinary expenditure—		
Fruits	36 1 6	998 4 3	Labour	1,680 5 7	
To value of Farm produce of 1892-93, unsold on 31st March 1893—			Skilled labour	29 5 6	
A.—Since sold—			Purchase of manures	26 0 4	
Grains	75 2 8		Purchase of seeds for sowing	238 6 7	
Potatoes	99 15 1		Do. dead stock	97 0 0	
Fodders	145 6 5		Do. stationery and Service Stamps	40 9 3	
Vegetables	0 8 6		Miscellaneous expenses	116 3 0	
Mangoes	40 11 0	361 11 8	Charges for irrigation water	28 15 0	
B.—On stock—			Repair of implements	28 9 0	2,285 6 3
Grains	4 0 0		By cost of fencing and buildings		500 0 0
Potatoes	38 7 9		Net cost of bullocks		479 15 4
Fodder	46 12 2				
Lucerne and Guinea grass-value of growing crop and establishing plantation	190 0 0	279 3 11			
To net increase of dead stock		43 9 0			
Total		1,682 12 10			
To net cost		3,716 3 9			
		5,399 0 7			5,399 0 7

APPENDIX II.

Dairy Balance Sheet for 1892-93.

Income and Increase in value of Stock.	Amount.	Expenditure.	Amount.
	Es. a. p.		Ks. a. p.
To sale of milk and butter the produce of Farm cattle.	10,981 0 9	By concentrated food bought...	4,269 5 0
		„ Fodder bought ...	1,514 12 8
To butter on hand on 31st March 1893.	69 8 0	„ Eent of grass land ...	1,130 0 0
Increase in value of Dairy herd and young stock.	625 0 0	„ Hay making expenses ...	432 6 3
		„ Labour	1,635 1 6
Value of hay in stock ...	450 0 0	„ Horsè and bullock hire ...	44 9 6
Increase in value of dead-stock	240 0 0	„ Water-rate	25 9 7
		Cost of repairs and incidental outlays incurred for manage-ment of Dairy and Dairy herd.	1,051 7 7
		Purchase of milk cart and Dairy machinery.	306 2 0
		Purchase of 2 horses for Dairy cart.	190 0 0
		Purchase of 6 buffaloes and 4 cows.	545 0 0
		Erection of temporary cattle-shed,	90 9 10
		Total ...	11,234 15 11
		Profit ...	1,130 8 10
Total ...	12,365 8 9	Total ...	12,365 8 9

APPENDIX III,

Working Bullocks.

Receipts.	Amount.	Expenditure.	Amount.
			Rs. a. p.
Nil	.....	By cattle food and fodder ...	396 4 4
		Ropes, &c.	20 11 0
		Shoeing charges ...	8 10 O
		Medicines	1 6 0
		Wages	36 0 0
		Decrease in value ...	17 0 0
		Total ...	479 15 4

APPENDIX IV.

Variation Statement.

Description.	Stock on hand on 31st March 1892.		Stock on hand on 31st March 1893.		Increase.	Decrease.
	Number.	Amount.	Number.	Amount.		
		Rs. a. p.		Rs. a. p.	Rs. a. p.	Es. a. p.
Working bullocks ...	4	177 0 0	4	160 0 0	...	17 0 0
	4	177 0 0	4	160 0 0	...	17 0 0
Dead Stock.						
Farm implements ...	...	439 0 0	...	485 11 0	46 11 0	
Office furniture... ...	...	66 6 0	...	63 4 0	.	s'"2 0
	...	505 6 0	...	548 15 0	46 11 0	3 2 0
				Net increase ...	43 9 0	...

APPENDIX V.

Dairy Herd.

Description.	Strength on 1st April 1892.	INCBRASB.			DSCRBASB.				Strength on 31st March 1893.	Re-classification on 1st April 1893.	VALUATXO*.		Increase or decrease during 1892-93.
		Purchased.	Born.	Total.	Sold.	Died.	Transferred to working stock	Total.			1892.	1893.	
Stud built	3	...	...	...	...	...	...	...	3	3	1ôô	140	+ 5
cow8	17	3	...	3	6	...	...	6	14	14	800	706	—95
Heifers	10	...	...	—	...	...	...	...	10	10	100	185	+ 85
Bull calves	8	...	7	7	2	2	...	4	11	11	65	106	+ 50
Cow calves	6	1	6	7	...	2	...	2	11	11	30	85	+ 65
Total ...	44	4	13	17	8	4	...	12	49	49	1,120	1,220	•flOO
Buffaloes.													
She-buffaloes ...	33	4	...	4	...	...	...	...	37	37	3,470	3,590	• 120
Heifers	...	...	...	...	...	...	...	...	...	...	...	...	...
Bull buffalo calves...	6	1	16	17	...	4	...	4	19	19	30	120	+ 90
She buffalo calves ...	10	1	13	14	...	...	...	...	24	24	70	195	+ 125
Total ...	49	6	29	35	...	4	...	4	80	80	3,570	3,905	+335
2 Dairy cart horses .	...	2	...	2	...	...	...	...	2	2	...	190	+ 190

Review on the Annual Report of the Nadiád Farm for the year 1892-93, by J. Mollison, Esqr., M.R.A.C., Superintendent of Farms, Bombay Presidency,

1. The report of the Nadiád Farm for 1892-93 is uninterestingly brief. The tabulated statement which accompanies the report, as well as the cultivation book, each contain useful information. I will endeavour to extract from these, as far as I can, the results of the year and try to show causes for failures as also reasons for good results. I have only been an occasional visitor at the farm and therefore the analysis of results which ought properly to be done by some one connected with the Society must necessarily be imperfectly performed.

2. *Season.*—Throughout Gujar&t, the season for staple crops especially for bájri and tobacco was most unfavourable. The rainfall although over average was unseasonable. Bájri suffered, because rain in quantity fell when it was in flower. The stamens hang outside the spike in such a way that fertilization is prevented if heavy rain falls when the pollen is being shed. An excessive rainfall late in the season rotted the straw, and throughout gorádu tracts bdjri was comparatively a failure. So also were other cereals. Tobacco, too, suffered from an unfavourable season. Seedlings succumbed at time of transplantation and afterwards, and nearly every tobacco field in the tobacco-growing districts, like the plots on the Nadidd Farm, presented an irregular patchy appearance.

3. If the entries in the cultivation book indicate accurately the net results of cultivation in the year under report, the results are not unsatisfactory. I have totalled the figures and find that on the cultivated area (7 acres 26 gunthas) the cost of cultivation amounts to Es. 248-15-2 ; the value of outturn to Es. 177-2-4 (unsold tobacco being valued at Es. 19-8-3); loss Es. 71-12-10. This represents a loss of Es. 9-6-2 per acre as compared with about Es. 3 last year. I cannot reconcile the figures in the cultivation book with the outlays on the farm. Excluding extraordinary expenditure, and the Superintendent's pay, the report shows that the following expenditure was incurred :—

	Rs.	a.	P.
Pay of farm eervacts	200	10	8
Purchase of seeds	25	4	0
Purchase of manure	50	13	5
Feeding charges of farm cattle	31	4	7
Labour charges	91	15	3
Total ...	399	15	11

This total exceeds the cost of cultivation by Es. 160, and this difference can only be explained by the supposition that the farm-labour was employed otherwise than on the farm.

4. The Society's seed store has made decided progress. For several years the transactions were almost stationary. This year as compared with last they have almost doubled. Seed was sold to the value of Es. 309 and the distribution was effected at a cost of one rupee and a half on cost price. The rent of the store and the storekeeper's pay with other contingent expenses (amounting together probably to Es. 190) are I think not included. But even if this amount has to* be added to that shown in the report, the Committee are to be congratulated upon their persevering in an undertaking which is now doing good and will eventually do much good. This year's distribution means that pure seed sufficient to sow about 800 acres has been sold. And the benefit does not end here. For every cultivator, who buys at the' seed store, will take care of the produce if the seed he had bought has proved itself a success.

5. The Association's contribution to the Veterinary Dispensary (fts. 150) is continued as usual. It is not quite so satisfactory to note that a Es. 5 per month scholarship to agricultural pupils of the Nadiád High School has been discontinued.

6. A new scheme of experiment has been in progress for two years. Of course it has not been sufficiently long in progress to draw definite conclusions yet; and this year's results are vitiated to some extent as they were last year by unfavourable climatic conditions. The first series of plots compare continuous tobacco and tobacco in rotation. They also afford a comparison between exotic and indigenous varieties. Tobacco is rotated with guvdr and bájri. The crops are taken in the order named. Three plots are thus cropped. The three next adjoining plots are occupied by continuous tobacco with the object of showing a comparison between indigenous, Havanna and Virginian sorts as well as with the rotation tobacco plots. The report does not show the relative prices obtainable for indigenous and exotic varieties ; but in this—an unfavourable year—the indigenous sort gave much the better outturn. 1 he crops on all the plots were however poor. Guvár unmanured taken after tobacco, heavily manured, this year yielded well, but not so well as last year. The crops of both years were unmanured. The relative seed-rates and outturns are shown below :—

Year.	Seed per Acre.	OUTTURN PBR ACBB.	
		Grain.	Straw.
	Lbs.	Lbs.	Lbs.
1891-92	12	1,630	2,025
1892-93	12	955	1,235

The difference between this year's bdjri crop of this series and last year's is also striking. The difference as shown below is attributable to season to a greater extent than that noted in respect of guvár. The bájri was unmanured this year as well as last:—

Year.	Seed per Acre.	OUTTURN PBR ACRB.	
		Grain.	Straw.
	Lbs.	Lbs.	Bundles.
1891-92	10	860	400
1892-93	10	8124	555

The effect of season is well shown this year by the small yield of grain in comparison to the straw.

7. The cultivation of cotton has received a good deal of attention for year on the Nadidd Farm, and it has been conclusively proved that American cotton which is now so discredited, has proved itself a failure in Gujardt as it has done in other districts. Its cultivation even experimentally should therefore be stopped forthwith and the Association should not offer American seed for sale at its seed store. It might be of advantage, if, instead of American, the Society thoroughly tested good-stapled cottons indigenous^ to Gujarát which have not yet been grown experimentally. Lalia, a long silky stapled cotton grown extensively near Ahmedabad is at least worthy of trial; and the present comparisons, between the Ghogh&ri and Deshi varieties should be persevered with until definite conclusions are arrived at. The results of this year and last year tend to prove that there are good grounds why Ghoghdri—which is a cotton somewhat inferior to pure Broach—is making headway against the Deshi variety in the Broach District. Both show a vast superiority over American. Broach and American grown under like conditions gave the following results :—

	Seed per acre.	OUTTURN PER ACRE.	
		Seed cotton.	Lint.
	Lbs.	Lbs.	Lbs.
Broach (Deshi)	8	307	104
American	8	121	36

The comparison between Broach and American cotton (Ghoghári or L&lia should be substituted for the American in future years) is taken advantage of to study the effect of good rotation also. Jowári and safflower (kusumbi) are rotated with each variety of cotton ; and because ifc is believed to be a good practice, the jowari is the only crop of the rotation which is manured. The residue of manure left is expected to benefit the cotton grown the following year, and to extend to the kusumbi grown in the third year. The plan of experiment has not been strictly followed out. The plots under kusumbi were this year manured because they had received no manure for several years, and it was improbable that kusumbi would thrive in exhausted soil. It will be possible in future years to adhere strictly to the proposed line of experiment.

8. The jow&ri plots were each manured with castor cake 500 lbs. per acre, and the following tabulated figures compare the results this year with those of the last:—

	1891-92.		1892-93.	
	Grain.	Fodder.	Grain,	Fodder.
	Lbs.	Bundles.	Lbs.	Bundles.
American cotton rotation ...	1,625	700	197J	685
Broach cotton rotation -.	1,875	940	167*	660

The difference in yield of grain is almost entirely attributable to season.

0. In regard to safflower (kusumbi) the difference between this year's yield and that of last is not so marked. Safflower is a rabi crop, and probably the heavy rains which proved so disastrous to cereals were beneficial to it. The following figures compare the yield of 1891-92 with those of this year :—

	OUTTURN PEB ACRB 1891-92.		OUTTURN PER ACBR 1892-93.	
	Seed. *	Flowers.	Seed.	Flowers.
	Lbs.	Lbs.	Lbs.	Lba.
American cotton rotation ...	960	I11*	605	87*
Broach cotton rotation ...	986i	115	695	110

The figures tabulated under heads of " flowers " represent the weight of petals plucked for dye.

10. Four plots are allotted to an experiment on bdjri with subordinate pulses, in comparison with bdjri alone, rotated with tur and potatoes. It is generally believed that the cultivator avoids risk by growing a mixed crop rather than depending entirely on a sole crop. That there are good grounds for

this belief is well shown by the results of this experiment this year. This year owing to heavy unseasonable rain, the season was most unfavourable for all cereals but was favourable for the more vigorously growing pulses. Bdjri alone gave :—

1891-92.		1892-93.	
Grain.	Straw.	Grain.	Straw.
Lbs.	Bundles.	Lbs.	Bundles.
755	390	217	490

In comparison with the above I note below the result this year and last from the mixed crop plot:—

Crops.	PEE ACRE.		
	Seed rate.	Outturn, 1891-92, Grain.	Outturn, 1892-93, Grain.
	Lbs.	Lbs.	Lbs.
Bdjri...	6	520	115
Mug...	1	42*	20*
Muth	1	35	5
Chola	H	2611	200
Tur	2"	120	201*
Total ...	...	978|	541£

It will be noted that both this year and the last (a favourable and an unfavourable year), the bdjri with subordinate pulses, has had a decided advantage over bdjri alone.

11. Tur unmanured after bdjri unmanured, gave this year as it did Inai year, an extraordinary outturn. The respective outturns are 1,949 lbs. of '* ·^ · per acre this year and 2,200 lbs last.

12. Potatoes again failed. The only reason vouchsafed was that they \M-: eatea by insects. The seed rate is entered at 440 lbs. per acre, just one-third of what it ought to be. On the garden land near Nadiád potatoes do well and there is no reason why they should not succeed on the Nadi&d farm. I have asked the committee to try the English seed to be imported this year.

13. Three plots have been set aside for a " bdjri unmanured rotation J> experiment. The object is to see how long bájri in rotation with castors and tur can be grown on land, that, although not manured will be thoroughly tilled every year. The results this year as compared with last year are tabulated below, not for the sake of comparison, but to put them on record so that continuity can be maintained in future years :—

Y«r.	OUTTURN PER ACRE.		OUTTURN PER ACRE,	OUTTURN PER ACRE.
	Bdjri.		Tur.	Castors.
	Grain.	Straw.		
	Lbs.	Bundles.	Lbs.	Lbs.
1891-92	400	290	1,025	532^
1892-93	195	405	1,195	285

Other results do not call for analysis this year. They can be remarked upon better when the scheme has been under trial for a few years.

14. The testing of seed got some attention in the year under report. White and chocolate "barley (both huskless) were successfully grown. The former variety was some years since considered a good sort by English maltsters and might perhaps be introduced successfully into the Ahmedabad District, where barley is largely grown. I doubt if there is any practical advantage in either growing chocolate coloured barley on the farm or of distributing its seed. From a maltster's point of view the colour would be against it.

15. White jowdr gave a fair outturn; but the giant bájro did no better than the common country sort. The advantage of growing bájro is, however, thoroughly established and its seed is being widely distributed. A small lot was sent all the way to Hyderabad, Sind, from the Nadiád seed-store.

16. I must direct attention to the fact that the straw or fodder from all plots should be weighed and not recorded as so many [c] bundles \ The outturn of tobacco this year is also noted in bundles and not its actual weight. The Honorary Secretary complains that owing to the transfer of the Superintendent, the records were incomplete. The report and the tabulated statements are certainly less satisfactory than they were last year.

J. W. MOLLISON,
Superintendent of Farms, Bombay Presidency.

20th October 1893.

ANNUAL REPORT

OF THE

GOVERNMENT EXPERIMENTAL FARM,

POONA,

For the year ending 31st March 1894.

Office of the Survey Commissioner and Director, Land Becords and Agriculture, Bombay.

No, 34 OF 1894.

The accompanying Report on the working of the Government Experimental Farm, Poona, for 1893-94 is published for general information and for distribution to Government officers and public bodies according to the sanctioned list.

C. W. GODFREY, Colonel,
Acting Survey Commissioner and Director,
Land Records and Agriculture,

*Dated Poona, 2nd October 1894**

ANNUAL REPORT OF THE GOVERNMENT EXPERIMENTAL FARM, POONA, FOR THE YEAR ENDING 31ST MARCH 1894.

No. 226 OF 1894.

I have the honour to submit herewith the Annual Report of the Poona Farm for the year 1893-94.

Season.

2. The regular monsoon burst seasonably in the second week of June. Heavy ante-monsoon showers fell during the last week of May. This rainfall facilitated preparations for sowing. General sowing was, however, delayed owing to continuous and heavy rainfall during the second fortnight of June. During this period annual weeds grew unchecked, and fields which thus became weedy had to be again worked before seed could be sown, with the advantage, however, that less hand-weeding than usual was subsequently required. The season was, on the whole, favourable. The kharif rain was sufficient and timely. The late rains were deficient. Very little fell after the first fortnight in October. In the Poona district the area under rabi crops was less than usual. On the farm, cold-weather crops, which are usually grown without the help of irrigation, had to be assisted by two or three waterings from the canal. Grass and grazing were abundant. Hay and other dry fodders were saved in first-rate condition. Guinea grass and other irrigated crops suffered owing to a short supply of canal water during the hot weather. Water could only be obtained irregularly and in insufficient quantity.

3. The following table compares the rainfall of the season with that of 1892 and with the average of the preceding eight years :—

Rainfall Return.

Months.	1892.		1893.		Average of eight years (1885 to 1892).
	Rainy days.	Rainfall in inches.	Rainy days.	Rainfall in inches.	
May ... 1st fortnight ...	1	0-05	...	...	1-73
,, ... 2nd ,, ...	3	1-23	5	3·36	
June ... 1st ,, ...	8	4-62	7	2-26	3·87
,, ... 2nd ,, ...	8	3-15	12	12-27	
July ... 1st ,, ...	13	11·06	8	1-31	8-43
... 2nd ,, ...	12	1-36	10	1-02	
August ... 1st ,, ...	9	1·16	12	3-67	2-86
... 2nd ,, ...	9	1-83	8	0-52	
September ... 1st ,, ...	11	2-87	11	0-71	6-44
... 2nd ,, ...	7	2-52	5	1-24	
October ... 1st ,, ...	4	1-57	5	3-41	5-04
... 2nd ,, ...	10	13-24	...	...	
November ... 1st ,, ...	1	0-41	3	0·51	191
... 2nd ,, ...	...	...	2	0-52	
December ... 1st ,, ...	...	...	...	...	0-51
,, ... 2nd ,, ...	...	...	...	...	
Total ...	96	45-07	·88	30-80	3079

4. The following table shows the areas under different crops during the year under report:—

Statement- showing the Area under Cultivation, l8(r3-94.

Crops.	Area.		Remarks.
	A.	g.	
Bajri and bajro ... ,..	3	28	
Cotton	1	18	Three varieties.
Pulses and oil-seeds	0	28	Demonstration plots for agricultural students.
American sugar sorghums ..	0	17	Two varieties.
Tur	3	26	
Potatoes	7	17	
Niger seed	2	0	
Safflower	2	0	
Gram	5	12	
Lucerne	1	11	
Guinea grass	7	20	
Various fodders	14	39	
Total .>.	50	16	Of the total, 14 acres 28 gunthas were twice cropped, 4 acres 21 gunthas were thrice cropped, and 7 acres 30 gunthas are under perennial fodder crops.

It will be observed that a portion of the cultivated area was thrice cropped during the year. This practice is quite possible on the farm, because owing to the upkeep of a large dairy herd there is always a large quantity of manure available. But the success of the practice depends upon a sufficient supply of irrigation water. In the year under report, there was a short supply of canal water; otherwise a considerably larger area could have been thrice cropped. A luxuriant fodder crop ripening in May is surely a good object lesson on a Government farm, especially in the Deccan, where, at this season, hay or any other dry fodder is often scant and always dear.

Experiments.

5. The farm is essentially a demonstration farm, where ordinary work-a-day practices can be successfully adopted. Hardly any portion of it, for reasons given in paragraph 6 of last year's report, is suited for comparative manure and other experiments. This has necessitated the taking up of land elsewhere for this purpose.

Fodder Experiments.

6. The results of trials in former years indicated that as fodder crops sonic of the ordinary millets and sorghums commonly grown are very difficult to improve upon, and this conclusion is borne out by results again obtained this year. I must specially commend, as a very valuable fodder, sundhia jowári, a distinct variety of sorghum (Cernuus), which has been grown probably for centuries by the well-to-do cultivators of Gujarát. In Gujarát it is largely grown under well irrigation in the hot weather, and purely as a fodder crop. I think this variety of sorghum has a very decided advantage over any other, in as much as the crop not only yields heavily, but the stalks are very thin from the root upwards, and, therefore, there is no wastage in feeding. Cattle and horses are very fond of sundhia, either as green fodder or as dry kirbi. During the ensuing season this crop will be largely grown at the remount dep6ts at Ahmadnagar and Bdbugarh. More than 2,000 lbs. of seed have been supplied by the Nadidd seed store for this purpose.

Sundhia jowári.
Nilva jowári.
Maize.
Reana luxurians.

7. Sundhia jowári was compared with nilva jowdri, maize and Reana luxurians. The land was even and each plot was £ acre. The previous crop was lucerne, which failed owing to disease. The lucerne had been heavily manured, and in other respects was, no doubt, a capital preparation for each of the cereals tested.

8. I tabulate below the results giving seed rates and the yields per acre, the cost of cultivation, and the values of outturns :—

Crop.	Seed per acre.	Outturn per acre.	Cost of cultivation.	Value of outturn.	Bate per rupee.	Remarks.
	Lbs.	Lbs.	Rs. a.	Rs. a.	Lbs.	
Sundhia jow&ri (Sorghum cernuus).	44	26,766	15 12	107 1	250	Sown on 30th June. Reaped 17th August to 1st September.
Nilva jowári (Sorghum vulgare).	72	32,548	16 9	108 8	300	Do. do.
Maize (Zea mays).	64	30,731	22 9	94 8	325	Do. do.
Teosente (Reana luxurians).	24	34,388	27 15	114 10	300	The seed was sown on the 30th June. The young plants were thinned out to a foot apart on 20th July. The crop was cut on the 28th September to 1st October. A second cut was obtained on the 28th October, butit was insignificant, being only 75 lbs. from J acre.

9. The sundhia, the nilva and the maize appeared to be ready for harvesting about the same time, and an equal portion of each plot was cut each day. Each fodder was fed green to milk cows and buffaloes. In feeding the sundhia there was practically no waste. The wastage in feeding the nilva and maize was considerable, on account of the cattle rejecting the coarse stalks. The value of each fodder, in lbs. per rupee, is fixed in ratio to the degree of wastage. In the neighbourhood of Poona, ordinary green jow&ri fodder is easily saleable at from 250 to 300 lbs. per rupee, and when sold is either wet with rain or artificially watered. I note this as indicative that the rates which I have charged are fair rates. The Reana made slow progress as compared with the other fodders to begin with. The plants were singled out to about a foot apart three weeks after sowing; and because the plants did not shade the ground early, the crop had to be hand-weeded. The other plots required no hand-weeding. After singling, each plant tillered freely and the crop began to grow vigorously. If the seed had been dibbled at the proper distance apart, probably 2 to 4 lbs. per acre would have been a sufficient seed rate.

10. The Reana took 3 months to reach the flowering period. The other fodders were in flower in 48 days, and the reaping of these was completed in 62 days. The rainfall and season were very favourable. The enormous root development of Reana became evident when the stubble was ploughed up. I think I am safe in saying that compared with the other fodders it is an exhaustive crop. This was, to a certain extent, indicated in the succeeding crop (potatoes), which occupied the whole fodder experiment area. The potatoes were heavily manured. Yet those after Reana did not turn out so well as those after the other fodders. It would be unsafe to conclude from this alone that Reana is exhaustive. Still I think it may be presumed to be.

11. The effect of good rotation on fodder jowári was strikingly illustrated on one of the fields of the farm this year. The results were casual, *hut* could not escape observation. In fact, the field presented a remarkable object lesson. The soil of the field was undoubtedly in high manurial condition. A heavy dressing of farm-yard manure was given for potatoes in 1892. The rain crops on the field this year were b&jri on one portion, maize on a second portion, and various pulses with a small plot of ambádi (Hibiscus cannabinus) on a third portion. The pulses and ambádi were grown in small contiguous plots as illustrations for the agricultural students. Nilva jowdri was grown on the field as a hot-weather irrigated crop. That portion after pulses was far superior to that after amb&di,

Value of good rotation.

and still more so to that after the cereals (bdjri and maize). The jow£ri stalks, on the pulse area were 10 to 11 feet high, and as the seed had been sown thickly the crop was very heavy.

The respective outturns per acre as determined by cutting the crop on test areas are noted below, the weights being those of the fodders cut green:—

Nilva jowári, after pulses (vál, chola and udid)	...	40,965 lbs. per acre,	
Nilva jowdri, after ambádi	...	...	25,793,, „
Nilva jowári, after Mjri and maize	...	...	11,115 „ „

These results confirmed the acknowledged importance to Indian agriculture of practising systematic rotation of crops. The alternation of pulse and cereal crops in consecutive years undoubtedly tends to maintain the fertility of the soil; and the prevalent Indian practice of growing mixed crops, in which pulses are invariably subordinate to the cereals, exercises a similar influence. It is because this practice of growing mixed crops is so common that the ordinary rayat is enabled to cultivate his fields, profitably with the assistance of so little applied manure. The want of systematic rotation not only induces a diminished outturn, but also affects the healthfulness of the crops grown.

12. Although sorghums and millets yield heavy crops under liberal management, it is impossible to grow them continuously on the same land. Therefore on a dairy farm they should not only be alternated with a good rotation crop, but that crop should be such as will provide useful fodder for milch cattle.

Chola (Dolicbos catiang). Vdl(Dolichoilablab),

So far as our trials have yet progressed, chola (Doli* ^ catiang) and ^ (Dolichos iablab) stand out 0Qn, spicuously as the most promising leguminous crops which can be rotated with the millets. Each of these pulses does well in the rains, and both thrive well on medium black and deep black soils. As cold or hot weather irrigated crops they also succeed, Vál can be grown, without irrigation, as a cold-weather crop on good land if there is a fair late rainfall; but without the assistance of irrigation, it is doubtful if chola would succeed under like conditions, The green fodder of each of these pulses is greedily e?tten by highly fed milch cattle, and there is little or no wastage. Each crop forms a matted mass of trailing stems, which completely shade the ground and smother surface weeds. This is an obvious advantage. This year a hot-weather irrigated crop of chola gave a considerably greater weight of produce than vál grown at the same season and under similar conditions. The respective acre outturns are noted below:—

	Lbs. per acre.
Vál	10,262
Chola	15,253

Ya i thick seeding for foddei sowing for cereal fodder crops. I had then no figures to Pro^ the advantage of the one over the other. This point has been under test this year and is a subject still for future enquiry. So far in respect of fodder jowari it has been made quite clear that thick seeding not only gives an increased outturn, but also improves the quality of the produce, inasmuch as the stalks are thinner, probably more nutritious and digestible, and can be fed to highly fed cattle with very little waste. The following tabulated figures give the relative acre outturns from three plots of Nilva jowari grown, except as regards seed rate, under precisely similar conditions :—

Seed rate per acre.	Outturn of green fodder per acre.
Jibs.	Lbs.
80	29,531
52	22,004
31	20,514

14. *'Flat Pea (Lathyru$ sylvestris).—!* must reiterate the unfavourable opinion already reported as to the utility of this fodder plant in India, The plot

on the farm has been established over two years, and has meantime yielded nothing of any practical value as fodder. The plants are gradually dying out, and those that still remain look as if they would not survive long. It is regrettable that glowing accounts of the successful cultivation of this "Great Fodder Plant" occasionally yet appear in several Indian newspapers. No efforts have been spared to advertise the seed, and sales have been effected with considerable success in India. One Native State, I am informed, has purchased to the value of Rs. 1,000, and the results are no better than those I have reported.

15. *Mauritius Water Grass or Buffalo Grass.*—This is the chief fodder grass of Ceylon. There it remains green all the year round and is employed largely for feeding milk cattle. A few roots were obtained from the School of Agriculture Farm, Colombo, The plant can be propagated either from the roots or from the stoloniferous stem? which grow out laterally along the ground and root at every node. From these rooted nodes straight shoots spring up. When ready to cut, the grass is very thick and stands about 18 inches high. Cattle like it, but it grows slower than Guinea grass, and does not give the same outturn. It has this advantage—it thrives well in a damp, even a wet situation. The best method of propagating is to cut the long lateral stems into short lengths. Broadcast these sparingly over the surface, and cover lightly with soil. The plot on the farm since it has become fully established has been cut twice at an interval of 87 days. The yields of green fodder were :—

	Yield from 4 gunthas.	Yield per acre.
	Lbs.	Lbs.
1st cutting	1,070	10,700
2nd cutting	1,802	18,020

16, *African Sugarcane {Sorghum saccharcttum)*—Imphee was again tried as a fodder. It was grown as a hot weather irrigated crop, the seed being sown in the second week of February and the crop harvested in the third week of May. As a fodder crop in the Poona district it must be classed as decidedly inferior to any of the common millets. It has gained in the north of India a good reputation, and, in order to thoroughly test its value, it is being again grown as a rain crop in the current season. The following figures show the results obtained:—

Seed rate per acre.	Outturn of green fodder per acre.	Value of outturn per acre.	Cost of cultivation.
Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
50 .	6,475	32 5 11	32 10 10

17. *Bdjro and Bajri**—The giant bdjro of Gujarát was again compared with the ordinary Deshi variety of bdjri. The season was specially favourable, and I am satisfied that the results obtained fairly indicate the comparative values of these two varieties. The conditions under which both varieties were grown were identical. The plots were each £ of an acre. Before harvest it could easily be seen that the bájro was distinctly superior to the bdjri, both in length of straw and in the size of the spikes. The largest spikes were selected from each plot, and the seed from these has been saved with the object of continuing the trial again in the current season. The largest and best filled spikes, both of Mjro and bájri, will be selected year by year, and the seed of each variety compared *inter se ;* also with seed which has not been specially selected. All the farm-grown bdjro seed, which could be spared, has been distributed in small parcels, each of 5 lbs. (sufficient to sow \ acre) to about 50 selected cultivators in the Poona district. The improved bdjro will only succeed on good land or land in fair condition. Its seed is larger than ordinary bájri, and, therefore, the seed rate is necessarily a little higher. The comparative plots gave this year the following results:—

Crop.	Seed rate per acre.	OUTTURN PER ACSE.		Cost of cultivation per acre.	Value of outturn per acre.
		Grain.	Straw.		
	Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
Bájro	is*	1,080	5,250	33 1 1	65 7 11
B4jri	10	820	4,812	34 3 10	53 15 5

Note,—The cost of cultivation for bájri is higher than for bájro, because of the extra cost entailed in cutting off the many small bájri spikes, and the difficulty of trampling the **grain out from these** aa compared with the large* bájro spikes.

18. *American Sugar Sorghums.*—Two varieties, respectively named Amber and Collier, were tested. These are recognized as two of the finest sugar-yielding sorghums in cultivation in America. Only small parcels of seed were obtained * and the object of the test was chiefly to determine whether these varieties would grow satisfactorily in India, and if so, to obtain as much seed as possible for future sowing. The Collier variety ripened sooner than the Amber, but the latter made the more vigorous growth. The graceful drooping panicle gives each variety, when in flower and in seed, a very handsome appearance. Both sorts were allowed to fully ripen. The seed is pretty safe from birds, particularly if there are jowári or bájri fields in the vicinity. Birds get no proper foot-hold on the panicles ; moreover, the hard membranous glumes securely enclose the grain. The seed is about the size of jowári and would be equally valuable as a food grain. In America these sorghums are reported to yield the highest per centage of sugar as they approach maturity, *i.e.,* when the seed has fully formed but has not yet hardened. At this stage the heads of grain should be removed with a small portion of the top end of the stalk. If stored thus for a week, the seed fills more fully and is good for seed purposes.

Only 1| lbs. seed of each variety was sown. The Amber yielded of seed 87 fold ; the Collier, 106 fold. The area under Amber was £ acre ; that under Collier, $\frac{1}{40}$ acre. The seed was sown on the 14th July. The Collier variety was harvested on 18th October; the Amber, on the 19th November. The plants stood far wider apart than would be the case in ordinary practice, but, as already noted, the chief object was to get seed. When the seed was ripe, the stalks were green, and appeared succulent and juicy. Supposing these sorghums do not prove valuable as sugar-producers in India (this is not anticipated), they will undoubtedly prove very high class fodder crops.

Qul was made from the Amber variety. The stalks were dead ripe. These when stripped and topped yielded 39 per cent, juice 'and 9*2 per cent. *gul.* The percentage of *gul* is about 4 per ceht. less than the average of sugarcane. The *gul* did not harden into a sugar loaf. It had the consistence of very thick molasses. The results obtained cannot be accepted as indicative of the full capabilities of this crop when grown specially for sugar. They are sufficiently satisfactory to warrant exhaustive experiments to test the stage at which the crop should be harvested for sugar-making, to determine the characters of the soil best suited, the seed rate which will give the best results, and the manner in which the juice should be manipulated during the boiling process to produce crystallized sugar. The information obtained from America indicates that the soil should be of medium character and not too highly manured, that there should be ample room between plants, and that the crop should be harvested as already described.

Dr. Leather, the Agricultural Chemist to the Government of India, estimated the sugar in both mature and immature stalks of the Amber variety with results as under ;—

	Mature.	Immature.
	Lbs. oz.	Lbs. oz.
Weight of grain heads ...	1 13	0 8
Leaves	0 14	1 4
Stalks stripped and topped ...	5 3	6 14
Juice	3 0	3 11
Refuse	1 15	3 0
LOBS	0 4	0 3
	5 3	6 14
Percentage of sugar—		
Injuice	**11*89**	**15-21**
In cane	**7*16**	**8*43**

Note.—**The sugar in the mature stalks was all cane saga*, but the immature stalks contained a small proportion of glucose.**

19. *Potatoes.*—I regret to report that English potatoes which have been grown three or four times in India, do not continue to resist the " riug " disease in the manner which newly imported seed does. In the* year under report,

English seed of the third Indian generation, was so badly diseased, that some varieties yielded of sound produce less than the seed planted ; whilst newly imported seed, grown on clean land, was absolutely free of disease. It is very difficult to determine in what manner the disease germs are harboured, but I think it is certain that on all cultivated fields in the Poona district the cause of contagion is present whether the land has been recently under potato cultivation or not, and that the disease becomes actively destructive when potatoes which are not of robust vigorous variety are planted. I believe that English varieties three or four times cultivated in India get degenerated to the extent that they become susceptible of attack. The manner in which cultivated fields get tainted with disease spores can only be conjectured. But I have noticed that when farm-yard manure in quantity is applied, the disease becomes more rife. I believe farm-yard manure to be a fruitful source of infection, and that it should be so, can easily be explained. The manure pit would certainly be a very good medium in which disease spores would multiply, and it is certain that household waste, which generally finds its way to the manure pit, would include diseased portions of potatoes, if potatoes are used as an ordinary article of food. I am certain that the farm manure pit has been contaminated in this manner and on this account. The potatoes imported during the year were grown with the assistance of artificial manure only, with the result that the produce was absolutely free from disease. The rain crop now in the ground is being grown in the same manner, and it will be interesting to note whether the disease manifests itself.

The potatoes which grew diseased crops on the farm were, when first imported, grown at Khed, where although every field in the district is subject to disease, very good results were obtained. On the farm the damage by disease has increased with each generation. The following tabulated figures show the outturn, &c, of the second generation :—

Seed rate per acre,	Produce per acre,	Value of Produce per acre*	Cost of cultivation per acre,
Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
1,136	4,149	148 2 11	94 7 9

The differences between varieties in respect of outturn and susceptibility to disease are noted below :—

Name of variety,	Outturn per acre*	Remarks.
	Lbs.	
Sutton's Windsor Castle	6,376	Rather badly diseased.
Do. Perfection	6,240	Do. do.
Do. Triumph	5,910	Slightly diseased.
Do. Snow-drop	5,496	Badly diseased.
Do. Early Regent	4,995	Very badly diseased.
Do. White Kidney	3,493	Do. do.
Do. Satisfaction	1,975	Do. do.
Carter's Magnum Bonum	4,266	Slightly diseased.
Do. Cosmopolitan	3,964	Very badly diseased.
Do. King of Russets	2,546	Do. do.
Do. Reading Giant	2,002	Do. do.
Kumaon (India) Magnums	3,218	Do. do.

I note below the results from, the third generation. The crop was a cold weather irrigated crop, and ought, therefore, to have succeeded better than the preceding rain crop :—

Seed rate per acre.	Outturn per acre.	Value of outturn per acre.	*Cokt* of cultivation per acre.
Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
1,505	3,112	44 7 3	119 12 1

All varieties were badly diseased. That portion of the produce which was apparently sound was sold in the baz^r at the above noted rate. Triumph and Windsor Castle were least diseased. The outturn from the White Kidney and the Kumaon Magnums barely equalled the seed planted.

Government this year sanctioned a large importation of English seed potatoes. Arrangements were made with Messrs. Sutton & Sons, Reading, England, to supply 20 tons of those varieties which our trials had proved were most suitable for India. Owing to a disastrous season in England, the potato crop there was a comparative failure, and only 12 tons could be supplied. The intention was to distribute this import at half cost price to *bona-fide* cultivators. Applications from every potato-growing district in the Presidency and from Sind were received, and about 40 tons could have been sold. Unfortunately, although the potatoes were as carefully packed as in previous years, they arrived in very bad condition in Bombay. This, I believe, to have been due to unnecessary delay during transit. The Bombay Health Officer ordered the removal of the cases to an open space by the sea. There the potatoes were sorted, and only about a tourth of the consignment was found to be sound and good for seed purposes. It was not certain that those apparently sound would germinate satisfactorily. Therefore it was deemed unadvisable to distribute any amongst cultivators. All were planted on the Poona Farm. The potatoes were, as far as possible, planted whole, because of the uncertainty of germination. Even with this precaution the crop grew uneven. Italian potatoes, which are now largely imported into Bombay, were also tried, but, as will be seen from results tabulated below, they did not succeed so well as the English potatoes :—

	Name of variety.	Seed rate per acre.	Outturn per acre.	Value of outturn per acre.	Cost of cultivation per acre.	Remarks.
		Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
	Italians	2,372	4,415	183 15 4	173 13 0	Seed rate high, because the sets were cut from potatoes much larger than ordinary seed size. The crop whilst growing had a very thriving appearance. The haulms were tall, and completely shaded the drills. The outturn was disappoint* ing and the tubers small.
Eng.	Windsor Castle.	1,466	3,339	141 10 0	126 1 11	Germination somewhat uneven, and outturn thereby lessened.
	Matchless ...	2,400	9,670	402 14 8	176 14 9	Seed rate high, because potatoes were of large size and were mostly planted whole; germination satisfactory.
	Supreme ...	2,993	7,266	302 12 0	208 2 2	Potatoes large and mostly planted whole ; hence seed* rate high; germination satisfactory.
	[Early Regent.	2,306	8,468	352 13 4	178 6 7	Potatoes mostly planted whole; hence seed rate high; germination uneven and crop patchy.

Note.—The potatoes planted were valued at 19 lbs. per rupee, being fair market value. The produce was valued at 24 lbs. per rupee, being fair market value.

replant the whole on the Poona Farm; and from therah, cm"t Present growing it is estimated that approbate* 35 tons will be available for S t & J K 3 October, provided disease does not appear.

20. *Potatoes propagated from Seed.—The* cultivation of the seedlings ot potatoes raised from the absolute seed three years since has been continued. None have yet shown any liability to disease. A few promise to be useful varieties, having increased considerably in size with each generation.

21 *Cotton* —The Poona district is not a cotton-growing district. Messrs. Thackersey Mulii & Co., Bombay, were anxious, however, that we should test the value of Suakim cotton, which as imported into the Bombay market commands a high price on account of the length and silkiness of the staple. The »uakim seed supplied by the Bombay firm was sown in comparison with Varádi, the short-stapled discredited variety of Khándesh, and with the Deshi variety ot Broach. The latter is one of the finest long-stapled variety in cultivation in India. The Suakim cotton, which is of American type, failed signally Ihe seed germinated well, but the seedlings never made any progress, and gradually died out. On the other hand, both the VarMi and the Deshi Broach grew luxuriantly. The crops would compare most favourably with the very best found in the districts to which each variety is indigenous. Unfortunately the cotton boll-worm proved most destructive. Throughout Gujarát, this insect did a great deal ot harm last season. But in a cotton district on account of the large areas under the crop the attack could not be so concentrated and destructive as was the case in the small area (f acre) on the Poona Parm. The boll-worm discolours the lint, so that its value is materially lessened, and, moreover, many of the bolls do not mature at all. The following tabulated figures give the results :—

Name of variety.	Seed rate per acre.	Outturn of seed cotton per acre.	Value of outturn per acre.	Cost of cultivation per acre.	Remarks.
	Lbs.	Lhs.	Rs. a. p.	Rs. a. p.	
Varádi (Khdndesh)	134	586	32 8 8	49 9 0	The cost of cultivation is high, because the field was heavily manured in anticipation of sowing a crop other than cotton,
Broach (Deshi) ...	16*	513	33 5 4	46 12 6	

22. *Improvement of Indigenous varieties of Cotton,*—Under the orders of Government a conference was held in 1891 to consider this question. The conference formulated a plan of experiment; the guiding pruiciple of which is that greater success would attend the development of existing indigenous, forms than the introduction and acclimatization of exotic varieties. Dr. Watt's researches in connection with the compilation of the "Dictionary of Economic Products" have proved that the commercial cottons of India are hybrids which originally sprung from certain wild forms, and that these commercial cottons, by continued hybridization, are continually undergoing change which is mostly in the direction of deterioration. The conference, guided by this knowledge, resolved that the first step taken should be the organization ot a « census " of the existing forms grown in the Presidency. From this census it would be possible in future to trace out degenerations or improvements. Dr. Watt during the last cotton season completed the census in Gujarát and Káthidwar. That of the other cotton districts of the Presidency has still to be made. Dr. Watt during his tour found a wild cotton which, he thinks, has exercised a very material influence on the cultivated varieties of Gujarát and Káthiáwár.

Besides the effect of hybridization, there are other controlling influences which tend to make the cotton of one district superior or inferior to that of another. Soil, climate, good or bad cultivation, each exercises a material effect. At the same time I am quite convinced that any attempt to supplant an inferior variety, indigenous to a district, by the introduction of a superior variety, indigenous to another district, would probably fail. The cotton soils of Khdndesh and Surat are not unlike. The cultivation is about equally good in each district. A discredited short-stapled variety (Varddi) is the chief crop of Khandesh; whilst the cotton of Surat is one of the finest long-stapled varieties cultivated in India. I believe that neither of these cottons could with advantage **be mter-**

changed between districts. The results obtained in growing Surat cotton (Broach Deshi) on the Poona Farm exemplify how stubbornly cotton lends itself to any change. The outturn of lint was quite satisfactory. The length of staple also was good ; but the fibre compared with that grown in Surat was coarse and harsh. I selected from the farm crop the best bolls from the best plants, and the seed obtained therefrom has again been sown in comparison with seed similarly selected from the best plants in the best fields I could find in the neighbourhood of Surat. Ldlia, similarly selected at Navsari, occupied another plot. This variety is probably a sport from the Deshi variety of Broach and Surat, and is perhaps the finest long-stapled cotton in cultivation in India. Samples of the lint of each have been kept, and it will be interesting to note the differences between these samples and the produce of the different plots. I think it is certain that in the dry bracing air of the Deccan, Broach cotton will deteriorate in quality. If it does not, there is room for hope that fine indigenous varieties may, in some districts, supplant inferior indigenous varieties. If this cannot be done,—and I am not at all sanguine that it can,—then all that need be attempted is to improve each indigenous variety, even supposing the variety is an inferior one. This can chiefly be done by annually selecting the best bolls from the best plants of the best fields and by pedigreeing by further selection the produce of the seed thus obtained.

This would not entail much more trouble than a practice which prevails in Gujardt, *viz.*, selecting the largest spikes of bájri and heads of jowdri to provide seed for the following year's crop. The Surat Farm, when it has been fairly started, will form a convenient centre, where an effort will be made to improve one or two of the best Gujarát cottons on the lines indicated above.

Wild forms of cotton.

23. The conference of 1891 proposed another line of experiment, *viz.*, tliat, tlle trul y wil(i cottons which occur in Sind, Rajputana and the Punjdb "should be cultivated over a series of years in localities apart from each other and in proximity, and apart from and in proximity to cultivated cottons. The object of the experiments should be to ascertain whether the wild plants can be improved by any system of cultivation, and whether under cultivation they show any tendency to produce valuable sports which by seminal cultivation can be perpetuated, or whether by hybridization between these species and between them and cultivated cottons a superior quality of hybrid cotton could be produced which would be fairly fixed or less liable to degeneration than some of the cottons presently grown."

A beginning has been made at the Poona Parm. Authentic specimens of rooted plants of *Gossypium arboretim* from the Punjáb and of *Gossypiwn Stocksii* from Sind have been obtained, and have thriven and fruited well under cultivation. Seed of *Gossypium Wightianum* (the plant will not transplant) from Western Rájputdna was obtained, and the plants which grew therefrom have also grown well and fruited once. These varieties have been under cultivation strictly in accordance with the scheme of experiment formulated by the conference. This year the wild cotton discovered by Dr. Watt will be added. These experiments can be continued on the Poona Farm for a year or two ; but it may be foreseen that very soon there will be so great a multiplication of plots and results that a much wider area than the Poona Farm will be required, and the experiments would demand nearly the full time of a good botanist. It will be very interesting to note the changes evolved from year to year by cultivation, &c, but it will probably take many years to get any new staple of real practical value. Meantime, if the improvement of existing commercial varieties was seriously taken in hand, a good deal of progress could be made in a very little time.

24. *Gram.*—It is a common practice in the cultivation of gram to nip off the leading shoots with the object of making the plants branch out more freely and consequently flower and fruit more abundantly. To test the value of this practice against non-pruning, two plots, each of ½ acre, were marked out in the middle of a gram field on the farm. This was done when the crop was ready for nipping, *i. e.* when the plants were beginning to bloom. The plots selected for experiment were to all appearance perfectly even. The outturns were :—

The nipped plot	...	...	HO seers,	or 275 lbs. gram.
The other plot	...	...	88J	or 218 lbs. „

The operation of nipping costs nothing. Farm labourers are glad to do the work in their own time if they are allowed to take the shoots which are removed. Care must be taken that the plants are not cropped too much. The tops removed are dried in the sun, and when dry can be kept and used subsequently as a delicate green vegetable.

Scheme of sugarcane experiments at Manjri.

25. I give below the scheme of sugarcane experiments initiated at Mánjri Budruk in the neighbourhood of Poona.

1ST SEEIES.

Object:—To test the value of trashing, wrapping and tying up cane as practised at Bassein and elsewhere, with the ordinary Poona method of cultivation; also to test the comparative value of American sugar sorghum.

Plot 1, \ acre.—American sorghum.

Plot 2, \ acre.—Cane cultivated in the ordinary way.

Plot 3, \ acre.—Cane trashed, wrapped and tied up.

Note.— The variety of sorghum which is being tried has, by selection, been improved, so that in America the nearly mature stalks yield 15 per cent, of sugar. Ordinary cane in Poona yields *16* or 14 per cent, sugar. The sorghum is a poor man's crop, which ripens in three months and, therefore, may be grown as a rain crop without the assistance of irrigation. In the comparative trial, two crops of sorghum will be grown in the same period as one crop of sugarcane. Each sorghum crop will be directly manured. The double application to the sorghum plot to be equal to the single dressing to each of the cane plots. One sorghum crop to be a rain crop without irrigation ; the other a cold-weather irrigated crop. The test to be the actual weight of *gul* produced.

2ND SERIES.

Comparative Manure Experiments.

Object:—To test the comparative values of such manures as are within the reach and means of ordinary cultivators, and when the effects of the various manures tried have been clearly demonstrated, then to determine whether two or more of the manures used cannot be judiciously combined, so as to secure economy without diminution of net profit. Plots each \ acre. The weight of manure applied to each plot to be regulated by the per centage of nitrogen it contains. Equivalent weights of nitrogen to be applied to each plot. The per centage of other elements of value will be known, and any marked difference between the crops of the various plots will, no doubt, be traced to the value oj elements other than nitrogen. Count will be taken of these differences, and deductions will be made which will eventually regulate the manner m which two or more manures may be mixed with the object of reducing cost and getting equally good results. Poudrette has been taken as a basis, and of this manure 42 tons per acre have been given—the quantity used in the district by the best cultivators of sugarcane. The applied quantities of other manures have been regulated in ratio to that of poudrette in the manner described above.

Plot 4.—Bones crushed fine (bone meal).

Plot 5.—Bones dissolved with sulphuric acid.

Plot 6.—Crushed bones fermented in a pit with sugarcane ash refuse and stable urine.

Plot 7.—Fish manure (dried fish from Thána).

Plot 8.—Castor cake.

Plot 9.—Karanj cake (refuse oil cake from seeds of *Pongamia glabra).*

Plot 10.—Bone meal and saltpetre.

Plot 11.—Dissoved bones and saltpetre.

Plot 12.—Poudrette.

Plot 13.—Cattle dung from ordinarily fed cattle, preserved without litter or urine.

Plot 14,—Cake-fed cattle manure preserved with both litter and urine.

Plot 15.—Ordinary town manure (sweepings, ashes (fee).

3RD SERIES.

Plot 16.—Ratoon cane, \ acre. To test how long cane can *be* ratooned profitably. The plot to be manured equally and similarly to plot 15, and the outturn to be compared with the outturn of plot 15 of 2nd series.

Plot 17.—This irregular plot is affected by the shade of hedgerow timber trees. It will be manured similarly to plot 15 of the second series, and the results are intended to indicate how far cane is injured by the shade of b&bhul and other trees.

4TH SERIES.

Object:—To test whether a less quantity of water than that usually applied by local cultivators to sugarcane will or will not give equally good results. Irrigation water to be given every eighth day in the hot weather and every tenth day in the cold weather or during breaks in the monsoon rains. Ordinary cultivators get canal water once a fortnight in the hot weather, and this interval between waterings is believed to be too long. The plots of this series will be compared with plot 22 of the 5th series, which has been similarly manured and has been planted and will be harvested at the same time. The only difference between plot 22 and those of this series is that a full flooding was given to the former only as often as the canal was opened for the cultivators' fields in the neighbourhood, which on an average was once in 14 days during the hot weather. Plots | acre.

Plot 18.—Watered with half the ordinary supply.

Plot 19.—Watered with three-fourths the ordinary supply.

Plot 20.—Watered with full ordinary supply, which will be actually gauged and recorded as a basis for the supply given to plots 18 and 19.

5TH SERIES,

Object :—To test at what period of growth sugarcane yields the highest percentage of sugar. Plots \ acre each. Manured with poudrette similarly to each other and to the plots of the 4th series.

Plot 21.—Cane cut and converted into *gul* 11 months after plantation.

Plot 22.—Cane cut and converted into *gul* 11| months after plantation.

Plot 23.—Cane cut and converted into *gul* 12 months after plantation.

Plot 24.—Cane cut and converted into *gul* 13 months after plantation.

6TH SERIES.

Object:—To test the effect of manure applied before plantation with the same quantity of manure applied at intervals partly before and partly during growth as a top dressing. Plots all \ acre.

Plot 25.—Farm-yard manure, all applied before plantation as is customary.

Plot 26—Farm-yard manure, same quantity :
| applied before plantation in February.
^ applied as a top dressing in May.
i „ „ in July,

Plot 27.—Poudrette, all applied before plantation as is customary-

Plot 28,—Poudrette, the same quantity :
i applied before plantation in February.
applied as a top dressing in May.
J „ „ in July.

Plot 29.—Castor cake, all applied before plantation.

Plot 30,—Castor cake, same quantity :
i applied before plantation in February.
applied as a top dressing in May.
i „ „ in July.

7TH SERIES.

Object:—To test two varieties of newly imported Mauritius cane for comparison with each other and with the local Pundia variety, on plots similarly and liberally manured.

Note,—The varieties which, have been rocently introduced are known to yield in Mauritius at least 2 per cent, more sugar than the best varieties now in cultivation in the Bombay Presidency ; and, if they maintain this superiority in India, the distribution among ordinary cultivators will be a decided advantage; because a difference of 2 per cant, of sugar in cane represents a difference in outturn of *gul* of about 2,000 lbs. per acre.

Area selected for sugarcane experiments most suitable.

26. These experiments have been begun under the most favourable conditions. The field selected is specially suitable for sugarcane. The soil is medium black of fair depth. It overlies murum. This porous substratum secures thorough drainage; whilst the soil is heavy enough to retain moisture. The field owing to a fortuitous circumstance had not been under cultivation for several years. This makes it all the better suited for comparative manure experiments. The expense, however, of turning waste land into a good state of tilth has added considerably to the initial cost of the experiments. A lease of the land has been obtained ; therefore the experiments can be continued until definite issues are obtained. The field is in the centre of a very large area almost entirely under cane, and the results obtained must attract the attention of a large number of cane cultivators. Samples of the soil and sub-soil and of all the manures applied were submitted for analysis to the Agricultural Chemist to the Government of India. The cane was planted seasonably in March.

Results more or less definite from sugarcane experiments.

27. I do not now wish to anticipate results which will be reported fully when the first year's crop is harvested, but there are differences between plots now which are so remarkable that I may refer to them.

Nitrogen in immediately available form an important constituent of manures for sugarcane.

In regard to the comparative manure experiments, there is ample evidence to prove that nitrogen in an immediately available form is the most important constituent in manures used for sugarcane, and that a sufficient application in this form should be given before plantation. The cane sets (pieces of cane about a foot long) evidently contain very little to nourish the young shoots, and the rootlets must at once find a supply of available nitrogen in the soil; otherwise germination is uneven. This was made strikingly manifest in the plot manured with bones. In this plot the young shoots were yellow and evidently starved, and the germination was most irregular. Another plot, also manured with bones, presented the same appearance until a top dressing of saltpetre was given, when there was a remarkable improvement in the appearance of the crop almost immediately. It might be argued that the potash of the nitre was as effective as the nitrogen. This could hardly be so, because a plot adjoining the bones plot, manured with bones and the ash of sugarcane fermented with stable urine, had quite as unthrifty an appearance as the plot manured with bones alone. The ash of the sugarcane must of necessity have contained a good deal of soluble potash. The bones, ash and urine would have been more effective if fermented for several months before application ; but this was impracticable this year, as arrangements for the experiments were not completed until a month prior to the date on which the cane had to be planted. For the same reason, the farm-yard manure and cattle dung were applied before they were thoroughly decayed, with the result that, although, according to analysis, they contained each 1 per cent, of nitrogen (probably none of it immediately available), the young cane was starved for a time. The check at this stage is never afterwards recovered, although, when the land has been several times irrigated, there is evidence that even bones become dissolved to the extent that a fairly liberal supply of plant food becomes available. The practical lesson learned is that organic manures should be thoroughly decayed or artificially dissolved before application, or that a small dressing of nitrogen as nitrate should be added to the soil before plantation, the nitrogen as nitrate being necessary to give the young plant a fair start. If germination is even, and the young shoots are healthy and vigorous, I believe

that afterwards the effect of irrigation will extract from the most insoluble of manures sufficient to feed the crop liberally if a liberal application of manure has been given.

28. The quantities of manures applied to all plots have been liberal, but not more so than that afforded by the best cultivators in the district. The plots which are least promising compare very favourably with the average cane of the district, whilst those plots which have been most successfully manured stand considerably ahead of any cane I have seen in the neighbourhood. The plot manured with fish is perhaps so far the best, but there is little to choose between this plot and those manured with castor cake, karanj cake, poudrette, and dissolved bones and nitre. The plot manured with dissolved bones alone is not far behind, and this is encouraging to possible future economy. Bones can be bought at a very moderate price locally. They can be ground up cheaply under the stone of an ordinary chunarfl mill (found in every village), and the manufacture, at the Reay Paper Mills, of sulphuric acid is now a local enterprize. The acid manufactured is weak, but I believe it is intended to manufacture it of standard strength soon. With the weak acid I have been able to make bone superphosphate for about Us. 60 a ton, which I believe to be sufficiently dissolved for application to sugarcane or any other irrigated crop.

Comparative manures applied. possibility of making bone superphosphate locally.

29. The least promising plot of the comparative manure series is the one to which sugarcane refuse ash and urine were applied. The results bear out a wide-spread beliel held by cultivators, that the refuse ash obtained during the *gul-making* process is practically worthless as manure. This ash is really the only residue left of an expensively manured crop, the crushed cane and dry leaves being used for fuel in boiling the cane juice. If this ash is proved worthless as manure, it will be the more disappointing, because the nitrogen—the element which is admittedly the valuable one for cane—has gone with the smoke !

Sugarcane refuse apparently of little value as manure.

30. The present appearance of the plots of the 4th series shows in the clearest manner the importance of giving water often and in small quantity. Frequent watering in the hot weather is specially important. Each of the three water-experiment plots is far ahead of any other in the whole field, and this must be attributed entirely to frequency of irrigation. The plot that got the least water is the best, and I have seen no crop, except under a well, that can compare with that of this plot. If a cultivator draws water for irrigation from a well, he waters his crop, on an average once in 8 days in the fair season, and he gives no more water than the crop absolutely requires. If, on the other hand, he takes water from the canal, he knows he can only get it once a fortnight, so each time he irrigates he literally floods the field. It is certain that a good deal of this water is wasted, and it is a question whether less water would not be actually used per acre per annum if the canal was opened every eighth day. Our experiments are intended to prove that a much better crop than ordinary can be grown by frequent watering, and that there need not necessarily be so much water as usually used.

Importance of sufficient irrigation in hot season.

31. I regret to report that the two varieties of cane introduced from Mauritius did not arrive in good condition for planting. The consignment reached Bombay in first-class order, but during transport to Poona was delayed for a week owing to the breakdown of the Thana bridge. The canes heated in the truck, and many of the buds were destroyed. Sufficient sets were, however, saved to plant a fair area. The panes imported were much larger than any produced in the Poona district. One variety is red, the other white. Each gives good promise of being a useful introduction. The habit of growth is quite different from any local variety. The power of tillering is enormous. A very large number of shoots spring from one stock, and next season the sets will be planted further apart than those of local cane.

Recently imported Mauritius cane.

32. *Maize.*—The stalks and leaves of maize when fully ripe are in India almost worthless as fodder. In America a practice prevails of stripping the side leaves from the stalks before the crop matures. Thus a useful fodder is

obtained, whilst the outturn of corn is said not to be materially lessened. The Government of India desired that the system should have a comparative trial on Provincial Government Farms. I do not think it possible to adopt the system with maize crops as ordinarily cultivated in India. The method of cultivation is totally different from that practised in America. Our varieties are dwarf in comparison with the giant varieties of Kentucky and Illinois, which are planted with as much exactness as tobacco is in Gujarat. In American maize fields three or four plants grow together in a « hill." Each hill is 4' distant from the next. The rows, which are absolutely straight, are four feet apart both lengthwise and across the field. Afield planted with such precision can easily be entered, and the stripped leaves can easily be carried out. But this is quite impossible in a maize field as ordinarily cultivated in India. The rows are seldom more than 15" apart and are not straight, and the plants stand close together in the rows. It is quite impracticable to penetrate to the centre ot a held and remove the leaves from the standing crop.. Such at least was found to be the case on the two comparative plots grown on the farm. I concluded that it would cost more to strip and remove the leaves than the whole crop would possibly be worth, and the experiment was abandoned.

General Cultivation.

33. *Lucerne.*—This fodder crop has again shown susceptibility of considerable damage from disease and from other mishaps. The cultivation of lucerne in the Poona district is declining. During the last two years it has been found that well-established thriving plantations have been attacked and completely destroyed in a very short time by aphides, caterpillars, and by fungoid disease. The insects swarm in such numbers that any ordinary insecticide application has little or no beneficial effect. Native cultivators dust the affected plants with ashes and lime, and a belief is held that a border of carrots round a patch of lucerne will keep away insects whilst the lucerne seedlings are young and until the plants are well established. But even after this stage the crop is not safe. I have seen several fields almost totally destroyed with green fly in the hot season, recovering somewhat, however, during the rains. Heavy continuous rain for several days will completely destroy this pest. Lucerne if it remains healthy is one of the most paying crops which can be grown. But the cost of establishing a plantation is high, and cultivators are not keen to risk the losses above referred tof Consequently owing to restricted cultivation this fodder is scarce and dear.

34. The lucerne grown on the farm became diseased to the extent that it was advisable to plough it up. I referred, in last year's report, to a piece of lucerne which had become patchy through disease and which was filled up by planting Guinea grass. The mixed crop did well last year, and has continued to thrive this year. The lucerne plants have remained quite healthy. Uniay be that the losses attributable to disease, &c, may be avoided by growing Wrne mixed with Guinea grass. This point will be definitely settled by actual tes t r t h e current season. There is no practical difficulty to be anticipated. The fodder from each crop can be cut separately, and even if it were not so, the fodder could be easily disposed of as mixed fodder, Guinea grass being as suitable a green food for horses in hard work as lucerne is. That is the experienced many owners of horses in Poona; and at the Remount Farm, Ahmadnagar, I believe the young horse stock are regularly fed with Guinea grass. The daily ration increases with age-25 lbs. Guinea grass with other food being the maximum allowance. Only one small patch of lucerne was maintaTned during the year and it has since, been ploughed up. The results are:—

Probable advantage of growing lucerne and Guinea grass as a mixed crop.

Weight of produce per acre.	Value per rupee.	Value per acre.	Cost of cultivation per acre.	Remarks.
Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
31,816	120	265 2 0	85 3 8	The crop was cut 11 times in 12 months. No mannre applied during the year, as soil was rich from a previous heavy application.

35. [illegible] I regret that the results this year have been very unfavourable [illegible] an extremely short and irregular supply of canal water during the cold season. In former years there was generally sufficient [illegible] the whole area irrigated in the neighbourhood. This year, owing [illegible] the supply was, I think, insufficient, and because the canal outlet to the farm is rather unfavourably situated, our irrigated crops suffered perhaps to a greater extent than others. Guinea grass suffered [illegible] frost. It [illegible] plants withered [illegible] repeated [illegible]. On the lighter lands the [illegible] Since the rains set in, the fields have recovered in a marvellous manner and the same area now yields at each cut more than double the weight of produce obtained during the hot weather. The results for the year [illegible] cannot be accepted as indicating the capabilities of the crop grown under favourable conditions. The produce is valued at 200 lbs. per rupee, the rate at which it was charged to the dairy cattle.

Fully established Plantations.

Rate per rupee.	Produce per acre.	Value per acre.	Cost of cultivation per acre.	Remarks.
Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
200	21,295	106 7 7	81 11 5	Three fields cut 10 times during year; 2 fields cut 9 times.

Plantation established during the year.

Rate per rupee.	Produce per acre.	Value per acre.	Cost of cultivation per acre.	Remarks.
Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
200	9,547	47 11 4	83 10 3	Cut 8 times during year, first 3 cuts being very light.

36. [illegible] The [illegible]um was grown specially as a fodder crop. [illegible] and were partly dried and stored as kirbi. [illegible] fed as green fodder and [illegible] loss in weight [illegible] varies [illegible] with the luxuriance of growth [illegible] what [illegible] The bundles, when dried sufficiently for safe storage, were found [illegible] have [illegible] in weight. There is no question that [illegible] better produce is [illegible] with very thick seeding. If, however, the seed is sown at [illegible] rate with the country drill, the implement should be worked first lengthwise and then across the field. This secures more even [illegible] Sundhia [illegible] the seed by the plough. In either case the land should be clean, as these [illegible] sowing [illegible] of a bullock hoe [illegible] weeding hook being used [illegible] The average [illegible] field [illegible] green fodder [illegible] weight of [illegible]

Seed rate per acre.	Rate per rupee.	Outturn per acre.	Value of outturn per acre.	Cost of cultivation per acre.
Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
54	300	15,097	50 5 2	42 0 2

37. *Sundhia Jowári.*—Sundhia jowári, grown as a rain crop on the lightest soil of the farm, gave the following results. The field was, however, liberally manured: hence the high cost of cultivation:—

Seed rate per acre.	Rate per rupee.	Outturn of green fodder per acre.	Value of outturn per acre.	Cost of cultivation per acre.
Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
54	250	13,636	54 8 8	41 13 9

38. On two fields of the farm, bajri with tur and tur alone were grown to give the land a change from the cereal fodder crops T . Importance of mixed crops, J ^ ^ y cultivated. Tur grown alone must have undoubtedly left the land richer and in better condition for the succeeding crop than the mixed crop did. But the latter gave much the better returns of the two. The tur subordinate to the b^jri occupied every fourth row, and when the bajri was harvested, the tur branched out and soon completely covered the ground. There is a common country saying that the more tur is trampled and broken when the b£jri is harvested, the more vigorously will it subsequently branch, flower and fruit. The field growing tur alone was, if anything, in the better condition of the two. The results from each field are noted below. They are not intended for critical comparison. They tend, however, to show that there is safe economy in growing mixed crops.

Kind of crop.	Name of crop.	Seed rate per acre.	OcTTTtBN PER ACRE.		Value of outturn per acre,	Cost of cultivation per acre.
			Grain.	Straw.		
		Lbs.	Lbs.	Lbs.	Bs. a. p.	Bs. a. p.
Mixed crop ...	Bdjri ...	10	188	2,376	1 40 14 1	22 7 0
	Tur ...	9	787	Not weighed...		
Sole crop ...	Tur ...	18	607	Not weighed...	17 8 10	18 15 10

39. *Gram.*—This crop was grown chiefly for its value as a good rotation crop. The rabi season was unfavourable owing to a scant rainfall. Two of the fields were irrigated, being each twice watered at an interval of a month. A third small area was not watered, because it could not be commanded by the canal. The difference in outturn between the irrigated and unirrigated crops is rather remarkable.

Kind of crop.	Seed rate per acre,	OcTTTUEH' PEE ACEE.		Value of outturn per acre.	Cost of cultivation per acre.	Remarks.
		Grain.	Chaff (fodder).			
	Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p,	
Irrigated crop...	68	773	Measured, not weighed.	25 2 2	18 11 0	The value of chaff is estimated.
Dry crop ...	69	98	Do. ...	3 10 4	7 11 1	

40. *Oil-seeds.*—Niger seed (Khur&sni) and safflower (Kusumbi) were grown on a field of the farm which has not recently been manured, and which was known to be in rather poor condition. Half the field was under each crop. The niger seed was grown as a rain crop, the safflower as usual as a rabi dry crop. These oil-seeds are important crops in the Deccan, and were grown on the farm chiefly with the object of getting reliable information as to outturn from land in no better condition than that of the ordinary rayat. The season was unfavourable for the safflower, there being a deficient rabi rainfall, but for the niger seed the season was quite favourable. The results, therefore, from the latter crop are alone of value, but those from both are noted below:—

Name of crop.	Seed rate per acre.	Outturn of seed per acre.	Value of outturn per acre.	Cost of cultivation per acre.
	Lbs.	Lbs.	Rs, a. p.	Rs. a. p.
Safflower ... ... #••	18i	225	6 8 4	11 5 0
Niger seed ,,. ,tt *.	n	272	11 5 0	9 12 6

41. Oil was extracted from the niger seed in the ordinary country ghan& The weight of oil and of oil-cake exceeds the weight of oil-seed, because water is added after the seed had been half crushed, in order to give the degree 01 wetness necessary to consolidate the cake properly, so that the oil separates properly from it. The cake consolidates by the action of the revolving pestle into a thick layer against the sides of the' mortar, whilst the separated oil sinks to the bottom of the mortar. The oil is removed by soaking it up in a mop, ana from it the oil is squeezed by hand. The oil-cake is removed in pieces by means of a short crow-bar. The results were as under:—

Weight of oil-seed.	Weight of water added.	Total weight.	Weight of oil.	Weight of oil-cake.	Loss.	Percentage of oil to seed.	Percentage of cake to seed.
Lbs.	Lbs.	Lbs,	Lb».	Lbs.	Lbs.		
543	76	619	152	457	10	28	8415

Samples of the oil, of the oil-cake and of the seed were submitted to the Agricultural Chemist to the Government of India, in order to know whether the ordinary country mill did effective work. The results of Dr. Leather's analysis have not yet been received.

Ploughs.

42, *The Seebpore Plough.*—This implement is cheap, light of draft an(i serviceable when the soil is moist and easily moved. It is too frail an implement to be used on the soils of the Deccan, except during the monsoon, and even then it cannot be used with advantage so soon after rain as a wooden indigenous plough can. It has neither the strength nor the durability of a well-construct eel native plough, nor has it, in my opinion, any advantage over the indigenous implement either in penetrative power or otherwise.

43. The Madras Department of Agriculture has recently issued a circular m, a v i. TO , to implement makers in India directing attention The Swedxsh Plough. ^ the fact that iron -turn-farrow ploughs made *in* Sweden have been sold in large numbers to *bona-fide* cultivators in the Bellary district, and that the demand for these ploughs is increasing. This plough is apparently in use for deep ploughing black cotton soil. The ploughs are of three sizes. That which is most liked costs about Rs. 50 in India. It is strongly constructed wheeled plough of ordinary English pattern. It is fitted with a mould board of medium length, a coulter, and a share, which is rathe* broad. The wheels can be adjusted to regulate the depth and width of the furrow. * have tried this plough on the Poona Farm. There is no question that it does effective work under favourable conditions. But I am sure that it would not penetrate the soils of the Deccan when they have set and hardened in the fair season. It is just at this season that a good Deccan cultivator incurs considerable expense in deeply stirring his field, and uses for the purpose a heavy native plough. I am not at all sanguine that the Swedish plough will become popular with ordinary cultivators in the Bombay Presidency. I tried the plough *on* field which had recently given a heavy crop of fodder jowári. The stubble was strong, and the roots had a firm hold of the soil. The land was medium black. The soil in respect of moistness was in good condition for ploughing. A farrow 8" deep and about the same width was turned. The draft was decidedly heavy for 4 good strong bullocks. The area ploughed in a day of 8 hours was 12 gunthas or fo of an acre. The plough will penetrate the soil 10 or 12 inches or more if sufficient draft power is allowed. I think the Swedish plough might with economy be used as a substitute for, the indigenous plough in the preparation of sugarcane land in the Poona district* It could be used at any season, because the land is kept moist by irrigation all the year round -> and there is room for economy in the cost of tillage, because ploughing alone costs about Rs. 25 per acre.

44. *Ramome's Turn-wrist Plough.*—I have found this an excellent implement. But like the Swedish plough it is not likely to be taken

up except by sugarcane growers. I tested it on the same field with the Swedish plough, with the same bullocks, but on the following day. A furrow 8" deep was turned. The area ploughed in 8 hours was 17 gunthas or $\frac{17}{40}$ of an acre. The " Turn-wrist plough " has one decided advantage over the Swedish. The mould board and share, by an ingenious arrangement, can easily and quickly be adjusted to one side of the plough as it goes in one direction and on the other side of the plough as it returns. Therefore as with an indigenous plough no "feerings" are required, and the field is not ploughed in "lands " or sections, as is necessary with the Swedish plough. The " Tarn-wrist " is decidedly the lighter in draft of the two. It is fitted with a wheel which regulates the depth of the furrow, and is guided by the ploughman to regulate the width of furrow. It costs ^ in England £2 7s. 6d, or Rs. 40. I hope this season to arrange for a comparative trial, on a cultivator's sugarcane field in the Poona district, between the Swedish, the " Turn-wrist" and a native plough, and the results will be reported. I think it would be unwise to attract the attention of cultivators to the imported implements, except as regards their suitability for sugarcane cultivation.

45. The American Planet Jr. combined hoe and plough I have found extremely useful in the cultivation of Guinea grass and potatoes, also in the last ploughing for sugarcane and in ridging up, preparatory to planting tne sugarcane sets. The last operation is commonly done by a native plough yoked with four bullocks. The Planet Jr. does the work better and more expeditiously. It is easily drawn by two bullocks. It costs Rs. 33 in India.

Planet Jr. combined plough and bullock hoe.

Accounts.

46. The Farm accounts have been kept distinct from Dairy and Dairy Herd accounts. Two balance sheets are appended, showing the financial results of each. The farm balance sheet shows that the net cost to Government, inclusive of the Assistant Superintendent's pay, has fallen from Rs. 3,716-3-9 in 1892-93 to Rs. 1,484-8-11 this year. In 1892-93, however, the net cost was increased to the extent of Rs. 500 by cost of buildings and fencing.

Dairy and Dairy Herd.

47. The financial results of management are shown in the appended balance sheet. The profit for the year is Rs. 2,254-13-2, as against Rs. 1,130 last year. No interest is charged on invested capital, which amounts to about Rs. 10,000. On the other hand, nothing has been credited this year for a large quantity of manure produced by the milflh cattle and the young stock. The upkeep of the young stock has again been, costly, because orders as to the establishment of a Stock Farm were not passed until nearly the end of the financial year. Therefore the balance sheet is unfavourably affected. Now, however, the young stock and dry cattle are comfortably housed in a new steading at Mánjri Budruk. And although the rains came late, the grazing in the Stock Farm is excellent, and the grass reserved for hay promises to give a good yield. Under existing arrangements I see no reason why the Poona Farm with its auxiliaries, the Dairy, the Dairy Herd, and the Stock Farm should cost Government anything in future years, unless the seasons prove unfavourable. At the end of the financial year there were 3 stud bulls, 68 milch animals, and 97 head of young stock. The ^ increaged from 123 head ill 1892-93 to 170 head this year. There were 27 animals sold and 42 bought, whilst there were 50 births and 11 deaths, the latter being mostly calves of purchased animals.

Dairy accounts.

Increase of Dairy Herd.

48. The dairy produce from 68 milk cattle was sold during this year for Rs. 14,701-11-3. Cattle food, fodder, and grazing cogt Rs. 9,358-6-2. The herd was quite free from contagious disease. The dairy has proved itself a profitable institution. Not only so, but the sick soldiers in hospitals are supplied with purer and cheaper milk and butter than can be obtained elsewhere. The saving to Government on thi3 account is considerable. The public are supplied from the dairy at rates fixed purposely higher than the prices charged by private dairymen in Poona, yet daring the year we have had

The Dairy a profitable institution and profitable m

numerous applications from private residents for a regular supply of dairy produce, which could not be complied with. Those people who have young children appear to be particularly anxious that they should obtain milk from the Government farm. If the Government dairy interferes in any way with the trade of private dairies, it is because the public demand a higher standard of

Demand for farm dairy produce greater than the supply.

l ^ T J ft?^ ?? ^ P^reVails> SOme of tho a.a.ines established by private enterprize in Poona and elsewhere. There is no question that the initiative example of the Agricultural Department has raised the quality standard of dairy products throughout this presidency, and has educated the European public to become critical as to the quality of dairy produce. It is perhaps a healthy sign that butter of inferior quality is vetoed, whilst that of superior quality is bought up readily at almost any price. In course of time, good butter will undoubtedly be obtained in India at a cheaper rate than at present. The extended use of improved dairy machinery has made it possible to make butter in Bombay and elsewhere from cream separated in districts where milk is cheap.

The far-reaching benefit of improved methods in dairying.

At present, the advantage to the milk producer in outlying districts is con- *1* ^ ^ ' ' ^ ^ *is* ^ ^ ^ *Y* greater to the dairy- man - He obtains for good butter about double the ordinary price of ghi. Well-made butter yields approximately only 80 per cent, of ghi. In time the profits will be more equalized. Meantime, the owner of improved dairy machinery drives a lucrative trade. This is evidenced by the fact that butter made in Bombay irom cream obtained from distant districts is railed daily to Poona and several outstations in large quantities, and is offered for sale in attractive looking pats at bungalows, and presumably is readily sold, the price beino- 12 annas a pound,

T* !49' i ^elie ve the Government Farm Dairy stimulates private enterprize. It also affords thorough practical tuition free of cost to all who desire to be properly instructed m improved dairy methods. We insist, however, that those who come to learn must not be mere onlookers. They must work.

Breeding for milk.

50. The young stock bred on the farm are commencing to come into profit. ^ is premature to anticipate results. Yet the milk yields from these young cows force the conviction that they are likely to prove superior to their dams as milch cattle. It is the chief object of our breeding experiments to gain that result.

Effects on dairy cattle of good feeding and good management.

51 • » T h re * s v e r y little to add to the information already published in respect of dairy cattle. I am certain that a great deal of success in dairying in ^ h ing8 upon the possibility of providing milk cattle wi th a fairly liberal supply of green fodder during the whole year. A liberal ration of green fodder increases the milk yield, but it lowers the quality. It has that effect at any rate in respect of the per centage of butter fat. If a fair allowance of green fodder is regularly given, cows and buffaloes, especially the former, come sooner in season for the bull after calving, and, therefore, breed more regularly than would otherwise be the case.

Gir cattle.

52. Gir cows in the Deccan are disappointing as regular breeders and as regular milk producers. Under the most skilful management, they do not yield the same quantity of milk as they do in the Gir hills of Kathiawar. They improve, however, when aclimatized. It has yet to be ascertained whether pure bred Girs bred in the Deccan are an improvement on imported dams. When the Surat farm is started it is proposed to continue the breeding experiments with Gir cattle there, that locality being probably more suitable than Poona.

Aden cattle and half-bred Adens.

53. Aden cows maintain their reputation as regular breeders and deep milkers. The record of yields reported further on does not this year afford much information as regards this breed, because nearly all the Aden cows were in milk at the end of the year, and their yields are excluded from the statement, Half-bred Adens are regular breeders and fair milkers.

54. Nine Sind cows bought in the neighbourhood of Karachi have done well. Several had calved and were in milk when brought by steamer and rail to Poona. Naturally they went off milk during transport, and did not recover their normal yields. I expect them to do better during the current season. All these cows calved in May 1893, and five were giving a fair quantity of milk at the end of the year (31st March 1894). The yield record noted in the subjoined statement is, therefore, not complete for the whole period of lactation. Still it compares very favourably with that of other breeds. The best Sind cow gave in 330 days 4,864 lbs. of milk, worth, at the rate charged at the farm, Rs. 374, and at the end of the year was still giving 9 lbs. or 4| seers per day. Sind cattle are not accustomed to wet weather, and in the Deccan must not be exposed to heavy rain.

Sind cattle.

55. Buffaloes are decidedly more irregular as breeders than cows. Jdfferabádi buffaloes, owing to their large size and the necessarily larger ration they require, are not, I think, so profitable as well-selected Surat buffaloes, because on the average the latter yield quite as much milk as the former. The two best buffaloes were of Surat breed :—

Surat buffaloes most profitable breed.

No. 1 yielded during the period of lactation (371 days) 6,959 lbs. milk worth Rs. 497.

No. 2 yielded during the period of lactation (415 days) 6,875 lbs. milk worth Rs. 491.

The wofst buffalo (a cross-bred Deccani) yielded during the period of lactation (227 days) 1,971 lbs. milk worth Rs. 141.

The cost of upkeep of these buffaloes did not d iffer materially. Surely, therefore, there is room to believe that if we go on in the direction which we are pursuing, and retain for breeding purposes the young stock of the best only, we will in time breed up to a higher standard. In any case, it is a useful line to follow on a Government farm; for, as far as my experience goes, " breeding for milk " is entirely beyond the purview of the native stock-owner except in Sind, where well-to-do Zamind&rs know the pedigrees of all the best cattle they own, and are particularly proud of their best milk cows.

56. I submit below a tabulated statement which gives details of the milk yield of cows and buffaloes in milk during the year :—

Cows.

No.	Name.	Breed.	Date of calving.	Number of days in milk.	Maximum yield.	Average yield.	Total yield.	Date of birth of next calf or due to calve.
					Lbs. oz.	Lbs. oz.	Lbs. oz.	
1	Sárji ...	Gir	33th October 1?9?	320	18 12	14 12	4,736 4	5th December 1893
2	Gowlan ...	Do. ...	7th October 1892	366	20 0	11 0	4,026 8	16th February 3894
3	Siti ...	Do. ...	23rd October 3892	339	18 12	9 0	3,073 4	Cast calf on 18th September 189»
4	Bhági ...	Aden ...	6th November 1892	303	12 12	9 0	?,726 8	22nd November 1893
5	Chandráwal	1 Half Aden,	[15th September 1892	304	15 8	10 0	3,055 .8	18th August 1893
6	Bahuli ...	f	(16th August 1892	2S9	16 12	9 12	2,800 8	29th July 3893
7	Mhdlsa ...		(12th February 1893	203	8 12	5 4	1,165 0	25th January 1894
8	Batftsi ...	j Cross ...	j 21st March 1893	219	11 0	6 8	1,424 0	20th November 1894
9	Putali ...	Deccan ...	3rd November 3892	192	10 8	6 4	3,192 8	13th October 3894
10	Pándi ...	Sind ...	14th May 1893	322	21 0	10 8	3,369 12	14th August 1894
11	Devri ...	Do. ...	21st „ 3893	368	19 12	12 4	4,497 8	3rd August 3894
12	Kousáli ...	Do. ...	6th „ 3893	330	22 4	14 12	4,864 0	8th March 1894
13	Mangli ...	Do. ...	11th „ 1893	194	16 8	10 W	2,056 8	13th June 1894
14	Gulji?r ...	Do. ...	12th „ 3893	312	20 4	>9 6	2,917 12	3rd July 1894
15	Amini ...	Do. ...	18th „ 1893	318	19 8	10 10	3,391 32	14th August 1894
16	Fulchendn .	Do. ...	16th „ 1893	311	22 4	8 10	2,700 4	1st August 1894
17	Jánki ...	Do. ...	18th „ 1893	318	17 12	9 12	3,093 8	21st July 1894
18	Piakhmi ...	Do. ...	25th „ 1893	311	34 8	9 14	3,083 0	25th October 1894

No. 30 giving 4 lbs. 8 ozs. of milk <m Is1; April 1894.
No. 12 „ 9 „ „ „ 3) „
No. 15 „ 9 „ 12 „ 3) 3) „
No. 37 „ 6 „ „ „ „ 3)
No. 18 M £> 33 1 2 3» 3) „
„

Buffaloes.

No.	Name.	Breed.	Date of calving.	Number of days in milk.	Maximum yield.	Average yield.	Total yield.	Date of birth of next calf or due to calve.
					Lbs. oz.	Lbs. oz.	Lbs, oz.	
1	Kami	Jafferabad	15th December 1893	429	22 0	11 4	4,813 12	12th September 1894
2	Thaiui	Do.	30th June 1892	291	27 8	14 0	4,077 0	1st September 1895
3	Bichwa	Surti	4th December 1892	437	25 4	11 5	5,026 8	28th October 1894
4	Eupa	Do,	15th Do. 1892	465	29 0	30 12	5,0i)8 0	28th November 1894
5	Kh&idi	Do.	20th January 1893	436	24 8	12 9	6,483 4	18th November 1894
6	Chandani	Do.	4th December 1892	342	22 0	12 0	4,113 4	30th April 1894
7	Gendi	Do.	9th June 1892	367	30 8	18 16	6,959 0	15th June 1893
8	Mohan	Do.	24th November 1892	451	21 8	12 8	5,624 8	29th August 1894
9	Keshar	Do.	14th January 1893	399	20 12	11 9	4,592 10	22nd October 1894
10	Bhori	Do,	20th June 1892	415	29 0	16 9	6,875 12	20th October 1893
11	Pddi	Do.	16th November 1892	191	23 0	13 11	2,635 0	34th September 1894
12	Tuftta	Do.	25th September 1892	328	19 0	12 6	4,072 0	30th October 3893
13	Thaki	Do,	30th September 1892	338	23 0	13 30	5,299 0	13 th February 1894
14	Láli	Do.	14th August 1892	436	22 0	12 3	5,323 0	18th January 1894
15	Asinán	Do.	20th November 1892	497	13 8	9 8	4,695 8	20th November 1893
16	fburat	Do.	30th December 1892	280	15 12	10 15	3,067 12	22nd August 1894
17	Bilori	Do.	22nd July 1892	291	23 0	13 7	3,930 6	7th December 1893
18	Mukhran	Do.	15th January 1893	441	13 8	8 6	3,697 32	Not covered.
19	Mahitáb	Do.	22ndEptember 1892	250	17 12	10 14	2,726 4	24th September 1S93
20	Ládi	Do.	5th June 1892	315	22 0	14 6	4,513 30	15th September 1893
21	Anandi	Do,	21st June 18921	318	24 8	13 5	4,232 32	28th September 1893
22	Avdi	Do.	7th March 1893	378	22 4	10 12	4,084 4	2nd November 1894
23	Lahiri	Deccan	28th August 1892	346	19 0	13 4	4,598 0	3rd November 1893
24	Diváli	Do.	20th December 3892	254	17 0	12 10	3,212 4	6th March 1894
25	Ingalat	Do.	27th December 1892	316	12 4	7 1	2,239 32	3rd October 1894
26	Zendi	Do.	9th August 1892	350	13 8	7 15	2,773 4	15th June 1393
27	Mirga	Cross	19th December 1892	260	17 0	12 1	3,337 4	15th December 1893
28	Chandri	Do.	14th December 1892	430	17 0	8 9	3,757 6	11th November 1894
29	Dasrath	Do.	7th January 1893	449	16 0	11 4	5,044 8	N«b covered.
30	Hira	Do,	21st January 1893	227	13 8	8 12	3,971 32	15th February 3894

No. 4 giving 5 lbs. of milk on lst April 1894,
5°' ^ " 6 » » " " "
£o. 15 „ 4 „ 8 ozs. " " "
No. 18 „ 4 ,,4 ozs. " " "
No. 29 „ 7 ,,4 ozs.

57. The average number of days between two calvings were as under :—

Jáfferabadi buffaloes	532
Surat do.	530
Deccani do.	548
Cross bred do.	483
Gir cow9	457
Aden do.	381
Cross bred Aden cows	342
Cross cows	483
Deccani do.	699
Siud do.	445

58. Below I give the average number of pounds of buffalo's milk required to make a pound of butter during each month in the year. It will be noticed that a less quantity of milk is required to produce a pound of butter in the hot season when green fodder is scant, than during the rains, when it is more plentiful:—

Month**	Milk in lbs.
April	9-9
May	9-9
June	11-6
July	11-8
August	12·1
September	12-2
October*	12·1
November	11·0
December	11·0
January	11·1
February	10-2
March	10-9

59. I give below a good»formula, obtained from the dairy expert Mr. Revenger, tor making butter colouring:

tut 4 ozs. ground annatto seed into a bottle. Pour on the annatto seed rectified spirit sufficient to cover it. Allow the mixture

Butter colouring. Then, empty and spirit into

a cooking vessel. Mix the seed and spirit with If pints of quite fresh sesamum (til) oil. Boil the mixture until all the spirit is evaporated, stirring constantly to avoid burning. When ready keep in a tightly corked bottle and use as required. The spirit effectively dissolves the colouring matter from the annatto seed. By boiling, the spirit, if pure, is entirely volatilized, and the colouring matter is transferred to the sesamum oil.

60. Buffalo's butter requires to be artificially coloured, because in its natural state it has a blue white colour, which detracts from its market value in the estimation of Europeans.

61. *Sheep.—A* small flock of Deccani ewes are being crossed with a Dumba ram. The experiment has not progressed sufficiently to report results, but I have watched with interest Captain Morgan's experiments at Ahmadnagar, and I can without any hesitation say that his results are most encouraging. There is no doubt that the cross from well-selected Deccani ewes by the Dumba ram are remarkably good mutton sheep, with frames deep, wide and near the ground with a very fair fleece of wool. The ewes are a small lot selected from the Bhadgaon Farm flock before the farm was sold. The appended table shows the increase since.

62. *Establishment*—My Assistant, Mr. Kelkar, has proved himself a capable active farm manager. Mr. Kanetkar, my clerk, has had the opportunity of gaining a good deal of practical knowledge during the year, and will, I think, be a useful man for more responsible work in time. The other subordinates have given satisfaction.

I have the honour to be,
Sir,
Your most obedient Servant,
JAMES MOLLISON,
Superintendent of Farms, Bombay Presidency.

Kirkee, 28th August 1894.

APPENDIX'i.

Blance Sheet of the Poona Farm, IS93-94.

Receij^ts,	Amount.		Expenditure.	Amount.	
	Rs. a. p.	Rs. a p.		Rs. a. p.	Rs. a. p.
To sale-proceeds of farm produce of 1893-94—					
Grains	51 14 10		*By* rent of land	.....	122 0 0
Oil-seeds	17 8 0		Assistant Superintendent's pay	.....	1.358 0 10
Fodder crops	1,558 12 10		Establishment pay	.....	526 0 0
Potatoes	280 5 7		Horse allowance	.....	240 0 0
Gfil(jagri)	9 0 0		Travelling allowance	.....	84 12 0
Miscellaneous receipts	W2 8 0				
Fuel	3 0 0				
Niger seed oil A	17 4 0				
Niger seed oil-cake	12 11 1				
Fruits	2 5 9				
		2,145 6 1	By ordinary expenditure—		
To value of farm produce of 1893-94 unsold on 31st March 1894-					
A. Since sold—Grains	208 13 5		Labour and cost of upkeep of farm bullocks...	2,019 1 9	
Potatoes	'21 1 6		Skilled labour	27 1 0	
Fodders	69 5 9		Purchase of manures...	184 1 9	
Cotton	i 4 e		„ seeds for sowing	200 0 0	
Fruits	0 15 0		„ dead stock	136 2 0	
		301 7 8	„ stationery and service stamps ...	38 5 9	
B. On hand—Grains	69 0 0		Miscellaneous	52 5 0	
English potatoes valued at...	520 0 0		Irrigation charges	122 12 0	
Jowári fodders growing and nearly ripe	160 0 0		Petty improvements	21 4 3	
Cotton	23 6 8				2,801 1 6
Fibres	7 14 0		By purchase of live stock...	.....	200 0 0
Lucerne and Guinea grass — value of growing crop and established plantation ...	290 0 0		By transfer of implements from Bhadgaoo Farm valued at	.....	1,347 0 0
		1,070 4 8			
To value of manure supplied for sugarcane experiments at M&njri	.....	120 0 0	Total ...	.....	6,678 14 4
To increase of live stock	.....	160 0 0			
To net increase of dead stock	.....	1,397 3 0	By extraordinary expenditure—		
Total ...	.....	5,194 5 5	Part oi initial cost in starting sugarcane experiments at Mán^ri	726 5 6	
To net cost ...	.....	1,484 8 11	Cost oi iencing and \yu\ldmgs	497 9 0	
Total ...	.....	6,678 14 4			1,2'& 14 6

APPENDIX II.

*Dairy Balance Sheet for the year 1893-94**

Income and increase in value of Stock.	Amount.	Expenditure,	Amount.
	Es. a. p.		Rs. a. p.
To sale of milk and butter, the produce of farm cattle...	11,701 11 3	By concentrated food bought	5,235 2 9
», sale of milk tins and jars	15 15 7	,, fodder bought	2,929 9 3
•, sale of live stock	327 6 0	,, rent of grass land	974 1 9
Butter on hand on 31st March 1894... ...	35 0 0	,, hay-making expenses	219 8 5
Value of hay in stock	625 6 3	,, labour	1,998 6 10
Increase in value of live stock	1,256 6 6	,, water-rate	27 0 0
		,, Cost of repairs and incidental outlays incurred for management of dairy and dairy herd	1,529 9 11
		,, purchase of dairy utensils, &c.	126 4 0
		,, . do. live stock	1,497 11 6
		Butter on hand on 31st March 1893, but disposed of during the year	69 8 a
		Total ...	14,606 14 5
		Profit ...	2,254 13 2
Total ..	16,861 11 7	Total ...	16,861 11 7

tfote<--Th& depreciation in va'ue of dead stock is held to be balanced by purchases made during the year (Ri* 12C«4«0)i

APPENDIX III.

Valuation Statement.

Description.	STOCK ON HAND *OK* 31ST MARCH 1893.		STOCK ON HAND ON 31ST MARCH 1894,		Increase.	Decrease.
	No.	Amount.	No.	Amount.		
		Rs. a. p.		Rs. a. p.	Rs. a. p.	
Working bullocks ...	4	**160 0 0**	6	**320 0 0**	**160 0 0**	...
Total ...	**4**	**160 0 0**	6	**320 0 0**	**160 0 0**	...
Dead Stock						
Farm implements ...	...	**485 11 0**	...	**1,881 6 0**	**1,395 11 0**	...
Office furniture ...	*..	**63 4 0**	...	**64 12 0**	**1 8 0**	» •«
Total ...	...	**548 15 0**	...	**1,946 2 0**	**1,397 3 0**	...

APPENDIX IV.

Dairy Herd.

Description.	Strength on 1st April 1893.	Increase.			Decrease.				Strength on 31st March 1894.	Re-classification on 1st April 1894.	Valuation.		Increase ot decrease durtaf 1893*
		Purchased ami transfer* red.	Born.	Total.	Sold.	Died.	Transferred to working bullocks.	Total.			1893.	1894.	
											Rs.	Rs. a. p.	Rs. a. p.
Stud bulls	3	1	...	1	1	...	...	1	3	3	140	160 0 0	+20 0 0
Cows	14	20	...	20	2	...	...	2	32	32	705	2,061 5 6	+1,356 5 6
Heifers	10	...	...	..	...	...	3	3	7	7	185	220 0 0	+35 0 0
Bull calves	11	3	17	20	8	2	...	10	21	21	105	265 0 0	+160 0 0
Cow calves	11	3	13	16	5	3	...	8	19	19	85	275 0 0	+190 0 0
Total	49	27	30	57	16	5	3	24	82	82	1,220	2,981 5 6	1,761 5 6
Bvffaloe$t													
She buffaloes	36	1	...	1	1	...	...	1	36	36	3,590	2,940 0 0	—650 0 0
Heifers	...	11	...	11	...	...	...	...	11	11	...	240 0 0	+240 0 0
Bull buffalo calves	19	...	11	11	9	2	...	11	19	19	120	120 0 0	.....
She buffalo calves	24	1	11	12	1	4	11	16	20	20	195	190 0 0	—5 0 0
Total	79	13	22	35	11	6	11	28	86	86	3,905	3,490 0 0	—415 0 0
Dairy cart horses	2	...	...	...	...	...	...	...	2	2	190	100 0 0	—90 0 0
Total	2	...	...	...	...	...	...	...	2	2	190	100 0 0	—90 0 0

APPENDIX V.

The Sheep Flock.

Description.	Strength in September 1893.	Increase.			Decrease.				Strength on 1st April 1894.	Valuation* 1894,
		Purchased.	Born.	Total.	Sold.	Died.	Transferrtd.	Total.		
										Bs. a. P-
Breeding rams	...	1	...	1	...	...	...	...	1	31 6 0
Ewes	20	...	...	...	...	1	...	1	10	67 0 0
Female lambs	1	...	13	13	...	2	...	2	12	18 0 O
Male lambs	...	...	5	5	...	...	...	...	5	10 0 *0*
Total	21	1	18	19	...	3	...	3	37	116 6 *0*

ANNUAL REPORT

OFTltB

GOVERNMENT EXPERIMENTAL FARM,

POONA,

For the year ending 31st March 1895.

Office of the Survey Commissioner and Director, Land Records and Agriculture, Bombay.

No. JJ$_{1894}$ or 1895.

The accompanying Report on the working of the Government Experimental Farm, Poona, for 1894*95, is published for general information and for distribution to Government officers and public bodies according to the sanctioned list.

0. W. GODFREY, Colonel,
Acting Survey Commissioner
and Director, Land Records and Agriculture.

bated Pooua, 8th July 189õ.

ANNUAL REPORT OF THE GOVERNMENT EXPERIMENTAL FARM, POONA, FOR THE YEAR ENDING 31ST MARCH 1895.

No. 236 OF 1895.

From

J. W. MOLLISpN, ESQUIRE, M.R.A.C.,
Superintendent of Farms, Bombay Presidency ;

To

COLONEL C. W. GODFREY,
Acting Survey Commissioner and Director,
Land Records and Agriculture, Bombay.

KirJcee, 6th July 1895.

SIR,

I have the honour to submit the Annual Report of the Poona Farm for the year 1894-95.

SEASON.

2. The character of the season was somewhat unusual. The total rainfall was nearly average, but wag not well distributed. Very little rain fell before July. In that month the fall was abnormally heavy. Sowing operations, which began late, were much interrupted, and in the Poona district the earliest sown crops were damaged to the extent that they had to be re-sown. Throughout the Deccan, and especially in the districts where cotton is the staple crop, the season was distinctly unfavourable. During August and September the rainfall was light, and crops generally suffered owing to the long breaks between showers. In October there was heavy rain when it was not wanted. The rainfall at the end of the month damaged, to a very serious extent, crops which were cut and lying in the fields or were ripe for harvest. The grain sprouted in the ears. Bajri in the Deccan and rice in the Konkan suffered most in this respect. There was no grazing until late in July, and for several months before this the rates for cattle food and fodder were very high. • The season for grazing was very short on grass land which we rented. No rain fell in November or December, &nd on dry-crop land rabi crops were poor. This did not materially affect the ei*ops on the farm, canal water being available to help late sown crops. Imported English potatoes, owing to the heavy July rain, rotted in part before they germinated. Bajri was damaged by the October rain, but other crops did not suffer much, chiefly because a considerable area was under fodder crops which were in part ready for reaping earlier. Some of the fodder crops got over-ripe because they could not be reaped during the continuous rain of this month. The heavy rain helped the grass left for hay on the M^njri stock farm and a very good crop was obtained. On the whole, the season for the farm w^s favourable.

3. The following table compares the rainfall of the season with that of 1893 and with the average of the preceding nine years:—

Rainfall Return.

Months.	1893.		1894.		Average of nine years (1885 to 1893.)
	Rainy days.	Rainfall in inches.	Rainy days.	Rainfall in inches.	
May, 1st fortnight	...	..	...	...	X 1-98
Do, 2nd do. ...	5	3-*36	1	0-22	
June, 1st do. ...	7	2-26	7	2-02	J 5.86
Do. 2nd do. ...	12	12-27	4	0-94	
July, 1st do. ...	8	1-31	9	7-97	]• 8-10
Do. 2nd do. ...	10	1-02	7	7-35	
August, 1st do. ...	12	3-67	3	1-10	} 304
Do. 2nd do. ...	8	0-52	3	1*66	
September, 1st do. ...	11	0-71	4 *	1-65	} 6-36
Do. 2nd do. ...	5	1-24	4	1-60	
October, 1st do. ...	5	3-41	3	4-07	} 6-12
Do. 2nd do. ...	.. *	..	7	3*86	
November, 1st do. ...	3	0-51	...	...	} 1-86
Do. 2nd do. ...	2	0-52	...	...	
December, 1st do. ...	...	...	...	...	} 0'45
Do. 2nd do. ...	...	...	...	...	
Total ...	88	30-80.	52	82*44	33-77

4. The following table shows the areas under different crops during the year under report:—

Statement showing the Area under Cultivation, 1894-95.

Crops.	Area.		Remarks.
	A.	g-	
Bájri and Bájjro	4	29	*N'ote.—Ot* the total, 13 acres 29 gunthas were twice cropped and 5 acres were thrice cropped ^ whllit 7 acres 25 gunthas were under perennial crops.
American sorghum ...	0	15	
Potatoes	5	22	
Gram	5	17	
Ginger	0'	10	
Turmeric	0	12	
Vegetables .. » ».	0	28	
Guinea grass, &c. ...	7	25	
Lucerne .. *	0	&	
Various fodders... ...	34	21	
Total ,..	59	24	

The above statement does not include about four acres under fodder crops and onions which were not ripe at the end of the year under report. It will be observed that part of the land was thrice cropped during the year. This can be managed, because we have a large supply of cattle manure, and a larger area would have been so treated if a better supply of canal water could have beei* obtained in the hot weather.

EXPERIMENTS..

5. The farm affords no great scope for comparatfve manure and other experiments on account of the uneven character o* » " \ I* - chiefly utilised to grow fodder crop* *or the daïry rattle. The improvement ot the iouu<-r supply in the Deccan is of very great importance. think we will be able in time to estimate correctly tne value of local varieties for fodder in comparison with varieties introduced from other districts andfrom abroad. The varying character of the soil on the fern* will help the issue, in as much as trials can be made under a variety of conditions. There is good hope of supplanting inferior varieties by good varieties, the latter being introduced from other districts. There are very great differences in the quality of both the grain and fodder of the same crop indifferent districts of the Bombay Presidency. This may in part be due to natural conditions over which the cultivator has no control, but is not entirely so. I have made an effort to get this year for trial as many varieties of Jowdri(Sorghum vulgare) as possible. It is the most important grain and fodder crop we have. I have obtained in the Presidency more* than sixty kinds, and the difference in the appearance and quality of the grain from different districts is most remarkable. Each sample of seed has been sown, half for a seed crop and half for a fodder crop, my object being to select from the ripe crops the best heads from the best grain Varieiues and from the best fodder varieties. The seed obtained in this manner will be of undoubted purity. The best fodder varieties are intended for continued cultivation on the Poona farm, the best grain varieties for the Surat farm, where, when started next year, the improvement ot seed by selection will be made a speciality. In addition to the fodder question, the Poona farm is utilized to study and improve the milch breeds of India, to test native practices, to test exotic crops, and crops ot other districtsnot known in the Deccan. The comparative value of leguminous fodder crops suitable for rotation with cereal fodder crops has been under trial for some years. A little has been done in the improvement of seed by selection and in the distribution of seed, also in comparing manures and in trying implements. The selection and improvement of seed and comparative experiments with manures, have not been attempted to any extent *t Pooiuk \ ^ w Q \ t o' \S \W SRWfc % fo\\\fc 80. * ^ d selec il- for A? 8urat W ls **cli TMTM BuiUUe for comparative experi nts, and this work will be started there in a systematic manner next year-

The farm ... nitable for com ... riments but can be usefulij employed otherwise.

Selection of seed.

The ob ects aimed at on. the farm. [3]

Fodder Experiments.

6. The results of trials in former years proved that some of the sorghums generally cultivated are, when sown thickly, exceptionally good^ fodder crops. I referred last year to the superiority of Sundhia Jow&ri, a distinct variety of sorghum (cernuus) introduced from Gujarát. Its superiority depends upon its yielding heavily and at the same time in producing long thin stalks which can be fed with little or no wastage. A considerable quantity of seed was supplied last year to the Superintendent of the Remount Depôt farm, Ahmadnagar, and he was so satisfied with the results, that I obtained for him this year 5,000 lbs. of seed (enough to sow 100 acres). There were a number of other applications for small parcels of seed.

Sundhia Jowári, Imphee, Nilva Jowári, American Sugar Sorghum, Reana luxurians.

7. Sundhia Jowári was compared with Nilva Jow&ri (the best local variety), American sugar sorghum (Sorghum saccharatum), Imphee or African sugarcane (Sorghum saccharatum), and Teosente (Reana luxurians). The plots were \ acre each and fairly even. The area was double cropped in the previous year by a cereal in the kharif season and by a well manured potato crop in the rabi season. No manure was given in the year under report, the field being in good condition. The crops on these plots were, like most of the other rain-crop fodders on the farm, sown late • in July and were sufficiently matured to be harvested early in October. Rain fell more or less during the whole month. There was abundant grazing at this time and there was no need of other green fodder for the dairy cattle; consequently it was decided to cure the fodder into *Icadbi*, although, if the unusual character of the season had been anticipated, the decision would have been otherwise. The rain was so heavy and so incessant that the crops were lodged and harvest belated. During breaks in the rain efforts were made to harvest the fodder crops before they became over-ripe. This was only partially successful. The Dutch barn on the farm proved specially valuable. The half dried *Icadbi* was carried to the Dutch barn and stored there whilst rain threatened and was brought out to dry in fair weather. Under the circumstances it was impossible to prevent the mixing of the crops of different plots and different fields, and the outturn results which I report are only approximately accurate. The bundles or sheaves from each plot or field were counted. Twenty bundles from each plot or field were selected as average and kept separate until sufficiently dry for safe' storage. The outturn results are based on the dry weight of these bundles and on the supposition that average bundles were selected. I am almost certain that the bundles selected were as near as possible average ; and although the outturn figures are in round numbers, they may be accepted as approximately accurate without any hesitation.

8. I tabulate below the results of the comparative fodder plots giving seed rates and the yields per acre, the cost of cultivation, and the value of outturns:—

Crop.	Seed rate per Acre.	Outturn per Acre. (Dry fodder)	Cost of cultivation per Acre.	Value of outturn per Acre.	Rate per Rupee.	Remarks.
	Lbs.	Lbs.	Rs. a. p.	Rs. ». p.	Lbs.	
Sundhia Jowdri—(Sorghum cernuus).	75	8,960	15 13 4	68 14 0	130	Crop sown on 29th July. Reaped while in full flower on 7th October. The crop suffered more than the other comparative crops during the dry weather of August and September. The seed rate being high, the produce was of exceptionally good quality, the stalks being very fine. The green fodder gave 49 P« CeUt Ol ..fç fl atter drying 15 day s.

Crop,	Seed rate per Acre.	Outturn per Acre. (Dry fodder)	Cost of cultivation per Acre.	Value of outturn per Acre.	Eate per Rupee.	Remarks.
	Lbs.	Lbs.	Us. a. p.	Rs. a. p.	Lbs.	
Imphee—African sugarcane— (Sorghum saccharatum.)	75	11,220	19 10 7	74 12 0	150	Sown on 29th July. Reaped when in full flower on 7th October. The stalks were not so thin as those of Sundhia. The fodder Was of fine quality. Imphee is apparently very succulent in the green state. The green fodder gave 37 per cent of dry fodder after drying 1& days.
Nilva Jowdri— (Sorghum vulgsfre.)	65	18,200	17 13 0	113 12 0	160	Sown on 29th July. Reaped on 5th November. It was ripe for fodder in the third week of October, but owing to the continuous rain harvest was delayed three weeks. Meantime the crop lodged and got over-ripe for the best quality of fodder.
American Sugar Sorghum— (Sorghum saccharatum.)	70	19,200	17 7 0	120 0 0	160	Do. do. do.
Teosente— (Reana luxurians.)	20	6,690	17 14 0	37 2 0	180	Sown on 29th July. Reaped on 5th November. The fodder was very coarse, yet the crop was not over-ripe for fodder. Germination was uneven and the crop made very slow progress during the dry weather of August-September. It improved during the rains or October. It evidently requires a regular rainfall to keep it thriving.

3. The results reported above are to some extent unsatisfactory, because owing to the character of the season they are not strictly comparable. General deductions can be drawn which are of importance. We may conclude that Sundbia Jowdri, although it yielded a finer description of fodder than any of the varieties tested, suffered more from drought than the Nilva or the American sugar sorghum or Imphee. I have in a former report noted that it is more subject to rust and to be lodged by rain than the local varieties. Although the Sundhia results were somewhat disappointing this year, there is no doubt it is one of the best fodder crops that can be grown on good land in good condition in a year of good well distributed rainfall. The American sugar sorghum yielded uncommonly well, and its feeding value cannot be doubted, as the stalks When nearly ripe contain about 10 per cent sugar. Like Imphee (which is also rich in sugar) it is very succulent if cut at the flowering stage. Sundhia Jowâri and Nilva are much less so. The Imphee results are considerably better than those I reported last year. It was then grown as a hot weather irrigated crop. The inference is that it does best in the Deccan as a kharif rain crop. It, like

Analysis of the above tabulated results.

Sundhia, matures very quickly. Teosente (Reana luxurians) is an introduction from South Africa. Its value as a useful fodder plant may be discounted. It yields well in a season of good rainfall. The field must be in good condition for Teosente. The seed should be dibbled at the rate of 2 to 4 lbs. per acre. If drilled, more seed must necessarily be sown, and the seedlings require to be thinned out to a foot or fifteen inches apart. The crop tillers freely, is exhaustive, and produces in a favourable year a great weight of fodder, which is however coarse, the stalks being very thick and woody.

Some fodders more succulent than others. The dry weight the correct basis for comparison.

10. In my last report I compared fodders according to their green weight. There is a wide range in the percentages of water found in various fodders in their green state, and the dry weight is the correct basis for comparison. This standard will be adopted henceforth, or at any rate the loss by dryage will be determined, This year in the comparative plots we were only able to compare the green and dry weights of Imphee and Sundhia, the other crops being over-ripe when harvested.

Thick and thin seeding fodder crops compared.

11. In my last report I showed by actual figures the importance of sowing sorghum fodder crops thickly. I pointed out that thick seeding increased the outturn and improved the quality of the fodder by making the stalks thinner. Again this year we had comparative plots to test the best seed rates for the Nilva and Sundhia varieties of Jowári. During the dry weather of August-September it became clear that the plots were uneven. The lighter soil of the field suffered most. I do not report the figures, because they are unreliable. But I concluded from the appearance of the crops of the farm this year and during the previous two years that thick seeding succeeds best on deep black soil in good manurial condition with average well distributed rainfall. It does very well on light land if the rainfall is sufficient and the land in good condition. If the rainfall is deficient or if the crop passes through a period of drought, a thinner rate of seeding would give probably better results on good deep soil and certainly better results on thin red soil. On the latter description of soil, a thickly sown crop withers much sooner than a thin sown crop during prolonged periods of dry weather. Comparative tests are being again made this year on light soil and on deep black soil.

Nilva Jowári and Sundhia Jowćiri compared as rain crops.

12. The average outturn &c. results from all the fields on the farm of Nilva Jowári and Sundhia Jowari are as under. The results are from rain crops only, and the weight of outturn is for dry fodder :—

Crop.	Seed rate per Acre.	Outturn per Acre (Dry fodder)	Cost of cultivation per Acre.	Value of outturn per Acre.	Rate per Rupee.	Remarks.
	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	Lbs.	
Nilva Jowári (Sorghum vulgare).	54	6,604	26 10 0	44 0 0	150	
Sundhia Jowari (Sorghum cernuus).	33	5,005	24 1 0	38 8 0	130	Valued at a higher rate on account of its better quality.

13 In last year's report a similar comparison was made of these fodders. Last year the outturn weights were those of green fodder. This year's results are not comparable with last year's for other reasons also.; but the results of both years tend to show that on the good land and the inferior, land of the farm, if taken together, there is little to choose between the two varieties. It the farm consisted entirely of good deepland, the Sundhia would, I feel sure, give the best results. Both these varieties succeed only moderately well as cold or hot weather irrigated crops in the Deccan. . In Gujardt, Sundhia is extensively cultivated in

the hot weather to supply fodder- in May and June when other fodder is scant and dear.

Nilva and Sundhia as weather irrigated crops.

14. The following results were obtained from Nilva and Sundhia sown side ^ side on a comparatively even field. Seed was so\n <* the 13th March 1894. The Sundhia was ready much the soonest, being reaped for fodder between the 21st and 25th May 1894, whilst the Nilva was harvested for fodder between the 30th June and 18th" July :—

Crop.	Outturn per Acre (Dry fodder).	Cost of cultivation per Acre.	Value of outturn per Acre,	Rate per Rupee.	Remarks.
	Lbs.	Rs. a. p.	Rs. a. p.	Lbs.	
Nilva	6,369	36 5 0	42 7 0	150	The Nilva was watered oftener than the Sundhia, hence the extra cost of cultivation.
Sundhia.	4,411	30 8 0	33 15 0	130	

15. The above results are poor considering that the crops were regularly irrigated. I think it is probable that Hundi, a Deccan variety of Jowdri, which is now under trial, will be found to do better as a hot weather crop than either Nilva or Sundhia.

Hundi Jowari.

16. *Guinea Grass* (Panicum jumentorum).—The results this year are much the same as they were last. In both years they were unfavourably affected by a short and irregular supply of water from the canal, especially in the hot weather. At this season Guinea grass requires a full flooding at least every eight days, whereas we cannot get water oftener than once a fortnight. Although Guinea grass has no dead season, it grows with far more vigour during the rains than at any other season. In the year under report the rains came late and the Guinea grass did not recover the check of the hot weather until July-Augtist. Then tne outturn at each cutting was more than double what it was in the hot weather. A considerable portion of the farm crop has been purposely planted along borders under fruit trees, also on lands adjoining the irrigation channels, where

Guinea grass grown under conditions unfavourable to other crops.

Slt^ ^ iS oft en t0o ?et f or Other cr0P 9 and in ^l^ne situations where other crops would not thrive. \> of the chief advantages of the crop is that it thrives well in such situations. During the hot weather it was observable that the crop produced much more under shade than it did in the open. It is not likely that this would have been the case if there had been a full supply of water for irrigation.

Replantation of Guinea grass necessary after three years.

17. I think I may state definitely that it will pay to re-plant Guinea grass i?en tbe Potation is established about three years. If tne cr0P was originally planted in regular rows it is unnecessary to change the area. Sets chopped oft trom the old stumps which occupy the ridges may be planted at the correct distance apart m the furrows ; and when the new sets are fully established, the old root stocks may be removed. When this is done the new sets should be earthed up and then they occupy the ridges. Furrows for the irrigation water are thus formed, one between every two rows. If this method of plantation is ad-opted, the old root stocks will yield some produce whilst the youno- plantation is becoming established.

Gninea grass outturn results unfavourably affected.

18. The results for 1893-94 and for 1894-95 from fully established plantations a™ tabulated below for comparison. This cannot be accepted as indicating the capabilities of the crop when grown under more favourable conditions. The produce is valued at 200 lbs. per rupee, the rate at which it is charged to the dairy cattle :—

Year.	Kate per Rupee.	Outturn per Acre.	Value of outturn per Acre.	Cost of cultivation per Acre.	Remarks.
	Lbs.	Lbs.	Es. a. p.	Es. a. p.	
1893-94 ...	200	21,295	106 7 0	81 11 0	Three fields cut ten times and two nine times.
1894-95 ...	200	21,112	105 9 0	45 10 0	The cost of cultivation is less in 1894-95 owing to lighter applications of manure. Four fields cut seven times and two six times.

19. *Mauritius Water Grass.*—This grass was obtained from* Ceylon, where it supplies the chief fodder for milch and other cattle. As its name implies it likes a low-lying damp situation. It is sometimes called Buffalo grass. The farm plot is situate under one of the distributing water channels. The soil is continuously moist, sometimes wet. No other cultivated crop would thrive in the same situation. The plot is only one-tenth of an acre, but it is well enough established now to afford cuttings for planting out a large area. The only other suitable area on the farm is at present under ordinary grass. I intend to break up a portion of this land in the current season and plant it out with water grass. The method of propagation is very simple. The stalks are cut into lengths, each length having two or three nodes. Broadcast these sparingly and cover lightly with soil. The stems root at every node and as the plant grows the lateral stems root* down'to the soil at the nodes. From the nodes straight stems shoot up. The grass grows very thick on the ground, and when ready to cut stands 18 inches to- 2 feet high. Cattle like it. The plot on the farm yielded four cuts, the outturn being as under :—

good crop for low-lying wetsk u atio Bs.

Plot.	Yield per Plot. (Green fodder.)	Yield per Acre. (Green fodder.)
Acre.	Ltis.	Lbs.
$\frac{i}{10}$	5,002	50,020

20. *Flat Pea* (Lathyrus Sylvestris).—The unfavourable opinion given in former reports as to the utility in the Deccan of the "Great Fodder Plant" must be reiterated. The plants gradually died out on the plot of the farm until only *a scattered plant here and there remained. When established about two years and a half I had the few remaining plants grubbed up. They only cumbered the ground, for they yielded absolutely nothing of any value as fodder. A large quantity of seed was sold in India at exorbitant rates by the accredited agent of the grower, chiefly through advertisement and laudatory notices in the Press. The agent at one time published his intention of starting a "Great Fodder Plant" farm in the Deccan, but evidently wiser counsel has prevailed since.

A complete failure.

21. Mr. Keventer, the dairy expert, supplied me with some Egyptian clover seed which he brought from Egypt. The trial was practically a failure. The seed germinated all right, but the seedlings made no progress. They grew into dwarfed plants just like the vetches, sainfoin, and other leguminous crops of England tried on the Poona farm several years ago. It is useless persevering with an exotic fodder crop which does not under fair trial succeed at once, because in India we have a large number of really good indigenous fodder plants both cereal and leguminous to select from.

Egyptian Clover.

u anted.

22. Good rotation is as necessary in growing fodder crops as in ordinary cultivation. The sorghums and millets yield heavily, but they ^[\\ not thrive unless they are regularly alternated with a good rotation crop. In the light of very ancient practice both

Value of good rotation.

in India and elsewhere, and in the light of recent scientific investigation, leguminous plants of the papilionaceous sub-order are the best crops to rotate with cereals, because, to put it briefly, they enrich the soil with nitrogen which becomes available as plant food. The number of leguminous crops cultivated in India which can be referred to the papilionaceaB is most remarkable. The growth of these crops in rotation with cereals or as mixed crops has probably done more to maintain the fertility of the Indian soils than any other cause. It is by no means difficult to . select from these crops, several of which are suitable as fodder in their green state and are at the same time useful for rotation. We are chiefly interested in testing such leguminous crops as in their green state are good for milch cattle. Chola (Dolichos catiang) and Vál (Dolichos lablab) each give promising results. Both do well in the rains on any kind of soil with sufficient rainfall, but best on good deep soil. Each crop if it grows well form's a thick matted mass ot vegetation which completely shades the ground and smothers all surface weeds. This is a point of special value, for, the succeeding crop requires much less weeding. Vdl does well in the cold weather without irrigation on deep black soil if the late rains are favourable, and does exceptionally well under irrigation at this season. Chola, on the other hand, does not. Our results indicate that Chola is better than V&d as a rain crop on any kind of soil, Val is the best in the cold weather with or without irrigation. At this season this year Chola practically failed, whilst last year an irrigated crop in the hot weather gave 50 per cent more produce than V£l (see Report for 1893-94). Both these fodders in their green state are greedily eaten with little or no waste by milch cattle.

Chola (Dolichos catiang), Vál (Dolichos lablab), both good fodder and rotation crops.

23. The following tabulated figures show the raiu crop results. The estimated value is the rate at which the fodder was charged to the dairy cattle :—

Crop.	Seed rate per Acre.	Outturn per Acre.	Cost of cultivation per Acre.	Value of outturn per Acre.	Rate pet Rupee,	Remarks.
	Lbs.	Lbs.	Rs. a.	Rs. a.	Lbs.	
Chola	40	12,089	16 14	48 5	250	Figures not intended for critical comparison. Crops grown side by side in some fields, but soil uneven.
Vál	47	7,998	19 6	32 0	250	

24. *Lucerne* (Medieago satiya).—This excellent fodder crop is so susceptible of damage by disease and other mishaps in the Poona district-that the area cropped with it to P.J«»»Jg ment. a°d less every year. We have made efforts to comu<* the damage done by fungoid disease and insect pests, but so far with very little success. The fungoid disease attacks the roots, ana light dressing of copper sulphate applied to the soil during rain has no effect in checking it, and the insects swarm* to the extent that they are very difficult to deal with. I have noticed in former reports that if lucerne is grown as a mix*d crop, it remains longer healthy than if grown alone. This fact was illustrat'ed in several lucerne plots which had become patchy through disease and we're filled up with Guinea grass sets. The lucerne revived in a remarkable manner, and the mixed crops have done very well. I kav'e sown lucerne a^a in with the object of testing definite- * the comparative value of lucerne and Guinea grass as compared with lucerne alone. The experiment i<*o not yet advanced sufficiently to report results. If we can prove any advantages the cultivation of Guinea grass as well as lucerne will extend particularly i^n the vicinity of military cantonments. It is certain that Guinea grass is nearly as good a food for horses in hard condition as lucerne is, and it is probable that a half-and-half mixture of lucerne and Guinea grass would be superior to either alone.

Probable advantage of

•25. *American Sugar Sorghums.—In* the appended note of sugarcane experiments at Mánjri, I have explained that the Two American varieties of American sugar sorghum will not likely prove a use-£r »rd« c K " m,> "Am" ftd sugar crop for the Deccan or for any part of India. ber and Collier. ^ g^ ^ ^ varieties under trial-Amber and Collier. There is little to choose between them either as to the percentage of sugar they contain or as fodder crops. As fodder rain crops they haye each exceptional merit, but if sown in the cold weather neither of them succeeds. Nature asserts her sway in an extraordinary manner. In the year under report we sowed sorghum for a cold weather irrigated crop. It was clear that only a portion of the seed germinated. Many of the seedlings soon died off, the others made no progress. The field was several times irrigated. The small amount of produce was reaped, the land ploughed up and harrowed. It was left in this condition until the first rains of the current season, when the seed left in the ground germinated, and soon the seedlings.in rows could easily be seen. The same thing occurred with Teosente (Reana luxurians), another exotic crop, the seed in each case being the produce of the rain crop reaped about a month before. Even in the case of indigenous crops *new* seed does not germinate well,

26. We sowed as rain crops'the two varieties of sorghum. The chief object was to get seed. A portion, however, of each crop was cut earlier for ⋖MZ-making. Apparently the sorghums contain the greatest amount of sugar m the stalKs when the flowering stage has passed and the seeds have not yet formed to any extent. If there was any hope of the sorghums proving useful as sugar crops, this point "Would be thoroughly investigated.

27. The sugar results from the two varieties were as under, the product being molasses :—

Variety of Sorghum.	Weight of Molasses per Acr«.	Value of Molasses per' Acre.
	Lbs.	Rs. a.
Collier	1,174	36 11
Amber	1,072	33 8

28. In comparison with the above, I show below the combined values of the two varieties for seed and fodder. The fodder being dead ripe is valued at the cheap rate of 300 lbs. per rupee. I regret that the fodders of the two varieties were not separately weighed :

	Dry fodder per Acre.	Seed per Acre.	Value of outturn per Acre.
	Lbs.	Lbs.	Rs. a.
Collier and Amber ...	12,457	457	55 13

29. The seed of each variety is large and plump, and should, as food gram, command an equal market rate with the red and yeuow varieties of Jowá>i so largely grown in the Southern Mahratta Country. The sorghums have a decided advantage as grain crops, because the grain head takes the form of a graceful drooping panicle on which birds can obtain no foothold, . lue crop Requires no watching if there are fields of Jowári or Bájri in the vicinity.

Sorghum seed probably a useful food grain.

Experiments with Grain Crops.

30. *Bxijro* and *Bajri* (Pennisetum typhoideura).—The giant Bdjro of Gujarát was again compared with the *deshi* variety of Bájri. The crops were grown side by side on |aQ(j wj1jCQ ua(J previously grown potatoes. The Soil was io exceptionally good condition. Each crop was grown from selected seed, t. *e.* from the seed of the largest and best filled

The giantB*jr0 of Gujarat compared with the indigenous Bajri of the Deccan.

ears of the comparative crops of the previous year. The results this year would have been exceptionally good if the crops had not been more or less damaged when ripe by heavy rain. Each crop was badly lodged and harvest was delayed after ripening. The grain sprouted in a good many ears lying against the ground. I compare in the following table the results of this year and last. I do not compare cost of cultivation in each year, because extra expenses were incurred this year to prevent damage by birds whilst harvest was delayed. Each plot was only nine . ESS. which it was necessary to watch . There was no other crop near works out high. the per acre rate of watching

Crop.	Outturn per Acre, 1893-94.		Outturn per Acre, 1894-95.	
	Grain.	Straw.	Grain.	Straw.
	Lbs.	Lbs.	Lbs.	Lbs.
Bájro	1,080	5,250	1,738	6,666
Bájri	820	4,812	1,031	6,133

31. In each year Bájro has shown a decided advantage over Bájri. I am hopeful that the distrib been made to selected c Will De permanently beneficial « the cultivators will keep the seed pure. I do not think, however superior to B&jri unless the land on w j h i tbe Bájro would prove itself m? condition. is grown is good deep soil in fair

Continuance of selection and pedigreeing of Bájro and Bájri seed.

The selection of seed from each variety will be continued y b d i t I T enous J "P to a higher standard, at the very few varieties of Bájri. In Bá m&y also improve. There are hl-S 1? 3ency. I know of only one other

Another superior variety of Bájri.

Des %>se referred to above. It is a superior I ty the cultivation of which is almost confined to good cultivation. The Brake* n^ * villa So of the Kaira district noted for its the deahi variety of Gujarat %if rai n -^ m?ch larger and better filled than in cultivation is limited to a small area 1S also larger, and considering that its by selection and possibly from 11 7 7o D0 doubtfc was recently obtained believe to be pure and will tesufin, 6 plaat I have obtained seed which I Bajri of the Deccan, on li*ht so Z \ mmm\ year ago Bajro and the ep mixed black soil.

White and red Tur (Cajanus indicus) compared.

which is extensively grown jarát, was comp the red-seeded ty, which is the only sort the Deccan. riet was a mixed crop with Bájro. The Tur occupied every fourth r T w th varieties branched out well after the Bajro was reaped in October but the ed Tur Each variety was ripe about the same time. UDeven than the white each variety yielded as under :— respective of the Bájro produce,

	Outturn of Pulse per acre, lbs.
White Tur	540
Red Tur	328

respective merits of the varieties are not fairly gauged by figures. The trial is being continued in the current season, it will be found that the ur has not the advantage over the red indicated above. The pulse of the white Tur is however undoubtedly the best in quality.

33. Gram (Cicer arietinum).—The leading shoot off the branching and the formation of more flowers and fruit was again tested this year against non-pruning. The

The outturn from nipped gram and that of non-pruned gram

the farm servants

will do the work in their own time, if they are allowed to take the shoots which are removed. Care must be taken that the plants are not cropped too much. The tender shoots when sun-dried are stored and can be used at any time as a delicate vegetable. The results of this year and last are tabulated below for comparison. In both years the crops were irrigated. Some of the pods did not fill this year owing to cloudy weather at flowering time, otherwise the crop was exceptionally good.

Plot.	Outturn of Pulse per Acre, 1893-94.	Outturn of Pulse per Acre, 1891-95.
	Lbs.	Lbs.
The nipped plot	1,375	1,325
The unuipped plot	1,090	1,071

This year the test was taken on doiJble plots selected in two fields.

Experiments with other Crops.

Garden crops grown annually.

34. *Brinjals* (Solanum melongena),—One or two market garden crops are grown on the farm every year chiefly with the object of getting reliable information as to outturn results, and for purposes of demonstration to the agricultural students attending the College of Science. Brinjals occupied \ acre and the area was divided into three plots. The Variety grown was the large long purple sort. The seedlings were raised in a seed-bed and transplanted into hills 3 feet apart in each direction.

Comparative manure experiments.

The plots were manured respectively with fish manure (2) dissolved bones, (3) castor cake, part being given before plantation and part as a top dressing. Saltpetre was subsequently applied as a top dressing to the half of each plot, and its effect was seen to be remarkable. It is probable that the potash of the nitre was the most effective ingredient because we know that potash manures are specially useful for potatoes and tobacco, both near relatives of the brinjal. The results were as under :—

Saltpetre (nitre) as manure gave remarkable results. The probable reason explained.

Kind of Manure.	Quantity of manure per Acre.	Outturn per Acre.	Cost of cultivation per Acre.	Value of outturn per Acre.	Remarks.
	Lbs.	Lbs.	Es. a.	Its. a.	
Fish ... ... Nitre	1,451 433	16,322	138 6	325 5	Comparable.
Fish	1,451	11,400	79 9	227 3	
Dissolved bones ... Nitre	1,651 433	11,700	224 11	233 2	Do.
Dissolved bones ...	1,651	7,882	165 2	157 2	
Castor cake ... ... Nitre	1,488 544	15,080	182 11	300 10	Do.
Castor cake	1,488	7,546	81 14	150 7	

The effects of the different manures analysed.

35. The variation in cost of cultivation between plots is almost entirely due to difference in value of manures applied. The cogt wag tne same otherwise except for gathering the brinjals which varied with the outturn. The most effective and at the same time the most economical dressing is fish with a fair application of nitre. The nitre is exceedingly dear in Pooija, yet in this case it

paid well to use it. The inference is that where crude nitre is cheap it could with every advantage be used for this crop. Nitre with dissolve^ bones gave a slight profit; dissolved bones alone a loss. Dissolved bones did not pay because it is now impossible to produce this manure in Poona except at a pronibitive rate. Bones owing to export demands have trebled in value in three years. Weak sulphuric acid is made locally, but it is not cheap. ^ In fact it is almost as economical to use imported strong acid. Bones or dissolved bones will certainly not pay for any crop in the Poona district as long as other more effective manures can be obtained at their present market rate. No doubt tne export of bones is a drain on the agricultural resources of the country, but uncle existing conditions it need not be deplored. Nitre added as a top dressing to tn castor cake plot doubled the outturn. The application of nitre was greater than it was intended to give, through a misunderstanding as to the exact area o plot at time of application. Probably a lighter dressing at less cost would • have been equally effective. Still an application costing about Ks. 100 per acre (at tne exorbitant Poona rates) increased the value of outturn by about Us. 150 per acre,

Risk in importing English varieties.

36. *Potatoes* (Solanum tuberosunT).—This crop occupied about five acres in the kharif season. The sets planted were tne first generation from imported English seed.^ J-^e original stock was imported in October 1893 specially for direct distribution to cultivators. But the potatoes arrived in Bombay in such bad condition that DO distribution was made. Only about one-fourth of the consignment was found to be good. The produce of the rain crop of the year under report was distributed at full market rates to cultivators in every potato.growing district in the Presidency an^ also in Sind. The supply available for distribution was not nearly sufficien to meet the indents. This was chiefly due to a poor crop owing to an exceptionally unfavourable season. Long before rain came, the potatoes began to sprout, and in anticipation of rain we began to plant towards t end of June. The potatoes were planted whole, because it was known ^ a V rain did not soon come cut sets would undoubtedly shrivel up or rot, and it raiu was heavy, the cut sets would also probably rot. The rainfall of July "& exceptionally heavy, and many even of the wn *VptAoes* rotted in 4e ground. The crops g*>*»£ light land succeeded best. The river rose to a neig seldom, if ever, reached before, and flooded a portion of a field, so that the crop there was entirely lost. There was some appearance of the Ring disease • * the crop, but »every precaution was taken to remove diseased plants as tne^ were seen to wither ; and moreover, when distributed to cultivators, tubers o the apparently healthy plants were carefully selected. I believe the potato which were distributed were mostly sound. The results have not been from all districts where the seed was distributed. »a we have got reports from several. Sarddr BahWur Bechardas Vihandds Desai of Nadiad reports a wi between the English varieties and the indigenous &or In each case the English potatoes gave better results than the indigenous sor one English variety, • Supreme," doing exceptionally well. A good report na been received from Sind. In the Poona district the cultivators who got English potatoes from the Department three years ago were keen to buy, but we had to send many away disappointed. Three or four times the quantity sold could easily have been disposed of. In the face of these facts, it might be asked why should not English potatoes be imported to a large extent tor direct distribution or be grown on <jo\eiu inent farms and the increase distributed. The answer is that cultivators could not afford to pay more than half the cost price of imported potatoes. Moreover, there is the risk of the consignment being destroyed during transit; and there is the certainty that although newly imported potatoes resist the Ring disease for a little, they succumb to it in the third or fourth generation. Our efforts towards clxeck- ing this fungoid disease have already been fully reppr- ed- g«t that I cannot suggest any simple treatment beyond what has been tried already..

Why should not the distribution on a large scale of English potatoes be undertaken,

Efforts made to check the Indian potato disease.

per sulphate applied with the irrigation water was certainly effective to a considerable extent, but it is costly and requires careful application, and the treatment would require to be general to be effective. The disease is more rife in the Poona district than in any other part of the Presidency, the reason being that potatoes are here taken in such rapid succession on the same land, that disease germs harbouring in the Boil attack each succeeding crop. The effect of the disease has been so disastrous in the Poona district that cultivators have stopped growing potatoes to a considerable extent and a plant onions instead. If this practice be generally adopted, the fields will get clear in time and sound crops may probably be grown again.

Cultivators-responsible for prevalence of potato disease.

A probable ameliorating influence.

37. The rain crop results on the farm were as under. The varieties were supplied by Messrs. Sutton and Sons, Reading, England :—

Variety.	Seed rate per Acre,	Outturn per Acre.	Cost of cultivation per Acre.	Value of outturn per Acre,	Remarks.
	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
A.—Grown on light land, field not much damaged by rain—					
Windsor Castle ...	1,920	7,981	155 4 0	332 8 0	Valued at 24 lbs. per Rupee, the price at which the potatoes were sold to cultivators.
Early Hegent ...	2,014	8,902	159 4 0	373 6 0	
B.—Grown on other fields considerably damaged by rain—					
Early Regent ...	1,886	3,824	137 7 0	159 5 0	Do.
Supreme	1,396	5,050	133 10 0	210 7 0	
Matchless ...	1,534	1,820	139 11 0	75 13 0	
Italian potatoes ...	2,085	2,610	162 7 0	108 12 0	

38. *Potatoes propagated from Seeds.*—I regret that the seedlings which I raised from the absolute seed four years ago and continued to propagate from the tubers since, have become affected with Ring disease, and there is now no hope of their being useful varieties.

Failure.

39. *Steeping Potatoes before Planting.—The* Commissary General, Bombay Command, requested that the effect of steeping potatoes before plantation in a solution of nitrate of potash and sulphate of ammonia might be tested. The Commissary General sent the following extract from the *Indian Agriculturist* :—

" According to the *Australian,* an enormous yield of potatoes was obtained in one of the districts of Melbourne in the following way. The farmer used sound potatoes of medium size and planted them whole, first ploughing the ground very deeply. Before, planting he steeped the tubers for 24 hours in a bath composed of sulphate of ammonia and nitrate of potash of each 6 lbs. to 25 gallons of water, then allowed them to stand for 24 hours before planting. The result was that there were 30 to 40 large potatoes on each stalk and a little patch 16' X 9' yielded 180 lbs. net, being equal to 24 tons 6 cwt. and 18 lbs. per acre. An adjacent plot of ground was planted in the ordinary way and gave a yield of 7 tons per acre."

40. I can conceive no rational explanation why potatoes treated as above should yield better than untreated potatoes, excepting that the steeping might kill germs of disease and the nitrate of potash and sulphate of ammonia would collect more or less in the eyes of the potatoes as the solution evaporated and

when the eye-bud and rootlets began to grow would be at hand to stimulate the plant into active growth. If, however, the tubers were sprouted (as they generally are when ready to plant), it is questionable what effect a strong solution like that recommended might have on the tender shoots: It might destroy the shoots and also the germinating power of the potato. I make this observation because not a single potato germinated on the farm when treated according to the formula recommended. The tubers which were steeped were more or less sprouted. They were planted in alternate rows with untreated potatoes of the same variety. They were not planted under favourable conditions. A heavy rainfall came soon afterwards, and a good many of the unsteeped potatoes rotted in the ground.

Steeping unsuccessful in Australia and New South Wales,

41. I see from a recent report in the Agricultural Journal of New South Wales that many farmers who tried the steeping with a solution of standard strength reported complete failures; whilst an officer of the New South Wales Agricultural Department got the following results from weaker solutions and from non-treatment. In each case the same number (33) and the same weight (3 lbs.) of tubers were planted :—

	Outturn.
Half strength	22 lbs.
Quarter strength	19 „
Water only	20 „
Not treated	26 „

42. The Commissary General, Bombay Command, reports the following results at Mhow, Neemuch, and Deesa :—

Experiments undertaken by Commissariat Department only partially successful.

		Outturn from steeped seed. (Increase of seed rate.)	Outturn from untreated seed.
Mhow ...	English seed ...	11-4 fold	7*0 fold
Neemuch ...	English seed ...	4-3 fold	No comparative plot.
	Country seed ...	2^65 fold	
Deesa ...	English and Simla seed.	3-97 fold	5'9 fold.

It is reported that only about half the seed germinated at Neemuch. The English seed was supplied from the produce of the rain crop of the Poona tarm and at date of plantation could not have been sprouted, or if so, only to a trifling extent.

43. A further experiment will be undertaken on the Poona farm to prove the effect on sprouted and unsprouted seed, also to test whether a solution of weaker strength gives better results than one of standard strength.

The cultivation of ginger and turmeric not successful.

44. Small areas of ginger (Zingiber officinalis) and turmeric (Curcuma longa) were grown. The season was unfavourable. Poor results were obtained from each. The turmeric is again being grown with the object of getting accurate outturn figures of a good crop.

Cotton.

Improvement of indigenous varieties,

45. In my report of 1893-94, I detailed at considerable length the plan of experiment formulated for the improvement of indigenous varieties of cotton at a Conference held in 1891 under the orders of Government. The Conference proposed as one line of experiment that the truly wild cotton from which the improved cottons originally sprung "should be cultivated "over a series of years in localities apart from each other and in proximity and "apart from and in proximity to cultivated cottons. The object of the experiment should be to ascertain whether the wild plants can be improved by "any system of cultivation and whether under cultivation they show any "tendency to produce valuable sprouts which by seminal cultivation can be "perpetuated or whether by hybridization between these species and between the

" and cultivated cottons, a superior quality of hybrid cotton could be produced " which would be fairly fixed or less liable to degeneration than some of the "cottons presently grown."

46. We have had three wild forms (Gossypium Stocksii from Sind, *G.* arboreum from the Punjáb* and G. Wightianum from Western R%ufa£na) under cultivation for tvvo years. We got seed of a fourth wild form recently found by Dr. Watt in •Káthiáwdr, but none of the seed germinated. The wild forms are under cultivation strictly in accordance with the above scheme. Bat there is nothing to report of practical value. The seed produce-in the first year (except that of G. arboreum) failed *to* germinate. Each wild form fruits and flowers freely. But I do not see that the lint is any better than that produced when th& plants grow in their wild state. The behaviour of wild cotton plants under cultivation provides no doubt an interesting botanical study. But if the chief object is to improve existing staples, there is little doubt that much more progress can be made by selection of seed and the careful cultivation of our best commercial varieties.

Wild cottons of India.

The improvement of cotton on practical lines.

47. The Surat farm when it is started next year .will afford scope, in an important cotton district, for taking up the question of cotton improvement in a systematic mftnner. We may accept the fact from previous experience that it is a mistake to meddle much with any variety indigenous to a district. The only hope of improvement appears to be in the selection of seed and in the distribution of seed of the best local variety, the best local variety in Broach and Surat being that which the cultivators find pays them best.

The improvement of local varieties of cotton to be started systematically at the Surat farm.

48. The cotton in Surat is to all intents and purposes *pure.* In the vicinity of Surat, Dr. Watt, though he walked through miles of cotton fields found practically no differing from the recognised type. We know that cultivators in the Surat Collectorate recognize several varieties which Dr. Watt determined were closely related botanicaliy to the *deshi* variety or almost identical.

Surat cotton practically pure.

The cultivators differentiate between varieties wmch botanicaliy are practically identical.

A variety called *Ldlia* is cultivated to a considerable extent atNavsari (Baroda), and doubtless its cultivation will extend because of the cultivators find it pays them well to grow it, and cotton buyers are keen to get it because the staple is long and fine. It is probably one of the best cottons in cultivation in' India. With the object of having pure seed for making a beginning at Surat next year, I obtained last year a small quantity of seed by selecting the biggest bolls from the most vigorous growing plants in a good field. This has been grown one year at the Poona farm, and alongside the *Ldlia* I sowed seed of the *deshi* variety-of Surat obtained by picking the best bolls from a single plant, the plant being selected on account of its size, its branching habit of growth, and the numerous bolls it carried. According to my judgment, the lint was of fine quality. I also selected from a number of plants the best bolls I could find, always choosing a well grown plant with numerous bolls. This also was sown on the Poona farm; and the seeds of the crop grown from it from the single plant seed and from the *Ldlia* seed have again been sown on the Poona farm in separate plots. As the crops ripen I will go through them and again select the best bolls from the best plants, and I hope to have selected seed of undoubted purity to begin with at Surat next year.

Efforts to select and pedigree cotton seed.

49. This year's crop grew vigorously and yielded well, but the lint is decidedly inferior to that produced at Surat. ' The fibre is coarse or hargh. The staple continues however long. I think the coarseness may be due to the plant being cultivated away from the soft sea breezes of Surat, in the dry and bracing" atmosphere of the Deccan. The crop at Poona took longer to ripen than at Surat, most of the cotton being picked in March and a good deal of it in April and May.

Degeneration of Surat cotton m the Deccan.

The cotton itself stubborn change, climatic or otherwise.

It is clear that cotton lends itself stubbornly to introduction of a good variety into a district where inferior cotton is grown may not always be advantageous.

SUGARCANE EXPERIMENTS AT MANJRI BUDRUK.

50. I give in Appendix I. a detailed note on the sugarcane experiments at Manjri. The experiments cost approximately Rs. 4,000 in the first year; The expenditure includes heavy tillage expenses incurred by and paid to the previous occupant for bringing the field from waste into good tilth, rent for 1^ years, capital outlays for sugar-crushing mills, boiling apparatus, centrifugal sugar refiner, tillage implements, &c., and the cost of new varieties of cane from Mauritius. The expenditure in future, except for chemical manures, will be ordinary tillage expenditure, and I believe the cost to Government will be trifling. It is not likely that receipts will exceed expenditure, because the area is divided up into permanent small plots, the cultivation of which is necessarily greater than of an ordinary field. Moreover, the roadways and divisions between plots take up about one-fifth of the whole area. Weeds must be kept down on this vacant land, and the tillage expenditure on it is fully as heavy as on the land under crop.

OBDINABY CROPS NOT EXPERIMENTAL.

51. The following tabulated figures give the results for the year:—

Crop.	OUTTUBN PEE ACRE. Principal product.	OUTTUBN PEE ACRE. Straw or useful by-product.	Cost of cultivation per Acre.	Value of outturn per Acre.
	Lbs.	Lbs.	Rs. a. p.	Rs. a. P-
Bájri (Pennisetumtyplioideuni) and Tur (Cajanus indicus)	751 379	4,384 ...	24 13 0	50 2 0
Bájri alone	382	5,850	33 2 8	36 6 0
Gram (Cicer ariethmm)	673	350	18 13 0	*22* 14 0

52. The above crops were grown for the benefit of rotation. The Bájri and Tur were grown to rest a field which had been under irrigation for some years. It is well known that black land in the Deccan requires occasional rebb from irrigation, otherwise the crops become sooner or later unhealthy.

The necessity of resWmixed bkck soil from irrigation.

THE DISPOSAL OF NIGHT-SOIL.

53. This year I undertook on behalf of the Poona Cantonment Committee an experiment in the direct application of night-soil on cultivated land. The method of application was what is called the shallow-bed system. It is, I believe, practised successfully on the Allahabad grass farm. Beds are formed along one side of the area to be treated. The beds must be sufficient in number and extent to receive the night-soil of the following day or nio-ht. The beds are best made moderately small, one for each cart-load of night-soil. The soil inside the bed should be dug up and loosened, so that the liquid part of the night-soil soaks at once into the soil. If the beds are small, the semi-li<l night-soil as it escapes from the carts distributes itself equally. It should be covered immediately with three inches of soil, the soil being obtained by digging out the beds necessary for the reception of the night-soTl of the following day. When sufficient soil is removed to cover the night-soil properly, the bottom of each bed should be dug up to loosen the soil. If the beds are properly prepared there is a guarantee that the night-soil is also sufficiently covered, consequently close supervision is not necessary. One inspection each day to see that the beds for next day's night-soil are properly prepared is all that is necessary.

The Allahabad shallow-bed system of disposal.

54. The Poona night-soil carts have each a capacity of 200 gallons ; probably on an average each cart contained about 120 gallons or say 1,400 lbs. Approximately 200 cart-loads were applied per acre, and it is certain that this was equivalent to 100 tons and probably 120 tons of mixed solid and liquid human excrement.

The quantity applied per acre.

55. The night-soil was applied between the 23rd June and the 9th July. There was hardly any noticeable smell when the night-soil was covered with the necessary quantity of soil and in a day or two there was nothing offensive or unsanitary.

No unsanitary conditions.

56. On the 29th of July, Jowtlri for a fodder crop was broadcasted by hand in the furrow behind a plough and covered by the soil moved in making the next furrow. The night-soil layer could be distinguished by its characteristic slate colour, the colour of poudrette. There was absolutely no taint or odour on its exposure at the surface. It had been buried 3 to 4 weeks. The experiment did not get a full and fair trial because *(a)* the land was secured by the Cantonment Committee too late in the season to get the full benefit of the rains ; *(b)* the land was of light character and was unsuitable for growing any crop in the fair season without irrigation, and no water for irrigation was available; and *(c)* the season was unfavourable, the rains came late, and there were long breaks of dry weather most trying for all crops on light laud and particularly so for a crop forced by a heavy dressing of manure.

The field of experiment fatou^Se· ^ SeaSon Un"

57. The crop throve vigorously as long as there was sufficient moisture in the soil and with timely showers would have been very beavyj but it withered as it matured. It yielded 1,133 bundles per acre of fair fodder worth about Rs. 45. Rain came immediately after the crop was harvested. A second crop from the previous crops' stubble grew, but was comparatively light

Outturn results.

53. The practical utility of the system on good soil in the Poona district for ordinary dry crop cultivation is doubtful, because poudrette is saleable at a very high rate and moreover is more Portable than night-soil and more easily applied as manure. In* the Poona district the system might be economically applied for the cultivation of sugarcane and other valuable garden crops where irrigation facilities exist. Cultivators of sugarcane do not. hesitate to tise Rs. 200 "to Rs. 250 worth of manure per acre, which is mostly poudrette carted from Poona. Unquestionably if the shallow-bed system of disposal be carried out unsanitary conditions are minimized. All the same, few people would like to see the system adopted in^the vicinity of a populous centre, certainly not within a radiu3 of three miles, and the cartage of night-soil that distance in various directions, even at night, would be seriously objected to by the public.

The practical utility of the syste· distri· S· 4011 ^Ul iU ^ ?00Da

IMPLEMENTS AND MACHINERY.

59. *Ploughs.—I* went to Adoni, Madras Presidency, specially to see a trial of "turn-furrow ploughs on black cotton soil. Two agents of rival firms showed the advantages of their respective implements.

60. The Swedish turn-furrow plough specially strengthened was tried for the deep ploughing of black cotton soil set and fissured jn the *fa[Y* season. Ploughs made by Messrs. Massey and c o. of jyja(}ras were also tried. There is no need said is that they did good work over the greater portion of a field ; but part of the work was scamped in a manner which I will particularize further on. The indigenous plough of this part of India did most inferior work when tried against the turn-furrow ploughs, the game number of pair (six small pair) of bullocks ein« ^d f^ ^^ ^ indigenous plough IS by no ,means an effective implement ° It is in penetrating power and otherwise greatly

A trial of Swedish and Indian made ironTurn-farrow Ploughs a t Adoni, Madras.

^ ^^ ^ ^^ OpitioaUy- A H thafc need be

The indigenous Plough as seen at Adoni an inferior implement.

inferior to the heavy indigenous plough of the Deccan, and this is probably the reason why so many iron ploughs have been sold in Madras to *bond fide* cultivators. I bought a Swedish plough which I thought was doing better work than the others, and have tried it on the medium black soil of the Poona farm and on the deep black soil of the Surat farm. On the Poona farm it did fair work. On the Surat farm, 4 pair of powerful Gujarát bullocks were unable to draw it for any length of time. I brought a ploughman from Poona who was quite experienced at the work, and it was impossible that he or any other man could have continued to work a full day, it being almost impossible to hold the plough steadily in the soil. The field on which the trial was made had been lightly ploughed two or three times. The surface was loose, but the under-layer was hard set, but no harder set than the land I saw ploughed in Madras. I concluded that the black soil of Surat differs in some way from that in Madras. Certainly the former becomes so hardened in the fair season that no turn-furrow plough will do good work, and if it did, so little is done in a day that the work can be done better and cheaper by hand. In proof of this I had overgrown head-lands and other rough ground dug by hand by contract at about Rs. 25 per acre. The soil had set hard and a plough yoked with six pair of bullocks could not have ploughed \ acre per day. The labourers could with ahard pick turn up huge clods. They could do the work best and cheapest when the soil had set, because it requires much less power (the pick being used as a lever) to turn up a huge clod than to dig the same volume of loose soil. The work is facilitated because the cracks allow entrance to the pick without labour.

The Swedish Plough does not work so well on the black soil of Bombay as in the black soil of Madras.

The Swedish or any other turn-furrow plough does good work when the soil is moderately loist, and with a pair of good bullocks half an acre can then be done in a day. A Deccan wooden plough can however be used sooner after rain and does as much work, perhaps it does not do as effective work, still it does very good work.

61. The great objection to the Swedish plough is that the ploughman cannot begin at one side of a field and make furrow after furrow until he finishes at the other side. With a native plough the furrow is not necessarily straight. The ploughman purposely continues it in a curve along the head-lands at each journey of the plough across the field. The head-lands (except the corners which are best dug by hand) are ploughed without any cross ploughing and with the least possible loss of time. Moreover the bullocks turn easier. With the Swedish plough the field has to be ploughed in sections or lands. In the dry season 3 or 4 pair of bullocks at least are required and two head-lands of considerable breadth must be left to allow the cattle room to turn. Plough cattle in the Deccan are trained to always turn away from the ploughed ground, and as they have to turn with a turn-furrow plough some of the in one direction, sometimes in another, they get almost unmanageable at ends unless old and very steady. A lot of time is wasted at the ends in turning the plough along the head-lands whilst not actually doing work. The head-lands are at the best of irregular width, and when ploughed the work is almost certain to be badly done. As each land is finished a good deal of work is required because as the unploughed ground between two adjacent lands gets narrower the cattle must walk over the rough surface of the ploughed ground and then they are unable to pull straight or to advantage. It may be argued that all these objections do not apply to work done during the rains or on moist easily worked soil. Even if this were so, what is the good of an implement that only works well at one season ? It is most important to have an implement that will work well in the fair season, because it is most advantageous that black soil should be turned up into huge clods for exposure to the sun.

The disadvantages of a Swedish Plough when compared with a good indigenous Plough.

It is of great advantage to have a plough black soil in the fair season.

The price of the Swedish plough.

The Swedish plough costs in Madras from Rs. 50 to 75, according to size and strength.

The extent of work done by a Swedish, a Turn-wrist, and a Deccan Plough compared.

In a comparative trial in the fair season at Poona, it ploughed seven-ninths of the area respectively covered by the turn-wrist plough and a heavy Deccan plough. The Deccan plough required an extra pair of bullocks. The soil was medium black and fairly set*

62. *Ransom^s Turn-wrist Plough.*—This plough, in my opinion, is better suited to the conditions of Indian agriculture than any *QfaQj.* turn-furrow plough which I have seen or tried. It is of undoubted strength and durability. It does capital work on any kind of soil, which in respecPof moistness is in good condition for ploughing. It can be used with as good effect as the best indigenous plough on black soil which has become hard and fissured in the dry season. If the late rains fall in October-November, it will work up to the end of February, but not later except in fields which have been under irrigation. The draft is less than that required for a heavy Deccan plough. Four pair of bullocks in a turn-wrist plough will do equal work with six pair of bullocks in a Deccan plough in deep cotton soil. In each case huge clods are turned up. But only about one-fourth acre is done in a day. This year the turn-wrist plough yoked with two pair of bullocks ploughed the sugarcane experimental field at Mánjri soon after the crop was harvested. Such land although moist is very difficult to plough ov/ing to the root stocks of the sugarcane having a firm hold of the ground. The plough did the work as effectively and as expeditiously as a native plough with five pair of bullocks. Each implement is capable ofpdoing good work. The draft of the turn-wrist plough is much lessened by the combined action of the coulter and share cutting through and dislodging the tough root stocks. The mould board completes the dislodgment. In sugarcane cultivation, a saving in bullock-power is of great importance, because the crop is a \\\ or 12 months' crop, and the field should be ready for re-plantation as soon as possible after harvest, because the crop can only be seasonably planted in January, February or March.

A good plough.

63. The chief advantage which the turn-wrist plough has over any other turn-furrow plough is that it ploughs the field in precisely the same manner as a native plough. The mould board and share by an ingenious arrangement can easily and quickly be adjusted on one side of the plough as it goes in one direction and on the other side as it returns. Therefore the opening furrow is made along one side of the field, and furrow alongside furrow is turned until the whole field (inclusive of the head-lands but excepting the corners) is ploughed* At each forward and backward journey of the plough one of each pair of bullocks walks alternately on the rough ploughed ground and on the smooth unploughed ground, and the bullocks do not get foot-sore to the same extent as if yoked to an ordinary turn-furrow plough, in which case the same bullock or bullocks would continue walking on the rough ground all day, unless the ploughman took the trouble to unyoke and give the bullocks turn and turn-about on the rough ground.

The special advantages of the Turn-wrist Plough.

64. The turn-wrist plough is made of three sizes, the cheapest being, at current rate of exchange, worth about Us. 45 in England.

Cost.

65. It is not likely that it or any other turn-furrow plough will be taken up by the cultivators in the Deccan except for sugarcane cultivation, the reason being that the indigenous by no means the ineffective implement it is sometimes called. It might with every advantage be introduced to many other parts of India.

Not likely to be adopted by cultivators except under special circumstances.

66. *Centrifugal Sugar Refiner.—We* were unable to give this machine a full trial tbis Year. It was received when a considerable portion of the sugarcane crop was harvested. It was found to require repairs be|ore it worked satisfactorily, being an old machine.

Not yet fairly tried.

67. It separates the treacle from the crystalline sugar by centrifugal force. A drum revolves at a high speed inside an outer shell. The speed is sufficient to throw the sugar and molasses against the perforated sides of the drum. The treacle is forced through the minute perforations and the sugar remains. By sprinkling with water the sugar can be further purified, the last of the treacle being thus conveyed away. The treacle drains to the bottom of the shell and flows through a hole and may be collected in a vessel set under the machine. When the sugar

The manner in which it works*

is seen to be of a clear white colour, the machine should be stopped, the sugar removed, and the machine re-charged. It takes about five minutes to separate the treacle thoroughly from the sugar. The best results were got when the sugar layer against the sides of the drum was %" to £" thick. When a larger charge of semi-liquid Gul than what represented thfl thickness of sugar was put on the drum, the sugar could not, without much extra work, be quite freed from treacle by washing ; and if more water than is necessary is sprinkled into the drum, it dissolves part of the crystalline sugar and carries it as well as the treacle away through the perforations. Our trials were not complete enough to determine at what stage the boiling of the sugar-w£ñ ^ t S V e s ^ 2£ ?r 3™» should stop in order to give the best results; yet to be determined. It was clear that the boiling should not continue <** long as is necessary to produce solid Gul (crude sugar)* It must stop at an earlier stags, and the proper stage has yet to be determined.

It was made quite clear that Gul as generally prepared is not a very clean is S a"leTp'r'aoLr^acle, product. The solid impurities do not escape with the treacle, but remain in the sugar and are much easier seen in the white sugar than in the *gul.* It is perhaps impossible to prevent impurities entering the boiling pan during the boiling process under the present system, because the pans are large and open, and when wind is blowing in a certain direction, particles of fuel and smoke are carried directly over the pan. The skimming during boiling is supposed to remove impurities, and does so most effectively if a mucilaginous extract from the *bhendi* (Hibiscus esculentus) plant is mixed with the juice when boiling begins or at a later stage. It would no doubt be advantageous to pass the juice through a sieve or strainer as it is poured into the pan. These points will receive attention when further trials are made.

The percentage of sugar was too small to pay.

68. So far as our trials have gone, we have not been able to get sugar in paying quantity. From a given weight of semi-solid Gul we only got 25 per cent of white sugar, The treacle by re-boiling can be made into good solid Gul, which proves that a *good* deal of the crystallizable sugar escaped with the treacle, If 50 per cent of white sugar could be got; the use of the machine (with Gul at its present rate) would be distinctly advantageous. Fine crystalline Mauritius sugar commands the same price only as sugar very inferior in quality, butpuri- fied in the native way. Imported sugar is objected to by strict Hindus because animal charcoal may possibly have been used to purify it.

Imported sugar objected to by strict Hindus.

Figures to show that the centrifugal machine may or may not prove useful.

69. The following figures would show the advantage of the centrifugal sugar refiner if it produced 50 per cent white sugar :—

240 lbs. Gul is worth now Rs. 12 and may be worth Rs. 15 later in the season.	
120 lbs. of refined sugar is worth	Rs. 12-8
120 lbs. of treacle if re-boiled and converted into Gul is worth	3-8
Total	Rs. 16-0
Deduct cost of making sugar, cost of one sack, and cost of re-boiling treacle	Re. 1
Balance	Rs. 15

There would thus be an advantage of three rupees per *palla* if Gul gets no dearer than its present rate ol Rs. 12 per *palla (i. e.* 240 lbs.).

70. If we get no better results than we have got so far, the centrifuge machine would be worked at a loss as shown by the following figures :—

240 lbs. Gul worth	Rs, ig 0
60 lbs. sugar worth	Rs. g 4
180 lbs. treacle worth	„ 5 4
Total	Rs. 11 8
Deduct cost of manufacture &c.	Re. 1 0
Balance	Rs. 10 8

There would thus be a loss of Re. 1-8 per *palla* of 240 lbs.

71. The native method of refining sugar is a very filthy process, but it answers financially, because 50 per cent of crystallized TM%f * sported to be obtained. The jagri in a semi-solid state is placed in large bamboo baskets about 7 feet in diameter and 3J or 4 feet high. The baskets are supported 3 or 4 inches from the floor. The treacle drains away through the wicker work and collects in a reservoir or pit placed so that the treacle of several baskets may collect there. The treacle is sold at 7 or 8 rupees per 240 lbs. for the manufacture of country spirit. A superlayer of purified sugar of about one inch in thickness is scraped off daily from the contents of each basket. The sugar is placed on a cloth, exposed to the sun, and trampled under the feet of coolies until it is reduced to a dry and granular condition. The coolies take short steps and give a twisting action to their feet. The trampling is necessary, because the presence of small §plid yellow lumps reduces the market price of the sugar. A moist layer of *sheva'l,* a weed or moss which grows in streams, is spread over the jagri in the baskets and has the effect of clearing the surface sugar of treacle. The moss layer should be renewed every two or three days. It takes a month or more before all. the treacle from one basket drains away, and the sugar got from the basket towards the end of the process is not so good as that taken out previously.

The native method of refining sugar a dirty process.

POONA FARM ACCOUNTS.

72. The farm accounts have been kept distinct from the dairy and dairy herd accounts. Two balance sheets are appended showing the financial results of each. The farm balance sheet shows that the net cost to Government has fallen from Us. 1,484-8-11 last year to Rs. 611-12-8 this year.

DAIRY AND DAIRY HERD.

73. The financial results are shown in the appended balance sheet. The profit for the year is Rs. 266-11-6 as against Rs. 2,254-13-2 last year.

74. The reason why. the margin of profit is so small is due to a very serious outbreak of rinderpest during the year. If reference is made to Appendix V. it will be seen that 54 cattle died during the year ; of these one cow (our best Aden) was poisoned (intentionally I believe), one cow died from inflammation of the lungs, and a few calves were lost, as they ordinarily will be. There were 34 deaths due directly to rinderpest, and some calves which recovered from the disease died from after-effects. They never recovered their strength though well cared for. The indirect loss due to diminished milk yield in the healthy Cattle was probably more than that from death. The disease first broke ou£ amOngst unweaned calves,and these had necessarily to be separated from their dams. .The maternal instincts of Indian cattle are very strong, and the effect of separation from the calves upon the milk yield, especially of the buffaloes, was remarkable. The cattle were in full milk at the time, the whole herd giving about 700 lbs. daily. A week after the rinderpest appeared the daily yield was about 450 lbs., representing a daily loss of 18 rupees. It seems*to be practically impossible to wean calves at birth from Indian milk cattle unless done when the heifer has her first calf, but the above results point to the necessity of doing so if possible. The carcasses^of the cattle that died were all burnt. This with medicines cost Rs. 266.

Rinderpest.

The effect of separating calves from their dat.

The number of deaths was about 70 per cent of affected cases. It is significant that indigenous breeds escaped contagion to a far greater extent than exotic breeds. An English cow and calf belonging to His Excellency the late Governor were about the first to succumb. Two Bahrein cows of a noted milk-breed which I had bought at considerable expense from the head of the Persian Gulf, f th hd f th P i died within thirty hours of the first symptoms. Every Aden which came in contact with contagion became infected and died. We lost one Sind cow, but no Gir

The death-rate.

Exotic cattle more susceptible to indigenous aglon ^ tbe °

cattle,.and only, two buffalo-cows, though a number became infected, but only in a mild manner. Young buffalo and cow-calves died very quickly* Cows advanced in pregnancy were hopeless cases. Symptoms of abortion became apparent and inversion of the uterus Resulted in every case. We had a *post-mortem* examination on one of these cases, and the foetus was found to have characteristic rinderpest symptoms.

Cows advanced m pregnancy died very quickly

As far as I could judge, careful veterinary treatment did very little good* The most effective medicine was carbolic acid given in careful nursing. it* influence being a healing one on the highly inflamed membranes of the intestines. I believe tno cure of cases to have been chiefly due to careful nursing and to drenching the animals with good gruel. The gruel consisted of linseed boiled with rice, fresh separated milk, and water.

careful nursing.

75. We got rid of the disease by segregation. The apparently healthy animals were moved at once.from the farm building* Here disease made its appearance in about seven or eight days, that period being I think the period of incubation.

The importance of segregation.

The healthy cattle were moved a second time to another grass *kit ran* about a mile distant, and here they were kept for about three months. Meantime the byres were re-floored and the whole surroundings disinfected—crude carbolic acid being used on floors, drains, and manure heap, tar for wood work, and white-washing for walls.

76. The disease was disastrous at the farm, but I can conceive that it was far more so in the city of Poona and the surrounding villages where it was rife. Under existing conditions the spread of contagion is not only absolutely uncontrolled but is encouraged. The Mhdrs eat the flesh of animals that die and they sell the diseased skins in any market where they can get a good price. The carcass is generally cut up on the bank of a *ndla* or stream and the offal is left there. It is a centre of contagion for every healthy animal that grazes in the vicinity, and it is common knowledge that when outbreaks of rinderpest occur they usually spread along the course of streams or rivers. These are points affecting the unhealthiness of the cattle of the country. But there is another question, *vi?*-> that which affects the public health. It is absolutely certain that milk from cattle suffering from rinderpest was sold in Poona to the public during the prevalence of the disease. There is some consolation in the fact that as regards buffalo's milk, the public have some protection, inasmuch as a butralo, unless in milk, will not give any. cow, when infected with rinderpest or ailing in other ways, almost always refuses to give any.

The danger to the public health by the sale of milk from diseased cattle.

77. The dairy produce from about seventy milch cattle was sold for Rs. 15,303, cattle food, fodder, and *Stock* Rs. 10,968. There was a stock of fodder on hand at the end of the year worth Rs. 1,507. If the herd keeps healthy there will be no difficulty in every year in making the dairy a profitable institution. The price of dairy produce supplied to the Commissariat Department for sick soldiers in hospitals is lower than the rates charged to the public. The latter rates are fixed purposely higher than the rates of private dairymen in Poona. Yet we could sell to private families to a much greater extent than is done now if there was available supply, which there is not.

There will be no difficulty in making the dairy a profitable institution.

The farm dairy may interfere with the trade of private dairymen, but only because we supply purer and cleaner milk and better than they can do, and the public do not hesitate to pay higher price for the superior article. This should stimulate native enterprize to supply what is required, but in many cases I am afraid it does not.

The farm dairy may interfere with the trade of private enterprize.

I am afraid it does not.

The City of Bombay is at present the great centra of butter^makin^ for India and also for export. It is almost impossible to make good butter in India without using ice except in the cold weather. Ice in Bombay is not dear. But it is not used by many dairymen, consequently the budter is churned so soft that it cannot be worked on the butter-worker and therefore contains butter-milk, which will soon cause rancidity. If sold for immediate consumption, there is no great harm done excepting that the butter contains water and other impurity to a far greater extent than it ought to do. This adds to the weight, naturally to the satisfaction of the dairyman. The same butter if salted and packed in tins for export or for the use of district officers will certainly not keep good long.

75. It is extremely satisfactory to note that the initiative example of the Agricultural Department started the dairy enterprize in Bombay but it is unsatisfactory to know that the enterprize although it has assumed enormous proportions (about 3 lakhs rupees worth of dairy apparatus haying been sold) will inevitably come to grief unless many of those employed in it will mend their ways. The use of improved dairy machinery has made it possible to make butter in Bombay and elsewhere from cream separated in remote districts where milk is cheap; but the manner in which the cream is transported and the usual filthy condition of the vessels (there may be exceptions) leaves a great deal to be desired. In connection with our own operations the cleaning of milk vessels requires persistent supervision.

rr, iJt^TZ°JZ^i^3 satisfactory.

79. The Manjri stock farm is an adjunct of the Poona farm which will prove healthy up-bringing of our young stpck: We have now fair scope and good opportunities to prove whether the milk-breeds of India can be bred up to a better standard than the present one which is in respect of selected cattle (especially buffaloes) by no means low.

The advantage of the Manjri Stock Farm.

Breeding for milk does not necessarily mean that the male offspring of our best milk-cows will not be good plough cattle. On the contrary, we expect to be able not only to breed good plough cattle, but heifers which when they come into profit will be better milkers than their dams.

80. I have no hope that the bulls, the produce of our best milch cows, will be good for stud or cattle. I would object to see them used for this purpose, because I believe the small indigenous hardy Deccan breed is the outcome of natural conditions. The greater portion of the Deccan is silbject to famine and often to periods of scarcity, and there is no hope that a larger and softer breed would survive these trying seasons unless the fodder and food supply is improved, and how that can be done to any great extent is difficult to conjecture. I see no practical method of improving the Deccan breed (which is notoriously inferior as plough cattl^) except by using only the best indigenous bulls.

The disposal of young bulls for stud purposes.

81. Gaolis (professional milk-men) are keen to buy our young bulls. They like the Gir bulls best, but do not object to the Sindis. The Aldens they consider too small. The Gaoli likes the Gir bulls best because they are big enough to take a good load in a single cart, the cart being used to carry the milk to the sweetmeat-makers in the bazar or elsewhere and carry back the concentrated food required for the cattle. These bulls are also used for stud, chiefly on Gir cows brought, because they are good milkers, from Kathia war. The calves of these cows are well cared for, because the owner knows that a heifer will grow iato a good milk cow and a good bull will in time be worth Rs. 75 to 100. The effect of the sire is just as potent as that of the dam in breeding for milk, and for this reason I think the sale of young bulls from our best milk cows to professional milk-men must do good. I sold a Sind bull to each of two dairy farmers at Ahmadnagar and a Gir bull to one of them. I also sold a farm-bred Gir bull for the use of the dairy herd of the Central Jail, Jabalpore, and four were sold to Poona milk-men. These were all that were ready for sale.

82. I could not in the report refer, except at considerable length, to experience gained about dairy cattle. It is unnecessary for me to do so as I have written for the Agricultural Ledger Series a full note on the management of

aairy cattleand young stock in India and another on milk and milk products, these publications are printed and will soon be circulated or can be had on application.

Tlie milk-yield of tlie Dairy Herd.

83. i submit below two tabulated statements which give details of the milk-yield of buffaloes and cows during the year :—

Cows.

No.	Names.	Breed.	Date of Calving.	Number of days in Milk.	Maximum yield.	Average yield.	Total yield.	Date of birth of next calf or due to calve.
					Lbs, oz#	Lbs. oz„	Lbs. oz.	
1	Amini	Sind ...	36th May 3893 ...	431	39 8	9 14	4,249 4	H thAug. 1894.
2	Káveri	Bo. ...	25th Dec. 1893 ...	446	33 12	8 9	3,834 0	23rd June 1^95.
3	Sdbarmati ...	Bo. ...	16th Jan. 1894 ...	359	36 8	11 30	4,tf9 0	34th Jan. 1895.
4	Kousdli	Bo. ...	6th May 3893 ...	442	22 4	32 11	5,607 12	8th Aug. 3894.
5	Devri	Bo, ...	23st „ 3893 ...	420	39 J2	11 2	4,705 4	3rd „ 1894.
6	Rakhmi	Bo. ...	26th „ 3893 ...	424	34 8	8 13	3,732 8	30th Oct. 3894.
7	Jdnki	Bo. ...	38th „ 1893 ...	406	37 12	8 9	3,481 4	21st July 1894.
8	Krishni	Do. ...	13th Dec. 3893 ...	337	12 8	7 6	2,492 6	3rd Feb. 3895.
9	ándi	Bo. ...	14th May 3 893 ...	410	21 0	9 3	3,757 0	34th Aug. 3894.
10	Gowlan	Gir. ...	36th Feb. 1894...	375	22 8	30 3	3,819 0	34th April 1895.
11	árja	Bo. ...	5th Dec. 1893 ...	235	20 0	13 3	2,830 0	Died on 9th July 3894.
12	Lakshmi	Bo. ...	3st March 3894...	293	15 8	5 1	3,474 4	10th Dec. 3895.
13	Thaki	Bo. ...	22nd Feb. 1894 ...	281	14 8	6 14	3,936 12	13th July 3895.
14	Nárali	Bo. ...	8th Jan. 3894 ...	240	35 0	9 8	2,273 32	30th Dec. ie94.
15	Sitt #	Bo. ...	18th Sep. 1893 ...	308	36 12	9 6	2,878 4	26th Oct. 1894.
16	Jamni	Aden ...	12th July 1893 ...	344	16 32	12 3	4,385 8	7th Aug. 1894.
17	Damayanti ...	Bo. ...	2nd June 1893 ...	380	12 4	6 3	2,366 8	27th Oct. 1894.
18	Bhági	Bo. ...	22nd Nov. 3893...	239	7 0	4 10	3,039 32	32th Oct. 1894.
19	Mori	Cross ...	9th Dec, 3893 ...	414	10 0	5 15	2,480 12	Died on 23rd December 1894.
20	I Tári	Bo. ...	19th July 3893...	341	16 4	8 4	2,814 6	Do. do.
21	j Chandrával ...	Half Aden .	38th Aug. 1893...	307	11 8	6 13	1,792 8	29th July 3894.

Buffaloes.

No.	Names,	Breed,	Date of living.	Number of days in Milk,	Maximum yield.	Average yield.	Total yield.	Date of birth of next calf or due to calve.
					Lbs, oz.	Lbs. oz,	Lbs, 02.	
I	Champa	Jáfarabad...	28th May 3893 ...	446	23 0	15 32	7,011 0	24th Aug. 1894.
2	Thami	Do, ...	1st Sep, 1893 ...	30S	19 8	9 14	3,039 8	25th Nov. 1894,
3	Ra	Delhi ...	12th April 1S93...	431	27 0	36 4	7,00S 32	J9th Sept. 3894.
4	Bhori	Surat ...	20th Oet, 1893 ...	506	21 4	11 8	5,84* 12	34th Sept 1*95.
5	Lálj	Do. ...	18th Jan. 3894 ..	370	39 8	33 7	4,960 32	6th Feb. 1895.
6	Th^ki	Do, ...	Uth Feb. 189i ...	411	38 8	12 12	5,232 8	16th Oct. 18«5.
7	Tupha	Do, ...	30th Oct. 1893 ...	292	34 4	9 9	2,787 32	16th Nov. 1*9*.
8	Tikkal	Do, ...	18th July 1*93 ...	463	35 4	30 4	4,738 12	34th Dec. 1894,
9	Kapili	Do, ...	12th Sep, 1893 ...	489	32 32	30 11	5,221 12	9th Nov. 1S9&,
30	Kamali	Do. ...	16th Dec. 1893...	319	32 0	9 4	2,947 8	27th Aug. 3890.
13	MahiUb	Do. ..	24th Sep 1893 ...	2*8	34 8	5 10	3,621 4	2nd Oct. 3894.
32	Asmdn	Do. ...	20th Nov 1892 ...	585	33 8	8 11	5,086 0	6th Aug. 1894,
13	Anandi	Do. ...	28th Sep. 1893 ...	451	12 8	7 3	3,241 0	28th Sept 3894.
14	Chakkar	Do, ...	6th May 3893 ...	353	27 8	34 33	5,222 8	13th May 3894.
35	Rupa	Do. ..	15th Dec. 1892 ...	688	29 0	9 5	5,488 0	... ..
36	Khandi	Do, ...	20th Jan. 1893 ...	487	24 8	11 11	5,6*1 12	6th Nov."l894,
17	Mukhran	Do, ...	15th Jan, 1893 ...	493	33 8	7 34	3,876 0	21st Feb. 1895.
38	Lahiri	Deccan ...	3rd Nov. IS93 ...	416	37 4	11 14	4,940 32	30th Nov. 1895.
39	Divdli	Do. ...	6th March 1894...	326	38 4	32 7	4,046 8	36th Jan. 3896,
20	Zendi	Do. ...	1st Dec. 3893 ...	324	30 12	7 8	2,428 4	33th Jan. 1895.
21	Mirga	Grogs ...	15th Dec. 3893 ...	376	38 8	J2 7	4,059 32	5th March 3890.
22	Hira	Do. ...	35th Feb. 1S94 ...	258	14 4	9 3	2,367 32	6th August 1895.
23	Dashrath	Do, ...	7th Jan, 3893 ...	659	16 0	9 4	6,305 0	22nd Feb. 1895.

No. 6.giving 3 lbs. 4 ozs. of milk on Is* April 1895f

84. The average nnmber of days between two calvings were as under :—

Jáfarabadi bdffaloes	M,	4*1
£Urat	»	599
Deccani	;;	61_5
Cross-bred	„	461
Delhi	„	525
Gir cows		467
Aden cows		409
Cross-bred Aden cows		345
Sind cows		454

85. Below I give the average number of pounds of buffalo's milk required to make a pound of butter during each month in the year. It will be noticed that a less quantity of milk is required to produce a pound of butter in the hot season when green fodder it scant than during the rains when it is more plentiful :—

Months,	Milk in lbs.
April	11·3
May	10·9
June	11·3
July	12·0
August	11·4
September	12·7
October	11·6
November	11·2
December	11·7
January	10·7
February	10·5
March	11·1

SHEEP.

86. We have crossed a small flock of Deccani ewes with a Dumba ram with very satisfactory results. We are gradually increasing the flock to give full work to a capable shepherd. The Dumba-Deccani cross-bred is a remarkably good mutton-sheep with a good coat of wool. I do not intend to use the Dumba beyond the first generation. The cross itself is good enough to go on with. We kept two of the best ram lambs for stud and sold all the others (nine) to one of the Military Messes in Poona at Rs. 8 each, which was equivalent to about 4| annas per lb. of dressed carcass, the best mutton selling in the bazár at 6 lbs. per rupee. Good young Deccan ewes can be bought at Rs. 3. or Rs. 3-8-0 each.

ESTABLISHMENT.

87. Mr. Kelkar, my Assistant, has as hitherto taken keen and active interest in his work and is a capable farm manager. My clerk, Mr. Kitnetkar, and the Farm clerk, Mr. Kulkarni, have both done well. Their time is only partly occupied with office work. Both get full opportunities of gaining practical knowledge, and the former helped me well during the harvesting of the experimental sugarcane, in dealing with weighments and the recording of results. Mr. Kdshinath, the overseer at Mdjijri, has done good work both in looking after the young cattle and in attending to the cultivation operations in our experimental sugarcane.

I have the honour to be,
Sir,
Your most obedient Servant,

J. W. MOLLISON,
Superintendent of Farms,
Bombay.

APPENDIX I.

A DETAILED NOTE ON THE SPECIAL SUGARCANE EXPERIMENTS AT MANJRI.

Area selected for experiments most suitable.

The series of sugarcane experiments begun in 1894 have, in their first year, given results which are of special interest and value. The results are fairly concordant with expectations, and I am quite satisfied that the area selected for experiment has been well chosen. This is of special importance, because it is in the centre of a large area almost exclusively cultivated with cane. The cultivators of the district are well-to-do and skilful, and have evinced considerable interest in the results of last year, and I have no doubt in future years our experimental plots will attract a good deal of local attention.

Scheme of experiments to be extended.

2. Government have sanctioned the purchase of the field, also of adjoining lands, to admit of the scope of the scheme being extended. Thus the experimental area can be permanently occupied or at least until definite issues are obtained.

Arrangement of plots.

3. There are thirty plots on the present experimental area which are permanently marked and numbered. Next year the additional area to be acquired will be laid out, so that there will be about forty plots in all. There are vacant places between plots five feet in width. These with the roadways necessary for easy access to each series take up a good deal of ground—about one-fifth of the whole area. The spaces between plots undergo practically the same tillage as the plots, excepting that the former receive no manure, but are more frequently weeded than the latter.

Necessity of binding up the canes in lodged field.

4. In a field entirely planted with cane, it is usual to find the canes on the head-lands leaning over towards the borders of the field, whilst the canes throughout the main portion of the field maintain an upright position, because standing thick on the ground they support each other. Heavy rain or high wind may lodge an exceptionally good crop. On our best plots the cane was to a considerable extent lodged by heavy rain and high wind, chiefly because the wind and rain had greater effect on account of the vacant spaces between plots. The practical lesson learned is that the crop on each plot must in future years, when half-grown, be tied up, *i. e.* four to six canes will be bound loosely but seeurely together, about four feet from the ground, by a twisted band of dried leaves stripped from the cane. This practice prevails to a considerable extent in Gujarat, and in respect of our experimental cultivation, becomes absolutely necessary, because it is known by cultivators that upright cane contains a higher percentage of sugar than lodged cane, and this fact has been corroborated by Dr. Leather's tests *(vide* page 41).

The greater percentage of sugar in upright than in lodged canes.

Tillage operations costly in the first year.

5. The field owing to a fortuitous circumstance had not been cultivated for some years. The cost of bringing waste land into proper tilth for sugarcane is heavy. The tillage operations of the first year have cost much more than they will in future years, and are much in excess of what they ordinarily would be. It may be accepted that the tillage of the plots and the spaces which divide them must cost per acre always considerably more than a field under ordinary cultivation.

Differences in treatment of plots shown in tabulated statements of results.

6. In the comparative manure series, the per acre cost of manures applied to the different plots varies considerably. Again, in other comparative plots, there are differences in cost of cultivation due to intentional differences in treatment. The prices at which different manures can be bought depend upon supply and demand and may

vary considerably from year to year. In the tabulated statements of results the differences in the cost of cultivation due to the varying prices of the manures applied or to other intentional differences of treatment are shown.

First series.

7. *Object,*—To test the value of trashing, wrapping, and tying up cane as practised at Bassein and elsewhere with the ordinary roona method of cultivation; also to test the comparative value of American sugar sorghums.

Trashing, wrapping, and tying up cane.

8. The American sorghum has failed to prove itself a useful sugar crop. The failure cannot be attributed to want of acclimatization because the crop under experiment was the fourth generation from imported seed. The variety tested is reported to yield, in America, from the nearly mature stalks 15 per cent of sugar. Here it only gave 8-29 per cent of treacle, from which only a small percentage of sugar crystallized out. The treacle was not saleable except at a very low rate, and was used to sweeten the concentrated food of our dairy cattle. It was worth a fair price for this purpose, and the cattle relished the sweetened food. It was intended to grow two sorghum crops [illegible] rain and a cold weather irrigated crop. The former grew well, whilst the latter failed completely though sown twice. The young seedlings died soon after germination. The failure was due, I think, to the wide different between the [illegible] temperature. If the rain crop had been saved for fodder, the [illegible] would have been worth much more than the molasses. The cost of removing the stalks for [illegible] much more per acre than in the case of cane, because a [illegible] of sorghum to one of cane; the stage of growth when the stalks yield the most sugar, and I regret to report that the American sorghum compete with sugar-cane in the Poona district, and it is doubtful if it can anywhere in India be profitably for sugar. On the other hand, this crop is exotic; sorghum ranks as a fodder crop one of the most that can be grown in the Deccan. The results from the sorghum rain crop are given below :

The American sugar sorghum comparatively a failure as a sugar crop.

		per Acre. Lbs.
	1st Series, Plot 1, 1 Acre.	
Weight of crop...	... ...	32,195
Do.	stajks with tops and side leaves removed ...	22,820
Do.	tops and side leaves, useful as fodder	9,375
Do.	juice per acre	16,612
Do.	treacle	1,892
Percentage of treacle to cane	... ...	8-29

Trashing, wrapping, and tying up not an economical practise in the Poona district,

The following tabulated figures give the results from cane cultivated in the ordinary manner and from cane trashed, wrapped, and tied up. Plots each one-fifth acre :—

Number of Plot.	Treatment of crop.	Weight of cane stripped and topped per Acre.	Weight of tops per Acre.	Weight of Gul per Acre.	Cost of special treatment per Acre.	Value of Gul per Acre.
		Lbs.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
2	Ordinary cultivation ...	95,270	12,280	12,070	Nil.	622 2 7
3	Cane trashed, wrapped, and tied up	94,065	12,215	11,845	45 0 0	610 8 9

Each plot was manured with 42 tons poudrette per acre. To all appearance the crops were perfectly even until the cane of Plot 3 was trashed, wrapped, and tied up. The effect was a decided check to the crop, the younger leaves becoming distinctly lighter in colour. I can give no satisfactory reason for this, excepting that the work was done at a later stage of growth than at Bassein (near Bombay), where the practice prevails. The reason why the work was done late was that cane at Bassein is planted two months later than at Poona; whilst the trashing, wrapping, &c, must be deferred at either place until the rains cease. 1 brought an expert at the work specially from Bassein, in order that our own labourers might see the work properly done

Wrapping, &c., not likely to prove economical in isolated fields.

The practice might be proved advantageous in the case of isolated fields, because the tying undoubtedly prevents a heavy crop from being lodged by wind or rain, whilst the wrapping protects the cane to a considerable extent from destruction by rats, jackals, and pigs, especially the two latter. The cultivation of cane in the neighbourhood of our experimental field is so extensive, that the damage done by the animal pests referred to above is comparatively trivial in any particular area, though

Reasons why wrapping did not pay at the Poona Farm.

extensive enough on the whole. For this reason the wrapping did not pay. It has been decided that this year's results in Series No. I. have given conclusive results, both as regards the American sorghum and the value of trashing, wrapping, and tying up. Therefore there is no object in continuing the experiments, and Plots 1, 2, and 3 have in this year been added to the comparative manure series in order to extend it.

SECOND SERIES.

Comparative Manure Experiments.

10. *Object.*—To test the comparative values of such manures as are within the reach and means of ordinary cultivators, and when the effects of the various manures tried have been clearly demonstrated, then to determine whether two or more of the manures used cannot be judiciously combined so as to secure economy without diminution of net profit.

11. The weight of manure applied to each plot to be regulated by the percentage of nitrogen it contains. Equivalent weights of nitrogen tcr be applied to each plot. The percentage of other elements of value will be known, and any marked difference between the crops of the various plots will no doubt be traced to the value of elements other than nitrogen. These differences will eventually regulate the manner in which two or more manures may be mixed with the object of reducing cost and getting equally good results.

Equivalent weights of nitrogen to be applied to comparative manure plots.

Count to be taken of other elements of nutrition.

12. In the year under report poudrette was taken as a basis, and of this manure 42 tons per acre were applied. Dr. Leather, the Agricultural Chemist to the Government of India, could not, owing to insufficient time, complete the analyses of the manures before they were applied. The plots necessarily had to be manured in February-March to admit of the cane being seasonably planted, and arrangements as to the renting of the land were only completed a short time previously.

Poudrette taken as a basis.

13. The quantity of manure applied to each plot was fixed in relation to the reputed percentage of nitrogen in each kind of manure, but subsequently Dr. Leather found that the reputed percentage of nitrogen varied very considerably from the actual in almost all the manures applied.

Reputed percentage of nitrogen in the manures used differed from the actual.

14. There is no definite relationship between the value of the manures as determined by chemical analysis and their actual commercial value. The price of a manure should chiefly depend upon the percentages of nitrogen, and phosphoric acid and the condition in which these constituents exist. Organic matter present in a

No definite relationship between the cost of manures and their chemical composition.

high percentage, as in cattle dung, would of course add appreciably to the value

Cane cultivators in the Poona district fail to recog- °j; *]le manure. It is certain that the cane cultivators ot the Poona district, though they are much over

S5ŠZSZX£ S e S i! !Tfi; =T ? T

use· value of the manures they use. In sup

, n ,. . . . . 1 T 1 Por\. of this I note the fact that castor cake has doubled m price m the Poona district during the last three years; whilst poudrette (agunst the «^ no prejudice) has not risen appreciably m value. The chemical analysis of these manures would indicate that castor cake in comparison with poudrette is exceedingly dear. This fact becomes the more anomalous when it is known that poudrette is perhaps four times dearer at Poona than at any other populous centre of the Presidency. At Surat the town manure consisting largely of night-soil, is worth 8 to 12 annas per cart-load as compared with Us 3 at Poona. The Surat poudrette is not strictly comparable with that at Poona, because it is manufactured in a different manner; but at both places it is readily bought by Kunbis for the extensively irrigated crops of the neighbourhood, and at both places castor cake is also largely employed. The price of castor cake cannot differ to any great extent between districts because citors are widely cultivated and the cost of transporting the cake by mil a consider^ distance is not great. Poudrette is dear in Poona because of the keen demand for

JL * t iT r V ^ TV ^ cart-load and cart it

four to eight miles often make the dung of their cattle into fuel cakes to be sold in

*T!iJi5 inf r l S that .?tt fe d ^S ^ Poona is worth as fuel a better price

tiianasnwmre, the manure if well decayed being worth at best Bs. 4 per ton. Bones in the Poona district have trebled in value during the past threeyearl, otrin? entirely to the extrinsic circumstance that there is a keen demand for export.

15. There are several edible oil cakes now used for feeding cattle in India

Some of the edible oil cakes much cheaper per ton and contain a much higher percentage of nitrogen than the manure cakes.

an(1 lar gely exported which can be bought in Poona at a considerably cheaper rate per ton than the castor cake and TCuvnni IPnnr oivi;n i I \ i i. -^OIVPIV ~ ™ w T ^ S ami » glabra) cake now so extensively employed as manure. Dr. Leather's analysis proves that the edible cakes contain much higher percentages of nitrogen (the most valuable constituent of manures) than the manure cakes, and in our extended scheme of comparative manure experiments started in the current season, the value of the edible cakes as manure is being tested. I had no hesita-

A plea why edible cakes should be directly used as manure.

ticm in;ProP<*ing this trial, because these edible oil cakes are either exported and thus lost to the country or they are cluefly fed to milch cattle in lar°-e towns. I he ,« m , n n v> TI • T^ and li<luid excrement of these cattle is not used as manure. The urine drains away somehow, whilst the dung is sold (m Bombay, for instance, at 8 annas a cart-load) to be converted into cowdung cakes and burnt as mel.

16. The result of Dr. Leather's analysis of the manures applied last year and in the current season, considered in conjunction with the question of cost, necessitated a considerable alteration in the per acre quantities of manures

m, applied this year as compared with the last. We have

.4Sjrs£rsK ^t*?r»r» - • taS S the p« «» poudrette

ably modified for reasons given.

aPPlica™n of it and of all other manures in comparison with it, each contains 500 lbs. of nitrogen. This quantity is much more than is taken up by a very heavy cane crop, but is less than that contained in a full dressing of poudrette or cattle dung as given by the cultivators of the district On one plot of the comparative manure series we have applied a heavier dressing of poudrette equal to the heaviest application given by good cultivators. I think it may be accepted without any question that if an application of 500 lbs. of nitrogen per acre is found ample to produce a maximum crop, then the manures which are being tested must also contain sufficient of the other elements of nutrition. In any case the standard which has been adopted this year will be continued year by

The importance of noting the effects of elements other than nitrogen.

S ^ j J J6?^*6 **?« are Stained. Meantime it is certa P «»at the varying proportions of potash, phosphone acid, and organic matter in the manures used must have some influence on results. If this influence

is fully or partially disclosed, the value of the experiments will be much enhanced.

Comparative manure experiments with bones, dissolved bones, and saltpetre, modified for reasons given.

17. Last year plots for bones, dissolved hones, bones + saltpetre, and dissolved bones + saltpetre were included in the comparative manure series, and compared with the other manures, taking the reputed percentage of nitrogen as a basis of comparison. It was known, of course, that the amount of phosphates necessarily applied with the nitrogen would be much in excess of what the crop could require. It was believed that bones, dissolved bones, and saltpetre contained higher percentages of nitrogen than they were found to contain, but we did not clearly anticipate that the cost of the dressings would be prohibitive and much beyond the means of ordinary cultivators. Saltpetre is dear in Poona, and it has already been explained that bones are rapidly rising in value in Bombay; and although the manufacture of weak sulphuric acid is now a local enterprize, making the local manufacture of dissolved bones possible at a cheaper rate than with imported acid, yet it is not expected that bones or dissolved bones, either alone or in com-

Bones or dissolved bones, either alone or with saltpetre, not expected to be economical manures in the Poona district.

with for sugarcane m the Poona district. But the results of our tests may be useful to cultivators in other parts of India, especially in the North, where bones and crude saltpetre can be bought at moderate rates.

Top dressing an economical practice.

13. Our last year's tests, I think, proved the fact that nitrogen in immediately available condition (as it exists in saltpetre) is the most important element of nutrition for sugarcane. This I will endeavour to show clearly further on. Saltpetre is exceedingly soluble, and as sugarcane is heavily irrigated, a good deal of the saltpetre would probably be lost by drainage, unless it is applied in repeated light dressings, and it is being so applied this year and will be so applied in future years. Last year's experiments tended to show also that it was advisable to apply manures which are much less soluble than saltpetre partly before plantation and partly as a top dressing, and for this reason we have decided to apply all manures, in the comparative manure series, three-fifths before plantation in February-March and two-fifths in June-July.

19. The complete scheme as now arranged, which I tabulate below, will be better understood from the above explanations.

A.— *Comparative Hanure Ser'ies.*

Manures aj·plied for crop of 1S95-96.	Quantity per Acre.	Percentage of JSitro-	Nitrogen per Acre.	Price of Manure per Ton.	Cost of manuring per Acre.	Remarks.
	Tons.		Lbs.	Rs. a. p.	Rs. a. p.	
Poudrette	41·6	1'007	1,000	6 12 0	301 0 0	Cost of manure includes application and cartage 10 miles,
Do.	22-3	3-007	500	6 12 0	150 8 0	Do. do.
*Cattledung	25*1	0-89	500	6 6 0	160 0 0	Do. do.
*Farm-yard manure	29-0	0*77	500	6 6 0	184 14 0	Do. do.
Fish manure	2*9	7-60	500	65 1 7	188 12 0	Cost of manure includes application and freight from Thana, cartage 4 miles, and charge for reducing fish to powder under stone of chunam mill.
Castor cake	5-9	3*75	500	51 7 4	303 10 0	Cost includes cartage 8 miles, application, and charge for reducing cake to powder,
J-Karanj (Pongamia glahra) cake.	6·6	3-35	500	42 6 11	280 0 0	Do. do.
Mowra (Bassia latifolia) cake.	8-6	2*85	500	37 10 0	323 9 0	Cost includes application and freight (Rs. 3 0 per ton) from Bombay, powdering, and cartage 4 miles.
Cotton-seed cake	7'1	3*14	500	44 8 0	316 0 0	Do. do.
Safflower and groundnut cake.	3·4	6*50	500	47 30 0	162 0 0	Do. do.
Safflower cake	3*3	6-85	500	51 5 4	169 6 0	Cost includes application and cartage 8 miles and powdering.

•Cattle dung and farm-yard manure are much dearer in the neighbourhood of Poona than in out-districts. Where irrigated crops are largely grown in out-districts iu the Deccan, the price is Rs. 2 J to Rs, 3 per ton, Indry crop tracts the price is not more than Rs, 1-8 per ton.

B.— *Comparative Manure Series.*

Manures applied for crop of 1895-96.	Quantity per Acre.	Nitrogen per Acre.	Phosphoric Acid per Acre.	Cost per Acre.	Remarks.
	Lbs.	Lbs.	Lbs.	Us.	
Bone meal	3,520	130	750	316	The actual weight of dissolved bones will vary with strength of acid. This year the dissolved bones were manufactured on the farm. The acid was nearly pure, and 640 lbs. were used to dissolve 3,520 lbs. of bones.
Dissolved bones	3,520	130	750	19G	
Bone meal and saltpetre ...	3,520 bone meal, 1,290 saltpetre.	130 } 120 } 250	750	116 } 148 } 264	Saltpetre applied £ before plantation, £ in four top dressings at intervals of two months.
Dissolved bones and saltpetre.	3,520 bones dissolved. 3,290 saltpetre.	130) 120) [250	750	196 } us } 344	Do. do.

Comparative manure series results of the first year.

20. I tabulate below last year's results from comparative manure series. Each crop was irrigated twenty-eight times, and was harvested on an average 11^ months affcer plantation.

Cr n harv T d Tal7g1v en il

21. The crops were not equally ripe. Those which germinated well, and were dressed with quick-acting manures, ripened "onart; but it is impossible to decide definitely from the appearance of a cane crop when it is just ripe.

The Gul (crude sugar) very cheap this season.

The Gul (crude sugar) owing to an overstocked market, and because we have no means of storage, was sold at an exceptionally f/ayaV? ' I ^^ u to te M r pa "a t 240 lbs. Later m the season it usually rises to Us. 15 to Us. 18 per *palla.*

The weight of juice not entered in tabulated statement for reasons given.

The weight of juice is not entered because the cane was freely watered after it was prepared for the mill. This tends to prevent evaporation of the juice in the cane. If evaporation goes on the juice in the cane becomes more concentrated and a greater percentage of sugar is left in the crushed cane.

2nd Series. Comparative Manures. Plots 1 Acre each.

No. of Plot.	Kind of Manure.	Weight of manure per Acre.	Nitrogen per Acre.	Cost of manure per Acre.	Weight of cane stripped and topped per Acre.	Weight of tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to cane.	Value of Gul per Acre.	Remarks.
		Tons,	Lbs,	Bs. a. p,	Lbs.	Lbs.	Lbs.		Rs. a. p.	
4	Bone meal	5	420	244 11 0	56,710	11,640	6,945	12·2	358 0 0	Germination irregular and indifferent. Growth of crop was at first slow. Subsequently, owing probably to Ration more rapid and ... might have freely. The outturn might have been considerably more if the crop had been cut a month later.
5	Dissolved bones ...	6	434	987 8 0	80,325	17,005	9,870	12·3	508 12 0	Manure obtained from a Calcutta firm, who manufacture chiefly for export. Freight charges added considerably to cost. The manure was believed to be more soluble. Analysis proved that only a small percentage of phosphates had been made soluble. This manure was applied in top dressings. It was believed would be economical because of the risk of the frequent waterings before germination washing it out of the soil. Results have proved that part should be given before plantation. The quantity of manure ... germination. A ... young plants had an unfavourable effect in ... colour and ... ripe when harvested. A ... surface efflorescence formed on the surface after each watering.

No. of Plot.	Kind of Manure.	Weight of manure per Acre,	Nitrogen per Acre.	Cost of manure per Acre.	Weight of cane stripped and topped per Acre.	Weight of tops per Acre.	Weigh* of Gul per Acre.	Percentage of Gul to cane.	Value of Gul per Acre.	Remarks.
		Tons.	Lbs.	Us. a. p.	Lbs.	Lbs.	Lbs		Es. a. p.	
6	Bones fermented with sugarcane ashes and cattle urine.	10	213	206 8 0	47,950	11,175	5,660	31-8	291 12 0	Manure applied partly before plantation, partly as a top dressing. The germination was uneven, and at no stage did the crop make satisfactory progress, nor did the plants tiller well. The manure was prepared in a pit, cattle urine being added daily to the refuse ash of sugarcane mixed with bones. Analysis has accounted for the nitrogen of the bones. The ashes could contain little, if any, nitrogen. The nitrogen of the urine, which must have been considerable, was lost. The urine during fermentation probably gave off carbonate of ammonia which escaped to the atmosphere. The ashes if they contained free lime would probably accelerate this loss. Anyway, it is clear that this method of fermenting bones causes a loss of nitrogen. The result might have been different if good Bbam had been used instead of ashes ; but the object was to utilise as manure the refuse ash of sugarcane. It is the only residue left of an expensively manured crop, the crushed cane and dried leaves being used as fuel in boiling the juice. The results are considered conclusive, and this plot will be utilised to test the value of one of the edible oil cakes as manure in the revised scheme.
7	Fish manure ...	5	600	255 4 0	105,490	14,335	13,400	12*7	690 12 0	Cost includes freight charges from Tha"na and crushing the dried fish to powder under the stone of a chunam mill. Germination satisfactory. Plants tillered freely. Growth vigorous throughout. Crop quite ripe when harvested. The fish attracted crows, dogs, jackals, and pigs to the plot. The last did some harm by digging into the soil to get at the buried fish. An appreciable quantity of the manure was no doubt eaten. In the current season we took the precaution to bury the manure deeper by broadcasting it in the furrow behind the plough, the soil moved in making the next furrow covering it completely. The outturn is the best of the whole series, and considering the results, fish manure is undoubtedly cheap, though the nitrogen it contains costs considerably more than that in poudrette or cattle manure.
8	Castor cake... ...	5	462	249 12 0	95,830	14,285	12,235	12-7	630 10 0	Cost includes powdering «the cake *and* cartage 4 miles. Germination and tillering quite satisfactory. Crop made satisfactory progress throughout." Quite ripe when harvested.
9	Karanj (Pongamia glabra) cake.	5	441	243 2 0	87,695	15,305	10,640	12-1	548 7 0	The remarks made against Plot 8 apply to this plot also.
10	Bone meal and saltpetre.	2-5 1*0	210 207 } 417	423 *U* 0	86,950	13,980	9,975	11·4	514 2 0	The results proved that the saltpetre ought to have been applied in part before plantation. The germination was indifferent because bones alone do not supply the young seedlings with the ready food they need. The first top dressing of saltpetre showed its effect as soon as water was given. The plants within a day or two gained a much better colour and soon began to tiller freely. Half the saltpetre was applied early in April, half late in July, The crop was perhaps hardly ripe when jiarT«sted. The percentage of Gul to cane is less than in any other plot of the series.

No. of Plot.	Kind of Manure.	Weight of manttre per Acre.	Nitrogen per Acre.	Cost of manure per Acre.	Weight of cane stripped and topped per Acre.	Weight of tops per Acre.	Weight of Gul per Acre,	Per-Icentage of Gul to cane.	Value of Gull per Acre.	Remarks.
		-Tons.	Lbs.	Rs, a. p.	Lbs.	Lbs.	Lbs.		Us. a. p.	
11	Dissolved bones and saltpetre	f 3 \ 1	217) 207)	795 15 0	105,735	i3,915	13,225	12-5	631 11 0	For reasons given in the *e ma* lv. against Plot 5 none of the &&,*> nta ed bones was applied before pi» tion. The saltpetre was * lso applied in top dressings. Conse- ven. quently germination was un e ^ The young seedlings began th, thrive and tiller soon after was application of dissolved bones 'g" given in March. The first] % dressing of saltpetre in April had the erfect of starting vigorous growth. The second top dressing was given in July. e crop throve well during the whole period of growth and wtf quite ripe when harvested. A salt e flor- escence formed on the soil a l ^ each watering. I have already explained that the cost of this manure is entirely prohibitive, necessitating a rearrangement ^ our scheme in respect of plot 5, 10, a»d 11 in the current sea*, and in fyture years.
12	Poudrette	42	547	280 12 0	103,175	13,975	13,270	12-8	684 0 0	Cost includes cartage 10 miles. The crop germinated well and pi°fc nd ed satisfactorily afterwards gca. was quite ripe when harve Our results and chemical analysis indicate that the manure is a cheap if not the cheapest obtainable source of nitrogen in India, even at the Poona price, which is very high, and in the agri ^ eD, interest of the country, an e ^ sion of its manufacture or utilization of night-soil as manure in some other economical way is of the very greatest importance.
13	Cattle dung from ordinary-fed cattle.	43	972	287 9 0	GG,430	16,020	7,885	11-9	40G 7 0	Cost includes cartage from the Poona Government farm (11 miles) ^e value of cattle dung as a ^ d for sugarcane must not be g* by the results this year for re* sol ls explained further on. ^ ver mina- tion irregular, and the crop ^ oj recovered the check at tin to th germination, due, 1 believe, want of immediately ava able nitrogen for the young seed The outturn would probably have been more if the crop had been allowed to stand a month lonjer.
14	Cake-fed cattle manure, preserved with urine and litter.	42	798	283 8 0	50,530	11,790	6,115	12*1	315 3 0	The remarks made against Plot apply with equal force here.
15	Town sweepings, ashes, &c.	64	Not determined.	240 5 0	48,490	10,630	0,395	13-1	329 20 0	Cost includes cartage 10 miles. estimation of nitrogen was mad But as the manure consisted mo ly of burnt material, it could do have contained a small percen Town aweopings ash varies J much in character that that & plied in one part of a plot ra differ considerably in composit and value from that applied another, and outturn results mu therefore be irregular. This p forms part of the comparati manure series, but it also for with Plots 16 & 17 a separate sen to test the economy of ratooni cane and the " effect of shad the same manure being ap phi to each of the three V Irregular and poor results must expected from town sweepi ash. It waa decided to ma these three plots in the current season and in future years wit one of the edible oil-cakes, which we are testing as manure. The percentage of Gul to cane is higher in this plot than in any other P of the comparative manure s

22. In analysing the results recorded in the abote table, I must in the first place direct attention to the differences in weight of nitrogen applied to different plots. The manures were applied*, as already explained, before the samples were analysed, and in the absence of determination by analysis we applied quantities believed to contain 500 lbs. nitrogen more or less per acre. The percentages of nitrogen in cattle dung, farm-yard manure and poudrette were much under-estimated. The nitrogen in bones and dissolved bones was over-estimated. The estimate made in respect of saltpetre, castor cake, and Karanj cake would have been nearly correct if these manures were pure, which they were not.

Analysis of manure series results.

We started our comparative manure series with an imperfect knowledge as to the composition of the manures employed, rather than lose a whole year. This is not to be regretted, because knowledge has been gained which necessarily must have been gained in the first year, which will be of very considerable value in the future.

Experience gained which will help the experiments in future years.

If the tabulated figures are closely studied, some of the results will be found inconsistent that they appear almost inexplicable. They can, however, I think, be satisfactorily explained. The farm-yard manure and cattle dung results, for instance, compare very unfavourably with other results, the latter being obtained from manures which were decidedly poorer in the important elements of nutrition. The explanation is that the cattle dung and the farm-yard manure were applied before they were thoroughly decayed. The large stock of nitrogen which these manures contained was not therefore in immediately available form, and I am convinced that nitrogen in this form is by far the most important constituent of manures used for sugarcane. This conviction was forced by the appearance of the crop on the different plots at time of germination and afterwards. In my report of last, year I noted that the sugarcane sets (pieces of cane about a foot long) evidently contained very little to nourish the young shoots, and unless the rootlets come at once in contact in the soil with nitrogen in immediately available form germination becomes uneven* A check in growth at this early stage is never afterwards recovered, nor do the plants tiller so freely as when the young shoots come up strong and vigorous.

An explanation of apparently inconsistent results.

Nitrogen in immediately available form an important constituent of manures for sugaicane.

23. The germination depends in a most remarkable manner upon the manure used. In the current season as in last year's experiments the fish manure and poudrette plots are conspicuously ahead of the others in evenness of germination and vigour of growth. Both these manures have the reputation of acting very quickly in an irrigated soil,-and doubtless do so. Last year we made the mistake of *not* applying any of the saltpetre *before* plantation, but entirely as a top dressing to the bones and dissolved * bones plots, with the result that germination was indifferent. In the current season one-Tfifth of the saltpetre was given before plantation and the germination has been quite satisfactory. So also is the germination in the farm-yard and cattle dung plots, and this I attribute chiefly to"the fact that these manures were kept over a year and were quite decomposed. It must of course be admitted that residues of manures in the soil left from the heavy dressing of last year may have some favourable influence on the satisfactory germination this year in the plots I have referred to, but judging from the appearance of all the plots, I am nearly certain that the chief influence is attributable to the manures directly applied.

Germination depends in a remarkable manner on the manure used.

The necessity of applying at least a light dressing of a quick acting manure before Plantatum.

Blk Bhouvbe before use.

Samples of the soil of the field were taken before our manures were started and analysed by Dr. Leather. It will be very easy therefore at any time to determine how much fertility any particular plot has acquired. This determination will be an important factor in fixing the relative values of the several manures after several years cropping. The relative values of manures will to some extent be gauged by the crop residues left in the soil of each plot conditions being equal, that manure which leaves the soil in the richest condition after several years' cropping must be considered best.

THIRD SERIES.

24. *Object*—To test (1) how long cane can be ratooned profitably and (2) how-far cane is injured by the shade of *Bdbhul* and other trees. The latter test is being made on an irregular plot affected by the shade of hedge-row timber trees. Each plot was manured similarly and equally with Plot 15, and the results are comparable with those of that plot. • As regards^ the results of the ratoon plot, the value of ratooning is in no way shown, the crop being grown from sets. The test really starts with the crop of the present season, which is a ratoon crop, *L e.* grown from the stumps or root-stocks of the previous crop. The injury to cane from the shade or proximity to large trees is well shown ; whilst the results on the ratoon crop, if compared with those of Plot 15, tend to show that town sweepings ash (a very heterogeneous mixture) gives irregular results. The results of the 3rd Series I tabulate below:—

Ratoon results begin with those from crop of present season.

Injury to cane by shade well shown by results.

3rd Series. Plots 4- Acre each.

No. of Plot.	Kind of Manure.	Weight of manure per Acre.	Cost of manure per Acre.	Weight of cane stripped and topped per Acre.	Weight of tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to cane.	Value per Acre.	Remarks.
		Tons.	lits. a. p.	lbs.	lbs.	lbs.		Rs. a. p.	
16	Ratoon plot (manured with townsweepings ash)	64	240 5 0	32,505	8,965	4,160	12-8	214 7 0	Germination very irregular. Crop made slow progress afterwards.
37	Shade plot (treated with the same manure)		240 5 0	25,497	8,720	2,874	11'2	148 2 0	Germination irregular and plants did not tiller much until the crop was half grown. Then » good many shoots came up which were halt grown when the crop was harvested ; hence probably the low percentage of Gul to cane.

FOURTH SERIES.

25. *Object.*—To test whether a less quantity of water than- that ustially applied by local cultivators to sugarcane will or will not give' equally good results. Plots to be irrigated every eighth day in the hot weather and every tenth day in the cold weather or during breaks in the monsoon rains. Ordinary cultivators get canal water once a fortnight in the hot weather, and this interval between waterings is believed to be too long.

26. The plots of this series are comparable with "Plot 21 of the 5th Series which was similarly manured and was planted and harvested at the same time, lhe watei taken 101 Plot 21 was not actually gauged, but it may be accepted that attach Hooding approximately the same quantity of water was taken for this plot as for the "full supply plot," because in each case as much as the beds could hold was taken and the beds were maae precisely of the same size in each plot. The cane was cut at eleven months ana the crops were all apparently quite ripe. Plot 21 of the 5th Series was irrigated twenty-seven times or as often as the canal was opened for the cultivators tieicis oi the neighbourhood. Mr. LeQuesne, the Executive Engineer for Irrigation, Had our water gauge fitted up and allowed us to take water for the plots of the 4th Series thirty-four times during eleven months. He also had a gauge fatted up m an adjoining cultivator's field. The cultivator irrigated his crop at night on several occasions, when there was no supervision at the water gauge. Averages are taken for these occasions, and I accept Mr. LeQuesne's figures as tairly accurate.

A narrative of the manner in which the comparative experiments were made in. this series.

27. The results of the water experiment series are striking, and in my opinion prove in the most conclusive manner the importance of giving water to a cane crop often and in smaller quantity. Frequent watering in the hot weather is specially important. The outturn from each of the "water experiment plot" is considerably more than

Results prove in a striking manner the advantage of giving water to cane often and in small quantity speciaiiy in the hot weather.

that from any other plot in the whole area under experiment; and this must be attributed entirely to frequency of irrigation. The value of frequent irrigation *in* the hot season is made strikingly manifest in the sugarcane area under canal irrigation in the Poona district where a good cultivator owns a well. He gives water at least every eight days, but he gives no more than the crop needs, because he has the troxible of drawing it. On the other hand, if an average cultivator gets water *ad libitum* from the canal only once a fortnight, he takes as much as the beds will hold at each watering.

Cultivators who own wells irrigate cane lightly but often.

Cultivators who get canal water literally flood their fiel(ls_

A plea for Irrigation JJe- payment's refusing to give water as often as the cane crop actually needs it.

28. In the interest of the Irrigation Department, I am compelled to admit that even if it was permitted to take water once ni eight days, the average cultivator would takemuch more than is absolutely necessary, until such time as ft {s demonstrated to him that he is thereby spoiling his crop, and it might take years to satisfy his mind on this point. Meantime count must be taken of the extra loss of water by leakage (which is greatest in the hot weather) from the numerous distributing channels owing to the more frequent irrigation; and I can understand any Executive Engineer for Irrigation objecting to give water for irrigation in the hot weather oftener than is done at present. Under existing conditions the cultivator of sugarcane to a certain extent protects himself. He makes the beds for water compartments so deep that each time his crop is irrigated the field is literally flooded, in my opinion, to the detriment of the crop. There is no question that a good deal of this water is lost in drainage, and it is questionable whether this loss would not be more than counterbalanced by any extra leakage from the distributing channels caused by more frequent irrigation. In any case we cannot get away from the fact that our experiments tend to prove that frequent light irrigation, especially in the hot weather, increases the outturn very considerably. If it were practicable to introduce this system generally, the Irrigation Department as well as the cultivator would be benefited.

The cultivator protects himself.

The Irrigation Department and the cultivators would be benefited if it were found practicable to introduce a system of frequent light irrigation.

29. I am quite convinced that one year's results on our experimental area are sufficient to prove this. Nevertheless the experiments are being continued. The results of the first year are tabulated below. The rainfall at Poona was 32#4 inches.' Probably it was about 2 inches more at M^njri, the ante-monsoon showers being there more frequent and heavy than at Poona,

First year's results believed conclusive but experiments continued.

Aik Series.

Comparative Water Experiments. Plots ^ Acre each.

No. of Plot.	Method of Irrigation.	Total quantity of water applied.	Equivalent inches of rainfall to water applied.	Cost of applying irrigation water per Acre.	Weight of canes stripped and topped per Acre.	Weight of tops per Acre.	Weight of Gul per Acre.	Per centag-e of Gul to Cane.	Value of Gul per Acre.	Remarks.
		Tons.	Inches.	Ks. a. p.	Lbs.	Lbs.	Lbs.		Rs. a. p.	
18	Watered each time with half the ordinary supply. Irrigated 34 timts'in 11 months.	4.81M	47*6	10 0 0	119,925	12,960	14,160	11*8	729 14 0	Cut 11 months after plantation. Plot manured with 42 tons poudrette per acre.
19	Watered each time with three-fourths ordinary supply. Irrigated 34 time* in 11 months.	7,267-5	71'9	15 0 0	115,765	10,210	13,710	11-8	706 11 0	Do. do.
20	Watered each time with full ordinary supply. Irrigated 34 times in 11 mouths.	9,670-0	95*7	20 0 0	111,590	16,500	13,300	114	685 9 0	Do. do.
21	Watered each time with full ordinary supply and irrigated 27 times in 11 months.	7,679 (approximate.)	76'0 (approximate.)	9 0 0	106,000	14,705	11,920	11*2	614 7 0	Theresulfs of this plot are given in this table for comparison with the above 3 plots. CIt 11 months after plantation. Plot manured with 42 tons poudrette per acre.
	Cultivator's field. Water gauged by Mr. LeQuesne. Field watered 2^ times iu 11^ months.	4,287	82							

FIFTH SERIES.

mJL^f^J[0] Sf[f] [a<]i what, P[eriod of] *S^owih* sugarcane yields the highest percentage of sugar. Plots , acre each and manured with 42 tons poudrette per acre.

31. This apparently is a more difficult proWem to solye than ^ ^^ i

A more difficult problem to solve than was anticipated for reasons given.

ated, V[ane ls] commonly called a 12-month crop. ^N^.l[m] & [from the] appearance of the crops treated with different manures on our comparative manure seri[es], force a cane crop to matur%fn ^ | S T S n ^ " ^ ^ ^[ma TM/e TM]? a slow-acting mahure may take , fii? months, whilst a crop treated with have occasion in anaCL S lt 3 *T* ^ *T*[s] [toripe?] A^ain, *l* ^ dressed crops were m[ies to point out that top-] plantation. The for[time than those manured only before] the latter were unquestionably growth at which cane contains the^highest percentage of sugar cannot be deter-

Necessary to extend this series of experiments in order to get definite results.

mine[d] ^"^and. The question is of sufficient import-[ance] to warrant a more extensive schema of experiments, and part of the additional area which will be a purpose. The results of th

5th Series.

No. of Plot.	Special treatment of crop.	Weight of canes stripped and topped per Acre.	Weight Of topi per Acre.	Weight of Gul per Acre.	Percentage of Gul to Cane.	Value of Gul per Acre.	Remarks.
		Lbs.	Lbs.	Lbs.	Lbs.	Rs, a. p.	
21	Cane cut and converted into Gul 11 months after plantation.	106,000	14,705	11,920	11-2	614 7 0	Crop irrigated 27 times. On this plot the former occupant of the field had a very large heap of poudrette, which when we took possession he carted away to other land. The site and surroundings of the poudrette heap were possibly manured more heavily than the remainder of this plot or the other plots with which it is comparable.
22	Cane cut and converted mto Gul 11$ months after plantation.	95,250	16,110	10,965	11\5	565 3 0	Crop irrigated 28 times.
23	Cane cut and converted into Gul *12* months after plantation.	300,165	14,470	11,585	11\5	5197 2 0	Crop irrigated 23 times; the last watering 3. weeks before harvest. The plot ought to have got one more watering. Canal water was obtainable the day before we began to harvest the crop.
24	Cane cut and converted into Gul 13 months after plantation.	105,785	12,120	12,475	11-8	343 0 0	Crop irrigated 30 times. The interval between the last watering and cutting the crop was longer than it ought to have been by four days.

32. I do not think that any definite deductions can be drawn from the above figures. The 13-months crop gave the best outturn and contained the highest percentage of Gul t° [c]ane. The results are irregular. I can offer no explanation beyond the remarks made in the remarks column.

No definite deductions to be drawn from results.

SIXTH SERIES.

33.- *Object.—To* test the effect of manure applied before plantation with the same quantity of manure applied at intervals partly before and partly during growth as a top dressing. I tabulate the results below :—

6th Series. Plots ¼ Acre each.

No. of Plot.	Kind and quantity of manure and method of application.	Cost of applying manure per Acre.	Weight of canes stripped and topped per Acre.	Weight of tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to Cane.	Value of Gul per Acre.	Remarks.
		Rs. a. p.	Lbs.	Lbs.	Lbs.		Rs. a. p.	
25	Farm-yard manure 42 tons per acre. All applied before plantation as is customary.	4 6 0	47,030	11,710	5,600	11-9	283 10 0	Germination irregular. Crop grew very slowly at first and never recovered the early check. The manure used was the same as in the comparative manure series (see remarks in tabulated results of that series). Crop harvested 12 months after plantation when quite ripe.
26	Farm-yard manure. Same quantity; one-third applied before plantation in February; one-third as a top-dressing in May; one-third as a top dressing in July.	36 14 0 includes cartage of quantity top dressed ¼ mile.	51,090	11,270	5,940	11-6	306 3 0	Same remarks as above as to germination and slow growth at first. Late in the season the appearance of the crop indicated that it was making more progress than that of Plot 25. Cut 32 months after plantation. The leaves were quite green when the crop was harvested, an indication that if cut a month or so later the yield of Gul would have been more,
27	Poudrette 42 tons per acre. All applied before plantation.	3 12 0	96,465	33,255	11,475	11-7	591 8 0	Germination satisfactory and crop throve well throughout. Dead ripe to all appearance when harvested 12 months after plantation.
28	Pondrette. Same quantity; one-third applied before plantation in. February; one-third as a top-dressing in May; one-third as a top-dressing in July.	15 1 0 includes cartage of quantity top-dressed, ¾ mile.	107,995	13,600	32,920	11-9	665 15 0	The crop made satisfactory progress throughout. Harvested 12 months after plantation, but the leaves were at the time quite green, an indication that the crop had not ceased to grow, The yield of Gul would probably have been more if the crop had been harvested later.
29	Castor cake 5 tons per acre. All applied before plantation.	2 8 0	79,465	12,445	10,095	12-7	520 5 0	This plot and the next with which it is comparable were damaged to some extent by flood water. The damage may have been greater in one plot than in the other. The results, I fear, are vitiated. Crop harvested 12 months after plantation and then quite ripe.

No. of Plot.	Kind and quantity of manure and method of application.	Cost of applying manure per Acre.	Weight of canes stripped and topped per Acre.	Weight of tops per Acre.	Weight of Gul per Acre,	Percentage of Gul to Cane.	Value of Gul per Acre.	Remarks.
		Rs. a. p.	Lbs.	Lbs.	Lbs.		Rs. a. p.	
30	Castor cake. Samel quantity ; one-third applied before plantation in February; one-third as a top-dressing in May ; one-third as a top-dressing in July.	6 9 0	88,525	13,500	10,145	*IVi*	522 15 0	See above remarks as to damage by flood water. The crop harvested 32 monthsafter plantation and had then the appearance of being still growing. The yield of Gul would probably have been greater if the crop had been cut later.

34. In analysing the results of the 6th Series I leave out of account the Eesults from castor cake plots unreliable. ™rH™WW fW *f* +i particularly those of the Cfst°J calfe P lofc s> able tor comparison for reasons given in the remarks colu mn of the above statement. The other results, poudrette plots, clearly indicate the advisability of

The results from the poudrette plots clearly indicate the economy of applying part of that manure as a top-dressing.

[a]PPtying manure to sugarcane partly before plantation and partly in repeated top-dressings. In the case of poudrette the results show a clear advantage, the outturn being increased in value to the extent of Rs. 74 per acre at a cost of about Rs. 11.

35. The advantage of top-dressing a crop like sugarcane might almost be taken for granted without experiment, because if a very heavy application of manure is given before plantation, a good deal of the soluble ingredients must be lost in drainage. The crop makes slow progress at first, and it is at least two months planted before there is any appearance of vigorous growth, meantime it is

The advantage of top-dressing might be taken for granted for reasons given, but it is necessary to prove its advantage by experiment, because the practice is unusual in the district.

gays cu . tn n, „ watered oftener than at any season (once every four part out of the s on[r3fc fortnigllt), and the effect must be to wash the manure in

36. The practice of top-dressing is unusual in the Poona district. The cultivator helps his crop in this manner only when an insufficient quantity of manure was given before plantation. It is therefore necessary to demonstrate, it possible, by experiment the advantage of top-dressing.

37. There was at least one result from this series besides those aimed at *7^ic]l* though casual is none the less interesting and important. It was made clear from the appearance of the crops at harvest time that those manured entirely betore plantation ripened sooner than those top-dressed. The latter were probably not quite ripe when harvested. It would have been of importance to have determined how much the yield of Gul would have increased by leaving the crop standing longer. This could have been done by leaving a portion of each top-dressed crop to be harvested when fully ripe. This would have, however, interfered with the experiments of the current year, and the point can be settled by separate investigation next year.

Casual results which may prove important.

38. The two new varieties of cane imported from Mauritius—one red and the *?tj*™*T*. ^bite-have not succeeded so well as I anti-[cl]P[at]ed in my last report. The first year s canes contained a small percentage of sugar compared with the local variety (Pundia). These imported varieties were reported to be two of the very best varieties in cultivation in Mauritius, and they there yielded about 14 per cent sugar, whilst here the white variety gave 10-08 per cent. -The red variety gave 9'1 per cent. The local (Pundia) variety grown in our experimental plots gave from 11'2 to 13'1, and in crop tests I have found it to contain often over 13 per cent. In other respects the new Mauritius cane aid very well.

New importations of cane from Mauritius not wholly successful.

The canes grew as tall and as thick as the Pundia canes in our best plots, but the habit of growth is different from the local variety. The power of tillering is enormous, 20 to 30 canes from one stock is common. This year the whole produce has been re-planted excepting what was required for the boiling of each variety for Gul. The Gul of each variety was of good quality.

The Mauritius canes have a different growth

Note by Dr. Leather on the Chemical Composition of Sugarcane and Sugarcane Juice and of the Raw Sugar obtained in the Experiments made at the Cawnpur and Poona Farms during 1894-95.

In the following note the results of a number of analyses of sugarcane juice and of the raw sugar are submitted, and in addition reference will be made to the several analyses of the whole cane.

The analyses obtained at these two farms are discussed in one note, with the object of comparing, as far as may be, the difference which occurred in the quality of the juice and of the Gur.

2. *The Juice.*—The amount of cane sugar was determined in a number of samples of juice from the cane immediately after pressing, at Cawnpur and at Poona, and the results are tabulated in Statement I;

STATEMENT I.

Percentage Cane Sugar in the Juice of Sugarcane.

Plot No.	Treatment.	Per cent Cane Sugar.
	Cawnpur Cane Sugar Juice,	
1	No manure	14·46 13·63 8·67 (laid).
2	7 tons cattle dung manure	10·61 17·56 15·57 35·63 (laid).
3	14 tons cattle manure	14·38 9·93 (laid). 9·29 (laid).
4	5 cwts. bone superphosphate	14·40 13·51 35·04
	Poona Cane Sugar Juice.	
6	6 tons dissolved bones	15·96
7	5 tons fish manure	16·22
8	5 tons castor cake	16·60 16·79
9	5 tons karanj cake	15·82 16·52
10	2½ tons bone meal 1 ton saltpetre	14·48
	Poona Cane Sugar Juice—contd.	
11	3 tons dissolved bones 1 ton saltpetre	17·19
12	42 tons poudrette	17·33 36·50
33	42 tons cattle dung	15·18 16·26
14	42 tons farm yard manure	16·10
15	55 tons sweepings	17·37
18	42 tons poudrette in all these plots. Normal water allowance	14·53 13·17 14·29
39	do. do.	14·09 13·53 14·33
21	Cane cut when 11 months old	32·57 33·33 34·51
22	Do. 11½ months old.	34·23 33·95
23	Do. 12 months old	14·11 15·11
24	Do. 13 months old	34·41 37·01

As will be seen the percentage of sugar (parts of sugar per 100 parts of juice *by weight)* varied very much more at Cawnpur than at Poona." This is in all probability owing to the fact that at *Gawnpur* the crop was very much laid in all the plots by excessive rain.

Four samples of the juice of such cane were analysed, and, as will be seen, the percentage of sugar in three of them was considerably lower than that of the juice of the standing cane. The percentage of sugar in the juice of the standing cane ranged from somewhat under 14 per cent, up to as much as 17·6 per cent. The latter is an exceptional figure, and the percentage of sugar in the juice of the Cawnpur crop may be taken to have varied from 13·5 to 15·5 per cent. The percentage of cane sugar in the juice of the Poona sugar-cane crop was determined in a much larger number of samples, and in these there was very much greater uniformity than in the juice analysed at Cawnpur. The crop was in no case laid by rain to any extent, and these facts taken together lend a certain amount of support to the opinion expressed above that the juice of laid cane will contain a lower percentage of cane sugar than that of cane not so laid.

S over the Percentages of sugar in the juice at Poona, it will be observed that a sharp line may be drawn between the juice of Plots 5 to 15 and that of Plots 18 to 24, that of the former series being considerably richer than the latter ... per cent. The juice from Plots 18 to 24 contained ... It is not possible to say what the exact cause of this difference was. The description of ... rf Planting. The Plots 18-24 were manured with about 42 tons poudrette. The manuring of the other series of plots varied in each case, but as Plot 12 was manured with ... it the manuring controlled the quality of the juice, the juice of Plot 12 would have ... to that of Plots 18-24. ... effect of manure ... in reference to the possible ... applied in the manures to the ... about twice as much as was ... the amount of phosphoric acid applied less in the case of Plots 18—24 and 8, 9 and 12—14, than in the case of other plots. It is evident therefore that the difference ... juice of these plots cannot be referred to the different ... or to the different amounts of nitrogen and of phosphoric acid applied in the manures.

The only explanation which appears probable is that the lie of the land may have indirectly ... the difference. The land on which these plots are situated ... and the soil is ... kopen one, with soft rock (*murum*) ... about two feet of the surface. The Plots 18-24 are all situated ... 5 to 15; and bearing in mind ... the subsoil, it must be admitted ... water is known to travel through some way ... possible that this drainage water has ... lower-lying land to grow more concentrated juice than that on the plots adjacent but higher lying.

In ... the difference between the percentage of sugar in the juice of the one ... the other is very marked, and it will be of interest to observe whether a similar difference exists next year.—

STATEMENT II.

Samples of Gur from Cawnpur.

Description.	Cane Sugar.	Glucose.	Water.	Ash.
Cawnpur—Plot I ...	75-45	8-57	10-92	2-54
Do. „ I (laid) ...	67-82	..	...	..
Do. „ II ...	74-12	8·47	11-45	2·55
Do. „ III ...	74-61	9-06	12·17	2-69
Do. „ IV ...	75-31	8-76	12-59	1-94
Do. „ V ...	73-12	9-39	14-84	1-68
Do. „ VI ...	76-52	7-93	12-36	1-46
Do. „ VII ...	71·13	10-27	14-92	2-61
Do. „ VIII ...	71-88	8-47	14-87	2'18
Do. „ „ (laid) ...	63-78	14-39	14-02	4-76
Do. „ IX ...	70-04	10-85	13-77	3-26
Do. „ „ (laid) ...	64-51	13-54	14-79	2-69
Cawnpur "Dhaul" ...	79-45	7-13	5·61	8-16
Do. "Dickchan" ...	76-63	8-13	6-55	3-33
Do. "Baranka" ...	74-96	5-42	13-03	3-16
Do. "Saranti" ...	75-07	8-74	13-48	2-46
Partabgarh ...	70-35	8-82	7-05	3-89
Lucknow ...	69-64	10-15	11-95	3-23
Unao ...	72-28	9-88	10-09	3-03
Fyzabad ...	73·14	9-91	8-26	3-65

*A more feasible explanation I think is that the cane of Plots 18—24 was lodged or laid more or less, whilst the cane of Plots 5—15 was either not laid or laid to a very trifling extent.—J. MOLLISON.

STATEMENT III.

Sample of Gul/rom Poona,

Description.	Cane Sugar.	Glucose.	Water.	A.h.
Plot No. 4	76-41	10-92	9-85	1-40
„ „ 5	69-12	18-88	7-69	1-64
„ „ 6	75-93	10-43	9·84	1·52
„ „ 7	75-42	12-41	4-82	1-58
„ „ 8	77-65	9-88	9-77	1-44
„ „ 9	79-23	5-89	9-66	1-16
„ „ io	74-73	10-66	10-27	1-58
„ „ 11	75-90	11-92	11-00	1-85
„ „ 12	75-56	12-25	9-86	1-88
„ „ 13	77-20	11-41	10-26	1-52
„ „ 14	77-40	11-85	7-18.	1-33
„ „ 15	77-38	10-86	8-97	1·37
„ „ 18	74-71	1571	10-44	1-40
„ „ 19	71-99	14-45	10-56	1-20
„ „ 20	75-23	13-77	9-58	1-45
„ „ 21	73-19	13-90	11-35	1-36
„ „ 22	75-85	12-56	8-57	1-28
„ „ 24	76-68	11-41	9-S5	1-40

a. *The Maiv Sugar ("Gur" or "Gid").*— The Statements II. and III. exhibit the analyses of samples of raw sugar from Cawnpur and Poona farms, in addition it was thought desirable to analyse some of the Gur prepared by cultivators. They are all samples selected from the North-West Provinces districts. Samples of cultivators' Gul prepared near Poona were not analysed this year, the amount of work having become already too great to admit of it at present.

In the case of the raw sugar it was possible to determine not only the amount of cane sugar but also that of the " glucose " or uncrystallisable sugar, the water, and the mineral matters. These have been determined in all the samples. In addition to these items, there has been determined in several of the samples the amount of nitrogen, the solid substances such as bits of cane and sand, and the phosphoric acid.

Considering now the analyses of the samples of Gur prepared at the Cawnpur farm we find that "the Gur of Plots I.—IX. (excluding for the present those relating to lai(J cane) contained from 70 to 76*5 per cent of cane sugar, from 7*9 to 10'9 per cent of glucose, from 10*9 to 14'9 per cent of water, and from 1/46 to 3*26 per cent of mineral matter.

In the case of Plots I., VIII. and IX., samples of the Gur from the laid cane were separately analysed, and as will be seen, the percentage of cane sugar was much lower and the glucose much higher than in the Gur from standing cane. There is thus a coincidence between the quality of the juice from laid cane and that of the Gur obtained, and this year's analyses would therefore indicate that *at least for this^ariety* of cane, the " Matna/' it is important to prevent it from being laid by heavy rain and wind.

The figures in the second division of the statement relate to the Gur of four varieties of cane grown on land adjacent to the Plots I.—IX., but which was more subject to water-logging than that of Plots I.—IX. Indeed this cane was so much damaged that the weight of the sugar obtained is, I believe, acknowledged to be far below what it ought to have been. If to this fact be added the evidence obtained by the analyses of the juice and Gur of some of the other (Matna) cane, it is not a little surprising to find that the percentage of cane sugar is higher and the percentage of glucose and water generally lower than in.the Gur of the adjacent crop of Matna cane (Plots I.—IX.). The proportion of mineral matters is distinctly higher. No analyses of the juice of these four varieties of cane were made, and it is not possible to say what its quality was; but if, with distinctly poor crops, these varieties produce a better sugar, it might be naturally expected that if the crops were really good ones, some of these

varieties of cane would be more profitable to grow than the M&tna. Another year's results may throw light on the point. The high percentage of ash is the worst feature in their composition.

In the third division of Statement II.-are exhibited the analyses of several samples of Gur prepared by cultivators in the districts named in the first column. They are on the whole of about equal quality to that prepared on the farm. • Their worst feature was the amount of dirt, bits of cane and earth, which they contained. This is of course readily understood, when it is borne in mind that the juice at the farm was all passed through a cloth before being boiled down, and this of course the cultivators can readily do, so soon as there arises any call for it in the bazdr.

In Statement III. are exhibited the analyses of the various samples *of* raw sugar (Gul) selected from that prepared in the Poona experiments. The percentage of cane sugar varies from 69*1 to 79*2, and in the majority of samples it was higher than that prepared at Cawnpur. The glucose, however, with one exception, was distinctly higher than in the Cawnpur samples. It varies from 9*88 to 18*88 per cent, one sample however containing only 5*89 per oent. The moisture, with the exception of one sample which contained only 4*8 per cent, varied from 7*1 to 11*35 per cent, and was generally less than what the Cawnpur Gur contained.

•The proportion of mineral matters varied from 1*16 to 1'85, which is distinctly less than that in the Cawnpur Gur. •

It may be well in concluding this paragraph to refer briefly to one or two points in connection with the quality of the Cawnpur farm Gur and the Poona Gul. Both these names apply to the raw sugar obtained by boiling down the juice, until it will solidify on cooling.

Doubtless it is, from the cultivator's point of view, the most important thing to produce as great a weight of sugar as possible, irrespective of any niceties of composition, and judging by the analyses of the five samples of Gur exhibited in the third division of Statement II., it would appear that for ordinary bazár purposes their Gur is just as good as that produced at the two farms. When therefore we find that from three to four times as much raw sugar per acre is produced at Poona as at Cawnpur, it will be evident that this result must, at present at any rate, bear a value very much above that of the composition of the Gul.

It is however to be noted that in the neighbourhood of both these farms refined sugar is being made on a large scale, and itr will not be out of place if, whilst determining the variety' of cane and the mode of growing it, which will produce the most raw sugar, we bear In mind that there will probably be a demand for raw sugar for *refinery* purposes. It is for this reason that I draw attention in the next place to the amounts of glucose and mineral matters in the raw sugars which have been produced at the farms. The. percentage of cane sugar was much about the same in the two sets of samples. But the proportion of glucose is distinctly less in the Cawnpur samples than in those, from Pqona. It may be that this is to be referred to some inherent quality of the juice of the cafte; but I think it may in part be owing to the faqt that at Cawnpur a mixture of potash and a mucilaginous substance was added to the juice, in order on the one hand to neutralize the acidity of the juice and thus prevent to-a greater or less degree the " inversion " *{i. e.* glucose formation) of a part of the cane sugar, and on the other hand to cause a precipitation of the albumenoids of the juice, and the analyses would indicate that the alkali has really had the above indicated effect to A certain extent.

This is a point •which will be worth while experimenting with another year. I am inclined to think that potash is not the most suitable alkali to employ, and it may prove better to add some caustic lime or carbonate of lime instead. The other point to be noted is the distinctly higher percentage of mineral matter in the Cawnpur Gur than in that made at Poona. Possibly the higher proportion at Cawnpur is to be referred in part to the addition of potash to the juice (as above mentioned), but that it is important for refinery purposes to keep the proportion of mineral matter low will be appreciated when it is mentioned that

refiners consider that one part of soluble mineral matter will prevent five parts" of crystallisable sugar from crystallising. All the mineral matter in thejraw sugar is not soluble, and the amount of soluble mineral matter was determined in only three samples, in which it amounted-to 2*06,3f79, and 2f59 per cent respectively.

It may be of value however to bear the point in mind.

4. *The total Sugar in the Gane.^When* the cane is crushed in an ordinary mill such as those employed by the cultivators, only a portion of the juice, and consequently of the sugar also, is extracted. A certain portion remains behind and is lost. An attempt was made to determine the amount of this in two ways. The one# jras by determining the amount of sugar left in the refuse crush#d cane, the other by determining the total amount of sugar in the cane. The results of neither method were however satisfactory. Difficulties, which need not be here entered upon, were met with, and it must be left to a future occasion to perfect the methods employed and thus arrive at the result.

An approximate estimate has been made by an indirect method, the *net result of which goes to showfhat at Poona from 2 to 2*5 per cent of sugar was thus lo^t, whilst at Cawnpur the Joss was not less than 5 per cent. The latter amount is certainly very large, amounting to fully | of the total sugar in the cane. #The cause of this must not be hastily put down to the mills employed. On the contrary, the results obtained with the Pundia cane, some of which was crushed by Mr. Sabbiah at the Cawnpur farm, show a very different result. In the case of the Matna. cane, which was the main grop •in the Cawnpur experiments, only 50 per cent of juice was extracted, whilst no les» than 69 per cent of juice was obtained from the Pundia cane with a corresponding proportion of Gur, and although no analyses were made of the Pundia cane or its •juice, therje cannot have been more than 2 per cent of sugar left in the refuse, and it was probably much less. The amount of Gur obtained was far higher than any grown at the farm, and the proportion of G-ur; namely, 13*7 from 100 parts of cane, was distinctly high. The Pundia G-ur gave the following results —

Cane Sugar.	Glucose.	Ash.
7576	-11-18	1-82

showing it to be a good sample of raw sugar. It would appear therefore that the high proportion of sugar *not extracted* at Cawnpur was more likely occasioned by the quality as hardness of the cane itSelf, and if this should prove to be the case, it will show the desirability of growing a cane from which a high proportion of the juice may be extracted.

5. The amount of phosphoric acid and nitrogen in the sugarcane crop.

The sugarcane crop is generally supposed to be a very exhausting crop, and it is therefore of interest to determine as accurately • as possible the amount of nitrogen and phc^phoric acid, lime and potash, which it takes from the soil. An attempt was made to determine the nitrogen *nd phosphoric acicl, but in this case, as in the determination of the total sugar, difficulties were experienced consisting chiefly in getting what were really representative samples of the materials, and a further endeavour to overcome tha difficulties and make more exact determinations will be undertaken next year.

So far, however, as one can judge by such analyses as have been made, the amounts of nitrogen and phosphoric acid in the crops at the two farms respectively are as follows :—

Assuming 40,000 lbs. of cane and 4,000 lbs. "of tops per acre to represent the Cawnpur crop, the total amount of phosphoric acid was about 24 lbs. and the nitrogen 34 lbs. per acre. And assuming in the case of the Poona crop 100,000 lbs. of cane and 14,000 lbs. of tops per acre, thfe total amount of pho^phoric acid was about 50 lbs. and the nitrogen about 94 lbs. per acre.

A wheat crop of 600 lbs. of grain per acre will remove (including the straw) about 6 lbs. of phosphoric acid and about 13 lbs. of nitrogen per acre.

Balance Sheet of the Poona Farm, 1894-95.

Receipts.	Es. a. p.	Amount. Es. a. p.	Expenditure.	Es. a. p.	Amount. Ks. a. p.
To sale proceeds of farm produce, 1894-95—			By rent of land ...	.....	122 0 0
Grain ...	105 15 0		Assistant Superintendent's pay ...	....	902 11 10
Fodder crops	1,989 8 6		Establishment pay ...	.....	588 0 0
Potatoes...	961 0 7		Horse allowance, ...	.....	240 0 0
Gul ...	13 9 0		Travelling allowance...	.....	127 10 0
Ginger ...	14 14 9				
Vegetables	140 10 2		By ordinary expenditure—		
Manures	72 13 6		Labour and cost of up-keep of farm bullocks...	1,872 3 4	
Fruits ...	11 8 0		Skilled labour ...	25 6 6	
Live stock	44 0 0		Purchase of manures...	329 5 3	
Miscellaneous receipts	76 10 6		Do seeds for sowing? ...	274 8 4	
To value of farm produce of 1894-95 unsold on 31st March 1895—		3,430 10 0	Do. dead-stock and furniture	175 10 0	
A. Since sold:—Grain ...	0 6 8		Do. stationery, service stamps, and telegram charges	59 12 6	
Potatoes ...	6 13 4				
Fodders ...	68 4 8		Miscellaneous ...	143 2 1	
Vegetables ...	0 15 0	76 7 8	Irrigation charges ...	163 3 0	
B. On hand—Fruits ...	45 0 0		Petty improvements ...	23 0 0	
Urain ...	170 0 10				3,066 3 0
Jowari and V&l fodder growing and nearly ripe ...	95 0 8				
Onions ...	50 0 0				
Turmeric ...	21" 2 6				
Potatoes ...	85 0 0				
Cotton ...	4 0 0				
Guinea-grass—Value of growing crop and established plantation ...	225 0 0	69 5 10 0			
To net increase of dead-stock ...	73 . 0 6				
Do. live-stock ...	159 0 0	232 0 6			
Total ...	.....	4,434 12 2			
To Net Cost ...	.....	611 12 8			
Total ...	.....	5,046 8 10	Total ...	.....	5,046 8 10

APPENDIX III.

Dairy Balance Sheet for the year 1894-95.

^come and increase in Value of Stock.	Es. a. p.	Amount. Es. a. p.	Expenditure.	Es. a. p.	Amount. Es. a. p.
To sale of milk and butter, the produce of farm cattle ...	16,302 15 5		By Overseer's pay ...	.....	180 0 0
„ sale of milk tins and jars ...	22 9 0		„ Herder's pay ...	.....	204 0 0
„ sale of live stock	620 11 6		„ Concentrated food bought	5,577 4 4	
„ water charges recovered	6 0 0		„ Fodder bought ...	4,013 11 0	
		15,952 3 11	„ Kent of grass land ...	854 8 0	
„ butter on hand on 31st March 1895	42 0 0		„ Hay-making expenses	523 0 1	10,968 7 5
„ value of hay in stock ...	1,507 9 2		„ Labour	2,515 11 3	
		1,549 9 2	„ Water-rate ...	36 0 0	
„ increase in value of live stock	.....	3,109 0 0	„ Cost of repairs and incidental outlays for" management of dairy and dairy herd	1,698 1 4	4,249-12 7
			„ Parchase of dairy utensils, &c. ...	207 12 6	
			„ „ of live stock	2,232 10 0	
					2,440 6 6
			„ Expenses incurred in connection with outbreak of rinderpest among the dairy herd (purchase of fel for burning carcasses, medicines, &c.) ...	.....	266 7 1
			„ Butter on hand on S1st March 1894, but disposed of during the year ...	.....	35 0 0
			Total ...	.....	18,344 1 7
			By Net Profit ...	.....	266 11 6
Total ...	.....	18,610 IS 1	Total ...	.....	18,610 13 1

APPENDIX IV,

Valuation Statement.

description.	STOCK ON BAKD ON 31ST MABCH 1894. Number,	Amount,	STOCH OK HAND OW 31ST MARCH 1895. Number.	Amount.	Increase.	Decrease.	Remarks.
		Bs. a. p.		Es. a. p.	Es. a. p.	Us. a. p.	
Working bullocks	6	320 0 0	4	185 0 0	.....	135 0 0	
	6	320 0 0	4	185 0 0	.....	135 0 0	
Dead Stock—							
Farming Implements	...	1,881 6 0	...	1,912 2 6	30 12 6	.....	
Office furniture	...	64 12 0	...	107 0 0	42 4 0	.....	
	...	1,946 2 0	...	2,01* 2 6	73 0 6	.....	

APPENDIX V.

Dairy Herd.

Description.	Strength on 1st of April 1894.	IJTCBBASB. Purchased and transferred.	Born.	Total.	DICBEASB. 8old.	Died.	Trans-ferred.	Total,	Strength on 31st Mar.ch 1895.	VALUATION. 1894.	1895.	Increase or decrease during" 1S94-95.
*Cows**										Ks.	Bs.	
Stud Bulls	3	2	...	2	...	1	..	1	4	160	250	+ yo
Cows	32	11	...	'if	5	12	...	17	26	2,061	1,770	- 291
Heifers	*1*	1	...	1.	1	...	4	5	3	220	120	- 100
Cow Calves	19	2	17	19	2	8	...	10	28	275	5f75	+ 300
Bull Calves	21	...	13	13	9	10	...	19	15	*265*	375	+ 110
Total ...	82	16	50	46	17	31	4	52	76	2,981	3,090	+ 109
Buffaloes.												
Bull Buffaloes	...	1	...	1	...	...	...	...	*1*	...	120	+ 120
She Buffaloes ...	36	11	...	11	1	2	...	3	44	2,940	3,550	+ 610
Heifers ...	11	...	...	...	...	...	2	2	9	240	235	+ 45
She Buffalo Calves	20	...	15	15	4	6	...	10	25	190	375	+ 135
Bull do.	19	...	20	20	16	15	...	31	8	120	110	- 10
Total ...	86	12	35	47	21	25	2	46	87	3,490	4,440	+ 950
Dairy Cart-horses	' 2	1	...	1	1	...	...	1	2	100	150	+ 50
												+ i,ioft

APPENDIX VI.

The Sheep Flock.

Description.	Strength on 1st of April 2891.	IirCBEAsa. Purchased and transferred.	Born.	Total.	DBCBBASB. Sold.	Died.	Trans-ferred.	Total.	Strength on 1st of April 1895.	VALUATION-. 1S94.	1895.	Increase ct decrease during
										•Es.	Rs.	Es.
Breeding Earns ...	1	1	...	1	...	...	...	...	2	SI	60	+ 29
Ewes	49	23	...	23	...	3	...	3	39	57	260	+ 203
Female Lambs	12	6	G	12	...	1	8	9	15	18	40	+ 22
Male Lambs	5	...	11	11	4	1	...	5	11	10	50	+ 40
Total ...	' 37	30	17	•47	4	*5*	8	17	67	116	410	+ 294

ANNUAL REPORT

OP THE

GOVERNMENT EXPERIMENTAL FARM,

POONA,

For the year ending 31st March 1896.

ANNUAL REPORT OP THE GOVERNMENT EXPERIMENTAL FARM, POONA, FOR THE YEAR ENDING 31ST MARCH 1896.

No, 304 OF 1896.

From

J. W. MOLLISON, ESQUIRE, M.R.A.C.,
Superintendent of Farms, Bombay Presidency;

To

COLONEL C. W. GODFREY,
Acting Survey Commissioner and Director,
Land Records and Agriculture, Bombay Presidency.

Poona, 3rd September 1896.

SIR,

I have the honour to submit the Annual Report of the Poona Farm for the year 1895-96. In April last I took three months' privilege leave, and the report is, therefore, submitted later than usual.

SEASON.

2. The monsoon burst at Poona on the 7th June, The season was on tie whole a good one. The rainfall was about average. It was well destributed between June and November. **No rain fell after the lst fortnight of Novem-**ber. The crops, therefore, suffered, except such as were helped by irrigation. There was good grazing earlier than usual, and the hay crops, both at Manjri and Bhdmburda, were quite satisfactory. Hay making during November and December was not interrupted by rain.

3. The following statement compares the rainfall of the season with that of 1894 and with the average of the nine preceding years :—

Rainfall Return.

Months.	1894.		1895.		Average of nine years (1886 to 1894).
	Rainy days.	Rainfall in inches.	Rainy days.	Rainfall in inches.	
May, 1st fortnight	...	...	I	002	} 1'47
Do. 2nd do.	1	0-22	...	4·72	
June, 1st do.	7	2-02	6	2-25	6-08
Do. 2nd do.	4	0-94	11	0·40	
July, 1st do.	9	7-97	5	3-68	8-88
Do. 2nd do.	7	7-35	14	3-35	
August, 1st do.	3	1·10	12	0·20	2-92
„ Do- 2nd do.	3	1-66	5	7-97	
September, 1st do.	4	1-65	7	2-44	5-45
Do. 2nd do.		1-60	4	0-88	
October, 1st do.	3	4-07	3	4-24	6-58
Do. 2nd do.	1	3-86	5	2-01	
November, 1st do.	...	...	2	...	1-64
Do. 2nd do.	...	...	...	...	
December, 1st do.	...	...	...	...	} 0-30
Do. 2nd do.	...	...	...	...	
Total ...	52	32-44	75	32-16	33-32

4. The following table shows the areas under different crops during the year under report:—

Crops,	Area, A.	Area, g.	REMAKES.
B&jro and B&jri...	4	21	*Note.*—Of the total area 13 acres 22 gvmthas were twice cropped; whilst 8 acres 38 gvmthas were under perennial crops.
American sorghum for seed ...	0	5	
Potatoes	0	4	
Sugarcane	0	15	
Halepense sorghum	0	17	
Cotton	1	3	
Jow&ri	3	22	
Surans	0	5	
Turmeric	0	12	
Vegetables	0	31	
Australian oats	1	10	
Shálu Jow&ri	0	30	
Gram	11	22	
Guinea grass	7	25	
Water grass	0	4	
Lucerne	0	29	
Various fodders ...	23	6	
Total ...	56	27	

EXPERIMENTS.

5. The farm is not an experimental farm. The soil is far too uneven in character for that purpose. It varies a good deal, some of it being very good, but the greater portion is light and naturally poor. Even the poor land is becoming fairly fruitful, because it has been helped by heavy dressings of farm-yard manure, the produce of our well-fed milch cattle. A good deal of attention has been given for some years to the cultivation of fodder crops, the improvement of the fodder-supply of the Deccan being held to be of very great importance. Jowdri (Sorghum vulgare) is the chief fodder-yielding crop of the Presidency. There are a very large number of varieties, some distinguished by very large heads of grain and coarse fibrous stalks; others by extremely thin sweet stalks and poor heads of inferior grain. Tliere are numerous gradations between these two extremes. With the help of Mamlatdars and other district officers I have been able to get seed of almost all known varieties. We will continue to grow the best fodder varieties on the Poona Parm until the characteristics and values of each are fully demonstrated. The best seed varieties have toeen sent for continued cultivation on the Surat Parm, where the improvement of seed by selection will be made a speciality. The Surat Parm has even soil suited for comparative experiments, and this work is being started there in a systematic manner. In addition to the fodder question, the Poona Parm is utilized to study and improve the milk breeds of India, and this year feeding experiments have been attempted. Native practices have been tested. Exotic crops and crops of other districts, not known in the Deccan, have been grown to a considerable extent. The comparative value of leguminous fodder crops suitable for rotation with cereal fodder crops has been under trial for some years. A little has been done in the improvement of seed by selection and the distribution of seed, also in comparing manures and trying implements.

The objects aimed at on the Farm.

Experiments with Fodder Crops.

6. It was made clear by experiments in former years that some of the *Sorghums* generally cultivated are, when sown thickly, exceptionally good fodder plants. All varieties do not lend themselves advantageously to this method of cultivation. Por instance, it is not likely that such varieties as ordinarily produce large dense heads of grain can be grown successfully if the seed rate is much greater than ordinary, the ordinary seed rate

Tie relative values of tbiok and thin seeding for sorghum fodder crops discussed,

being less than 10 lbs. per acre. On the other hand, there is no doubt that many varieties which under ordinary cultivation produce small heads of grain, can, with every advantage, be sown very thickly, especially on good deep well-manured soils. The effect of thick sowing is to produce long thin stalks, often very little thicker than wheat straw and having a minimum percentage of woody yore. A good crop grows 9 to 11 feet high, and the weight of produce per acre is very heavy. If the crop is cut at the flowering stage, fodder of exceptionally good quality is got, which can be fed with little or no wastage. A note of warning ought, however, to be sounded in respect of thick seeding, because a thickly sown crop cannot withstand the effects of extreme wet weather or of prolonged drought so well as a thinly sown crop can. Extreme drought is particularly disastrous to a thickly sown crop on light land. Moreover, a thickly sown crop must either be broadcasted behind the plough or drilled first lengthwise and then across the field, in order to secure even distribution of seed. In either case weeding by bullock hoe is impossible. Therefore a field thickly so.^n must be thoroughly clean; otherwise, without expensive hand-weeding, weeds w j do harm to the crop. Again a thickly sown crop is much more liable to lodging during very heavy rain than a thinly sown crop is. Lodging will not do much harm if the crop is nearly ready for cutting ; but it would cause loss at an earlier stage. A Jowdri crop thickly sown is, I believe, more liable to rust than when thinly sown, and probably also to other fungoid diseases. If due allowance is made for all these disadvantages, I believe that taking one season with another, thick seeding will undoubtedly pay, if the production of a heavy crop of excellent fodder is the chief object of the cultivator.

Many varieties of Jowari tested as to their comparative value as fodder crops.

7. In the year under report, we had 59 distinct varieties of Jowári under comparative trial, each variety being sown thinly for seed and thickly for fodder. The varieties which showed themselves conspicuously valuable as fodder crops were (a) Fai aria and (b) Amaria, two varieties of undma Jowari of Gujarat, which, though differing somewhat in appearance, are probably akin botanically ; (c) Dudhia, a variety with small fairly dense ears and long thin stalks, very common in the Goradu soils of Kaica and Baroda territory; and (d) Nilva, a local variety at Poona and common in the Deccan. ^N these four varieties were far ahead of all the other indigenous sorts in respect of early maturity and fineness of fodder, and to all appearance would compare favourably with any other variety in weight of produce per acre. Two varieties of sorghum, introduced from America several years ago, will, on good land, bear favourable comparison with the indigenous varieties named above. A few other varieties, mostly from the Southern Maratha Country, produced fodder which was much above the average in quality, but not equal to the varieties I have named. The ... combined in some degree two valuable characteristics, ... fairly well developed heads of grain. I believe ... require ... fully developed well filled heads of plump grain ... a thick woody stalk in order to support the grain head, a stalk of this sort being comparatively poor fodder. If, on the other hand, the chief aim is to produce a valuable crop of fodder, the stalks must be very thin, and such are only capable of supporting small heads of grain, The best fodder varieties have usually small heads of grain. It is rather curious that the sorghums which yield the finest stalks nearly all have a head of grain which takes the form of a graceful branching panicle. Small parcels of selected seed of the best fodder varieties will be available for distribution from the Poona Farm after harvest in the current season.

Four indigenous varieties of sorghum found to have exceptional merit as fodder crops.

Thick and thin seeding of Nilva and Dudhia Jowaris compared.

8. The value of fairly thin and comparatively thick seeding was tested with Dudhia and Nilva, three plots being allotted to each variety. I cannot' say that the plots were absolutelj even, but, so far as I know, there was nothing in the character of the soil or of the season to materially affect results. The intention was to sow in adjacent plots seed at the rate of 40, 60, and 80 lbs. per acre for each variety. It is impossible to sow seed with absolute accuracy as to quantity per acre with the implements at hand in,

India. The actual seed rates are given in the table of results below. The plots were approximately each -5 of an acre :—

Crop.	Seed rate per Acre.	Outturn per Acre (Dry Fodder).	Cost of Cultivation per Acre.	Value of Outturn per Acre.	Sate per Rupee,	KEMABKS.
	Lbs.	Lbs.	Its. a. p.	Rs. a. p.	Lbs.	
Sundhia (Sorghum cernuus).	38-3	7,114	29 7 0	54 11 5	130	Sown 30th. June to 3rd July; harvested 20th to 29th September.
Do. ...	60-2	8,642	30 7 0	66 7 a	130	
Do. ...	78-7	9,994	30 14 5	76 14 0	130	
Nilva (Sorghum vulgare).	88*5	9,888	33 6 2	65 14 8	150	Sown 30th June to 3rd July; harvested 30th September to 2nd October.
Do. ...	60-2	9,560	36 9 1	63 11 9	150	
Do. ...	83*9	10,271	36 4 3	68 7 6	150	

9. Heavy rain on the 8th August lodged all the plots more or less. The Nilva was distinctly coarser in quality than the Sundhia, and hence valued at a cheaper rate. The general appearance of the Nilva plots indicated to the eye that there was very little difference between plots ; whilst as regards the Sundhia plots it was easily discernible that the best plot was the one with the highest seed rate. The general inference to be drawn is that on good land in good manurial condition Sundhia requires a higher ?<f. rat* ^an Nilva to give the best results ; but 3ud gpg by the results of these and other tests, both on light poor land and on deep good land, no hard and fast data can be given as to the actual seed rate which gives the best results. So much will depend upon the character of the soil and climate. All I can positively say is that* on average good soil, with a moderate well distributed rainfall of 30 to 35 inches, sow at least 60 lbs. of Sundhia per acre and not less than 40 lbs, of Nilva.

Sundhia requires a higher seed rate than Nilva on good land in good condition.

10. *Sundhia* was compared with *Nilva,* two varieties of *American sugar sorghum* and *Bdjri.* The plots were \ acre each and fairly even. The whole area was double-cropped in the previous year by the comparative cereal fodders referred to in paragraph 8 of last year's report in the kharif season and by gram (Cicer arietinum) in the rabi season. No manure was given in the year under report or in the previous year. The field has, however, good deep soil and is in good condition. Bajri grows under favourable conditions probably as quickly as any other cereal; and the object of including it in the comparative trial was to determine whether it would yield in a shorter period than the sorghums a good outturn of high class fodder. The Bijri stalks, owing to a high seed rate, grew close together and were thin. The crop was cut when in full flower, at the stage when its fodder value ought to have been greatest. Yet the fodder, although having every appearance of being good, could not possibly be so, because our milch cattle and our work cattle (the latter being by no means pampered) did not relish it iri any degree. Ordinary Bajri fodder is considered inferior to almost any other kind in the Deccan. Yet, as grown in the Gor&du soils of Kaira and the Baroda territory, it is the chief fodder given to work and milch cattle, and they eat it greedily. Why the B&jri straw of the Deccan should, as fodder, be inferior to that of Northern Gujarat is difficult to understand. Yet unquestionably such is the case. The comparative experiment indicates that even when cut green and properly cured B&jri fodder is of inferior quality. It came into flower earlier than the other fodders grown in comparison.

Sundhia Jowari, Nilv* Jow&ri, two varieties of American sorghum, and Bajri compared as fodder crops.

Bajri Tatur fodder not liked by

11. I tabulate below the results of the comparative fodder plots giving seed rates and the yields per acre, the cost of cultivation and the value of outturns :—

Crop.	Seed rate per Acre (approximate).	Outturn per Acre (Dry Fodder).	Percentage weight of Dry Fodder to Green after drying for 31 days.	Cost of Cultivation per Acre.	Value of Outturn per Acre.	Rate per Rupee.	REMARKS.
	Lbs.	Lbs.		Rs. p. a.	Rs. a. p.	Lbs.	
Bajri—(Pennisetum typhoideum).	20	10,300	46-4	23 5 9	34 5 2	300	Sown on 29th June; reaped, when in full flower, on 18th September. Germination satisfactory, but growth subsequently rather uneven. Suffered from dry weather in July; season otherwise very favourable. Fodder poor in quality; therefore valued at a cheap rate.
Sundhia Jowari—(Sorghum oernuus).	50	11,780	50-	24 3 6	90 9 7	130	Sown on 29th June; reaped, when well in flower, on 19th September. Fodder of exceptionally good quality; therefore valued at a dearer rate than the other fodders grown in comparison.
Nilva Jowari—(Sorghum vulgare).	55	16,330	52-	22 3 5	108 13 8	150	Sown on 30th June; reaped on 20th September. Stalks fairly thin. Fodder had less leaf than the American sorghums, but was about equally valuable.
American Sugar Sorghum (Sorghum Saccharatum) Ko. 1.	50	14,785	44-4	19 13 11	98 9 1	150	Sown on 29th and 30th June; reaped, when well in flower, on 19th and 20th September. Stalks thicker than those of Sundhia; and fodder not of such good quality, but contained a good proportion of leaf.
Do.- ... No. 2.	45	15,985	45-3	18 4 11	106 9 0	150	Do. do.

Note.—The actual cost of tillage was practically the same for each fodder. The difference in cost of cultivation between plots is chiefly because owing to passing showers the produce of some plots required more handling to get the leaves dry than others.

Various fodders compared on the light land portion of the farm.

12. On the light land portion of the farm various cereal fodders were compared in adjacent areas. The land is so uneven that no absolute deductions can be drawn from the results. The land throughout was in fair manurial condition.

In one field *Bdjri, Nilva, Sundhia* and *Teosente* (Reana luxurians) were grown side by side. The seed in each case was sown thickly for fodder. We Proved in former years that Teosente, a south African fodder plant, could not

compete on good deep land saccessjMy in the Deecao with the indigenous sor-

The value of Teosente (Reana luxurians) as fodder crop in the Deccan may be discounted on any description of soil.

•g^ms. The quality of fodder which it produced under t-ne most ravonrahlA o\roMmai.nuces was ri of although it yielded , its value as a fodder crop was discounted. W it this year on light land not with t it ld but in order to give it one more dance n M j tee soTdror /LT—T % may be decided profitable introduction on any class of land in the Deccan.

with that it does not
weeding becomes nec
to drought about the middle of July, and the young seedlings of Bájri and Sundhia due were checked an extent that they did not fully recover afterwards. Nilva suffered

13. The results I tabulate as under :—

Crop.	Seed rate per Acre.	Outturn per Acre (Dry Fodder).	Cost of Cultivation per Acre.	Value of Outturn per Acre.	Rate per Rupee.	REMARKS.
	Lbs".	Lbs.	Rs. a. p.	Rs. a. p.	Lbs.	
Bdri— (Penuisetum typhoideum.)	20	5,368	14 3 1	17 14 2	300	Sown on 9th July; harvested on 21st September. Fodder of comparatively poor quality.
Nilva— (Sorghum vulgare.)	50-3	9,149	13 12 9	51 0 7	150	Sown on 9th July; harvested on 11th October. Fodder of very good quality.
Sundhia— (Sorghum cernuus.)	38-4	4,912	15 5 4	37 12 6	130	Sown on 10th July; reaped on 21st September. Fodder of first class quality. Forced by drought to maturity too quickly.
Teosente— (Reana luxurians.)	14	2,208	12 4 4	22 0 4	180	Sown on 10th July; seedlings thinned out to about 6 inches apart because plant tillers very freely; reaped on 17th October. Grew very slowly and did not tiller to the same extent as it does in good land. Fodder of fair quality.

14 On another light land field *Bdjri* was sown with the object of provid-

Bajri to provide very early !?gearly Sreen fodder for milch cattle. A portion of green fodder. the crop was fed to the cattle as green fodder cut when in flower with V>nwDIm». ^___rj i i •
They did not like it. The remain
stacked. The season was quite sat
the young plants easily withstood the dr/weather in July. "Vhe resuHs are Is' under :—

	Seed rate per-Acre.	Outturn per Acre (Dry Fodder).	Cost of Cultivation per Acre.	Value of Outturn per Acre.	Rate per Rupee.
	Lbs.	Lbs.	Rs. a. p.	Es. a. p.	Lbs.
Bájri	15-2	9,011	14 0 9	30 0 11	300

15. The experiments with Bájri this year as a fodder crop indicate that when sown thickly it yields heavily, but, though the stalks grow thin, the fodder is of inferior description. I infer this because neither well fed milch cattle nor work cattle like it. A crop of Bájri sown for fodder grows rapidly and comes into flower very quickly. It is essentially a light land crop, but grows well also on medium black soil. I think we may conclude that it is better suited to produce grain and fodder than fodder alone.

Bájri better as a grain crop than as a fodder crop.

16. *American sorghums* did well this year in a light land field. The season was more than ordinarily favourable, excepting that harvesting was somewhat delayed owing to wet weather. The two varieties were grown side by side, the land being comparatively even. The results are as under :—

American sugar sorghums did well on light land.

	Seed rate per Acre.	Outturn per Acre (Dry Fodder).	Cost of Cultiva- tion per Acre.	Value of Outturn per Acre.	Rate per Rupee.
	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	Lbs.
First variety	56	8,360	21 6 4	55 11 9	150
Second variety	64	7,175	18 12 0	47 13 4	150

17. The general deductions to be drawn from this year's and former years' results with the cereal fodders already referred to are of some importance. We may conclude that Sundhia Jowári, although it yields a finer description of fodder than any other variety tested, suffers in the Deccan from drought and from unfavourable climatic conditions to a greater extent than Nilva or the American sorghums do. Sundhia can only be recommended to give really good results on good land in good condition and possibly also in a year of average well distributed rainfall. The two varieties of Sundhia, viz., Amaria and Farfaria and another variety, Dudhia, all of which are under trial in the current season, yield fodder so fine in quality that possibly they are better adapted for horses than for cattle. The Remount Agent at Ahmednagar finds Sundhia an exceptionally valuable dry fodder for young horse stock.

Analysis of former results.

Nilva, although it does not yield fodder of the very best description, holds its own ... varieties ... in the Deccan to the same extent as exotic or become ... under unfavourable condition of climate. I supposed has them. Under ... unfavourable conditions and can withstand sugar sorghums ... in the conditions of soil and climate the American cannot be questioned. They ... uncommonly well, and their feeding value the ... are comparatively thin, free from crude fibre, contains ... are numerous and well developed, and the stalk, when nearly ripe, ... per cent, of sugar. Stock breeders might view with some suspicion a fodder which contains such a high percentage of sugar, because it is well known that sugar or treacle in quantity affects in a harmful manner the procreative ... of all farm animals, especially males. Imphee is a near relation of the American sugar sorghums, and like them does best on good land ... Teosinte (Reana luxurians) may be dismissed as of no economic value in the Deccan, and Bájri, for reasons already given, cannot be classed as a useful green fodder crop.

18. *Australian Oats.*—I got from Captain Broome, Remount Agent, Ahmednagar, a sack of Australian oats for trial. The seed was sown early in December, in beds prepared in the ordinary way for irrigation. The seed rate was ... lbs. per acre. The germination was quite satisfactory. The young plants ... out in a most extraordinary manner until the crop covered the field with a close sward. This was practically the whole growth. A few poorly developed seed stalks grew here and there. At this stage the leaves began to turn yellow and we decided to cut what fodder there was. The outturn, such as

Australian oats, a comparative failure.

it was, weighed green 5,146 lbs. per acre, and probably would lose at least 60 per cent, by drying. I may note that results very similar to those described here have been obtained with other descriptions of exotic crops. Thus English broad beans, although they flower, do not fertilize in the Poona district, and English clovers and vetches, although the seed germinates freely, make subsequently very little growth and produce a flower. There were, amongst the Australian seed oats, a few rye-grass seeds. This rye-grass grew fairly well and came freely into flower.

All exotic crops should be considerable.

19. *Shdlu Joivdri* was grown as an irrigated crop, and was practically a failure. We have tried for several years to grow hot weather irrigated crops, under irrigation in the fair season several varieties of Jowári in order to provide a supply of green fodder at a season when succulent food is of special value for milch cattle. We have had no success until this year when we tried Hundi Jowárl.

20. *Hundi Joivdri* is a variety grown in the Sholápur district under well irrigation. The seed is sown in the hot weather and the crop is ready for cutting as fodder early in June the hot weather. when all other fodders are usually scant and dear. The farm crop stood this year about 8 feet high and yielded at the rate of 10,791 lbs. green fodder per acre. The stalks of Hundi Jowári are coarse, but that is a contingency that we must put up with. It is, I believe, the only variety of Jowári which will grow well in the Deccan in the hot weather under irrigation.

21. *Sorghum Halepeme* is an introduction from the Allahabad Grass Farm and apparently will succeed admirably in the Poona district. The grass became fairly established in its first season. The land was laid out into long narrow beds at sowing time, so that, if necessary, the crop could be irrigated. It was allowed to run to seed. The seed was ripe early in November. Subsequently the plot was watered twice, but this grass has evidently a dead season, and even with irrigation it remained quite dormant during the cold and hot weather. In May of the current year it began to send forth shoots which, as soon as the rains came, grew with great vigour. The crop was in full flower and ready to cut as green fodder in the first week of July. The inflorescence is a much branched panicle, rich brown in colour. The crop when in flower has a very handsome appearance.- The flower stalks stand about 5 feet high and are distinctly thin and fine for a grass of such vigorous habit of growth. Cattle like it. New shoots spring from the rhizomes which are underground sterns. I have no doijbt the grass, if once established in arable land, would on this account be difficult to get rid of. This, as far as I know, is its worst fault. It is certainly good enough to take a prominent place on land growing grass permanently." The first cut in the current year yielded 4,720 lbs. of green fodder per acre, and I confidently expect that at least one other equally good crop may be expected before the rains have ceased. The rapidity of growth early in the monsoon is a valuable characteristic in the Deccan. The grass is ready just at the time when ordinary fodder is usually exceedingly scant and very dear. Some of the seed saved has been distributed,

A first rate perennial grass got from the Allahabad Grass Farm.

22. *Guinea Grass* (Panicum jumentorum) outturn results this year are much the same as in former years. Each year they have been unfavourably affected owing to a scant and irregular supply of canal water in the hot weather; Some of the Guinea grass plantations had been established over three years/ The root stock had become overgrown and it became necessary to hand dig, level, manure and replant these areas. Guinea grass does best on good deep free working land. It does better than any other crop under shade, along borders in damp situations and odd corners. A considerable proportion of the farm crop is grown in such situations and the outturn results are not so favourable as they would be if the grass was planted only on the most suitable description of soil. Guinea grass grows with less vigour in the fair season,

Guinea grass grown under conditions unfavourable to other crops.

especially in the hot weather, than it does in the rains; but it is in the hot weather that it is most valuable. Then it gives green fodder of exceptionally good quality and which we could not well do without for our dairy cattle. I noticed in my last report that it grows better under shade in the very hot weather than it does in the open, but this would not likely have been the case if there had been a full supply of water for irrigation.

Guinea grass outturn results unfavourably affected.

23. The results from fully established plantations for 1893-94, 1894-95 and 1895-96 are tabulated below for comparison. These do not indicate the full capabilities of the crop if grown under the most favourable conditions. The produce is valued at 200 lbs. per rupee, the rate at which it is charged to the dairy cattle:—

Year.	Outturn per Acre.	Cost of Cultivation per Acre.	Value of Outturn per Acre.	Bate per Rupee.
	Lbs.	Rs. a. p.	Rs. a. p.	Lbs.
1893-94	21,295	81 11 0	106 7 0	200
1894.95	21,112	45 10 0	105 9 0	200
1895-96	19,167	49 2 0	95 13 0	200

The area which was replanted and manured this year gave the following results :—

Outturn per Acre.	Cost of Cultivation per Acre.	Value of Outturn per Acre.	Rate per Rupee.
Lbs.	Rs. a. p.	Rs. a. p.	Lbs.
22,802	100 4 6	114 0 0	200

A good crop for low-lying wet situations.

24. *Mauritius Water Grass* was got from Ceylon, where it is the chief green fodder for milch and other cattle. Two plots have been planted on the farm each under a water distributing channel. The soil is continuously damp, sometimes wet to excess. Yet the Mauritius water grass thrives. No other arable crop would thrive in the same situations. This grass does not produce a very fine fodder, but cattle like it. For cultivation in wet situations it is undoubtedly a valuable addition to our fodder plants. The outturn results in 1894-95 and 1895-96 are noted below for comparison. The grass is probably worth about 300 lbs. per rupee. We charge it at that rate to our dairy cattle.

Year.	Outturn per Acre (Green Fodder).	REMARKS.
	Lbs.	
1894-95	50,020	Cut 4 times.
1895-96	37,860	Cut 3 times.

Probable advantage of growing Lucerne and Guinea grass as a mixed crop.

25. *Lucerne* (Medicago sativa) is difficult to maintain in the Poona district for any length of time owing to damage by disease and other mishaps. Insect Pests are particularly destructive. It is almost impossible to combat the damage done by insects and by the common fungoid disease which attacks the roots. At least I have found it so. I noticed in former reports that lucerne remains longer healthy if it is grown as a mixed crop with Guinea grass. I inferred that such was the case from more or less casual observation in the first instance. It was noticed that lucerne which had become patchy through diseases revived in a remarkable manner when vacant spaces were filled up with Guinea grass sets. This circumstance naturally recalled to my mind a

fact which every English farmer knows, *viz.*, that clover often refuses to grow or dies out in English fields if taken as a sole crop at short intervals. To use a common expression the land gets 'clover sick/ If, however, clover is grown mixed with grasses, nothing is known of clover sickness. Lucerne, it' it is not actually a clover, is a very near relation of the clovers; and there is reason to hope that it can be maintained for years as a healthy crop in any district, if it is grown mixed with Guinea grass. A small area (f acre) was sown with lucerne in order to decide definitely the comparative value of lucerne alone, as compared with lucerne and Guinea grass. The lucerne seed was sown in ridges, the ridges being about 22 inches apart. The crop was allowed to get fully established before the Guinea grass sets were planted. Then the whole area was apportioned into four equal plots. In two plots Guinea grass sets were planted about 18 inches apart on the ridge in the growing lucerne. This was in January 1896. Some of the Guinea grass sets failed and it was not until May of the current year that the Guinea grass was fully established. The lucerne has remained perfectly healthy on all plots. The seed-was sown between 28th and 30th June 1895, seed had previously been sown in the fair season, but failed. The crop was cut for the first time 31st August to 20th September 1895, and the eighth cut was obtained between the 8th and 24th March 1896. The results 'for 1895-96 are as under:—

Outturn per Acre (Green Fodder).	**Cost of Cultivation per Acre.**	Value of Outturn per Acre.	Rate per Rupee.
Lbs.	Es. a. p.	Us. a. p.	Lbs.
37,263	102 1 4	310 8 5	120

26. A separate record is now being kept of the outturn from each plot. The results from the first cut are as under. The crop was harvested between 19th June and 11th July 1896:—

Plot.	Crop.	Outturn per Acre (Green Fodder).
		Lbs.
Plot 1 ...	Lucerne and Guinea grass	982
» 2...	Do. alone	745
„ 8...	Do. and Guinea grass	926
„ 4...	Do. alone	746

Lucerne and Guinea grass mixed yield heavier than lucerne alone. The mixed fodder is suitable for horses in hard condition*

27. There is a possibility that the mixed crop may remain healthy, but irrespective of this there is a probability that it will yield more than the lucerne as long as both remain healthy. It is certain that Guinea grass is nearly as good a food for horses in hard condition as lucerne is, and for both horses and cattle a half-and-half mixture of lucerne and Guinea grass would be superior to either alone. There is no practical difficulty to overcome in growing the two fodders mixed,

Value of good rotation.

28. Sorghums and millets yield heavily as fodder crops, but they will not thrive unless they are regularly alternated with a good rotation crop. Leguminous crops of the papilionaceous sub-order are the best to rotate with cereals, because through the influence of bacteria existing in tubercles on the roots of these pulse crops, free nitrogen is taken from the atmosphere and converted into an organic compound of nitrogen. This combined or organic nitrogen becomes available as plant food as the root residues of leguminous crops decay in the soil. The growth of leguminous crops with cereals in rotation or, as is more common in India, as a mixed crop has probably done more to maintain the fertility of Indian soils

Cereal fodder crops grown with subordinate pulse crops.

than any other cause. In the year under report, the idea of growing a cereal *fodder* crop mixed with a pulse crop suggested itself. Three rows of Sundhia Jowari were sown alternately with one row of Tur (Cajanus indicus) in one-half of a field and three rows of Nilva Jowari alternately with one row of Tur in the other half of the field. A seed drill was not used, because the cereal seed for a fodder crop should be thickly broadcasted. The cereal and pulse seed was sown by hand in the furrow made by a plough and lightly covered by the soil moved by the plough in making the next furrow. If I had to repeat the experiment, the furrows in which the seed was sown would be made closer together. It was seen when the seed germinated that the rows were too far apart. The distance between the rows of Tur was almost five feet. Four feet would have been sufficient. This would have given ample space for the three rows of Jowari which occupied the space between the rows of Tur. The Jowari was reaped soon as the cereal fodder was in flower. The Tur then grew to maturity. And when it the cereal removed the Tur branched out vigorously, and if the rows had been at the proper distance apart, the crop would have completely shaded the ground. Tur generally occupies the ground at least eight months. It has enormous root development and resists drought in a remarkable degree. Its long tap roots penetrate the subsoil and collect plant food there. All the leaves fall as the crop ripens and this litter enriches the surface soil and, as already noted, the crop enriches the soil with nitrogen got from the atmosphere. These characteristics place Tur in the fore front as a rotation crop. There can, I think, be no doubt that healthy crops of fodder Jowari can be grown mixed with Tur year after year in the same land if the land is kept in fair condition by the application of manure as required. This mixed crop experiment is being repeated in the current season and the error made in the method of sowing has been corrected. The object of the experiment is twofold; primarily to get a good fodder crop from the same land every year, but a secondary consideration is to get what is equivalent to two crops in one year and at the same time rest the land from irrigation. If year after year a rain crop is grown and a second cold weather crop under irrigation is also taken, the land in time gets "sick" of irrigation and refuses to grow healthy vigorous crops until rested. Tur is not itself a fodder crop. Its fodder by-products are of trivial value, because insignificant in quantity. The stalks have some value for fuel, for making cheap wicker baskets and, if well grown and peeled, for the production of charcoal suited to make gunpowder.

Tur an exceptionally valuable rotation crop for reasons given.

Object of the experiment to get a good fodder crop annually and to get equivalent to two crops in a year and at the same time rest the land from irrigation.

Black land constantly irrigated gets 'sick' of irrigation,

29/ In the current season this line of experiment has been further extended by growing together cereals and pulses both to be cut for fodder when in full flower. The pulse fodders which, I believe, are best adapted for the purpose are Kulthi for light land and Val and Cholafor heavier description of soil.

Experiment further extended in current season by growing together cereals and pulses both to be cut as green fodder.

30. The results from the Tur-Jowari mixture grown on a comparatively uneven light soil field are as under:—

	OUTTURN PER ACRE.		Cost of Cultivation per Acre,	Value of Outturn per Acre,	REMARKS.
	Grain,	Fodder.			
	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
Sundhia mixed with Tur.	340	2,629	35 7 0	30 10 3	Fields manured; hence high cost of cultivation. Sundhia fodder valued at 130 lbs. per rupee; Nilva, at 150 lbs.
Nilva mixed with Tur.	341	4,644	35 7 0	41 9 3	

31. The above figures are not intended for critical comparison^ The germination was somewhat uneven, being unsatisfactory in those portions of the field where the soil is highest. Insects did some damage in places to both varieties of Jowári. The Tur was comparatively even throughout.

32. The number of leguminous crops which are cultivated in India and which can be referred to the sub-order Papilionaceee, are very numerous. Many of these are not ouly useful rotation crops but also, if cut green, provide excellent green fodder for milch or other cattle. Chola (Dolichos catiang) and Vál (Dolichos lablab) are pro-j^y in thege reSpects the most valuable. Bach crop, if it grows well, forms a thick matted mass of vegetation which completely shades the ground and smothers all surface weeds. Ttus is a point of special advantage, because the succeeding crop requires much less weeding. Vál does well in the cold weather without irrigation on deep moisture-holding soil, if the late rains are favourable, and does exceptionally well under irrigation at this season. Chola, on the other hand, does not. Vdl is at its best in the cold weather with or without irrigation. Chola does better than Val as a hot weather irrigated crop. Both fodders in their green state are greedily eaten by milch cattle. In the year under report, Vdl and Ghola sown in the monsoon did well, grown side by side in one field, but in another field were almost destroyed by aphides and caterpillars. The insects swarmed to such an extent that they could not be destroyed by any means at command.

Chola (Dolichos catiang) and Vál (Dolichos lablab) both good fodder and rotation crops.

We have since got two knapsack spraying machines which any ordinary coolie can carry and work and winch are capable of thoroughly spraying, with insecticide applications, the foliage of any crop, so that insect attack can be promptly checked. Fungoid diseases affecting tbe foliage of crops can be similarly dealt with,

A means of checking insect attack and fungoid diseases which fructify on the foliage of crops.

33. The following tabulated figures show the rain crop results from Chola and Vál in 1894-95 and 1895-96. The value is estimated on the rate at which the fodder was charged to the dairy cattle :—

Crop.		k'eed rate per Acre.	Outturn per Acre (Green Fodder).	Coat of Cultivation per Acre.	Value of Outturn per Acre.	Rate per Rupee.	REMARKS.
		Lbs.	Lbs.	Rs. a. p.	Its. a. p.	Lbs,	
Chola ..J	(1891-95 ...	40	12,089	16 14 0	48 5 0	250	Figures not intended for critical comparison, the fields being more or less uneven-
	(1895-96 ..•	48	7,346	13 8 0	29 6 0	250	
V41.	(1894-95 ..	47	7,993	19 6 0	32 0 0	250	
	(.1895-96 ...•	59	7,528	13 35 10	30 3 0	250	

34. Vál was tried as a hot weather irrigated crop and the outturn was comparatively poor as was the case two years ago. The yield was 5,143 lbs. green fodder per acre. The crop was grown at a loss.

Experiments with Grain Crops.

35. *Bdjri* (Pennisetuin typhoideum).—Only four "varieties of the commonly cultivated cereal have yet been identified throughout the Presidency. The varieties are :—

Four varieties of Bairi identified.

(a). The Deshi variety of the Deccan, which is, I think, identical with the indigenous variety of Gujar&t and which is grown largely in the light Gorddu soils of K&ira and the Baroda territory.

(6). Málbandro, a superior variety, the cultivation of which was until recently confined to Boriávi, a village of the Kaira district, noted for its good cultivation. The variety came originally from Petl&d. The spikes of grain are larger and better filled than in the Deshi variety and the crop has the reputation of standing up well in heavy rain.

(c). Bájro or giant Bájri, sometimes called Jabalpuri and in the Kaira district Bhávnagari, indicating presumably the districts whence the seed was originally obtained. This variety has very large spikes of grain. The stalks are very tall and the grain is large.

(d). Awned Bdjri which is grown near Petlád, also in the Ahmadnagar district. The ears are of medium size. The grain is small and round and the involucre which surrounds each spikelet is more prominent than usual. Hence the name.

Improvement of Bájri by selection and distribution of selected seed.

36. The three first named varieties were under trial on the farm in the year under report, but I do not report outturn results because the crops were very poor owing to unfavourable ram at the flowering stage and drought at another period. Moreover, there was no proper comparative trial owing to the uneven character of the fields. T&e best heads of grain from each variety were selected to provide seed for the crop of the current season. The spiked variety is also under trial in the current season. I got the seed at last year's Ahmadnagar show. Spikes of grain with the straw were exhibited. The selection of seed from each variety will be continued year by year. Bajro has been grown on the farm for some years. It requires fairly good land. On this description of soil it has shown a decided advantage over Bdjri. Seed has been distributed to selected cultivators in the Poona district with, I believe, beneficial results.

Red and white Tur (Cajanus indicus) compared.

37. *Tur* (Cajanus indicus).—Red Tur, which is the only variety known in the Deccan, was compared with the white seeded variety commonly cultivated in Gujarát, The white pulse is undoubtedly of finer quality than the red, but it is questionable whether it has any advantage over the red in outturn. Each variety both this year and last was grown subordinate to a cereal crop. Subordinate crops for obvious reasons are generally more or less uneven and, therefore, it is impossible to draw accurate conclusions from their outturn results, taking no count of the cereal outturn, the results in 1891-95 and 1895-96 from the variety of Tur were as under :—

	Outturn of Pulse per Acre.	
	3894-95.	1395-96.
	Lbs.	**Lbs.**
White Tur	540	**254**
Red Tur	328	**432**

In 1894-95 the crops grew on a medium black soil field and in 1895-96 the field had mixed red and black soil comparatively light. Each variety ripens about the same period.

The outturn from pruned or nipped gram compared with that of non-pruned gram.

38. *Gram* (Cicer arietinum).—The common practice of nipping off the leading shoots of gram in order to encourage branching and the formation of more flowers and fruits was again tested against non-pruning. Care must be taken that the plants are not cropped too much. The pruning costs nothing as farm servants in their own *time* will do the work if allowed to take the primings. The shoots, when sun-dried, can be stored and are used as a vegetable. The results of this year and the two previous years are tabulated below. The crops were each year irrigated. The test plots this year were marked out in the middle of a level black soil field which had a magnificent crop everywhere, except along the borders. Test plots were each year ! acre is extent :—

	Outturn of Pulse per Acre.		
	1893-94.	1894-95.	3895-96.
	Lbs.	Lbs.	Lbs.
The nipped plot	1,375	1,325	1,650
The unnipped plot	1,090	1,071	1,545

American sugar sorghums as grain crops.

39. *American Sugar Sorghum.*—A small area was sown to provide seed for the current season and for distribution. The land was medium black in good condition. A very fine crop was produced. The crop stood thick on the ground, and as the heads of grain were fully developed and the weather was close to the time of harvest, the birds did much damage to the crop before it was cut. We have two varieties, Amber and Collier. There is little to choose between them. They are, in habit of growth, almost identical. The only difference that I can detect is that the one variety has the seed inclosed in black glumes; the other, in light brown or amber coloured glumes. We have proved that these sorghums cannot be profitably grown in the Deccan as sugar-producing crops in the Deccan, but as fodder rain crops they have exceptional merit. They do not succeed in the fair season with irrigation. The seed is large and plump, and should, as food gram, command an equal market rate with the yellow, red and black Jowan so largely grown in the Southern Maratha Country. The sorghums have a decided advantage as grain crops, because the heads of grain take the form of handsome much branched drooping panicles which afford no foothold for birds, and the crop requires no watching, if there are Jowari or Bajri fields in the vicinity. The outturn results for 1894-95 and 1895-96 are tabulated below :—

Tear.	OUTTUBN PEK ACRE.		REMARKS.
	Dry Fodder.	Grain.	
	Lbs.	Lbs.	
1894-95	12,457	457	A light soil field in fair condition,
1895-96	14,360	1,760	A black soil field in extra good condition.

Varieties of Jowari and improvement of seed by Selection.

40. *Varieties of Jowári.*—Fifty-nine different varieties of Jowari were this season obtained from different parts of the Presidency. The objects aimed at were to identify the characteristics of each variety to determine the economic value in the Poona district of each variety as regards its production of grain and also of fodder, and to select from the ripe crops the best heads from the best grain varieties, and from the best fodder varieties. The only really good fodder varieties yet identified are those I have named in paragraph 7 of this report but there are evidently a large number of excellent grain varieties cultivated in different parts of the Presidency differing considerably in their general characteristics. There are remarkable differences as regards the size, shape and colour of the gram, as regards the length and stoutness of the stalks and also in the size and appearance of the inflorescence and grain head. Twenty-five varieties selected as the best grain varieties are under the current season

A large number of good grain varieties grown throughout the Presidency.

under comparative trial at both the Surat and Poona Farms, The seed sown was got from very large fully developed heads of grain, I am hopeful that if seed is selected year by year in this manner, e\en the *best* varieties can be improved. At any rate an effort will be made to accomplish this especially on the Surat Farm, where the improvement of seed by selection will get special attention. Last year's crop on the Poona Farm presented a remarkably interesting object lesson. There were only three rows of each variety. A glance was often sufficient to discern remarkable differences between adjacent varieties. All varieties were grown on good medium black soil. Varieties from any part of the Deccan and from the Southern Manitha Country, all did apparently well; but those varieties which are commonly grown in the Grorádu soils of Kaira and Baroda failed signally. They were affected with rust and were otherwise diseased, and many of the stalks produced no head of grain. The black soil varieties of Surat only did middling. The results confirm what has often been established, *v\z^*

The risks of failure when introducing in any large quantities varieties of cultivated plants of any one district into another district until they have been experimentally tested in the other district.

Experiments with other Crops.

41. Each year one or two indigenous vegetable crops are grown on the farm with the object of gaining authentic information about outturn and methods of cultivation. The cultivation of indigenous vegetables throughout the Presidency is very extensive, particularly in Gujardt, and especially in garden villages where alluvial soil of superior order is found associated with sweet *(i.e.,* not salt) well water. Very little has yet been put on record as regards the methods of cultivating these garden crop.

Market garden crops.

42. *Suran,* Elephant's Foot (Amorphophallus campanulatus), was this year grown on the farm. The crop does best on deep free working soil, heavily manured and copiously irrigated. The plant is grown for its corrns. On each corm is found a large central eye and also lateral tuberose shoots or buds. These latter are cut away along with a small portion of the fleshy part of the Suran and form the sets from which the plant is propagated. The sets are planted in the middle of May in well tilled, well manured soil. Beds should be formed in the usual way for irrigation. 'She sets are planted four inches deep, 40 sets in a bed measuring 12' by 6'. A layer of dry leaves is generally placed on the surface of the soil over each set to protect the young shoots from the sun. Stable litter would answer the same purpose. Water is given immediately after planting and regularly afterwards every 8 days, except when there is sufficient rain. Careful weeding is necessary. In January the first year's crop is dug out. The produce of the first year is unsaleable except for replanting. The corms weigh 1 lb. to 1| lb. each. They are heaped up anywhere in the shade and remain so until the following May, when they are replanted on a different area, which has been cultivated, manured and laid out into beds in the same manner as already described. 12 to 15 Surans in the second year are planted in a bed. Before planting, the buds of the lateral shoots should be destroyed by nipping them off. If only the central eye is left then one, two, or three shoots grow from each Suran. Each Suran weighs, when lifted in December or January, 3 to 6 lbs. The larger sizes are sold ; the smaller are replanted in May and produce in the third year Surans weighing 15 to 20 lbs. In this year a different area is again selected and prepared for planting as already described. Either six or eight plants occupy each bed. As this year's crop approaches maturity, tile plants stand 4 to 4^ feet high with two or three stems from each hill. The Surans are dug up when the stems die down in December or January, and the whole produce is saleable. The value of the third year's crop is very large, but it is practically the result of three years' cropping. Surans have been known to weigh 40 lbs. or more, but that weight is quite unusual. The corm keeps good for a considerable time. The farm crop

Method of cultivation of Suran described.

was grow ... the produce of a first year's crop, and these were got from S ... The cost, inclusive of freight, was Rs. 169 per acre. Farm yard manure ... per acre ... and a top ... of crude nitre, 450 lbs. form, as ... that nitrogen in immediately available Strden ... and ... of very great value to Surans and market ... to ... habit of growth. In proof of ... I need only ... crude nitre to brinjals which are ... under :— ... paragraph ... of last year's report. The Suran outturn, k, results

Outturn per Acre.	Cost of Cultivation per Acre.	Value of Outturn per Acre.
Lbs.	Rs. a. p.	Rs. a. p.
27,349	375 1 3	455 12 8

The larger corms have been sold; the smaller have been again planted in the current year.

43. *Turmeric* (Curcuma longa).—Small areas were grown on the farm in 1894-95 and 1895-96. In both years the outturn of "what full average yield is in the Surat district. The crop is grown in the Deccan and also in Gujarat. I conclude from our results that the soil and climate of the Poona Earm does not suit the crop. This year the whole area, ^ acre, was divided into three plots, each ... of an acre. The plots were manured differently. 2,410 lbs. per acre of castor cake, safflower cake and dissolved bones were respectively applied. The results I tabulate below :—

Poor outturn results 1894-95 and 1895-96.

Manure.	Outturn per Acre.	Value of Outturn per Acre.	Cost of Manure per Acre.
	Lbs.	Rs. a. p.	Rs. a. p.
Castor Cake	7,420	115 15 0	60 4 2
Safflower cake	6,450	100 12 6	50 3 4
Dissolved bones	5,290	82 10 6	73 0 4

The crop in each plot was grown at a loss.

44. *Potatoes* (Solanum tuberosum).—English potatoes, the fourth generation from ... obtained from Messrs. Sutton and ... -Reading, England, gave unsatisfactory results in as much as all the varieties were more or less affected with the ring disease. There is no doubt that English potatoes, grown on the ... after importation. I believe they remain much longer healthy if grown on the hills. Our efforts towards checking this fungoid disease have already been fully reported.

Riek of importing English Tarieties for cultivation on the plains.

Ring disease can be checked, but the treatment must be general to be effective.

... treatment must be *general* in a potato-growing district to do ... asting good. A diseased crop in one field will undoubtedly contaminate a healthy crop in an adjoining field.

45. Only a small patch of potatoes was grown and acre averages cannot well be calculated from the results. The following figures, however ... indicate the comparative value of each variety :—

Variety of Potato.	Seed Potatoes planted.	Produce.	REMARKS,
	Lbs.	Lbs.	
Windsor Castle	11	64	Slightly diseased.
Supreme	30	153	Do.
Matchless	10	42	Rather badly diseased.
Early Regent	42	58	Very do.

46. *Steeping Potatoes before planting.*—The Commissary General, Bombay Command, requested in 1894 that the effect of steeping potatoes before plantation in a solution of nitrate of potash and sulphate of ammonia might be tested. The Commissary General sent the following extract from the *Indian Agriculturist* :—

"According to the *Australian* an enormous yield of potatoes was obtained in one of the districts of Melbourne in the following way. The farmer used sound potatoes of medium size and planted them whole, first ploughing the ground very deeply. Before planting, he steeped the tubers for 24 hours in a bath composed of sulphate of ammonia and mtrate of potash of each 6 lbs. to 25 gallons of water, then allowed them to stand for 24 hours before P ^ n g. The result was that there were 30 to 40 large potatoes on each stalk and a little patch 10 X 9 yielded 180 lbs. net, being equal to 24 tons 6 cwts. and 18 lbs. per acre. An adjacent plot ot ground was planted in the ordinary way and gave 7 tons per acre."

Steeping unsuccessful.

47. I can conceive no rational explanation why potatoes treated as above will yield better than untreated potatoes. Steeping, as described above, resulted in a complete failure on the Poona Farm in 1894-95 and, in comparison with unsteeped seed, gave this year poor results. The Agricultural Journal of New South Wales reported that many farmers who tried steeping with a solution of standard strength, reported complete failures; whilst other farmers got from weaker solutions worse crops than from non-treatment.

48. I treated two varieties with full strength solution. Equal weights and equal numbers of potatoes being steeped and unsteeped. The tubers of one variety had begun to sprout slightly. The tubers of the other variety had sprouted considerably, but not more so than is ordinarily the case when potatoes are planted. The results were:—

Variety.		No. of Potatoes.	Potatoes plauted.	Produce.
			Lbs.	Lbs.
Windsor Castle (slightly sprouted).	Steeped	30	Si	14
	Unsteeped	30	8i	14
Matchless (sprouted considerably).	Steeped	30	3f	H
	Unsteeped	30	8}	m

49. A third variety which had sprouted considerably was treated with solution of half standard strength. The results were greatly in favour of non-steeping, but the variety was affected with ring disease to a considerable extent and, perhaps, it would be unfair to attribute the poor results entirely to the steeping. I think there can be no doubt that it is dangerous to steep seed potatoes which have sprouted in a solution so strong as that recommended, because the germinating power of the potatoes is almost certain to be destroyed.

50. *Onions Ullium cepa).*—Onion seed was grown on the farm from a fine white variety of mild flavour which is the only variety grown in the Presidency which is suitable for export. There is now a large export trade in onions from Bombay and this export is likely to increase, because onions have taken the place of potatoes in some districts owing to the

The necessity of distributing to cultivators the seed of fine varieties.

failure of the potato crop through ring disease. The seed will be distributed amongst cultivators in the Poona district. The red strong flavoured onion which is so extensively grown and natives like for home consumption is unsuitable for export.

51. *Importatio7i of vegetable seeds for distribution.*—Mr. C. N. Seddon, ^e Administrator of the Sachin State and Assistant Collector in the Surat district, is anxious to encourage the cultivators of garden land in his own villages and «. eneraU y in the Surat district, to grow better descriptions of English vegetables than they now produce. The cultivation of garden crops in this district is much more advanced than in any other part of the Presidency. Surat supplies the Bombay Market to a very considerable extent. Cabbages are extensively cultivated, but those grown are a very coarse variety. Very fine specimens are, however, grown, and the cultivators understand perfectly how to grow a very heavy crop. The seedsmen in Bombay charge very high prices for seed of inferior varieties. I have got out this year for Mr. Seddon from Messrs. Sutton and Sons, Heading, England, 30 lbs. of cabbage seed and smaller quantities of cauliflower, broccoli, onion, carrot and beet-root seeds, all of vigorous growing good varieties. The seed will be distributed at cost price, which is about J the Bombay price. Only the seed of such vegetables as have already been grown successfully under similar conditions of soil and climate to those of Surat, has been introduced and, therefore, there is the smallest possible risk of disappointment or failure. The list can easily be added to, if necessary, in future years.

Seed of choice varieties of English vegetables imported for dietribution at cost price t. cu. dltric^0"3 ^ thQ SUrat

52. *Cotton.*—Three wild forms of cotton have been grown on the farm for some Y€ars- The objects aimed at in growing these are fully dealt with in paras. 45 and 46 of the report for 1894-95. There is nothing of practical value to report this year.

Wild cottons of India.

53. I must this year modify the remarks which I made in paragraph 48 of last year's report regarding Surat cotton. I there said that we had under cultivation at the Poona farm a variety called * L£lia' obtained from Navsari (Baroda), this variety being grown in comparison with the 'Deshi' variety of Surat. I am now nearly certain that the Lalia of Navsari and the Deshi of Surat are botanically and otherwise identical. The Navsari cotton, especially that produced in certain villages, is sought after eao•erly ^y Bombay merchants, not because it is a ^stapled cotton grown in ^ g ^ ^^ ^ tbe Deshi of gura^ but because the soil or climate of these villages is suited to produce and actually does produce a finer quality of lint and a longer staple than is produced elsewhere, and for such cotton a better price is paid. There is no doubt that the cotton througout Surat and in the adjacent Baroda territory is to all intents and purposes pure. Dr. Watt, though he walked for days through a wide cotton tract, could not find in the Surat district a single plant differing from the recognised type. We have been growing on the Poona Farm for three years this type of cotton from seed selected each year with the greatest care, the biggest sound bolls being picked from the most robust vigorous growing plants. One plot was sown with seed selected originally from a single plant, the plant being selected on account of its size, its branching habit of growth and the numerous bt>lls it carried. Poona is not a cotton growing district, and the intention of carrying out these experiments on the farm was to have seed, more or less improved, ready to begin with on the Surat Farm. These cotton experiments have, in the current year, been transferred to the Surat Farm.

Surat cotton practically pnre%

Surat cotton as grown at Navsari probably the best ^stapled cotton grown in India.

The improvement of cottOn on practical lines.

54. The Poona Farm crop was this year exceptionally good, but the lint was this year as in previous years inferior to that produced in Surat. The fibre wtfs coarse and harsh, and the percentage of lint to s^d was only 32 to 33, whereas seed cottou from a good crop grown in the • Surat district yields always 35 to 36 per cent., and in exceptional cases as much as 38 per cent. lint. I think there can be no doubt that the dry and bracing atmosphere in the Deccan in the fair season is unsuited to the production of the finest quality of cotton

Degeneration of cotton in the Deccan.

The cotton plant lends itself stubbornly to any change, climatic and otherwise.

pre whilst the soft sea breezes which prevail through- Surat and Broach are specially suitable. It is clear that cotton does not lend itself readily to every change of soil and climate, and that the introduction of a good variety into districts where an inferior variety is grown, may not always be advantageous. The only hope of improving cotton appears to be the selection of seed of the best local variety and in the distribution of such selected seed. It will probably be found that the best local variety will usually be the variety which the cultivators find, pays them best.

outturn results from the Poona Farm crop were as follows :—

Seed Cotton per Acre.	Cost of Cultivation per Acre.	Value of Outturn per Acre.
Lbs.	Rs. a. p.	
839	29 11. 9	5B IS* H

If the lint had been of as good quality as that produced in the Surat district, the crop would have been worth over Rs. 70 per acre. The outturn, however, was above the average outturn in Surat, as determined by special tests taken last year.

55. Varieties of Sugarcane. - An effort has been made this year to bring under comparatively trial on the Poona farm all the varieties of cane known throughout the Presidency. Hitherto only one variety, Pundia, in general cultivation in the Poona district. It is probable that very few of the other varieties in cultivation in India surpass or even equal Pundia for the production of Gul or crude sugar. But we are not sure that such is the case. We know that Pundia, if pressed in a particular way, yields a large percentage of juice which is rich in chrystallizable sugar; and that on this account, and because India ... superior to other varieties cultivated in other parts of India, and the ... other Presidencies for experimental cultivation. Yet the reported results indicate that it compares favourably with local varieties. The Poona results are poor in every case the ... the same conditions of soil and climate ... variety deteriorates when grown under the same as those of its own district. I fear that the sugar producing power of sugarcane is very easily affected by change of soil and climate. In proof of this I instance the results of two varieties which were introduced from Mauritius three years ago. They were imported as two of the best Mauritius varieties, but in the Poona district they yield a miserably poor percentage of Gul, although they grow very heavy crops of sugarcane. The Agricultural Chemist to the Government of India in his investigations at Poona and elsewhere has proved that the juice of some varieties of cane is much richer in chrystallizable sugar than the juice of other varieties, and that the juice of some varieties has a considerable percentage of uncrystallizable sugar. The presence of much glucose is the chief reason being that Gul made from such juices does not solidify properly, if it is kept and will not bear transport. Dr. Leather has further proved that the percentage of sugar unexpressed is considerably more in the case of some varieties than in others even when the best known pattern of cane mill is used, and he is of opinion that a cane containing much crude fibre does not yield its juice so readily under pressure as a soft cane with more cellular tissues. A soft cane, however, can not be grown in some districts because jackals and pigs damage it to a far greater extent than they do a cane which is hard and fibrous.

The sugar producing power of sugarcane probably easily affected by any change of soil and climate.

Results of investigation by the Agricultural Chemist to the Government of India referred to.

56. Varieties grown on the farm will be ripe in December-January, and Dr. Leather has promised to determine the percentages of chrystallizable sugar in the juice of each variety as it ripens. Dr. Leather has also promised to estimate the percentages of sugar found in canes selected from crops grown in districts,

where each variety is commonly grown. In this manner we will be able to detect whether the change to Poona has caused deterioration or otherwise.

How to gauge the comparative values of different varieties.

57. In gauging the comparative values of different varieties count will be taken of the following :—

I.—The weight of cane from a given area.
IT.—Whether the cane is better suited for Gul-making or raw eating.
III.—The total percentage of juice in cane.
IV.—The percentage of juice expressed.
V.—The percentage of Gul to cane.
VI.—The quality of the Gul, *i. e.*, whether of good bright colour and solid.

Over 20 distinct varieties under trial.

58. We have in all 49 different plots, representing possibly between 20 to *30* varieties. Varieties cannot be identified by their vernacular names. The same variety in different districts is distinguished by different vernacular names. I think there can be no doubt that we have under comparative trial more than 20 different varieties. There are remarkable differences between plots. Some have thriven much better than others. All have done very well, except seven varieties from Surat, which all failed, or at least they have made such poor progress in the Poona district that they are not worth cultivating here.

Remarkable differences between comparative plots.

59. A detailed note on sugarcane experiments at Manjri is appended as last year at the end of the report.

ORDINARY CROPS, NON-EXPERIMENTAL.

60. The following tabulated figures give the results for the year :—

Crop.	OUTTURN PER ACRE.		Cost of Cultivation per Acre.	Value of Outturn per Acre.
	Principal Product.	By-product.		
	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.
Bajri (Pennisetum typhoideum) mixed with Tur (Cajanus indicus)	463 265	827	20 5 3	28 6 0
Bajri alone ...	369	1,160	15 12 3	16 2 9
Gram (Cicer arietinum) ...	994	298	22 10 8	34 2 0

61. The Bdjri and Bajri and Tur were grown for the benefit of rotation and were poor crops, owing to an unfavourable season for Bajri. Gram was grown on six fields and varied in yield from 1,460 lbs. to 625 lbs, per acre,

POONA FARM ACCOUNTS.

62. The farm accounts have been kept distinct from the dairy and the dairy-herd accounts. Two balance sheets are appended showing the financial results of each. The farm balance sheet shows that the net cost to Government has been Us. 1,853 as compared with Rs. 612 in 1894-95 and Rs. 1,484 in 1893-94.

DAIRY AND DAIRY-HERD,

63. The financial results are shown in the appended balance sheet. The profit for the year is Rs. 1,952 as compared with Rs. 267 in 1894-95 and Rs. 2,255 in 1893-94. The profit in 1894-95 was abnormally low, owing to losses from rinderpest.

64. The dairy produce from 77 milch cattle was sold for Rs. 15,793, Cattle food, fodder, and grazing cost Rs. 11,101. There was food and fodder on hand at the end of the financial year worth Rs. 2,140. The price of dairy produce supplied to the Commissariat Department for sick soldiers in hospitals is lower than the rates charged to the general public. The latter rates are fixed purposely higher than the rates charged at private dairies in Poona. The

demand for milk and butter by private individuals is much more than can be met. Residents in Poona and Kirkee, who have young children, are apparently particularly anxious to get their milk and butter from the farm.

65. There is no question that the initiative example of the Bombay Agricultural Department has done a great deal to advance the dairy enterprise throughout the whole of India. The Kirkee Dairy has been taken advantage of to a considerable extent by natives, who wished to acquire a practical knowledge of improved dairy methods. Four Madras men were so taught last year, one of them being the farm bailiff of the Saidipet College Farm. He was taught at the Poona farm so that he might be able to teach at Saidapet. The senior students of the Bombay Veterinary College come to the farm for about a month each year, and receive a course of instructions in dairying, in the management and feeding of farm stock, in the principles of breeding farm animals and in growing fodder crops, &c, &c.

General beneficial effect of initiative example.

Improved dairy methods taught at the farm to natives.

66. The Manjri Stock Farm is an adjunct of the Poona Farm, which is proving itself of great value. The stock-farm extends to about 280 acres of good grass land, well sheltered and watered. Last year we rented from the Forest department a considerable extent of grass land at Bhamburda. We have now a sufficient reserve of fodder to meet any ordinary emergency, such for instance as an unfavourable season. The Manjri Stock Farm affords every facility for the healthy upbringing of our young stock. The dry cattle are also kept there and at considerably less cost than at Kirkee.

The advantages of the Manjri Stock Farm.

67. The Sind, the Gir and the Aden cattle which are kept on the farm are maintained pure. I have no hope that any good can be effected by crossing these breeds *inter se*. The crossing of these and other *pure* Indian breeds leads to the production of offspring which at the best are half-castes and are often mongrels. Many of the indigenous pure breeds have characteristics which could only have been acquired by a careful system of breeding for many generations. The fixed type of Gir cattle, for instance, could only have become perpetuated by careful breeding for a very long time. These cattle and other pure indigenous breeds can no doubt be improved for milk or for work purposes by breeding from the best. The characteristics of the breed, these are the more or less the outcome of the natural conditions in which they are bred. These natural conditions in Sind, Gir and Aden are unchangeable, and therefore, in my opinion, it would be unwise to attempt to change in any marked degree the general type of any local breed.

Each indigenous milch breed maintained pure.

Objections to crossing.

68. In last year's report I said that I had no hope that the bulls, the produce of our best milch cows, would ever be used with advantage in improving the Deccan breed of cattle. I would object to see them used for this purpose, because I believe, the small indigenous hardy Deccan breed is the result of natural conditions. The greater portion of the Deccan *hrcLT* often to periods of scarcity, and there is no hope that a larger and softer breed would survive these trying seasons unless the fodder and food supply was improved. There is no practical means of improving the Deccan breed which is notoriously inferior as plough cattle, except by using only the best indigenous bulls.

Farm-bred bulls not suitable for crossing with the indigenous Deccan breed.

69. Our efforts are chiefly directed to improve the milking capacity of the various breeds that are under trial. We expect to get from a deep milking cow a heifer which in time will be a good milker. Well provided the stud bull used is of a good milking strain. It is well known that the effect of the bull in this direction is just as potent as that of the cow. Therefore the bulls used for stud purposes at the farm are not only individually good specimens of their respective breeds, but are also the produce of cows which were known to be good milkers. I believe that some of the bulls which have been reared on the farm, and which are now old enough to be used for stud purposes, will prove superior as sires to those hitherto used. It is also to be able to show, as our experiments proceed, that heifers bred on the farm will prove themselves exceptionally good milkers and be also typical specimens of the breeds they represent.

Breeding for milk.

Well known that the effect of the bull in this direction is just as potent as that of the cow.

70. The services of the farm bulls are given gratis for all healthy cows in good condition. A large number of very good Gir cows owned by private residents in Poona, also by Gaolis (professional milkmen), take advantage of the farm Gir bulls when sought for. It is intended to transfer the whole of the Gir cattle to the Surat Farm and breed only Aden and Sind cattle at Poona; but owing to the fact that a considerable number of Gir cows is brought to the Poona Farm for service at least one pure bred Gir bull will be kept there and be available for stud purposes. They are much more certain as stock-getters.

The services of farm bulls given gratis for all healthy cows in good condition.

The Gir cattle to be transferred to the Surat Farm.

71. I noted last year that Gaolis (professional milkmen) are keen to buy young bulls from our best milch cows. They like the Gir bulls best. I think there can be no doubt that the sale of good Gir bulls, from our best milch cows, to native owners of milch cattle, must do good; because these bulls are used for stud, Chiefly on Gir cows, the cows being imported from Kathiawar, but there are a few Aden cows owned by residents in Poona. The cows are brought regularly to the farm for service. A Aden bull was sent twice during the year to Sirur. There are several Aden cows at Sirur, and the owners were anxious to get the services of a pure bred bull.

The young bulls bought for stud purposes by Gaolis (professional milkmen).

72. Full information regarding experience gained at the farm about dairy cattle will be found in two Pamphlets, which I have written for the Agricultural Ledger Series, one on the "Management of Dairy Cattle in India," and the other on "Milk and Milk Products". These pamphlets are offered for sale at the Government Central Book Depôt, Bombay, at the cost of printing and binding,

Information regarding the management of cattle in India published in two pamphlets in the Agricultural Ledger Series.

73. I submit below two tabulated statements which give details of the milk of buffaloes and cows during the year :—

The milk yield of the dairy herd.

Buffaloes,

No.	Name.	Breed.	Date of Calving.	Number of days in Milk.	Maximum yield.	Average yield.	Total yield.	Date of birth of next calf or due to calve.
					Lbs. oz.	Lbi. oz.	Lbs. oz.	
1	Thami	Jafferabad..	25th Nov. 1894	327	24 4	12 32	4,186 32	17th Oct. 3895.
2	Bami	Do.	4th Sept 3894	339	21 12	34 6	4,879 4	23stOct. 1895.
3	Champ*	Do.	24th Aug. 1894	447	24 8	12 5	5,495 12	16th Nov. 1895.
4	Samarth	Delhi	39th June 1894.	298	27 8	16 10	4,956 8	12th Oct. 1895.
5	Bichva	{Surat	39th Oct. 1894	326	22 8	14 5	4,672 12	Not covered.
6	Tuphato	Do.	16th Nov. 1894,	292	17 32	31 14	3,459 4	17th Nov. 1895.
7	Khandi	Do.	6th Nov. 1894	299	18 0	14 2	4,231 4	6th Nov. 1895.
8	Keshar	Do.	37th Oct. 1884	266	39 8	12 4	3,263 8	11th Nov. 3895.
9	Mohan	Do.	29th Nov. 1894.	2^3	17 4	11 4	3,181 4	12th Nov. 3895.
10	Ayadi	Do.	26th Oct. 1894.	300	17 4	11 6	3,408 4	12th Nov. 3895.
11	Pafdi	Do.	15th Sept. 1894	298	14 12	10 0	2,972 0	8th Dec. 1895.
12	Mukharan...	Do.	2'stFeb. 1895	265	12 0	8 13	2,334' 8	Sold.
13	Lahira	Do.	30th h'ept. 1894	281	16 8	10 0	1,815 12	3rd Nov. 3895.
14	MahiUb	Do,	2nd Oct. *1SH*	253	17 12	30 8	2,653 0	21st Sept. 1895.
15	Nagina	Do.	29th Sept. 1894	377	14 0	7 2	2,680 4	29th Feb. 3896
16	Asmafn	Do.	6th Aug. I894	415	22 0	11 9	4,796 8	30th Dec.-1895.'
17	Somi	Do.	25th Sept. 1894	286	10 0	7 7	2,128 8	2nd Dec. 1895.
38	Gulafb	Do.	2nd June 1894	309	14 0	9 30	2,932 0	22nd July 1895.
19	Malbari	Do.	12th May 1894.	417	39 32	10 12	4,477 0	9th Nov. 1895.
20	Bhadra	Do.	15th May 1894,	352	16 12	10 9	3,725 0	1 8th Oct. 1895.
21	Sita	Do.	35th May 1894	36*	38 4	11 30	4,232 8	16th Oct. 1895.
22	Maina	*Do.*	28th May 1894,	440	37 8	9 13	4,326 4	27th Jan. 1896.
23	Tunga	Do.	8th May 3804	303	20 12	12 2	4,762 4	26th Nov. 1895,
24	Chandni	Do.	1st May 3894	366	18 12	12 2	4,432 8	22nd Oct. 1895,
25	Thaki	*Bo.*	11th Feb. 1894-	436	19 0	32 3	5,318 8	14th Oct. 1895.
26	Tikkal	Do.	14th Dec. 3894	113	9 12	4 6	482 8	18th April 1896.
27	Lali	Do.	18th Jan. 3894	372	19 8	33 7	4,938 8	6th April 1896.
28	Surat	Do.	22nd Aug. 1894.	3 05	18 32	9 8	1,858 0	12th Dec. 1895.
29	Dashrath	Cross	22nd Fe*b. 1895	276	n 12	8 7	2,333 32	12th Feb. 1896.
SO	Muga	Dc.	5th Mar. 1895.	352	17 12	11 11	4,122 0	39th Aug. 3896.
31	Chandri	Do.	19th Jan. 3895	188	13 12	8 14	3,668 4	16th Nov. 1895.
32	Zendi	Deccan	13th Jan. 1895.	401	11 4	7 3	2,895 8	24th Oct. 18&6.

Cows.

No,	Name,	Breed.	Date of calving.	No of days in milk.	Maximum yield.	Average yield.	Total yield,	Date of birth of next calf or due to calve.
1	Siti	Gir	26th Oct. 1894...	402	19-12	12·15	6,209-4	14th Dec. 1895.
2	Narali	))	30th Dec. 1894...	318	25-12	11-12	3,732-12	15th Mar. 1896.
3	Batatei	Sind.	20th Nov. 1894...	335	22-8	8-14	2,971-4	2nd Dec. 1895.
4	Kabarmati	,,	14th Jan. 1895...	341	15-2	9-6	3,203-4	28th Jan. 1896.
5	Krishni	,,	3rd Feb. 1895...	308	10-12	6-0	1,850-4	22nd Jan. 1896.
6	Kousali	,,	8th Aug. 1894...	405	18-8	10-12	4,363-0	26th Sept. 1895.
7	Amini	,,	14th Aug. 1894...	282	19-4	10-5	2,918-12	25th Aug. 1895.
8	Rakhmi	,,	30th Oct. 1894...	355	12-8	6-4	2,238-0	2nd Jan. 1896.
9	PAndi	,,	14th Aug. 1894..	347	20-8	8-12	3,055*0	25th Nov. 1895.
10	Janki	,,	21st July 1894...	343	13-4	7-2	2,455-0	13th Aug. 1895.
11	Devari	,,	3rd Aug. 1894...	231	14-0	7*6	1,711-12	17th Aug. 1895.
12	Damayanti	Aden.	28th Oct. 1894...	1C7	15·4	5·14	988-0	1st Feb. 1896.
13	Chandraval	Half Aden	29th July 1894...	308	16-8	8-6	2,587-0	1st June 1896,
14	Kolhi	Cross.	2nd Aug. 1894...	172	27-4	12-4	2,115-0	11th Dec. 1895.
15	Lalii		6th Dec. 1894...	130	9·0	5-6	702-12	14th Jan. 1896.

74. The average number of days between two calvings were as under :—

Jaff erabad buff aloe	...	429
Delhi	))	480
Surat	,,	484
Cross	,,	397
Deccan	,,	621
Gir	cows	427
Sind	,,	396
Aden	,,	461
Half Aden	,,	307
Cross	,,	410

75. I give below the average number of pounds of buffalo milk required to make a pound of butter during each month in the year. It will be noticed that a less quantity of milk is required to produce a pound of butter in the hot weather when green fodder is scant than during the rains when it is more plentiful :—

No.	Month,	Milk in lbs.	No.	Month.	Milk in lbs.
1	April	11-4	7	October	13-3
2	May	11-5	8	November	13-5
3	June	12·9	9	December	12-7
4	July	12·1	10	January	11·8
5	August	12-5	11	February	11-5
6	September	13-1	12	March	12·1

Feeding Experiments.

The difficulty of conducting feeding experiments in India.

76. During February, March and April of the year an attempt was made at the farm to conduct feeding experiments with milch buffaloes. Such experiments can only be conducted in India during the fair season. In the monsoon season several consecutive rainy days feact on the milk yield of cows and buffaloes to a prejudicial extent. Even in the fair season there may be conditions which cannot always be controlled which will affect the milk yield, for instance there, will be a noticeable decrease in milk yield if the nights are exceptionally cold or the days exceptionally warm. All animals will not be equally injuriously affected by paese conditions. A»ain, often a very trivial circumstance or slight irregularity »n management affects the milk secretion in Iudian cattle. The results of our experiments must, therefore, be accepted with a certain degree of caution.

77. Sixteen buffaloes were carefully selected for experiment. They were divided into four lots. During previous periods of lactation our milk register showed that the animals selected had yielded steadily. The four lots were as near as pos3ible equal in yield of milk and otherwise when the experiment began. On the 1st of February each lot gave practically 68 lbs. of milk. The daily ration for each animal of each lot was as under :—

The plan of experiment and the rations given,

Lot I.—5 lbs. mixed safflower and ground-nut cake.

1 !b wheat W crushed, gmm (Ucer anetmUm) -) \Moistened with water 4to 6 hours t S'salt before feeding times.

Lot II.—5 lbs. mixed ground-nut and niger seed cake.

4 lbs. wheat bran.
4 lbs. crushed gram.
4oz. salt.
20 lbs. hay.

} Moistened ^ wafcer 4 to 6 hours r. u c c y ±-) beforefeedmS times,

Note.—The cakes given to Lots I and II are extensively made in Bombay, are sold at a comparatively cheap rate, and are exported largely. One object of the experiments was to prove that these cakes are suitable food for milch cattle and might be used advantageously in India.

Lot **III.**—7 lbs. crushed gram.
4 lbs. wheat bran.
• **lib.** Gul.
4 oz. salt.
20 lbs. hay.

Note.—The Gul was dissolved in hot water and used to moisten the gram and bran. This was done 4 to 6 hours before feeding times, so that the gram had time to swell up and soften.

The ration to Lot III resembled in character the bean meal ration which is so much in favour for dairy cattle in England,

Lot IV.—7 lbs. crushed gram.
4 lbs. wheat bran,
lib, Gul.
4 oz, salt.
20 lbs. chaffed hay.

The chaffed hay for Lot IV was mixed layer and layer about with the concentrated food in a large tub. The mass was thoroughly moistened with hot water in which the Gul was dissolved. The food was mixed twice a day and fermented to some extent before it was fed. It was found that if it was prepared only once a day it fermented so much in 12 to 14 hours that it became sour and the cattle did not like it.

The concentrated food was given to Lots I, II and III in two equal rations at milking time, *viz*^ at about 4 A.M. and 2 P.M. The dry hay was given at 10 to 11 A.M. and 5-30 to 6-30 P.M.

The mixed food for Lot IY was given

\ at time of morning milking about 4 A.M.
\ at 10 to 11 A.M.
\ at time of afternoon milking at *i* P.M.
£ in evening at 5^30 to 6-30.

78. The cattle were in the stalls about 18 hours during day and night. They were turned out for exercise and water and bathing at 7 A.M. and returned to the byres at 10 to 10-30 A.M. They were again turned out at 3 P.M. and returned to the byres for the night at 5-30. The cattle stood two together in eaelx stall. The stalls are fatted with feed troughs. The floors are stone with joints cemented. The dung and urine from each lot of four was separately collected. The urine was daily weighed. The dung from each lot of four was

urine

collected in separate pits. The urine after weighment was daily poured over tbe solid excrement in the respective pits. The dung plus the urine added was weighed at the end of each month. No litter was allowed. A little of the dry todder was trampled under foot and soiled by excrement. Any soiled fodder jas added to the dung in the respective pits. Any dry fodder not eaten was daily weighed and weights recorded. The manure pits for Lots I, II and III contained a little waste fodder, but that for Lot IV contained practically no fodder nnxed with the dung because the fodder being chaffed there was practically no wastage, none being spilled from the feeding trough on to the floors of the stalls.

79. The cattle were accustomed to the rations during February. Lots I, II and IV did not take kindly to the food at first. They milked irregularly for some time, but before the end of February each lot greedily ate the respective rations. At the 1st of February each lot gave practically the same yield of milk. At the 1st of March, when the experiment really began, there was slight difference in the yield from different lots. The rations allowed were, as reported above, during Februai-y and March. During April 10 lbs. per head of Guinea grass was substituted for 5 lbs. °f dry hay to Lats I and III. The milk from each animal was separately weighed ni^ght and morning. Once a week the milk from each lot of four was separately separated both morning and evening. The cream for the day of each lot of four was kept until ripe and then churned into butter. Samples of the milk were submitted to the Agricultural Chemist for analysis. The results have not yet been reported.

The feeding experiments continued during three months but results for first month laot reported for reasons given.

SI). The results as regards yield of milk and butter were as under:—

Lot.	Yield of milk on 1st February.		Yield of milk on 1st March.		Average daily yield of milk during March.		Number of lbs. of milk required to produce a lb. of butter during March,		Averave daily yield of milk in April.		Number of lbs. of milk required to produce a lb. of butter iu April.	
	Lbs.	oz.	Lbs.	oz.	Lbs.	oz.	Lbs	oz.	Lbs.	oz.	Lbs.	oz.
Lot I ...	68	25	61	5	60	2	13	3	59	5	13	8
Lot II ...	67	25	63	0	61	1	13	1	57	8	13	1
Lot III ...	67	75	63	5	60	6	13	8	61	2	14	1
Lot IV ...	67	0	64	0	61	4	13	3	57	1	12	7

81. I am not sure that the figures reported above in respect of the number of lbs. of ^ r?9uird to P^duce alb. of butter are quite reliable for the reason that we were dealing with small quantities of milk and cream. I do not think that a separator will separate the cream so thoroughly when dealing with a small quantity of milk as with large, and it is quite possible that our churn, which is comparatively large, did not get so much butter from the cream as a smaller churn would have got. Dr. Leather's analysis of the milk will of course give reliable figures. I hesitate to make any absolute deductions from the reported figures although they are obviously suggestive. I think there can be no doubt that the Guinea grass during April given to Lots I and III in lieu of part of the hay had the effect of maintaining the yield of milk at a higher pitch than if no green food had been given, but that the milk from the grass fed cattle was poorer in butter fat than the milk from cattle fed entirely on dry food. As regards the question of relative cost of rations that need not be minutely examined. The resists are not sufficiently decisive. The rations given to Lots I and II during February and March cost exactly the same and are slightly cheaper than that given to Lot III and considerably cheaper than that given to Lot IV. The feeding experiments on a more extensive scale will be repeated during the fair season of the current year.

The results criticised.

82, The following figures give the weight of urine, dung, &c#, from each lot of four.

Lot.	Month.	Weight of urine during month weighed daily.	Weight of dung and urine collected in pit during month and weighed at end of month.	Concentrated food not eaten.	Dry fodder not eaten.	REMARKS.
		Lbs.	Lbs.	Lbs.		
Lot I ...	March ...	920	3,276	8	52	
	April ...	1,139	3,945	...	35	
Lot	March ...	895	3,207	5	60	
	April ...	1,047	4,228	...	7	
Lot III ...	March ...	549	3,632	3	49	I can offer no explanation as regards the small quantity of urine from this lot as compared with Lots I and II.
	April ...	623	3,896	...	28	
				Mixed food and fodder Lbs.		
Lot IV...	March ...	348	3,299	174	...	Do do.
	April ...	405	2,752	123	...	

Analysis of by Dr Leather.

83. The manure produced during Eebruary, March and April from each lot of 4 was thoroughly mixed and made up into separate ^aps. An average sample was taken from each heap about the 2nd or 3rd May and put in a kerosine oil tin and packed down tight. These samples were sent to the Agricultural Chemist for analysis on 17th July. Between the 1st of May and the 17th July a little water would have been given off by evaporation, but not a great deal. Dr. Leather's analysis is given below. Each sample, considering the amount of moisture present, is extremely rich in nitrogen and phosphoric acid :—

	Lot I.	Lot II.	Lot III.	Lot IV.
Moisture ...	72-42	73-25	74-96	74-86
Organic matter ...	16-37	16-62	14-72	14-54
Mineral matter ...	11-21	10-13	10-32	10-60
Total ...	100-00	100·00	100-00	100·00
containing nitrogen ...	0-53	0-47	0-47	0·10
Containing phosphoric acid ...	0-38	0-47	0-31	0·46
Containing sand ...	9-89	8-75	9-22	9-18

SHEEP.

84. A small flock of OroB? De<*ani Dumba ewes has given satisfactory results. Half-bre rams ar Vl*0 Used" The Deccani Du' ^a cross-bred is hardy matures eal capital matton sbee p and gives a good fleece of wool. The piS bred D t Ves n t lonf h ^ y in the ^ona district. The crossbred is h?wever, quite as hardy as the indigenous breed.

•ESTABLISHMENT.

85. I have again to report good conscientious work by my Assistants Messrs. Kelkar and Kánetkar, the former being in charge of the Poona Farm, the latter of the Surat Farm. Mr. Kulkarni, who was until lately clerk on the Poona Farm, has been promoted as clerk in my own office. A Diplomate in Agiculture has been appointed clerk on the Poona Farm. Mr. K&shindth, the Overseer at Md,njri, has done good work in looking after the young cattle and in surpervising the cultivation operations in our experimental sugarcane.

I have the honour to be.

Sir,

Your most obedient Servant,

J. W. MOLLISON,

Superintendent of Farms, Bombay Presidency.

TABLE I.

Balance Sheet of the Poona Farm, 1895-96.

Receipts.	Rs. a. p.	Amount. Rs. a. p.	Expenditure.	Rs. a. p.	Amount. Rs. a. p.
To Sale-proceeds of farm-produce, 1895-96—			By Rent of land	.....	152 0 0
„ Grains	87 15 0		„ Assistant Superintendent's pay	.....	960 0 0
„ Fodder crops	1,856 7 3		„ Establishment pay	.....	588 0 0
„ Potatoes	13 11 11		„ Horse allowance	.....	240 0 0
„ Vegetables	14 0 9		„ Travelling allowance...	.....	156 12 0
„ Turmeric.	3 0 0				
„ Fruits	48 0 0		„ Ordinary expenditure—		
„ Sugar-canes	*68* 15 3		Labour and cost of up-keep of farm bullocks	2,218 9 1	
„ Miscellaneous receipts	92 6 9		Skilled labour	43 4 0	
„ the value of produce of 1895-96 unsold on 31st March—		2,184 8 11	Purchase of manures	149 9 6	
A. Since sold—Grain	386 11 6		Do. seeds for sowing	279 14 9	
Gul	21 0 8		Do. dead-stock	515 1 2	
Fruits	43 0 0		Do. stationery, service stamps and telegrams, and petty supplies ...	120 2 9	
Cotton	38 0 0				
Fodders	107 13 3		„ Miscellaneous	99 1 6	
Miscellaneous	*28* 15 6		„ Irrigation charges	337 2 0	
		625 8 11	„ Petty impovements	29 9 9	
B. On hand—Grain...	272 7 7		„ Wire fencing...	175 0 0	
Fruits	39 0 0				3,967 6 6
Cotton	20 0 0				
Turmeric	20 8 10				
Vegetables	18 12 0				
Fodders	12 14 2				
Onion seed	12 8 0				
Gul	24 5 0				
„ Guinea-grass—Value of growing crop and established plantations	255 0 0				
		675 7 7			
„ Net increase of dead-stock	410 5 8				
„ Do. live-sock	315 0 0				
		725 5 8			
To balance, being net cost ...		1,853 3 5			
Total ...		6,064 2 6	**Total** ...		6,064 2 6

TABLE II.

Dairy Balance Sheet for the year 1895-96.

Receipts.	Rs. a. p.	Amount. Rs. a. p.	Expenditure.	Rs. a. p.	Amount. Rs. a. p.
To sale of milk and butter, the Produce of farm cattle ..	16,792 15 1	.....	By Overseer's pay) I Stock Farm, Manjri. (	180 0 0	.....
» sale of milk tins and jars .	6 4 0	.....	„ Herder's pay.)	204 0 0	384 0 0
" » livestock	393 6 0	.....	„ Concentrated food bought	6,712 11 0	.....
" >5 manure	137 8 0	.....	j, Fodder bought	2,524 4 1	.....
" » wool	12 2 0	16,342 3 1	„ Rent of grass land	260 0 0	.....
» ^tter on hand on 31st March 1896	445 9 6	445 9 6	„ Hay-making expenses	1,603 13 6	11,100 12 7
" Fodder on hand	1,839 12 8	.....	„ Labour...	2,629 9 5	.....
» Food.	300 0 0	2,159 12 8	„ Water-rate	36 0 0	.....
Interest in value of live	.....	530 0 0	„ Cost of repair and incidental outlays for management of dairy and dairy herd	1,669 34 9	4,335 8 9
			„ Purchase of dairy utensils, &c. ...	86 18 2	..
			„ „ of live stock.	1,566 8 6	1,643 0 8
			„ Butter on hand on 31st March 1895...	42 0 0	42 0 0
				.....	17,505 5 5
			By balance, being net Profit ...	.....	1,952 3 10
Total ,...	.....	19,457 9 3	Total ...	.....	19,457 9 3

TABLE III.

Valuation Statement.

Description.	STOCK ON HAND ON 31ST MABCH 1895. Number.	Amount.	STOCK ON IIAKD OK 31 8T MABCH 1896. Number.	Amount.	Increase.	Decrease.	Remarks.
		Rs. a. p.		Rs. a. p.	Ra. a. p.	Rs. a. p.	
Working bullocks	4	185 0 0	4	165 0 0	.....	20 0 0	
	4	185 0 0	4	165 0 0	.....	20 0 0	
Dead Stock-							
Farm implements.	...	1.912 2 6	...	2,274 12 2	362 9 8	.....	
Office furniture	...	307 0 0	...	154 12 0	47 12 0	.....	
	...	2,019 2 6	...	2,429 8 2	410 5 8	.....	

TABLE IV.

Dairy Herd, 1895-96.

Description.	Strength on the 1st of April 1896.	Increase.			Decrease.				Strength on the 1st April 1896.	Valuation.		Increase or Decrease during 1895-96.
		Purchased or transferred.	Born.	Total.	Sold.	Died.	Transferred.	Total.		1895.	1896.	
Cows.												
Stud bulls	4	1	...	1	...	...	...	...	5	250	325	+75
Cows	26	4	...	4	2	2	...	4	26	1,770	1,645	—125
Heifers	3	1	...	1	...	...	2	2	2	120	90	—30
Cow calves	28	1	9	10	1	6	...	7	31	575	585	+10
Bull calves	15	...	17	17	4	1	1	6	26	375	355	—20
Total ...	76	7	26	33	7	9	3	19	90	3,090	3,000	—90
Buffaloes.												
Bull buffaloes	1	2	...	2	...	...	...	...	3	120	180	+60
She buffaloes	44	11	...	11	3	1	...	4	51	3,550	4,190	+640
Heifers	9	...	...	...	...	2	2	4	5	285	175	—110
She buffalo calves	25	3	26	29	...	22	...	22	32	375	485	+110
Bull buffalo calves	8	6	13	19	6	13	2	21	6	110	30	—80
Total ..	87	22	39	61	9	38	4	51	97	4,440	5,060	+620
Dairy cart horses	2	...	...	...	...	...	...	...	2	150	150	..

TABLE V.

The Sheep Flock.

Description.	Strength on 1st of April 1895.	Increase.			Decrease.				Strength on 1st April 1896.	Valuation.		Increase or Decrease during 1895-96.
		Purchased or transferred.	Born.	Total.	Sold.	Died.	Transferred.	Total.		1895.	1896.	
Breeding rams	2	2	...	2	...	1	...	1	3	60	45	—15
Ewes	39	42	...	42	...	5	...	5	76	260	456	+196
Female lambs	15	...	68	68	...	9	42	51	32	40	96	+56
Male lambs	11	...	42	42	9	5	2	16	37	50	148	+98
Total ...	67	44	110	154	9	20	44	73	148	410	745	+335

APPENDIX.

A detailed Note on the Special Sugarcane Experiments at Ma'njri.

The series of sugarcane experiments begun in 1894 have in their second year given results which are fully as interesting and valuable as those of the previous year. The field of experiment occupies a central position in an extensive tract almost entirely under sugarcane, and the neighbouring cultivators cannot possibly fail to notice the results, and will, no doubt, imitate methods of cultivation which are absolutely proved to be profitable and advantageous.

Area selected for experiments most suitable.

2. The field has now been bought. It extends to about 13^ acres. It has been laid out into 46 experimental plots, each of which is permanently marked and numbered. There are vacant spaces between plots five feet in width. These, with the roadways necessary for easy access to each series, take up a good deal of ground, about £ of the whole area. The spaces between plots undergo practically the same tillage as the plots excepting that the former receive no manure but are more frequently weeded than the latter. It may be accepted that the tillage of the plots and the spaces which divide them must cost considerably more than a field under ordinary cultivation. The expenditure will, I think, always exceed income, especially if, as at present, Gul (crude sugar) continues to command low market rates. The ordinary cultivator has no facilities for storing Gul. He must sell his Gul to the Bania or middleman as it is made. The price of Gul invariably rises considerably during the rains. It is the middleman and not the producer, however, who gains any advantage. The Executive Engineer for Irrigation, Poona district, says that the area of sugarcane under canal irrigation has diminished considerably since poor prices for Gul have prevailed. The experiments were carried out at a net cost to Government of Rs. 1,830 as compared with approximately Rs. 4,000 in 1894-95. The latter sum includes abnormal expenditure on tillage and capital outlays for cane crushing mills, boiling apparatus and tillage implements, &c.

Arrangement of experimental plots.

Extra tillage will be more fully given.

3. The comparative manure plots on an average did not yield in the year under report such heavy crops as in the previous year. All these plots were replanted. It would have been more profitable to have grown in all plots a ratoon crop, *i. e.* a second crop from the roots of the previous crop. This is the ordinary practice in the district. In this way the preparatory tillage before planting and the cost of < sets ' are saved ; moreover time is saved; the young shoots from the old roots begin to spring at once, whereas it took us about two months to thoroughly prepare the land for replanting. The newly planted cane had not made much progress before the hot weather set in and, therefore, could not stand the effect of extreme high temperature so well as if it had been planted earlier. Two plots of the 5th Series were ratooned, and it was easily seen that the crops in these plots made steady progress during the hot weather whilst all the newly planted cane was decidedly checked in growth. In the current season the whole of the plots which had been under experiment for two years are growing a ratoon crop, whilst the additional area which was purchased last year is under new cane.

Advantageous to plant cane before the hot weather begins.

FIRST SERIES.

Comparative Manure Experiments.

4. *Object.*—To test the comparative values of such manures as are within the reach and means of ordinary cultivators, and when the effects of the various manures have been clearly demonstrated, then to determine whether two or more of the manures used cannot be judiciously combined so as to secure economy without diminution of net profit.

5, The weight of manure applied to each plot to be regulated by the percentage of nitrogen it contains. Equivalent weights of nitrogen to be given to each plot. Count to be taken of other percentage of other elements of value will be and any marked difference between the crops of the various plots may be traced to the value of elements other than nitrogen. These differences will eventually regulate the manner in which two or more manures may be mixed with the object of reducing cost and getting equally good results.

Equivalent weight of nitrogen applied to each plot, Count to be taken of other elements of nutrition.

6. In the year under report the various manures applied to the comparative manure Series A (with the exception of one plot) each contained 500 lbs. per acre of nitrogen. Dr. Leather has proved that the amount of nitrogen is about nv. times as much as is taken up by a very heavy cane crop, but is less than tna. contained in a full dressing of poudrette or cattle dung as given by the best cultivators in the district. On one plot of the comparative manure Series A we have applied a heavier dressing of poudrette equal to the heaviest dressing given by good cultivators, but it would appear from results that such a heavy dressing is in a great measure wasted. We are attempting to prove on the extended area which has been taken up in the current season what is the most economical dressing of nitrogen that should be given to produce the best results. Meantime we may take it as certain that although a heavy crop of sugarcane does not take up more than 100 lbs. of nitrogen per acre, yet if all the manure is applied as it very commonly is before plantation least 500 lbs, of nitrogen per acre must necessarily be given for the results. Sugarcane requires very heavy irrigation, and no doubt a great deal of the valuable ingredients of the manure is carried away in drainage. I think it may be accepted without any question that if an application of 500 lbs. of nitrogen is found ample to produce a maximum crop, then the manures which are tested will also contain sufficient of the other elements of nutrition. It is certain that the varying proportions of potash, phosphoric acid and organic matter in the manures must have some influence on the results. If this influence is fully or partially disclosed, the value of the experiments will be much enhanced. The mere fact that so much nitrogen is given in the manure and so little is taken up by the crop suggests the idea that it would be far more economical to apply a smaller dressing of manure in repeated top-dressings. This question will be carefully investigated as our experiments progress,

500 lbs. nitrogen given to each plot.

Efforts to prove the most economical dressing of nitrogen for sugarcane.

A good deal of the manure given washed away in drainage.

7. The manures which the cultivators of the district ordinarily use are poudrette, cattle dung, fish manure from the Thana coast, castor cake and Karanj (Pongamia glabra) cake. We tested last year in comparison with the foregoing and will continue to test several edible cakes which are now used for feeding cattle in India or are largely exported. These cakes can be bought in Poona at a considerably cheaper rate per ton than the castor cake and Karanj cake now so extensively employed as manure. Dr. Leather's analysis shows that the edible cake3 contain much higher percentage of nitrogen (the most valuable constituent of manures) than the manure cakes, and our comparative tests indicate that these edible cakes can with economy and success be employed as manure. It has been suggested that use of edible cake as manure is surely a wasteful practice. My answer to that is that it is a much more wasteful practice to feed other concentrated food and permit the solid excrement to be burnt as fuel, and allow the urine to drain away somehow. If edible cakes are used directly as manure something is returned to the land which will help to maintain fertility; neither the solid nor liquid excrement of highly fed milch cattle and work cattle of towns is used as manure to any appreciable extent* I quote below paragraph 14 of my last year's report because it has a direct bearing on this year's results of the comparative manure series.

Some edible cakes are much superior manure cakes,

Mible cakes very effective when used as manure.

should be used as manure, and that all cattle and work cattle on farms with cake and

8. *There is no definite relationship between the value of the manures as* determined by chemical analysis and their actual commercial value. The price of a manure should chiefly depend upon the percentages of nitrogen, potash, phosphoric acid and the conditions in which these constituents exist. Organic matter, present in a high percentage, as in cattle dung, would of course add appreciably to the value of the manure. It is certain that the cane cultivators of the Poona district, though they are much above average in intelligence, fail to recognize the differences in the manurial value of the manures they use. In support of this, I note the fact that castor cake has doubled in price in the Poona district during the last four years, whilst poudrette (against the use of which there is now no prejudice) has not risen appreciably in value. The chemical analysis of these manures would indicate that castor cake, in comparison with poudrette, is exceedingly dear. This fact becomes the more anomalous when it is known that poudrette is perhaps four times dearer at Poona than at any other populous centre of the Presidency. At Surat the town manure consisting largely of night-soil is worth 8 to 12 annas a cart-load a3 compared with Rs. 3 at Poona. The Surat poudrette is not strictly comparable with that at Poona, because it is manufactured in a different manner; but at both places it is readily bought by Kunbis for the extensively cultivated irrigated crops of the neighbourhood, and at both places castor cake is also largely employed. The price of castor cake cannot differ to any great extent between districts because castors are widely cultivated and the cost of transporting the cake by rail to a considerable distance is small. Poudrette is dear in Poona because of the keen demand for it; but dear though it is, the men, who buy it at &s. 3 a cart-load and cart it 4 to 8 miles, often make the dung of their cattle into fuel cakes to be sold in Poona. The inference is that cattle dung at Poona is worth as fuel a better price than as manure, the manure, if well decayed, being worth at best Ks, 4 per ton.

No definite relationship between the cost of manures and their chemical composition.

Cane cultivators in the Poona district fail to recognize the differences in manurial value of the manures they use.

9. In our comparative manure series the cattle dung and farm-yard manure applied is charged at full local rates; but it is right to notice that these rates are probably four times as high as cattle dung manure sells for in out-districts where irrigated crops are not extensively grown ; therefore, although the cattle manure compares unfavourably with other manures, as shown by the Manjri results, yet in out-districts it would probably be the most economical manure which a cultivator could use because much the cheapest. If we gauge the value of a manure by its chemical analysis, as of course we ought to do within certain limits, then we must conclude that the present differences in market rates are inexplicable and astounding. This does not alone apply to manures but to feeding stuffs as well. For instance, highly concentrated feeding cakes with low percentages of crude fibre and other non-digestible material, are worth in Bombay Us. 30 per ton. In the same market coarse hay cut after it is dead ripe and probably having 10 of the feeding value of the cakes I refer to, is sold at Us. 10 to 12, often more, per 1,000 lbs,

Castor cake is cheaper manure in out-districts.

Some feeding stuffs much dearer than others if relative values are gauged by chemical composition.

10. The results of our comparative manure experiments at Manjri are not only intended to prove which manures in given quantity are most effective for sugarcane, but also to show which manures are cheapest. It was very clearly shown by the results of this year that the edible cake made from safflower seed was **not only a more effective manure than castor cake for sugarcane**, but the application given of safflower cake was much cheaper than that of castor cake. **Cultivators of sugarcane will** of course appreciate the fact that safflower cake at its present market price is a cheap manure for sugarcane. If they use it extensively as manure the price will go up and the piesent advantage which this cake possesses over some other manures will disappear; but there will be an advaq* *age to the growers of the safflower crop if the price of the cake rises,

11. Although the quantity of eacli manure applied in the comparative manure series contained 500 lbs. of nitrogen, yet there are very great differences in outturn between the various plots. These differences are without any doubt due to variation in the activeness and effectiveness of the various manures. I saw the plots at short intervals during the whole period of growth and the most casual observer could have seen that some of the manures used acted far more actively and effectively than others. How far the action was due to the presence in the manures of elements other than nitrogen can only be conjectured at this stage of our experiments. My own convinced opinion is that nitrogen in immediately available form (as it exists in saltpetre) is by far the most important constituent that manure for sugarcane should contain. The experiments of the first year proved, I think, conclusively that nitrogen in this form was absolutely essential to feed the young shoots during the early stages of growth. On these plots, where nitrogen in easily available condition was not applied before plantation, germination was irregular and the young shoots which did grow were obviously starved and checked in growth. This check was not afterwards recovered. Oil-cakes, as made in Europe, are generally considered to be slow in action as manure. Oil-cake, as made in the ordinary Indian Ghani, is extremely quick in its action.

Some manures more active and effective than others.

Nitrogen in immediately available form essential to sugarcane.

12. In India oil-seed, as ordinarily pressed, is ground up into an impalpable powder after the oil is expressed. The oil-cake is consolidated during the process, but before it is applied as manure it is again powdered, and I have no doubt the minute particles of cake will, when they come into contact with the moisture of the soil, again disintegrate into impalpable powder. It is easy to understand that a manure in such a fine state of division will very soon show its effects upon a crop. The method of preparing cake in Europe and in the hydraulic press mills in Bombay is quite different. The seed is crushed, but not into fine particles. The crushed seed is cooked or steamed, thus the oil escapes freely from the oil cells. The cooking of the crushed seed would, of necessity, convert the albuminoids into a much more insoluble condition than as they exist naturally. The albuminoids contain nearly all the nitrogen of the seed; therefore it is reasonable to suppose that the nitrogen as it exists in hydraulic pressed oil-cake does not become available as plant food nearly so soon as that in oil-cake made in the ordinary country Ghani.

Country made oilcake as manure probably quicker in its action than that made from steamed hydranlic pressed seed.

13. Hydraulic pressed castor cake as made in Bombay is held by the market gardeners to be poor stuff as manure. At Bassein they have tried it. It costs in Bombay Rs. 22 per ton. They prefer to use castor cake made in Gujarat, which costs in Gujarat 80 lbs. per rupee, or, say, Rs. 30 per ton. In our extended scheme of experiments in the current season we are trying the one cake against the other.

Hydraulic pressed castor cake made in Bombay considered by market gardeners poor stuff as mannre.

14. The results of the comparative manure series which I tabulate below will be better understood from the above explanations. The crops were cut as they ripened 11J to 12 months after plantation. Those which germinated well and were dressed with quick acting manure ripened soonest. The Gul, owing to an over-stocked market, was sold at the cheap rate of 23 lbs. per rupee ; later in the season the price rises to 13 to. 16 lbs. per rupee.

15. The weight of juice is not entered because the cane was freely watered after it was prepared for the mill. This tends to prevent evaporation of the juice. If evaporation to any extent goes on, the juice in the cane becomes more concentrated and a greater percentage of sugar is left in the crushed cane.

16. The manure to each plot of Series A was applied fth before plantation and £th as a top-dressing in July. Plots 1, 2 and 3 in 1894-95 were used to test the value of trashing, wrapping and tying up as practised at Bassein (Bombay) and elsewhere with the ordinary Poona method of cultivation ; also to test the comparative value of the American sugar sorghum. It

The comparative manure experiments extended this year and divided np in Series A and series B.

was proved that the American sugar sorghum could not compete with sugar-cane in the Poona district as a sugar crop, and that trashing, wrapping and tying up was not an economical practice in the Deccan, except perhaps in isolated fields which on account of their isolation might be damaged by jackals and pigs to an excessive extent and wrapping might possibly prevent this damage in some degree. In 1894-95 Plot 6 was manured with bones and sugarcane ashes fermented with urine. The results were poor, and for reasons given in the report of 1894-95 it was considered that no good object would be served by continuing the use of this manure on this plot. In 1894-95 town sweepings were applied as manure to Plots 15, 16 and 17. It was decided that irregular results must be expected from town sweepings because it is of very variable composition. In the year under report Plots 1, 2 and 3 have been added to the comparative manure series in order to extend it. Cotton seed cake has in Plot 6 been substituted for bone and sugarcane ashes fermented with urine and safflower and ground-nut cake substituted for town sweepings in Plots 15, 16 and 37.

17. In 1894-95 the amount of nitrogen given varied considerably between plots. The quantities of manure applied were fixed in relation to the reputed Percentages of nitrogen which it was believed they contained; but the reputed percentage of nitrogen varied very considerably from the actual in almost all cases. It is quite possible that this has some influence on the results of the year under report owing to residues of manure. I cannot detect however that the varying quantity of nitrogen applied in 1894-95 has had any influence on the results of this year. The comparative manure scheme, as arranged for the year under report, will be continued, as far as possible, unchanged until definite issues are obtained.

18. The percentage outturn of Gul from each plot in 1894-95 is shown in block type under the Gul outturn figures of this year :—

First Series.— Comparative Manures (A) : Plots \ acre each.

No. of Plot.	Kind of Manure.	Weight of Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Weight of Tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to Cane.	Value of Gul per Acre,	Remarks.
		Tons.	Lbs.	Rs. a. p.	Lbs.	Lbs.	Lbs.		Rs. a. p.	
1	Poudrette	44·6	1,000	301 0 0	86,290	13,269	10,737	12-4	466 13 0	Poudrette containing 423 lbs. of nitrogen per acre applied to American sugar sorghum in 1894-95. Germination was even and crop progressed steadily throughout. It did not appear at any stage of growth that the crop benefited by the heavy application as compared with half the application given to Plot 12. I think there can be no doubt that a good deal of the manure applied was wasted, 1,000 lbs. of nitrogen per acre being unnecessarily Jarge. Irrigated 26 times; planted 1st April 1895, harvested 10th to 12th March 1896.
2	Safflower cake ...	3·3	500	169 6 0	95,555	12,520	12,320 12,070	12-8	535 10 0	Poudrette containing 847 lbs. nitrogen per acre applied to cane in 1894-95. Germination was even. The crop had throughout an extremely healthy appearance, the leaves until the crop ripened being of a rich dark green colour. Irrigated 27 times ; planted 1st April 1895, harvested 23rd to 27th March 1S96- The results are the best of the whole Series.
3	Mowra cake (Bassia latifolia).	8'6	500	323 9 0	72,410	12,980	7,725 11,845	10·6	335 14 0	Poudrette containing S47 lbs. nitrogen per acre applied to cane in 1894-95. The first application of Bassia cake had apparently a poisonous effect, only a set here and there germinated, The plot was re-planted a month later, and then germination was quite satisfactory. The top-dressing of manure given in July showed no harmful results. The crop from the second planting made steady vigorous progress through,--

No. of Plot.	Kind of Manure.	Weight of Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Weight of Tops per Acre.	Weight of Gul per Acre.	Per-centage of Gul to Cane.	Value of Gul per Acre,	REMARKS.
		Tons.	Lbs.	Rs. a. p.	Lbs.	Lbs.	Lbs.		Rs. a. p.	
6	**Cotton seed cake** ...	7-1	500	316 0 0	83,300	14,925	10,280 **5,660**	12-3	446 15 0	out and was certainly notful. when harvested. H ^ the result of the current, would have been iixter±«J«" Crop planted on 1st planted on 6th May, har to 28th March ; i™gf ?\ o &* The low percentage of Oui is noticeable and indicates crop was cut before it was x Manured in 1894-95 with bones ashes fermented sugarcane cattle urine containing nitrogen per acre. The cotto cake applied this year was g a Bombay mill which, however. stopped the manufacture cake because, I believe, the pe age of oil got from I* small and does not pay. mination in the plot was and the crop had a very appearance throughout. current season cotton seed ca being obtainable crushed seed has been substituted plot. 11 is believed that in where cotton is grown and wh seed is very cheap, it will probably be found an economical manure for sugarcane grown in the sa trict. Sugarcane is largely throughout-Surat, where the staple crop, and the dimcuw getting sufficient manure tor cane is felt more and more y year in the district. The cotton seed as manure W<ould possible solution of the Crop planted 31st March harvested 28th to 31st March and irrigated 27 times.
7	Fish-manure... ...	2-9	50Q	188 12 0	£0,485	14,445	11,900 **13,4001**	13-2	521 6 0	The same manure containing nitrogen per acre applied in The evenness of germination vigour of growth was nearly spicuous in this plot as in (safflower cake). Cost of includes freight charges from This manure must be pi deeply. Otherwise crows, jackals and pigs are attracted, latter do harm by digg soil to get at the buried fis outturn from this plot was of the whole series last year again very good. There is no doubt that dried fish is an excellent economical manure for sugarcane Crop planted 3rd Match harvested 10th to 17th Marc inigated 26 times. The high percentage of Gul to cane is noticeable.
8	Castor cake	£•3	**600**	303 10 0	**80,770**	13,010	9,820 **12,235**	12-1	426 15 0	The same manure containing nitrogen per acre applied in Ger mination and tiller ing quite satisfactory, but the crop had vigorous thriving appear? healthy colour of the previous year. Planted on 31st March 1895, reaped 11th to 17ih March 1896; irrigated 26 times.
9	Karanj cake (Pongamia glabra).	6-6	500	280 0 0	**83,270**	10,915	9,770 **10,640**	11•7	424 12 Q	The same manure contained 441 lbs. nitrogen per acre applied in 1894-95. There was very little difference in the appearance of this and the adjoining castor cake plot*. throughout the whole period of^rowtn- Planted 31st March 1895, harvested 12th to 17th March 1896; irrigated 26 times.

No. P.	Kind of Manure.	Weight of Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Weight of Tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to Cane.	Value of Gul per Acre.	REMARKS.
		Tons.	Lbs.	Rs. a. p.	Lbs.	Lbs.	Lbs.		Rs. a. p.	
12	Poudretto	22-3	500	150 8 0	80,720	11,456	10,455 13,270	129	454 9 0	The same manure containing 847 lbs. nitrogen per acre applied in 1894-95. The results this year as they were last year are conspicuously good as compared with some other manures. Our results and chemical analysis indicate that this manure is a cheap if not the cheapest source of nitrogen in India, even at the Poona price, which is very high. The extended manufacture of poudrette or the general utilization in some way of night-soil as manure would be of the very greatest importance to the agricultural interests of the country. Planted 30th March 1895, reaped 3 3th to 39th March 1896; irrigated 26 times.
13	Cattle-dung from ordinary fed cattle.	25-1	500	160 0 0	60,490	12,220	7,610 7,885	12-4	326 8 0	The same manure containing 972 lbs. of nitrogen per acre applied in 1894-95. Considering the recognized fact that cattle manure is slow in action and lasts in the soil, ifc might have reasonably been expected that a residue of manure from the heavy dressing of 3894-95 would have favourably affected this year's result. Possibly this was the case, but not to an appreciable extent. It is clear from this year's and last year's results that there are better manures than cattle dung for sugarcane. This year the germination was all right, whilst *in* the previous year it was not. Throughout the whole period of growth this year the crop looked as if it were more or less starved, the leaves being very light-coloured. Crop planted 30th March 3895, reaped 20th and 21st March 1896; irrigated 27 times.
14	Cake-fed cattle manure mixed with urine and litter.	29	500	184 14 0	53,790	11,175	6,950 6415	*12'9*	302 2 0	The same, manure containing 798 lb*. nitrogen per acre applied in3 894-95. The remarks made against Plot 13 apply also to this plot, Crop planted 30th March 3896. reaped 20th to 24th March 1806; irrigated 27 times.
15	Safflower and groundnut cake.	3-4	500	162 0 0	63,600	30,960	7,900 6,395	32*4	343 8 0	Manured in 1894-95 with 54 tons per acre of town sweepings, the nitrogen in which was not estimated. The 'sweepings consisted mostly of burnt material and, therefore, could only have contained a very small percentage of nitrogen. The cake used this year is a hydraulic pressed cake made in Bombay from coarsely ground steamed seed. For this reason the cake may act comparatively slowly. The results are poor, comparativly much poorer than might reasonably be expected from a cake so rich in nitrogen. The ratoon plot in the current season manured with this cake compares very favourably to all appearance at present with any other plot of the series. Planted 30th March 1895, reaped 21st to 23rd March 1896; irrigated 27 times.

First Series.-Comparatke Manures (B) : Plots #K Acre each.

No. of Plot.	Kind of Manure.	Weight of Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Weight of Tops per Acre.	Weight of Gul per Acre,,	Percentage of Gul to Cane.	Value of Gul per Acre.	REMARKS.
		Tons.	Lbs.	Rs. a. p.	Lbs.	Lbs,,	Lbs.		Rs. a. p.	
4	Bone meal	3,520	130	116 0 0	32,146	8,875	3,905 **6,945**	12*1	169 12 0	Manured with the same manure containing 420lbs. of nitrogen per acre in 1894-95. It is certain that the heavy application of bones was not utilized by the crop of the year and we might reasonably have expected that the residue left would have benifited the crop this year. There is not much to indicate that such was the case. The results go to prove that bones are extremely slow in action, so slow in fact that they cannot be economically used for sugarcane. The bones are slow in action and the copious irrigation given for the year for sugarcane. Bones probably act still more slowly in the case of irrigated crops which occupy the land for a shorter period. This year's crop has developed appearanee of being short throughout the whole season of growth. Planted 1st April 1895; reaped 25th to 27th March 1896; irrigated 27 times.
5	Dissolved bone* ...	**3,620**	130	196 0 0	36,275	8,535	4,950 **9,870**	13*6	215 3 0	Manured in 1891-95 with the same manure containing 434 lbs. of nitrogen per acre. The manure was prepared on the farm by crushed bones and acid of commercial strength got from Bombay. 640 lbs. acid used to dissolve 3,520 lbs. of bone meal. The price of the manure, considering the results of this year and the last, is altogether prohibitive for ordinary cultivation in the Poona district. Germination quite satisfactory; the crop had an unthrifty appearance at all stages of growth. Planted 1st April 1895, reaped 27th and 28th March 1896; irrigated 27 times.
10	Bone meal and crude nitre.	3,520 bone meal; 1,290 nitre.	250	**264 0 0**	41,000	**10,075**	5,015 **9,975**	12*2	213 0 0	Same manure containing 417 lbs. of nitrogen per acre applied in the 1894-95. This year the whole was applied before plantation. The remaining th in four equal dressings given in June, August October and December. The nitre being exceedingly soluble would readily be washed out of the soil by heavy irrigation. The repeated top-dressings of nitre were believed to be on this account an economical practice, but the crop did not benefit to the extent that was expected. The cost of the manure included the value of the crop, Crop planted 30th March 1895, reaped 30th and 31st March 1896; irrigated 27 times.
11	Dissolved bones and crude nitre.	3,520 bone meal dissolved; 1,290 nitre.	250	341 0 0	**65,715**	**11,695**	8,435 **13,225**	12*3	**366 12 0**	Same manure containing 434 lbs. nitrogen per acre applied in 1894-95. The nitre was applied this year as in. Plot 10 for similar reasons. Considering the results this and last, the cost of the manure is entirely prohibitive. Crop Planted 30th March 1895, reaped 30th and 31st March 1896; irrigated 27 times.

19. In analysing the results recorded in the two foregoing tables I have

Analysis of results!

manure series

Tne ck mannrpfi! action of manures has a great influence on sugarcane outturn results,

germination was much more even in all Poona's annual year. In my report of last year I noticed that the sugarcane sets" (pieces of cane about a foot long) evidently contained very little to nourish the young seedlings, and unless the rootlets are at once nourished by immediately available manure jn the soil, germination becomes uneven. A check in growth at this early stage is never afterwards recovered, nor do the plants tiller so freely as when the young shoots come up strong and vigoi'ous. No doubt the heavy application of manure given in the previous year to all plots left some residue of manure, and this residue may have helped the young shoots; but at a very early stage it was easily seen that the manures directly applied showed remarkable differences in their action. This year as well as last year the fish manure and poudrette plots were very early conspicuous on account of the vigour of growth and the rich green colour of the leaves. Safflower cake and cotton seed cake used for the first time this year showed similar effects. The above named manures act very quickly. This quick action of a manure has a very great influence on sugarcane outturn results. It has been made absolutely clear by this year s and last year's results that the plots which showed vigorous early growth owing to the quick action of particular manures more than maintained the early advantage throughout the whole period of growth. In both years cattle dung and farm-yard manure have shown that they are slow in action. These manures as applied this year had been kept over a year and were apparently thoroughly decayed. The large stock of nitrogen which these manures added to the soil in both years was, I feel sure, not in immediately available form and was slow in changing to this form. The ratoon plots which in the current year have been manured with cattle dung and farm-yard manures and which have also been manured with the same manures in the two previous years, compare favourably with the most of the other plots of the series, and it is probably safe to assume that owing to the heavy dressings of cattle manure and the well-known lasting effect of that manure that these plots have accumulated a good deal of fertility which is being utilized by the crop of this year. The plots for bones—dissolved bones, bones and saltpetre, and dissolved bones and saltpetre—•t have this year placed in a sub-division of the first series because the results from these plots are not strictly comparable with those of the other plots of the comparative manure series. We decided that, on account of cost, bones either in the iorm of bone meal or dissolved bones could not be compared with the other manures used, taking the percentage of nitrogen as a basis of comparison. The experiments with bones and nitre will be continued as arranged in the foregoing table of results, not with any idea that bones or dissolved bones either alone or in combination with saltpetre will be proved economical manure for sugarcane in the Poona district, but the results of our experiments may be of value to cultivators in other parts of India, particularly in the north, where bones and crude saltpetre can be bought at moderate rates. Crude saltpetre is dear in Poona and is of so variable a composition that it cannot be safely purchased as manure until a sample is in the first instance analysed. Of several samples selected in the bazar °ne was determined by Dr. Leather's analysis to be of much better value for Manure than the others. Bones in the Poona district have trebled in value within a very few years owing to the extrinsic circumstance that there is a keen demand for export.

SECOND SERIES.

20. *Object.*—To test (1) how long cane can be ratooned profitably, and (2) how far cane is injured by the shade of bábhul and other trees.

21. The latter test is being made on an irregular plot affected by the shade of hedge-row timber trees. The germination was very irregular and defective this year in the plot. No doubt the proximity of trees influenced the germination to some extent, but I believe the germination would have been touch better if the crop had been planted earlier in the season. The crop was exceedingly poor and there is considerable doubt as to how far the shade really injured the crop. I, therefore, do not report results. The results of the second series I tabulate below:—

Second Series.—Plots \th Acre• jack.

No. of Plot.	Kind of Manure.	Weight of Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and top*ped per Acre.	W"eight of Tops per Acre.	Weight Gnul per Acre.	Per-(?entag(of Gul to Cane	Value of Gul per Acre.	Remarks.
		Tons.	Lbs.	Rs. a. p.	Lbs.	Lhs.	Lbs.		Rs. a. p.	
15	Saffiower and ground-nut cake.	3·4	500	162 0 0	63,600	10,960	7,900	12-4	343 8 0	This plot forms part. ot *Manured parative manure series.. tons peC with town sweepings, &* acre, in 1894-95. Sj«.-* Series made against the plo* J (A).
16	Saffiower and ground-nut cake (Katoori cane).	3·4	500	162 0 0	55,120	10,805	7,530	33*6	327 6 0	Manured with town sweepings, 54 tons per acre, m 1894-95. The cultivation charges <> in fr<> are considerably leas ^an 15. The saving is <* sets and preparatory planting new cane. to Rs. 67 per acre. understood that it a thrives well as it the Poona district, the gec0Dd and third year from the crops a better profit the^new cane in After the third yea* weedy to the extent th^ ously affects the crop, ratoon crop after the generally believed to be able. The practice of ia not known in some the Presidency where is largely grown. It beprovedthatitisa economical practice tricts.

THIRD SEBIES,

22. *Object.—To* test whether a less quantity of water than that usually applied by local cultivators to sugarcane will or will not give equally good results. Plots to be irrigated every eighth day in the hot weather and every tenth day in the cold weather or during breaks in the monsoon rain. Ordinary cultivators get canal water once a fortnight in the hot weather. Sometimes the interval is as much as 18 days, and this is believed to be much too long.

Clear results in 1894-95, Rather contradictory results this year.

23. The~ results in the previous year from the water experiment series were most striking. It was clearly shown that frequent light irrigation, especially in the hot weather, increased the outturn for a sugarcane crop very considerably, I still believe such to be the case, although this is not borne out by this year's results, which I tabulate below. The figures show that Plot 21, which was irrigated only as often as the cultivators of the neighbourhood got water from the canal, g^ve the best results. I believe that cultivators in the district were better supplied with canal water last year than ordinarily; at least we had no cause to complain except about the time the crops were ripe when irregular irrigation would do less harm than at an earlier stage. Plot 21 was prepared for irrigation in the same manner as an ordinary cultivator prepares his field. The beds for water compartment were made very deep so that as much water as possible was taken each time the crop was irrigated. Probably less canal water than ordinary was taken for this crop because the rainfall was very well distributed and very little irrigation was required between June and October. I think that a cultivator in the Poona district takes in addition to average rainfall canal water equivalent to at least 80 inches of rainfall for a 12 months' sugarcane crop. I believe that a great deal of this water is lost in drainage, the field being literally flooded each time it is irrigated; and I believe also that probably 40 per cent, less water would be found sufficient if the water was applied at shorter

Cultivator who get canal water literally flood their fields.

intervals. The cultivator knows perfectly the advantage of frequent light waterings. If he draws the wato from a well he . V«ivators who own wells >mgate lightly but often. -ii i,. We his crop once in eight days, but be gives no more th|n the cr0£ needs on account of the trouble of drawing it. Sugarcane crop grows under well irrigation more in^thc.hot father in darker colour and healthier appearance than crops in the same district grown under canal irrigation.

24. The water experiments are being continued' on ratoon cane in Ptota , ng also on newly planted cane in our new 18J 19, 20 and 21 in the current season; experimental area.

25. Last year's outturn figures are shown in the Gul column in block type under those of this year. The figures in block type refer to the results from each system of irrigation in 1894-95 and not to the results from particular plots. I note this because Plot 18, which was irrigated in 1894-95 with the "full" supply of water this year, ft the « half » supplv of water, and *vice versd.* In each *7ear* *TM 19 got*tto "three-fourth " supply of water. Half of Plot 21 was cut at " monto «idu comparable with this series; half was cut at 11* months and forms pait ot the next series.

io?he °*tturn results of 1894-95 and 1895-96 from be water experiment plots compared.

Third Series-Comparative Water Experiments.-Plots J *acre each, excepting Plot 2L*

No. of Plot.	Method of Irrigation.	Total Weight of Water per Acre applied.	Equivalent Inches of Rainfall to Water applied.	Time occupied by two men per Acre in applying the Irrigation Water to the Crop.	Weight of Cane stripped and topped per Acre.	Weight of Tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to Cane.	Value of Gul per Acre.	REMARKS.
		Tons.	Inches.	Hours.	Lbs.	Lbs.	Lbs.		Rs. a. p.	
18	Watered each time with full ordinary supply. Irrigated 32 times in 11 months.	^0,507	104-0	142-5	7^,705	13,650	9,610 113,300	12-2	437 13 0	Plot manured in 1894-95 and again this year with 42 tons per acre poudretto.
19	Watered with three-fourths supply. Irrigated 39 times in 11 months.	7,890 5	78-1	98'0	93,095	1S.025	11,190 13,710	12-0	486 8 0	Do. do.
20	Watered each time with half the ordinary supply. Irrigated 26 times in 11 months.	5,169-5	52-1	67 7	93,445	12,665	11,050 14,160	12*0	480 7 0	Do. do. The results were unfavourably affected, but not to a great extent, by irregularity of germination. The crop was therefore not so regular as in the other plots of this series.
21	Watered with full ordinary supply, Irrigated 26 times in 11 months.	7,612	75-3	109*6	91,131	11,847	11,312 11,920	12-4	491 33 0	Planted on 2nd April 1?95 and irrigated eight times before the rains. There was monsoon rain early in June. This plot was sufficiently irrigated at short intervals during the hot weather, and was not checked in growth as would have been the case if the canal had been opened at longer intervale. The rainfall waa well distributed and average. After the rains ceased and up to 14th February the intervals between waterings were 11, 2 and 13 days. The crop was irrigated on the 14th February 1896 and not again until the 4th Mai ch. Such a long interval at an earlier stage would have checked growth, but as the crop was about ripe, it did not possibly do much harm.

FOURTH SERIES.

25. *ObJeeL-To* test at what period of growth sugarcane yields the highest perc mtage of sugar.

27. A s anticipated last year, this problem to solve than was at first pected. much liglitonihe matter either this year or throw last In each year they are irregular. I can offer no explanation beyond what appears in the remark column.

A rather difficult problem to solve.

28. Cane is commonly called a 12-months' crop, but judging by the appearance of the crop treated with different manures in the comparative manure series, there is no doubt that a quick-acting manure forces sugarcane to maturity in perhaps 11 months ; whilst a crop treated with a slow-acting manure may take 12 or 13 months to ripen. Again sugarcane which is repeatedly top-dressed with manure continues to grow for a longer period than a crop manured entirely before plantation. Ratoon cane ripens in less time than newly planted cane.

A quick-acting manure brings sugarcane to maturity sooner than a slower-acting manure does.

Fourth Series (A).—New Cane,

No. of Plot.	Special treatment of Crop.	Weight of Cane stripped and topped per Acre.	Weight of Tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to Cane.	Value of Gul per Acre.	REMARKS.
		Lbs.	Lbs.	Lbs.		Rs. a. p.	
21: 1st half: Area -4-19 guDthas.	Cane cut and converted into Gul 11 mouths after plantation.	91,131	31,847	11,312	12-4	491 13 0	Manured in 3894-95 and a*o this year with 42 tons per acre poudrette. Irrigated 2a tunes. Crop irrigated two days before cutting. It is generally believed that watering soon before cutting raises the Percenta?? of water in the cane so tnar more juice is expressed.
21 : 2nd half · Area —3-81 gunthas.	Cane cut and converted into Gul 114 months after plantation.	84,693	10,404	10,141	11-9	440 14 0	Manured as above. Crop irn* gated 26 times. The last time 14 days before the crop wa* harvested. This may have affected results.
22: Area —Jth acre.	Cane cut and converted infco Gul 12 months after plantation.	71,870	9,890	9,890	13-7	430 0 0	Manured as above. Irrigated *p* times, the last time being nine days before harvesting.

Fourth Series (BJ.—Ratoon Cane.

Ho. of Plot.	Kind of Manure.	Weight of Cane ptrip-ped and topped per Acre.	Weight of Tope per Acre.	Weight of Gul per Aero.	Percentage of Gul to Cane.	Value of Gul per Acre.	R.BMAH.K8.
		Lbs.	Lbs.	Lbs.		Rs. a. p.	
23: 1st half: Area —4-19 gunthas.	Ratoon cane cut and converted into Gul 10$ months after plantation.	82,281	12,801	9,546	11-6	tl5 0 0	Manured with a mixed mannre consisting of poudrette, superphospate and dried fish. The application contained 500. lbs* of nitrogen. Irrigated '-3 times, the last time six days before cutting.
23: 2nd half : Area —3-81 gunthas.	Ratoon cano cut and converted into Gul 11 months after plantation.	SI,459	13,643	10,393	12*7	151 *U* 0	Manured as above. Irrigated ** times, the last time eleven days before cutting..
24: Area- £th acre.	Ratoon cane cut and converted into Gul 11$ months after plantation.	77,630	9,870	9,995	12'8	434 9 0	Manured as above. Irrigated 25 times, the last time t^o days before cutting. It was intended to keep half of this plot for 33 months, but it was seen that the crop was obviously de^0" ripe at 11$ months and the cane began to lodge and, certainly, the crop would have deteriorated if left longer. So it was decided to harvest it.

FIFTH SERIES.

29. *Object.*—To test the effect of manure applied before plantation with the same quantity of manure applied at intervals, partly before and partly during growth, as a top-dressing.

I can report nothing in respect of this series this year. The two varieties of Mauritius sugarcane imported two years ago had thriven so well in the fixst year (although they gave disappointing percentages of sugar) that we decided to plant these varieties on the plots of this series. We had two objects in view, which is perhaps ordinarily unsafe procedure in experimental work. We wanted

to grow the Mauritius varieties so that if through acclimatization they showed improvement in th3ir percentages of sugar the cane could be distributed to curators. The second and the prime object was to test <^™™"*2%t manner described above. The Mauritius varieties m the first year showed remarkable vigour of growth and enormous power of tillering, •·e. the produc-

crops, out the new cane p, the ne gj^ ^f ^ i S ^ S Z *f

Mauritius varieties gave poor results when planted in the hot weather probably for reasons given.

- , » Anril Thp termination was irregular and 4th ot April. ine germinauuii throughout, and even the shoots that did appeal were unhealthy in colour and made exceedingly poor progress. The weather during April and May was exceptionally hot for the ***»*£ Met. The intervals between waterings in April-May varied from 9 to 14days The cane would certainly have benefited by more frequent; watei ngs. I believe so because the same^ varieties planted on the Poona.farm on the mh and 20th April under well irrigation and watered every seventh day'duringthe hot weather germinated well and grew vigorously afterwards. The t* « £ « * ™ Mauritiu! varieties at our Manjri experimental field was no « < ^ ^ Many fields owned by cultivators and also planted late in the season r w th the local variety of cane produced crops much below the average because ge mmation was irregular and owing to deficient irrigation the young ^ * " m ± Jon ram pear made extremely slow progress until the rams set in ^ ^ at M ri commenced and the temperature got cooler. The Mauritius ca ne ^ ^it made steady progress, and although owing to defici

Mauritius varieties re-covered in a remarkable man-De" d a n n g the m o ~

termination there were many vacant spaces in tne beds yet ow ? , x in~ t() the enormous tillering power Ot thes; varieties the plots did not look by any means bad as the cane approached maturity. The red Mauritius varities recovered to a greater extent than the white variety. These varieties were ^ t t o us by

Mauritius varieties as grown the Mauritius Department of Agriculture with a ^sE,iSs; £Ss it i* r rt. They were reported to yield in the ^d .variety was soft owing to which of course compares favourably with the a high percentage of trtade. 14 per cent Gul (crude sugar) got trom the local Pttndia variety. In the yeaf under report the Mauritius varieties appear to have further-deteriorated in respect of their sugar-producing power. Two years' results are recorded as under:—

Year.	Red Mauritius variety percentage of Gul to Cane.	White Mauritius variety percentage of Gul to Cane.	In experimental plot local Pundi i variety gives Gul to Cane percentage varying from
1894-95	9·4	10·08	11·2 to 13·1
1895-96	8·7	8·8	

The red variety moreover gave Gul so soft that it evidently contained a entage of treacle. Dr. Leather's analysis emphasises these results. He the white variety contained about 12 per ^nt. of cane sugar and 14 per cent, of the juice of the red variety ent lucose. The juice of

cane sugar and 1 to 1·5 per cent, glucose.

30. These results again indicate how careful we should be in introducing exotic varieties from one district in India to another, until experimented in the first instance. It is perhaps

Exotic varieties should be introduced with some caution.

meniaii^ , be acclimatized, may not Probable that the Mauritius varieties Deccan, even to Quintain their high Mauritius percentage; prove their worth or show that they are absolute failures. It will prouably take some years, to do so. * e will give these varieties a fair trial.

Note by Dr. Leather on the Chemical Composition of Sugarcane and Raw Sugars obtained in the Experiments made at Poona, Cawnpore, Dumraon and Burdwan during 1895-96.

1. The experiments on the growth of sugarcane which are being parried out at Poona, Cawnpore, Dumraon and Burdwan have two principal objects m view :

the one is to determine what quantity of manure can be most economically employed and for this purpose different alnounts of different manures are applied ;

the second is the comparative growth of different varieties of cane.

The annual results of these experiments are published in the reports of the several farms named and will not be referred to here.

2. In conjunction with these experiments, I have this year, as last year, made a number of analyses and experiments with the object of determining several other points which are of importance. These may be summarised as follows:—

(1) The amounts of cane sugar and of glucose in the juice.

(2) The amounts of cane sugar and of glucose in the raw sugar obtained and the amounts of inversion which occurs during the boiling process.

(3) The quality of the sugar prepared in the centrifugal machine.

(4) The loss of sugar which occurs during the boiling process.

(5) The total amount of sugar in the cane.

(6) The amount of juice and, consequently, of sugar which remains unexpressed from the cane.

(7) The amounts of nitrogen and of phosphoric acid in the sugarcane crop.

(I) THE AMOUNTS OF CANE SUGAR AND OF GLUCOSE IN THE JUICE.

3. The cane sugar and glucose were determined in the juice of six varieties of cane grown at Dumraon, in six varieties at Cawnpore, and in three at Poona.

The varieties grown at Dumraon were all manured equally with town-sweepings and castor-cake. At Cawnpore, five of the varieties were manured with about 1,0>0 maunds of poudrette, but the sixth (Matua) was grown on nine plots with different manures, containing very varying amounts of nitrogen or phosphoric acid, these being however, so far as the nitrogen is concerned, very much smaller than in any of the other experiments, and they are in all probability too small to produce a really heavy crop.

At Poona the three varieties were all manured with poudrette containing 500 lbs. of nitrogen per acre.

It is desirable to consider three points in connection with the results of the analyses of tlie juice of these varieties:

(1.) The comparative quality of the juice of different varieties grown at the same place.

(2.) The comparative quality of the juice of the same variety grown at different places.

(3.) The comparative quality of the juice of the same variety grown with very different amounts of manure.

(1) *The amounts of cam snyar and of glucose in varieties grown at the same place**

4. In the two Statements Nos. l.knd 2 are set out the percentage amounts of cane sugar and of glucose found in the juice of the varieties of cane grown at Cawnpore and at L)umraon :—

Note.—Regarding the methods of analysis employed the cane sn ‘ar was determined in one of Schmidt and Hainsch's polariscopes; tht glucose was determined bj Fehling's volumetric method.

STATEMENT NO. 1.

Six Varieties grown at Gawnpore.

Varieties.	Dhaul.	Dikchan.	Shaháranpuri.	Poona.	Madrási.	Matua.
Manure	Poudretie 80,000	Poudrette 80,000	Poudrette 83,000	Poudrette 83,000	Poudrette 83,000	*Fide* Statement. No. 4.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Cane sugar ...	12-74	9-68	15-69	12-48	13-80	16-36
Glucose	1-25	1-98	0-98	1-77	1-65	0-40

STATEMENT No. 2.

Six varieties grown at Dumraon manured with 8,200 lbs. of city sweepings and 6,500 lbs. castor-cake per acre.

Varieties.	Mungo.	Khari.	Red Bombay.	Poona.	Samsara.	Bhurli.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Cane sugar ...	9·55	11·55	13·70	12·99	13·91	13·01
Glucose	1·06	0·99	0·95	1·16	1·18	0·57

These analyses show at a glance how ^nsiderable are the v: the
Proportion of cane sugar and of glucose ir /^ £ W^h iWhilst the Matua
two of them fining only about 9-6 P^nt• °f wSTrefarence will be made
(and also the Poona variety as grown at Poona to wmen re
below) contains nearly 16"5 per cent, of cane sugar.

The glucose will be referred to more particularly in another j ^ J, this
note, but it may be here observed that it also varies very g^atl?, ; two
varieties contain only about 0-5 per cent., whilst the juice ol anou ler contained
nearly 2*0 per cent.

Now bearing in mind that the cost ^ivation, of crushing and of boiling
down the juice of different varieties may be ta ken as being equal in any p arti-
^lar locality, it will be at once apparent that il the sorts of cane i produce
Poor juice could be replaced by those P«£™»*ri of Z Poonz variety is pro- enormous benefit
would be conferred on the cultivator. The juice ^of^the Mauritius;
^a% not quite so rich as some of the varieties gi-ojjt in t^ ^^ ^ more
jot much below their best, and it seems not, unliJteiy, ittle improvement could
*ban one part of India, varieties of cane which with^a^ill be J^ presently, the
be.obtained equal to any in the world· Moieovergas w nce of sugarcane t long
«vidence which is at hand tends to show thai' ™ [e r e , and it would seem that a
Stances is accompanied by a lowering of ^ ^ m a particular province is
^arch alter the best varieties which J ™ " " ^ ^ ^ Wer to improve the
Perhaps the most important matter to be taken up
8ugar-producing power of that province.

ice of the same variety grown at different places.

5. The evidence at hand on t^ d is limited to two cases. The first is
that of some cane which was sent faom the Mauritius to the Director of Land
records and Agriculture, Bombay, two cm Two varieties were sent;
one a white and the other a red J^ ty. They were cultivated in 1894-95
and again in 1895-96 at Wanjri (? oona) *vith* very liberal amounts of
manure. They were said to be, varieties which produce juice containing some
18 per cent, of sugar. WbJst t hey grew luxuriant ly at tooua, the juice has in
father year contained any thing approaching the above. Several analyses of
the red variety showed only about 10. p er cent. of cane sugar and 2-0 per cent,
glucose ; whilst that of the white variety contained about 12 per cent, of cane

sugar and 1·4 per cent. of glucose. The second case is that of the variety grown around Poona and which contains about 15 to 17 per cent. of cane sugar and from 1·0 to 1·5 per cent. of glucose. This variety was grown at both Cawnpore and Bumraon last year and, as shown in Statements Nos. 1 and 2, there contained considerably less, namely, less than 13 per cent. of cane sugar. The evidence at hand, therefore, goes to show that the transference to long distant ... which entails ... quality by course that these varieties, after some years of acclimatization, will recover ... but the process is an expensive one, ... od varieties ... e,tend their cultiva... probably be better to ... fer varieties from long ...

(3) *The juice of the same variety grown with different manures and with different amounts of manure.*

6. ... list included ... various kinds of manure. The ... phate and saltpetre. In 1894-95 the ... from 200 lbs. to nearly 1,000 lbs.; whilst the phosphoric acid varied from 140 to 2,700 lbs. In 1895-96 the amount of nitrogen applied varied from ... lbs. to ... from 200 lbs. to 700 lbs. In neither year was there any relation observable between the quality of the juice and the amounts of manure applied. In 1894-95, the proportion of cane sugar (*vide* Agricultural Ledger Medical and Chemical Series No. 1, page 2) varied, but it is probable that the variation was due to causes quite apart from the manurings. The analyses of the juice from these several plots for 1895-96 are set out in Statement No. 3, and it is evident that in the case of this series of plots, which received varying amounts of different manures, that the quality of the juice is maintained almost uniformly throughout:—

STATEMENT NO. 3.

Composition of the Juice from Plots at Poona.

	Poudrette N 1,000 lbs. P_2O_5.	Poudrette N 500: P_2O_5.	Cattle-dung N 500: P_2O_5.	Farm-yard manure N 500: P_2O_5.	Safflower cake, N 500: P_2O_5.	Cotton seed cake: N 600: P_2O_5.	Safflower and Earth nut cake N 600: P_2O_5.	Bassia cake N 500: P_2O_5.	Castor cake N 500: P_2O_5.	Karanj cake N 500: P_2O_5.	Fish manure N 500: P_2O_5.	Bone meal N 130: P_2O_5.	Bone Superphosphate N 130: P_2O_5.	Bone meal and Salt-petre N 250: P_2O_5.	Bone Superphosphate and Saltpetre N 250: P_2O_5.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Cane sugar ...	16·46	16·22	16·20	16·36	16·03	15·50	16·61	14·29	15·02	15·03	15·96	16·91	17·30	16·72	16·52
Glucose ...	1·37	1·47	1·38	1·22	1·55	1·77	1·36	[illegible]	1·63	1·72	1·62	0·95	1·16	1·24	1·31

At Cawnpore likewise the series of plots on which different manures were applied lead to the same conclusion ... quantities of the amounts of manure applied ... Statement No. 4 exhibits again the proportions of cane sugar and of the juice obtained, and here ... amounts of manure not only ... remain constant, while the ... considerably, but were very much smaller than in the case of the Poona plots.

STATEMENT NO. 4.

Composition of the Juice of the "Matua" variety grown on Plots at Cawnpore.

	No Manure.	Cattle-dung 7 tons, N 94 lbs.	Cattle-dung 14 tons, N 188 lbs.	Bone Superphosphate 5 cwts, N 17 lbs.	Saltpetre, crude, 2 cwts., N 14 lbs.	Superphosphate 5 cwts, Salt-petre 2 cwts., N 31 lbs.	Bone meal 5 cwts., N 21 lbs.	Bone meal ... cwts, Salt... cwts., N 35 lbs.	[illegible]
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Cane sugar	15·67	16·90	17·04	17·08	16·74	15·14	15·03	16·58	16·03
Glucose	·57	·50	·37	·31	·31	·51	·44	·29	·32

Thus it appears evident that the quality of the juice of any particular variety is not *materially* affected by the amount or description of manure applied. I say *materially,* because I should not wish to imply that manuring can have *no* influence. On the contrary, and quite apart from the question of the amount of cane grown per acre or of other properties of sugarcane to be discussed later, which is altogether distinct from the point under discussion, I believe that the quality of the juice of sugarcane may £ V m p T t h L s W b good cultivation and liberal manuring. I have seen cane in Behar which had lost all the usual appearance of the crop and which I thought was reeds-a condition brought about, L do not doubt, by the scanty manuring applied. But 1 think the evidence above set out goes to show that the improvement m the quality ot the juice of a cane will at the best be a slow process. It also seems evident that We may place fair reliance on the information conveyed m Statements ^Nos. 1 and 2 in which the quality of the juice of different varieties was exhibited. It can hardly be suggested, for instance, that they are accidental m any way; it must rather he assumed that the composition of their 3ujces as there stated M, really what it is in ordinary practice. With the exception of the Poona variety, they were not brought from long distances to the farms in question, but belonged to the respective provinces, and we may \ J ^ J ^ . ^ £ ? that, for Sample, the varieties Dhaul and Dikchan of the North-Western Provinces and the Mungo and Khari varieties of Bengal are poor and may easily be replaced by better ones already at hand.

(2) THE COMPOSITION OP THE RAW SUGAR ("GUR" OR "GUL") OBTAINED.

7. Before discussing the analyses of the raw sugars, it will be well to first set out the obiects which were kept in view. So far as the cultivator's palatei is concerned, it matters probably little whether his "Gur" contains much or little molasses. Glucose is to him much of the same value as cane sugar. In the bazar, however, buyers make a difference between "Gur» which is nice and firm a»d showing a good colour and crystal, and «gur" of bad colour and softness. The Buniya who buys for either refining or sweetmeat-making, or for the simple retail of Gur, has to warehouse large quantities, and during the rains the mass w very apt to absorb moisture and run. The higher the proportion of glucose, the greater will be the loss, and thus, quite apart from the comparative value of raw sugars to the large refiner, the matter is of considerable moment to the cultivator in all large sugar-producing districts. To the refiner the matter is of still greater moment. Each part of glucose will prevent an equal weight of cane sugar from crystallising. Now the proportion of glucose in the raw sugar depends not only on the amount present in the juice, but also on the amount which is formed during the boiling down process. As in the case of plant pices generally, that of the sugarcane is slightly acid. When a solution of cane sugar w boiled with a dilute acid, it becomes "inverted," *i. e.* converted into glucose. The amount or extent of this inverting depends on the nature of the acid, its strength and on the length of time the solution is kept boiling. The amount of acidity* in those cane iuices which were examined, varied somewhat, as will be seen fr om the accompanying statement, though it is in all cases very small. It » due to the presence of several different organic acids, and while the juice is being boiled down, this acidity causes the inversion of a certain quantity of cane-sugar. This inversion may, at least in part, be prevented. I mentioned in my Qote on this subiect last year that a little alkali (potash) was added to the juice at Cawnpore before boiling down. This year I carried out sever*l experiments **th lime instead of potash. The latter has the disadvantage that it is itee lf a ^eans of preventing cane sugar from crystallising, whilst lime, in the small quan-% used, d 0es no harm. The extent to whioK it prevented «inversion" will be ^en presently. In order to determine the extent of inversion, t is necessary Jo compare the relative quantities of glucose in the pice and in the Gur ofrtaned, and the following Statements Nos. 5, 6, 7, 8 are drawn up with this object. In

g d ^ ! i lit per

The acidity was determined by neutralising the juice with standard ^ ! i, litmus pa: ^g used a 8 the indicator. The juice *in* too strongly coloured to allow of i any.ndica™*™g «wd in the liquid and clearing agents are inadmissible. Cochineal gave too high results and. Pbenolphthalun is inadmissible since the juice contains carbormc acid' ^he fignw·repwaent P^s of K,0 required to neutralise the acidity of 100 parts o pice. Since the add.ty is due to a variety of acids, this mode of expressing the results is preferable.

Percentage composition of the juice and of the Gur respectively, and then in order to show at a glance the relative amount of the glucose and the Gur, its Proportion per *100 parts of total sugar* is printed in block type. It will be seen that the proportion of glucose in the Gur varies greatly from about 2 parts per 100 of total sugar in the Matua variety to no less than 17 in the Dikchan variety (Statements 6 and 7).

The juice of the Whole much more uniformity; it is in the majority of cases between 10 and 12 per 100 of total sugar, but exceptions occur such as the Dikohan Gur which contained 22 of glucose per 100 of total sugar.

There was however a considerable variation in the amount of glucose formed during the boiling process. On the other hand the Bhurli variety at Dumraon had only 6 in the Gur, showing a very slight amount of inversion. There seems to be no clear relation between the amount of acidity and the amount of inversion.

STATEMENT NO. 5.

Composition of Juice and Gur from six varieties grown at Dumraon, 1895-96.

Varieties.	Mungo,	Khari.	Red Bombay.	Poona.	Samsara.	Bhurli.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Juice.						
Cane sugar	9-55	11-55	13-70	12-99	13-91	13-01
Glucose	1-06	0-99	0-95	1-16	1-18	0-57
Total sugar ...	10-61	12-54	14*65	14-15	15-09	13-58
Ratio : 100 parts.						
Total sugar contain of glucose ...	**10·0**	7·9	6·5	**8·2**	7·8	4·2
Gur.						
Cane sugar	71-85	68-07	73-99	69-20	70-60	77-46
Glucose ... ,,	11-37	9*39	9-81	10-31	10-79	5-27
Total sugar ...	83-25	77-46	83-80	79-51	81-39	82-73
Ratio : 100 parts.						
Total sugar contain of glucose ...	**13·7**	**12·1**	**11·8**	**12·9**	**11·9**	6·3

STATEMENT *NO.* 6.

Composition of Juice and Gur from six varieties grown at Cawnpore, 1895-96.

Varieties.	Dhaul.	Dikchan.	Saharan-puri.	Poona.	Madrasi.	Matua.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Percent.
Juice acidity]	0-055	0-049	0-006	0-0lf	0-049	0-074
Cane sugar	12-74	9-68	15-69	12-48	13-80	16-36
Glucose	1*25	1-98	0-9S	1-77	1-65	0-40
Total sugar ..	13-99	11-66	16-67	14-25	15-45	16-76
Ratio : 100 parts.						
Total sugar contain of glucose ...	8·9	**16·98**	5·8	**12·4**	**10·6**	2·3
Gur,						
Cane sugar	68-67	62-99	70-92	69-72	69-06	71-71
Glucose	11-40	17·99	9-94	13-90	12-82	10·35
Total sugar ...	80-07	80-98	80-86	83-62	81-88	82-06
Ratio : 100 parts.						
Total sugar contain of glucose ...	**14·2**	**22·2**	**12·3**	16·6	15·6	**12·6**

STATEMENT No. 7.

Composition of Juice and Gur of the Matua w% gro» at Galore mth different Manures., 1895-90.*

	No Manure.	Cattle dung 7 tons per Acre,	Cattle dung 14 tons per Acre.	Bone Kuper-phos-phate 5 Cwt.	Salt-petre 2 Cwt.	Super-phos-phate 6 Cwt., Salt-petre 2 Cwt.	Bone meal 5 Lwt.	Bone meal 5 Cwt., Salt-petre 2 Cwt.	No Manure.
Juice.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Cane sugar	15-67	16-90	17-04	17-08	16-74	15*14	1503	16-58	16-03
Glucose	0-57	0-50	0-37	0-31	0-31	0-51	0-44	0-29	0-32
Total Sugar ...	16*24	17-40	17-41	17-39	17-05	15-65	15-47	16*87	16-35
Ratio : 100 parts.									
Total sugar contain of glucose	3-5	2·8	2·1	1-79	.1-8	3-2	2-8	1-7	1-9
Gur.									
Caue sugar	72-51	71-28	72-73	68-76	72-04	6970	72-74	71-85	73-80
Glucose .,.		10-39	9*46	12-88	10-57	13-96	10-15	9-91	7-33
Total sugar ...	81-05	81-67	82-19	81-64	82-61	83-66	82-69	81-76	81-13
Ratio : 100 parts.									
*otal sugar contain of glucose	105	126	115	157	128	167	122-	121	90

STATEMENT NO. 8.

Composition of Juice and Gur from the Poona Sugarcane ,«m;a a Poona with different Manures.*

	Poudrette N 1,000 lbs. P_2O_5.	Poudrette N 500 lbs. P_2O_5.	Cattle dung N 500 lbs. P_2O_5.	Farm-yard manure N 500 lbs. P_2O_5.	Safflower cake N 500 lbs. P_2O_5.	Cotton seed cake N 500 lbs. P_2O_5.	Safflower and Earth-nut cake N 500 lbs. P_2O_5.	Bassia cake N 500 lbs. P_2O_5.	Castor-cake N 500 lbs. P_2O_5.	Karanj cake N 500 lbs. P_2O_5.	Fish manure N 500 lbs. P_2O_5.	Bone meal N 130 lbs. P_2O_5.	Bone Superphosphate N 130 lbs. P_2O_5.	Bone superphosphate and Saltpetre N 500 lbs. P_2O_5.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Juice acidity	0·061	0·049	0·061	...	...	0·074	...	...	0·049	0·061	0·049	..	0·049	0·061
Cane sugar	16·46	16·22	16·20	16·36	16·03	15·50	16·61	14·28	15·02	15·03	15·96	16·91	17·10	16·52
Glucose	1·37	1·47	1·38	1·22	1·65	1·77	1·36	1·87	1·63	1·72	1·52	0·95	1·16	1·31
Total sugar ..	17·83	17·69	17·58	17·58	17·58	17·27	17·97	16·15	16·65	16·75	17·48	17·86	18·46	17·83
Ratio : 100 parts.														
Total sugar contain of glucose	7·68	8·3	7·8	6·9	8·8	10·2	7·5	11·6	9·78	10·2	8·69	4·97	6·2	7·3
Gur.														
Cane sugar	77·90	74·93	76·55	75·19	75·35	75·99	76·61	73·16	76·48	73·67	75·95	73·17	69·71	72·85
Glucose	9·99	11·20	10·80	11·75	11·44	10·61	9·80	12·50	10·46	12·47	11·90	12·18	16·23	15·05
Total sugar ..	87·84	86·13	87·35	86·94	86·79	86·60	86·47	85·66	86·94	86·14	87·85	85·35	85·94	87·90
Ratio : 100 parts.														
Total sugar contain of glucose	11·2	13·1	11·8	13·5	13·1	12·2	11·4	14·59	12·0	14·4	13·5	14·27	18·8	17·1

8. It is possible (and perhaps practicabe) to pre^ nts with quicklime th* glucose formation. As already indicated, expenme i>ht be a ^^ ^ were made at Oawnpore and Poona to test how ±ar success m j,

this manner, and I must here thank Mr McGlashan, F fif' of the Cawnpore Sugar Works, Limited, for the interest?£ took in the ma

the ts it was desirable to add as =»«* lime t0 If an excess of l ...arly but not quite neutr a11 the acidity, no price in the bazars employed, the resulting Gur is black <l would command not ugh, as will seen belo W, its qualit y is really "milk of lime," *i. e.* quicklmi a d water To do this, e llme Was added, in the form of from all lumps, stones, &c £ a Sefinite mad ! mto a thin cream and separated operated upon until t hft%ortfon was P?*)ortl(? {* the Jui^ for each pan 'Hie remaining portion of £ wa. then ^ ix** ? ^ e neutral W > n and the whole thus became Tghtlfacid tralise fth of the acidity Hh^t ^ us, f P r f xam Ple, if it was desired to neu- rately neutralised w ftt& mi.k S f f i f ? S mtend ed for one P an was se P a, which means a juice was DMDMS 7?«f - ?~ T emainin g ith was added, by free acid; or, agSn if it ^ S S j ? f t a m m ^ ith of the 0^nal amount of juice int the one acid 9/10 ths of the juice wa with th ema ng 1/10 th of the

±f=£S=S'JS'tS

and although litmm 1O r,^I f? ity, The Process is extremely simple ; lime has bet added, *?$£ SSS E° ^ ployed to determine when-sufficient might be able after a very iStJl V he sP°°i lfu11)' 1 believe that cultivators assuming, rf«S tS;t & ^ S ? ^ the operation perfectly well, a They all know how many«™ ^ ? eirwhiJ e to go to the trouble to do there is no dMcuTv nthH Gh ?™» " of juice go to a pan-full, and hence The results of the ex oa^cu tym; ^ ^asurmg off the right amount for neutralising. Penments are set out in Statement 9.

It will be seen that boiling process was W™ ^ °i aSeS 4° P r ?P ortion of glucose formed during the where only Hhanl SS? 1?SS ftf the additioa of lime ^ two cases, 15th and F7th respectively of the acidity was left unneutralised, there was practically no rsi Also all the acid neSiseTVh re WhM ? Slight eXCess of lime was ^*Ployed* and majority of cSestwr WaS no 1UCrease in the amou^ of glucose. In the was added, WaS 8ome 1Ilver^ but much less than when no lime

STATEMENT NO. 9.

Showing the effect of Neutralising Juice with Lime before boiling.

	CAWNPOBB EXPERIMENTS.											POONA EXPERIMENTS.			
	Matua variety.						Saharanpuri variety.			Madrasi variety.		Plot 7.		Plot 9.	
Juice.															
Cono snjrar	16-74		16*58		1603		15*69			14*10		1596		1503	
Olucose...	0-81		0-29		0*32		0*98			1-35		1-52		1*72	
Total Bugar ...	17*05		16*87		16*35		16*67			1545		17*48		16*75	
Ratio : Total Sugar : Glucose ...	1-8		1*7		1*9		5*8			8*7		8*69		10*2	
Amount of acidity neutralised.	No lime.	Inde-finite.	Ko lime.	Alka-line.	No lime.	3/4	No lime.	6/7	4/5	No lim.	26/27	No lime.	9/To	No lime.	9/10
Our.															
Cane sugar	72*04	74*96	71-85	76*76	73-80	73'94	70"92	78*80	78-43	69-06	77 41	75*95	7988	73*67	78-00
Glucose	10*57	6*66	9*91	1*62	7*83	581	9*94	5*35	6*08	12*82	7*57	11*90	9'00	12*47	9*60
Total sugar ...	82-61	81-62	81*76	77*38	81-13	79-25	80-86	84*15	83*51	81-88	84*98	87*85	88*88	86*14	87*60
Ratio: Total Sugar : Glucose ...	12'8	8'16	12-1	2*09	9*0	6%70	12-3	6*36	6*08	15-6	8*9	13*5	10*1	14-4	10*0

In the case of the juice of Matua variety at Cawnpore, the juice was all used up before I knew how much lime might safely be added. Whenfthofthe acidity was neutralised, the inversion was still considerable, but it may fairly be assumed that if about £th of the acidity had been neutralised there would have been very little inversion. Thus generally it jnay be said that, if lime can be higier than owSn ^ ahS n ^ ^ ^ *luc T m? be Valued muc valued much lime or some other neTrafsiL atnt Ty^' alt?o Ugh Wlfc hout the ^™ of tained. The Matua variety Inlined advanfca^e 1S n ot t necessarily main- n«i-y contained a very low proportion of glucose in the

juice, but this was (excepting after addition of lime) of no value, for the Gur obtained from this cane contained a fairly high proportion (about 12 per cent. —*vide* Statement 7) under ordinary circumstances.

Mr. McGlashan informs me that the sample of Gur which was £th limed {*vide* statement) was better than average "pubi" or strained rab costing about Rs. 5-5 per maund.

(S) THE REFINING OF JAGGERY BY THE HAND CENTRIFUGAL MACHINE.

9.- Quite apart from any market which may exist for raw sugar required by large refineries, there appears to be a considerable demand for semi-refined sugar by small refiners. To the poorer class of cultivator molasses or Gur containing a high proportion of glucose, is just-as good a food as ordinary Gur. The feeding value of the two may be said to be identical. On the other hand the refine? wants as little molasses (glucose) as possible. The less its'amount, the less trouble will he have in his manufacture. It follows, therefore, that if, instead of Gur being sent to refiners, semi-refined sugar- be sent and the molas&es retained by the grower, a distinct economy will be effected.

This is precisely the state of things which I found around Behes^ The juice, instead of being boiled down hard to the form of Gur, is largely^nveited >nto a semi-liquid jaggery from which, by the aid of Messrs. Thomson Mylnes hand centrifugal, mosTof the molasses is separated from the sugar crystal and retained for local consumption, whilst the semi-refined sugar is sold. 1 have to tbank Mr. Mylne for showing me some of these machines at work and f<« some valuable information on the subject. Doubtless the proportion of sugar ciystai obtained will vary and depend on the sort of juice and on the method ot boil->og employed. But from what I could learn the semi-pure sugar obtained founts to about * of the jaggery* operated upon, the other halftjonwstag of a 1'quid molassefe which, on boiling down, forms Gur. perfectly good for _con sumption. The market value of the different materials were as follows at the time of my visit:—

Ordinary Gur ...	...	12 sers the rupee.
Semi-refined sugar	...	6 „
Gur jnade from the molasses...		14 „

Thus a maund of ordinary Gur would have sold for Es. 3-5-0, whilst if the same quantity of iuice.had been converted into jaggery and refined rathe centrifugal there would be obtained 20 sers of sugar worth Us. 3-5-0 and 20 sera of SeCond quality Gur of value Re. 1-8-0. The profit would not be quite *° large as these figures indicate, because of the cost of boiling the molasses do wn aga in> but the above example will show that it may readily pay a cultivator fco çonvert a part of bis juice into jaggery and prepare semi-refined sugar from *. instead of selling it all as Gur. The following analyses of samples of semi-refined sugar will illustrate their composition. There is in addition one analysis of a sample of the Gur made from the molasses :—

STATEMENT NO. 10.

	Sugar obtained by the Centri-fugal.	Gur from the Molasses of the same.	Sugar obtained by the Centrifugal.	Sugar purified by wet weed.
Cane ... SUgar	89-48	65-71	92-20	96-67
Glucose	3-34	13-81	1-95	0-89
Ash	1-41	5-08	0-84	.....
Total sugar ...	92-82	79-52	94-15	**97-56**
Ratio : Total Sugar : Glucose ...	**3-6**	**17*3**	**2-0**	**0-91**

It will be seen that the Gur which was prepared from ^e molajses was of not at all very poor quality, indeed nearly as good as some at the trurs wnicn were prepared from juice direct at the farms.

(4) TEE LOSS OF SUGAR WHICH OCCURS DURING THE BOILING-DOWN PROCESS.

m 10. The loss of cane sugar caused by inversion has already been dealt with. jWeia however another source of loss during the boiling process wnicn 1 nave

• I apply the term jaggery to the semi-solid mass which is prepared by staying the boiliDg process at an earlier stage than is the case when Gur is prepared.

attempted to estimate. Assuming that we have determined by analysis the percentage amount of sugar in any particular quantity of juice and that we know the weight of the juice; and, secondly, if we similarly determine the percentage amount of sugar in the Gur obtained and that we likewise know its weight, the weight of sugar in the juice employed and in the Gur obtained may be readily calculated. If no loss (excepting inversion, which is not a loss in the sense in which the word is applied in this paragraph, for if cane sugar becomes " inverted " it forms glucose) occurred, the total amount of sugar found in the Gur should be equal to the total sugar in the juice. In making such a calculation, however, it becomes necessary to bear in mind what the " errors of experiment " may be. In the analysis of the juice the error inay amount toi* 1 per cent, of total sugar; in the analysis of the Gur it may amount toi*2 per cent, of total sugar. Both these possible errors are insignificant in the question at issue. A greater source of error may be the obtaining of really representative samples of juice and Gur. For the former a sample was taken either from the tin cans at each mill which was done at Cawnpore, each sample bottle "of juice thus containing juice from eight different mills all crushing one sort of cane or the bottle was filled (as at Poona) from the large cisterns, two of which are filled as a measure of the juice for one boiling; in the latter case each sample represented about 900 lbs. of juice. Even with these precautions variations were frequently found between the composition of the juice of the same lot of cane; this variation sometimes amounted to 0'8 or 0*9 per cent, of total sugar, though in the majority of cases it fell to less than 0#4 percent. Assuming a juice to contain 17 percent, of total sugar, a difference of 0#8 per cent, between two samples would be equivalent to 4*7 per cent, of the total sugar; we may however fairly assume that the mean of the two analyses would really represent the average composition of the juice of a plot of cane or that at the most the error would not be greater than 2#3 per cent, of the total sugar. In the majority otcases, however, the difference between the composition of two samples of juice from the same plot of cane fell below this figure. In the case of the Gur, the sample could be very perfectly obtained. A long iron instrument of semi-circular form, like the one employed for sampling cheese, though much longer, was driven into the block of Gur and on withdrawing it a circular slice of Gur the whole length of the cut adhered to the instrument. A portion from the centre of this slice was taken from each block (or from one-half of the blocks as at Poona) and these portions on being mixed together give a very perfect average sample of the Gur of the whole plot. It may be mentioned here that although Gur is quite solid in the ordinary sense, still the molasses do pass gradually downwards and a piece chipped from the top of a block might contain less glucose than a piece taken from the bottom. The advantage of obtaining the sample from the very centre will thus be apparent. Only one sample of Gur was analysed from any one plot but the error of sampling, when done in the manner above described, cannot be supposed to be anything appreciable. In the accompanying Statement No. lithe weight of juice, the percentage of total sugar and the calculated weight of total sugar in the juice is placed in the upper portion, in the middle portion is stated the weight of Gur obtained, the percentage of total sugar in the Gur and tbe calculated weight of total sugar in it. Finally we have the difference between the weight of sugar in the juice and in the Gur respectively and the percentage of loss :—

STATEMENT NO. 11.

Shoiving loss ivhich occurs when toiling doivn juice.

		CAWNrORE EXPEEIMENTS.				POONA. EXPBRIMBNTB.			
		Matua Plot 1.	Poona variety.	Madrasi variety.	f. aharair puii variety.	Plot 18.	Plot 19.	Plot 20	I'lot 21 () boil-ing)^
Juice ...	Lbs.	1,807	3,492 "	2,833	1,920	11,400	13,284	12,833	900
Total sugar ...	Per cent.	16-24	14-25	15-45	16-67	17·2	16-75	17·17	16·11
Do. ...	Lbs.	293	498	437	31'0	1,968	2,224	2,203	145'3
Gur ...	Lbs.	316	534	460	352	1,922	2,238	2,210	151
Total sugar ...	Per cent.	81-06	83-62	81-88	80-86	88-1	• 89-69	87-92	87-26
Do, ...	Lbs.	256	446	376	284	1,093	2,008	1,943	181-7
Loss ..*	Lbs.	37	52	61	36	275	216	£60	13^6
Do. .••	Percent.	12-0	10·01	13-9	11-2	13-95	• 9-76	11-80	93

This has been calculated for four plots at Cawnpore and for three plots at Poona; in addition to which there is the result of a careful experiment on on8 Pan of juice made at Popna. It will be seen that the loss amounts to more than 10 per cent, of the sugar f the figures obtained from the Cawnpore experiments agreeing closely with those at Poona. There are two reasons for this loss, the °tte being due to juice which is unavoidably carried off with the scum, whilst the second one is due to sugar which adheres to cloth lining of the mould into which the Gur, whilst still warm and soft, is put. The experiment on one pan °f juice at Poona was made to determine how much sugar is carried off by the scum. In this case the total loss amounted to 9*3 per cent. It was intended to collect all the seum, weigh it and analyse it. But it is difficult to do this. As the <r drainer " with which the scum is separated is passed from the pan to the Vessel in which the scum is put, some 4rips on the ground, and again the sugar-boiler has to give the drainer each time a violent shake to detach some of the scum, and it thus happens that all the scum was not actually collected. In the experiment under notice the scum weighed 24 lbs. It contained 27*45 per cent, of sugar and this amounts to &6 lbs. of sugar. Of the 9-3 per cent, of loss, 4-5 per cent. w as thus accounted for. But the amount of sugar in the scum may be safely assumed to be greater than this; probably 6 per cent, of the loss would more accurately represent it. The remainder must be assumed to be attached to the cloth. Now although it is thus seen that a loss of more than 10 per cent, of the sugar in the juice is sustained, it ha'ppens that that portion which goes with the scum is usefully employed. At Cawnpore the scum was fed to cattle. At Poona an arrangement exists with the man who supplies all the ropes that he shall have the scum as payment. He takes it and prepares Gur from it; and considering that it contains such a high percentage of sugar, it will be evident that although the preparation of sugar from it will entail some little trouble, still it can be profitably done. It is a matter of satisfaction to find that this sugar is not pasted and affords another example of how economical the cultivator is, when by means of patience he can be so.

(5) THE TOTAL AMOUNT OF SUGAR IN THE CANE.

11. As is well known, the amount of sugar which actually exists in the cane ls L^.ar g re ater than that which is expressed by any mill. It appeared nevertheless of interest to make some determinations of the total sugar in different sorts of cane, partly because such determinations have not been previously made (as far as the writer is-aware) for Indian canes, but more particularly because from different sorts of cane very different amounts of juice are expressed, and this independently of the exact description of mill employed. Last year an attempt was made to determine the total sugar in the cane, and also (since we can calculate the amount in the juice expressed) the sugar in the refuse cane, the sum of the two latter would form a check on the correctness of the former. It has been found impossible, for several reasons, to determine the sugar in the crushed cane directly with any degree of exactness, and reliance must be placed on the determinations of the total sugar in the cane alone. As will be seen, however, these are probably very near the truth, and some interesting results obtained. It will be well in the first place to explain the process employed for the purpose. A succulent plant stem may be said to consist of two principal parts, the one is juice and the other *s f< c*ude fibre," which consists principally of cellulose and other insoluble carbo-hydrates. The former, the juice, is a watery liquid, whilst the crude fibre ls ^ practically insoluble in cold water. If, therefore, the stem (after being suitably cut up so as to admit water to pass among the fibres) be treated with Water, the latter will wash away the juice entirely, leaving the " crude fibre " behind and the latter may be dried and weighed. In the analyses of cattle fodders, chemists have usually found it more exact to employ hot water in washing the juice or soluble portion from the crude fibve. In the case of sugar-cane I have employed (for the purpose under discussion, namely, the estimation of the juice and sugar) only cold water, for our object is to separate only those batters from the crude fibre which are dissolved in the juice, *i. e.* in a cold watery fluid. If then we thus separate the crude fibre and weigh it, the other portion is considered to be juice. Having determined the proportion of juice, we can, from its analysis, calculate the amount of sugar or any other of its constituents which are present from the percentage of juice found in any cane. Thus, if we found 10 per cent, of crude fibre in a cane, the difference or 90 per cent, would be juice, and if that juice contained 15 per cent, sugar, the proportion of sugar in the cane would be 13#5 per cent.

dried. As chemical method we have evidence. A succulent stem, if water entirely and we have not exceeding the remaining will lose its the "dry matter." Now, it will be evident that what is termed by chemists "crude fibre," and the sugar in the juice dry matter contains the K, therefore, to the crude fibre we add the amount of solid substance which exist in the juice. albuminoids found in the juice the amount of mineral matter and amount of "dry matter." In the case of juice the sum should equal approximately the the solid matter dissolved in it consists of greater part of and albuminoids are very small a little be the amount of mineral matters In the Jamaica experiments we have quoted the data of the crude fibre and the sugar, or rather more than 2 per cent. Thus a check is placed on the determination of the total sugar in the juice, which would show lies in the fact that only small quantities (about 2 to 3 Ozs. from 3 or 4 canes) could be operated upon and as the weak point of the method for the purpose, still the canes were chosen than the samples of juice. The method is open to doubt but the results obtained are sufficient for the purpose to be quite accurate.

STATEMENT NO. 12.

The composition of Sugarcane.

	Poona Cane.		Cuwnpore Experiments.				
	Plot 2.	Plot. 11.	Dhaul.	Dikchan.	Matua.	Saharanpuri	Madrasi.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Dry matter	24·90	23·69	24·35	23·26	29·51	25·94	24·58
Water...	75·10	76·31	75·65	76·74	70·49	74·06	75·42
Crude fibre	8·33	8·52	12·72	11·00	14·81	10·34	10·00
Juice	91·67	91·48	87·28	89·00	85·19	89·66	90·00
Crude fibre	8·33	8·52	12·72	11·00	14·81	10·34	10·00
Total sugar	16·11	16·31	12·21	10·38	14·27	14·95	13·90
Albuminoids in juice ...	0·09	0·09	0·10	0·12	0·16	0·33	0·14
Mineral matter in juice .	0·25	0·34	0·49	0·40	0·40	0·29	0·42
Total ...	24·78	25·26	25·52	21·90	29·64	25·91	24·46

columns of the statements are the results of the analyses of samples of cane from two plots at Poona, both of which are of the same variety, and the result will indicate that the method employed may be relied upon. In the other five columns are the results of the analyses of five varieties of cane grown at Cawnpore. In the upper part of the statement is exhibited the proportion of water and of dry matter in each sort of cane. In the first two shows the proportion of crude fibre and of sugar, second section of the statement

In the third section are found the proportions of crude fibre and of sugar, ash and albuminoids which existed in the juice. The sum of these may be compared with the dry matter. In two cases the determined con- high and approximately, in the other four matter.

It will be seen that the proportion of very considerably, some varieties containing nearly twice as The percentage of juice on the other hand varies from 85 per cent. to a per cent. The per- centage of total sugar varies from 10 per cent. to an 16 per cent. It may be mentioned here that the best cane produced abroad does not contain more than 18 per cent. of sugar; and, consequently, it may be asserted that we have in the variety grown at Poona a cane which is nearly equal to any in the

world. It contains, moreover, a low proportion of crude fibre, a quality which, as will appear from the considerations discussed in the next paragraph, is of some moment. Of the varieties grown in the North-Western Provinces, the Saharanpuri contains about 15 per cent, of sugar, which is high, but the proportion of crude fibre is higher than in the Poona cane. The variety Matua contains a fairly bigh proportion of sugar, but it also contains a very high proportion of crude fibre. The varieties Dikehan and Dhaul rank far below, for they contain low proportions of sugar and high proportions of crude fibre.

(6) THE AMOUNT OF JUICE AND CONSEQUENTLY OF SUGAR WHICH REMAINS UNEXPRESSED FROM THE CANE.

13. Having determined the amount of juice and from this the amount of sugar which different canes contained, we may now compare this information with the amount of juice and sugar expressed.

In the Statement No. 13 is set out for the same seven samples of cane as were referred to in the foregoing paragraph the total juice in the cane, the proportion expressed by the mills, and the difference or that remaining in the refuse cane ; then similarly the total sugar in the cane, the amount expressed in **the** juice and that part remaining in the crushed cane; finally in the third section of the statement the relative proportions of crude fibre and juice in 100 parts of crushed cane :—

STATEMENT NO. 13.

Amount of Juice and Sugar remaining in the crushed Cane.

	POONA CANB.		CAWHPORB EXPERIMENTS.				
	Plot 2.	Plot 11.	Dhaul.	Dikcban.	Matua.	Saharan-puri.	Madrasi.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Juice in cane	91-6	91-5	S7-3	89-0	85-2	89-6	90-0
» expressed	71-6	72-2	51-2	56-0	45-4	57-4	64-1
,, in refuse cane	20-0	19-3	36-1	33-0	39-8	32-2	25-9
Total sugar in cane	16·11	16-31	12-21	10-38	14-27	14-95	13-90
„ in juice expressed	12-59	12-87	7-15	6-53	7-60	9-56	9-90
„ in refuse cane	3-52	3-44	5-06	3-85	6-67	5-39	4-00
Composition of the refuse cane—							
Crude fibre	29-4	30-7	26-1	25-0	27-1	24-3	27-8
Juice	70-6	69-3	73-9	75-0	.72-9	75-7	72-2
	100-0	100-0	1000	100-0	100-0	100-0	100-0

A glance at the figures in the first section of the statement shows that whilst there is no very great difference in the proportion of juice which the varieties contain, the amounts expressed vary enormously from the cane at Poona; more than 70 out of 91 per cent, of juice was obtained, whilst from the Matua variety at Cawnpore only about 45 out of 85 per cent, was realised. The other varieties occupy an intermediate position. At first sight it would be suspected that the mills were at fault, and the high proportion of juice expressed at Poona indicates that the mills employed there were better than those employed at Cawnpore. So far as this point is concerned, I believe that the mills employed at Cawnpur were in several cases (8 mills were used) bad ones, and possibly better mills would have expressed rather more. But this will not in any case account for the great differences which were found. From the Poona variety (grown at Cawnpore) 65 per cent, was expressed, which is distinctly less than what was obtained from it at Poona. But a comparison of the results of crushing the several varieties at Cawnpore shows that whilst 64 out of 90 per cent, of juice Was obtained from the Madrasi variety, only 45 out of 85 per cent, was got from the Matua, and this under perfectly similar conditions as regards mills. If, however, instead of making comparisons of the amounts of juice, the crude fibre

and the part it plays, be considered, an explanation offers itself. As soon as the oane is broken and whilst still in the mill, the crude fibre may be likened simply to a sponge. The cells which enclosed the juice in the original cane are broken, and there is nothing to prevent the juice from leaving the cane excepting the physical property of adhesion. Thus then, such being the case, the amount of juice which will remain with any refuse cane as it leaves the mill will depend principally on the amount of spongy material, in other words, on the *crude fibre* present. The lower portion of the statement exhibits this very clearly, for the refuse cane of all the five varieties at Cawnpore consisted of 25 to 27 per cent, of crude fibre and 73 to 75 per cent, of juice, showing that the mills had worked very uniformly indeed in each case. At Poona the refuse cane must have been unquestionably better crushed, for the refuse cane consisted of 30 per cent, of crude fibre and 70 per cent, of juice. It thus becomes apparent that the proportion of crude fibre in any cane is a very important factor; for it may be stated as approximately correct that the amount of juice remaining in the crushed cane varies directly with the proportion of crude fibre in the cane. The Matua variety contains about 15 per cent, of crude fibre and held 40 per cent, of juice within its substance when crushed; the Poona variety (crushed with an entirely different mill at Poona) contained 8 per cent, of crude fibre and retained 20 per cent, of juice. It will thus become apparent why it is that although the Mjtna variety contained 85 per cent, of a juice containing nearly 17 per cent. oFsugar, it is but a very poor cane for crushing purposes. Of the 14 per cent, of sugar in the cane only a little more than half was expressed, whereas in the case of the Saharanpuri and Madrasi varieties frd of the sugar they contained wa^ expressed, and from the Poona variety (grown at Poona) the proportion rises to fth. It may be said, therefore, that it is little good growing a cane with very rich juice if the proportion of crude fibre is likewise high ; it is indeed of greater importance than the possession of a good mill.

(7) THE AMOUNT OF NITROGEN AND PHOSPHORIC ACID IN THE SUGARCANE CROP.

14. Last year an approximate estimate of the amount of nitrogen and of phosphoric acid in the sugarcane crop was made, but it appeared to be worth while to make accurate determinations of these two constituents ; for this crop is considered generally to be a very exhausting one. Samples were, therefore, taken of the sugarcane, of the green leaves and tops of the cane which are not passed through the mill, and of the dry leaves which are stripped off the cane when it is harvested. The weights of these were also recorded, and from this and the percentage found by chemical analysis, the weight of nitrogen and phosphoric acid may be readily calculated :—

STATEMENT NO. 14.

The amount of Nitrogen and Phosphoric Acid in the Buqcircane Crop.

	DUMRAOH EXPERIMENTS.				CAWNPOBB EXPBBIMEKTB.			
	Poona variety.		Red Bombay variety,		Madrasi variety.		Matua variety.	
	Per cent. Nitro-gen.	Per cent. Phospho-ric Acid.	Per cent. Nitro-gen.	Per cent. Phospho-ric Acid.	Per cent. Nitro-gen.	Per cent. Phospho-ric Acid.	Per cent. Nitro-gen.	Per cent. PhoBpho-ric Acid.
In fresh cane	0-025	0-049	0*028	0·052	0*046	0036	0-054	0-084
la green tops and leaves	0*153	0 099	0-22	0121	0*320	0-117	0167	0177
In dry leave*	0'425	0'213	0-336	0160	0*550	0-220	0353	0*388
	Lbs.		Lbs.		Lbs.		Lbs.	
Weight of—								
Fresh cane	4,8,000		48,000		53,004		22,330	
Green tops	8,640		8,480		16,725		?6,17G	
Dry leaves	4,800		4,960		6,480		5,671	
	Lbi. Nitro-gen.	Lbs. Phospho-ric Acid.	Lbi. Notro-gen.	Lbs. Phospho-ric Acid.	Lbs. Nitro-gen.	Lbs. Phospho-ric Acid.	Lbs. Nitro-gen.	Lbs. Phospho-ric Acid.
In cane	12-0	23-5	13-4	25-0	24*3	19-1	12-0	38-7
Green tops	13*2	8-5	18*6	10*2	53-4	19*5	27-0	28'6
Dry leaves	20·4	10-2	16.6	7-9	35-6	14-2	200	22-0
	45·6	42-2	48-6	43*1	113-3	52-8	69*0	69-3

The accompanying Statement No. 14 exhibits the results for two varieties grown at Dumraon and two at Cawnpore, The largest amount of nitrogen was taken up by the Madrasi crop at Cawnpore and the largest amount of phosphoric acid by the Matua crop* The amount of nitrogen in the Madrasi crop is indeed far higher than in the others; the proportion of nitrogen in the several parts of the plant is high and so also is the relative weight of green and dry leaves. In none of the four cases were the crops so heavy as at Poona. The crop of the Poona variety at Dumraon was only about half as heavy as a good one at Poona and the amounts of nitrogen and phosphoric acid in a good crop of cane at Poona may be said to approximate to at least 100 lbs. per acre each.

Conclusion.

15. We may now summarise briefly the results obtained up to the present °& the subject of sugarcane :—

(1) It is evident that the juice of different varieties of cane contains very different proportions of sugar; further, that this proportion of sugar is not Hjaterially affected in any one year by any description of manure or its amount. J-his proportion of sugar in a cane *may* be affected seriously by a change of climate.

(2) The proportion of glucose in the juice of different varieties varies considerably ; this proportion is increased, in some cases largely, during the boiling process; but that this " inversion " may be prevented in a great measure by the addition of lime. It is also probable that the cultivators could easily be taught to " lime " their juice, if there were any call for it.

(3) That during the boiling down process there is a loss of about 10 per cent, of the sugar, which is in the juice operated upon, most of which is carried away in the scum. This sugar need not, however, be lost in the economic sense. *t may be fed to cattle or (as at Poona) some at least of the sugar in it may be recovered.

(4) The amount of juice and, consequently, of sugar also which remains unexpressed from the cane depends on the proportion of crude fibre in the cane. At is therefore desirable to grow varieties of cane containing a low proportion of crude fibre. The amount of sugar remaining in the crushed cane may be as much as nearly one-half of that in the cane, or it may fall to as low a proportion as ith.

(5) The amounts of nitrogen and of phosphoric acid taken up by the 8ugarcane crop will vary from some 40 lbs. each (or less in poor crops)* to about 100 lbs. in such heavy crops as those grown at Poona.

ANNUAL REPORT

BY THE

DEPUTY DIRECTOR OF AGRICULTURE,

BOMBAY PRESIDENCY,

BEING AS ACCOUNT OF THE

CULTURAL. DAIRYING AND BREEDING OPERATIONS

CONDUCTED ON THE

GOVERNMENT EXPERIMENTAL FARMS AT POONA AND SURAT

During the year ending 31st March 1897.

330*mhug*:
PRINTED AT THE GOVERNMENT CENTRAL PRESS.

1897.

ANNUAL REPORT BY THE DEPUTY DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, BEING AN ACCOUNT *OF* THE CULTURAL, DAIRYING AND BREEDING OPERATIONS CONDUCTED ON THE GOVERNMENT FARMS AT POONA AND SURAT DURING THE YEAR ENDING 31ST MARCH 1897.

No. 282 OF 1897.

From

J. W. MOLLISON, ESQUIRE, M.R.A.C.,
Deputy Director of Agriculture,
Bombay Presidency;

To

J. *W.* P. MUIR-MACKENZIE, ESQUIRE, I.C.S., M.RA.C,
Acting Survey Commissioner and Director, Land Records and
Agriculture, Bombay Presidency.

Poona, 12th July 1897.

SIR,

I have the honour to submit the following report for the year 1896-97.

POONA FARM.

Season.

2. There was heavy ante-monsoon rain in May which proved very favourable for preparing land for sowing. The June rains were considerably more than average. Rain fell more or less heavily on half the number of days in this month. Sowing operations, therefore, progressed very slowly. In July during the first fortnight there was a break favourable for sowing. In the second fortnight rain fell almost every day at an average rate of T25 inches daily. The rainfall for this month and during the first fortnight in August was much over average. -Ihe effect was that all tillage operations were at a complete standstill. Fields *vrere* swamped and the young crops were either completely killed or turned quite yellow. The only crops which showed any vigour of growth were sugarcane, Guinea grass and lucerne. The latter throve fairly well, because it was planted on ridges. Most of the fields in the'district, planted *in* beds in the ordinary way, were almost completely destroyed. The heavy early rains were followed by a long period of drought. The rainfall of September and October was practically nil. Crops sown early in June, particularly those on light land, yielded a fair amount of fodder. Crops sown after the heavy July-August rain came practically to nothing. They withered long before they reached maturity. The rainfall of November (0*78") was not sufficient to encourage rabi sowing. The rainfall for the year is fully 7 inches over average, yet it was so badly distributed that the season as a whole was probably the worst on record. The one redeeming feature was that there was good grazing earlier than usual and also a good crop of grass for hay particularly on uplands. In these situations the heavy downpours of rain did not harm the grass, which grew as the rain fell and helped by the moisture left in the soil continued to grow well into September. I do not think that the yield from ordinary grass *knrans* was materially under average. Moreover owing to the fair weather in October-November, the grass was secured as hay in better condition than usual.

-Ihe general effect of the season described.

As regards the arable crops on the farm, there was one particularly noticeable feature. They did not wither during the September-October drought nearly so soon as crops on similar land in the neighbourhood, the explanation being that all our fields are in high manurial condition from heavy dressings of farmyard mauure got from our large herd of dairy cattle. The circumstance referred

to is not astonishing, because it is well known that soil richly stocked with organic manure is much more retentive of moisture than soil impoverished in condition.

3. The following table compares the rainfall of the season with that of 1895 and the average of the 10 preceding years :—

Rainfall Return.

Months.		1895.		1896.		Average of 10 year* (1886 to] 895).
		Rainy days.	Rainfall in inches.	Rainy. days.	Rainfall in inches.	
May,	1 st fortnight ...	1	0·22	...	...	1·33
Do.	2nd do. ...	...	...	3	4·66	
Jnne,	1st do. ...	6	4·72	6	4·16	6·17
Do.	2nd do. ...	11	2·25	9	4·70	
July,	1 st do. ...	5	0·40	7	1·57	8·41
Do.	2nd do. ..	14	3·68	12	15·21	
August,	1st do. ...	12	3·35	13	6·89	2·99
Do.	2nd do. ...	5	0·20	5	2·30	
September,	1st do. ...	7	7·97	1	0·15	5·95
Do.	2nd do. ...	4	2·44	1	0·27	
October,	1st do. ..	3	0·88	1	0·15	6·44
Do.	2nd do. ...	5	4·24	...	...	
November,	1st do. ...	2	2·01	...	...	1·68
Do.	2nd do. ...	...	...	1	0·78	
December,	1st do. ...	...	...	...	...	0·28
Do.	2nd do. ...	...	...	...	...	
	Total ...	75	32·16	59	40·84	33·25

4. The following table shows the areas under current crops during the year under report :—

No.	Crops.	Area.	REMARKS.
		A. g.	
1	Ba*jri (4 varieties) ...	1 0	
2	B&jro acd Tur	4 0	
3	American Sorghum for seed mixed with Tur ...	0 3	
4	Imphee do. ...	0 6	
5	Sorghum Halepense ...	0 18	
6	Sugarcane	0 24	
7	Cotton	0 ŏ	
8	Jowári (varieties) ...	0 12	
9	Surans	0 7	
10	Vegetables	2 23	
11	Guinea grass	7 24	
12	Water grass	0 '9	
13	Lucerne	0 29	
14	Various fodders ...	20 33	
15	Fodders mixed with Tur ...	0 37	2 acres 12 gunthas flooded *hy* river and failed completely.
16	Onions	0 24	
17	Til (sesamum) ... , ...	2 6	
	Total ...	42 20	*K.B.-S* acres 12 gunthas double-cropped.

Besides the above there were small plots for 4 varieties of American maize and 6 varieties of Egyptian cotton, Also small demonstration plots for agricultural students under various crops.

5. The scheme of cropping prepared for the year under report had to be modified and experiments which had been arranged £or abandoned, when the character of the season had deciare(j itself. A good deal of what has to be put on record refers to disappointments and some failures. In former years we gave considerable attention to comparative trials between local varieties for fodder and varieties introduced from other districts and abroad. These trials were again arranged for, but with results which are more or less indefinite: The same may be said regarding some other comparative trials. Hie original seed of the various crops tested was obtained with considerable trouble horn abroad and from other districts. Efforts to improve varieties by selection have been in progress. It is satisfactory, therefore, to note that a sufficient supply ot fully developed seed for the current season of all varieties was got fiom the crops grown.

The cropping scheme modified owing to the character oi the season.

Fodder Experiments.

6. The high fodder value of certain varieties of Sorghum as compared with other varieties of the same cereal has been more or less fully d ^ ^ ^ i S former years. The results of our trials had before the preseot season :bown that two varieties of American Sugar Sorghum and tour indigenous varieties of ordinary Sorghum were, as fodder crops, specially valuable. The indigenous varieties are (A) *Fmfaria* (13) *Amaria,* two varieties of *Sundhia* J0wari0fGu3ar.it, (0^*Duf* •«, ^ ^ g ~ m ; monly grown in the lighter alluvial soils of Kaira and Baroda, and (D) *Aglva,* local variety at Poona 2nd common in the Deccan. In ordinary seasons heie is little to choose between these. Sundhia gives the finer stalks. T >e Amencan Sorghums give the sweetest fodder. In an average season of well ^tnbutea rainfall, thSre is little difference in outturn and value of . ^ " Wy sown to varieties, on any description of soil. All varieties should be * hlo " manured give good results. Thick seeding gives the best results on deep. weU d soil; Lt a thickly sown <«£^J»£« as a thinly estreine ^ ^ ^ f is more liable to rust, also to lodge during heavy ramtall. Under favourable circumstances, thick seeding increases the outturn and improves the quality of the fodder by making the stalks thinner, and, taking one season with another, will unquestionably p a y t h p i o - duction of a heavy crop of excellent fodder is the chief object of the cultivator.

Good varieties for fodder.

The value of thick seeding discussed.

7. In last year's report, I noted the fact that alt hough Nijya does not o-ive fodder of the very best description, it does not suffer in the Deccan to the same extent as exotic or nfavourable condition of climate. It can withstand cause by acclimatization it has become inured to them.

Nflva Jowt-i. pardes i unfavc^ o « ^

S. The croppln, seWewas^n^, ^Sundhia, ^ ™ ^ fairl" good De 1 , the two ican ^ and imphee were grown m comparison, botli

Various varieties of Sorghum

river those parts the crops were com August flooded the lower parts of several other fields and in these situations the ·ison of actual weighments of

gross outturn from all nelds growing Sorghurn jo^frJPV , was grown subor- vation and value of outturn. In <» ^^%X vS of its pnlse. This dinate to Sorghums for fodder in ^ 0 ^ xow fi^rhe ahxe 0 ^p second crop year being field had been double-cropped for ^ ^ / ^ " J ^h iand gets 'sick ' after con- an irrigated one. The soil£ ^ * ^ ^ ^ ^ ^ i n g Tur subordinate

The value of pulse crops as subordinate crops with cereals.

The growth of pulse - f ^ ^ rotation, or, as is more common in India, as «mixed crops" has P^ab^done moie^to maintain the fertility of Indian soils than any other cause. ^ ^ ^ ^ mixed crops» with pulsas year Sorghum or any other cereal can be grown as mixea cruj doubt that healthy crops of

after year on the same land if the soil gets manure as required. If the cereal is grown alone every year, it may not thrive well even though the land is kept in high condition. The reason for this cannot be definitely explained. Analogous results are found in European agricultural practice. Many instances could be cited, but one will suffice. A crop grown for the first time or after a long interval, if it succeeds at all will usually be a much heavier crop than any succeeding one of the same kind taken at short intervals. A farmer in England anxious to win prizes for potatoes or any of the ordinary "root[9>] crops such as mangolds, turnips, &c, will break up land which Las been some time under grass or pasture. Such land has, no doubt, a large store of fertility. The first crop of potatoes or of roots, if the land is in good tilth, will not only yield heavily, but the roots or tubers will be well shaped with good clean skins. Manure in any quantity or of any class applied to ordinary arable land will not in a high majority of instances give nearly such good results. Turis an exceptionally good rotation crop ; its period of growth usually extends over eight months, and if sown subordinate to a cereal, the plants branch out to such an extent after the principal crop is removed that they completely shade the ground, and practically two crops are got in one year. This pulse has great root development. It resists drought in a remarkable degree. Its long deep roots penetrate the subsoil anil collect plant food there. The leaves fall as the crop ripens and this litter enriches the surface soil. The crop fertilizes the soil with nitrogen got from the atmosphere.

9. This mixed crop line of experiment was further extended this year by growing on light soil fields three other pulses subordinate to Sundhia and Nilva, *Rnlthi (Dolickos uniflorus)* in the first field, Vál *(Dolichos lablab)* in the second and Chola *(Dolichos catiang)* in the third. The pulses were thickly sown and occupied every fourth row. The pulse and cereal crops were cut before maturity for fodder. The mixed fodder is a better description of food for all kinds of farm stock than either of the ingredients alone.

The "mixed crop" line of experiment further extended.

10. I can state from close personal observation the general effect of the season on the crops I have referred to. Sundhia did better than Nilva on light soil, but not so well on heavier soil. Both did much better than the American Sorghums, Imphee or Utávli. The American Sorghums

Sorghums.

August on light soil, but made no progress atterwaras and were cut as they began to wither when the September drought became severe. These varieties, early sown on heavier soil, yielded some seed and a fair amount of fodder. The same may be said of Imphee and TJtávli; but American Sorghum, which had germinated about a week before the heavy rain started, was completely destroyed. This field was harrowed as soon as possible after the heavy rainfall ceased and resown witll Sundhia. The crop made considerable growth before it began to wither from want of moisture. It yielded a fair amount of first class fodder. The seed was sown on the 29th August and the crop reaped on the 16th November. If the deficient rainfall of September and October had been anticipated, it would certainly have paid to have ploughed up in August all heavy soil crops damaged by the previous excessive rainfall and to have sown Sundhia- If sown in a favourable seed bed, it grows probably quicker than any other Sorghum. Under certain conditions, this is a valuable characteristic. In the Ahmadnagar district I saw in January a field of Sundhia which as a dry-crop had not only produced a fair amount of fodder but also a small amount of grain. The seed had been sown in November and ordinary Jowári sown at the same "time had quite withered long before reaching maturity. It is satisfactory to note that the crop is making progress in the district, tlie seed having been originally supplied by the Agricultural Department to the Remount Farm from whence the cultivation has spread.

^ Sundhia grows very quick- J%

11. Tur sown as previously described subordinate to Sorghums survived the heavy rainfall, except where the soil was absolutely flooded or much waterlogged. During the fair season it made steady pro- 8«»> .'«* ^ nrt yield so well as in an average year. Kulth; on light soil, subordinate to Sundhia, gave a

The effect of the season on the subordinate pulses.

fair outturn; but Vál and Chola, as row crops with Nilva and Sundhia, did not thrive during the heavy rainfall and became infested with insects afterwards. This circumstance is not unusual. Parasites thrive on unthrifty plants.

Outturn results from Sorghum fodder crops.

12. I show below the gross outturn, the value of produce and the cost of cultivation of the whole area sown with Sorghums for fodder or Sorghums and pulses for fodder, and deduce acre averages. I may note that the crops on some fields or portions of fields were cut green and soiled in this state to stall-fed cattle; others were reaped and dried into *kadbi* when they showed signs of withering from drought. From small &reas of American Sorghum and Imphee ?n good deep retentive soil, we got some seed. The more forward central shoots just managed to reach maturity, but the later side shoots withered before the seed got developed. Outturn, &c, results were as under:—

Crop.	Gross Outturn.	Rate per Rupee,	Value of outturn.
	Lbs.	Lbs.	Rs. a. p.
Dry fodder, Sundhia and pulse	39,703	100	397 0 0
Do. Nilva, American Sorghum and pulse.	17,628	lg)	135 9 0
Green fodder, various varieties	13,613	300	45 6 0
Tur pulse	325	25	13 0 0
Imphee and American Sorghum seed ...	90	20	4 8 0
Total ...	.....	...	595 7 0

	Rs. a, p.
Value of produce from 21 acres and 25 gunthas ...	595 7 0
Do. per acre	27 8 0
Total cost of cultivation	442 11 0
Do. per acre	20 7 0

The rates are those at which the fodder was charged to the dairy herd and are certainly not high. It should be noted that only 8| acres were this year manured; but the remaining area was in high condition from manure applied in previous years, and if its unexhausted value is added to cost of cultivation, the apparent profit will disappear.

This variety does well as an irrigated cold or hot weather crop.

13. *Hundi Jowciri.*—There is no doubt that this variety is specially adapted for cultivation as an irrigated crop in the cold and hot season?. It probably does best if sown about October, but I believe it to be the one variety of the Presidency which will thrive well under irrigation during the hot season. In January last I saw throughout the Ahmadnagar District magnificent crops of Hundi under well irrigation. The crops were ripening at the time. I can state with absolute confidence that the average outturn of these crops was well over 2,000 lbs. of grain and 10,000 lbs. of dry fodder per acre. I fear that the farm soil is not particularly suited for this crop. We have been unable hitherto to grow a particularly good crop of this or any other variety of Jowiiri under irrigation in the fair season. The farm fields which are commanded by the canal have been under irrigation almost every season for a good many years, and this has had a harmful influence, but in what particular respect I am unable to say. It is not a question of exhaustion, because from our large dairy herd we get a large supply of farm yard manure, sufficient to give every field on the farm liberal application as often as is necessary. There is no trouble in growing successfully certain crops, such as, gram, lucerne and sugarcane and vegetables under irrigation. But Jowári never succeeds well. The first unhealthy symptom is seen soon after germination. The leaves of the young seedlings get a grey mottled colour. The plants do not start into vigorous growth as they do in the monsoon. By and by the crop gets a better colour, but the early check is never recovered. Some plants start into more or less vigorous growth sooner than others, and the crop looks uneven

Irrigated crops of Jowári do not ordinarily well on

and is generally too thinly planted. Appearances, precisely similar to those I have described, I saw in a good many fields under well irrigation in the northern t&lukas of Sholápur and to a considerable extent in canal irrigated late sown crops in the Nira valley.

The food supply from certain irrigated crops ^ in a SSTmeX: ^e cessity for

14 In view of the enormous food grain value of irrigated crops of Jowdri, maize, wheat and gram, which have been remarkably demonstrated during the current scarcity, it is of the greatest importance" that the yields of these crops should be investigated under the direction of the Agricultural Department. I am not at all certain that the conditions are favourable (except as regards gram) at either the Poona or Surat Farm, Careful trials will, however, be made and varieties tested.

Outturn results from a Hundi crop on the farm.

15. The farm crop of Hundi was sown in April (11th to 23rd) 1896 and reaped as screen fodder in July-August. It yielded from 2 acres and 26 eunthas 20,360 lbs. green fodder or 7,683 lbs. per acre. On part of the field the ciop was poor. On the best portion the crop stood about 8 feet high, and a test area gave nearly 11,000 lbs. of green fodder per acre. The fodder was valued at 300 lbs. per rupee, which is a fair price. At this rate the crop was grown at a loss of nearly Rs. 12 per acre. The cost of laying the field out for irrigation and the cost of irrigation were the heavy items of expenditure.

A good perennial grass got from banaranpur.

16. *Sorghum Ilalipense.*—This is an introduction from Saharanpur. It is a handsome grass standing about 5 feet high when in flower. The inflorescence is a much branched graceiul panicle, rich brown in colour. The stalks are comparatively thin for such a vigorous growing grass. Cattle like the fodder, either green or dried. With favourable early rainfall the grass starts early into vigorous growth and this rapidity of growth early in the monsoon is in the Deccan a valuable characteristic, because fodder is generally scant and dear early in the rains. Sorghum Halipense, though a perennial, has a dead season like ordiuary grasses. Irrigation in the fair season does not start it into growth. In an average year the crop will, I believe, yield two cuts during the monsoon. Last year the second crop was not worth cutting. The drought in August-September completely stopped the growth. If once established in arable land, the grass would be difficult to eradicate on account of its numerous rhizomes or underground stems. Rats have beon troublesome to the farm crop in burrowing and feeding on the underground stems. But these are so numerous that no great harm can possibly be done.

17. *Guinea G?*ass (Panicmn jumentorum)* did not give such good results as \n former years. The crop grows with much more vigour during the monsoon season than at any other time. The early cessation of the rains and irregular and inadequate irrigation in the fair season unfavourably affected results. The canal water-supply was so scant, and the interval between waterings sometimes BO long, that during the hot weather the crop showed signs of withering on light soil and made very little growth on better soil. The value of Guinea grass as a useful fodder crop is fair beyond the experimental stage. It does better than any other crop under shade, in damp situations and odd corners. It needs a good deal of water regularly given. "We have had numerous indents during the year for roots for planting, all of which have been met. The cultivation of the crop is extending to a considerable extent in the vicinity of Poona and will, I believe, become in time extensive. Its green fodder is exceptionally valuable for dairy cattle and probably as suitable for horses in hard condition as lucerne is if cut before it gets overripe. The crop is not subject to disease or insect attack or the other mishaps to which lucerne in the Poona district is peculiarly liable. In old plantations, the root stocks get overgrown and it will pay to replant when a plantation has been established three years. The area need not necessarily be changed. I have said in former reports that Guinea grass can be profitably grown continuously on the same land. This is true, I believe, in respect of most descriptions of soil. I have not noticed on the farm that a crop newly planted on virgin soil is any more vigorous than a crop replanted on the area occupied by a dismantled plan-

tation ; but at the Ahmadnagar £emount De there is a marked difference in favour of the virgin land crop "e result m fully established plantations for 1893-94, 1894-95, 1890-96, «d. 1896-97 . r e^tabulated below for comparison. The produce is valued at JUU IDS, per rupee, th rate obarged tQ the dairy cattle.

Year.	Outturn per Acre.	Cost of Cultivation per Acre.	Value of Outturn per Acre.
	Lbs.	Rs. a. p.	Rs. a. p.
1893-94	21,295	81 11 0	106 7 0
1894-95	21,112	45 10 0	105 9 0
1895-96	19,167	49 2 0	95 13 0
1896-97	16,106	73 0 0	80 8 0

The high cost of ^ ^-94 and 1896-97 as compared with the intermediate years is owing to the extra expenditure for manure.

18. *Mauritius Water Grass.*—This grass was originally got from Ceylon, it affords the chief natural fodder for milch and lies, likes low-lying wet stations. damp gituations. It is sometim called Buffalo Grass. d other situations which It can be successfully grown along wa-tor ^annels T £e ~rasa would not.be likely are damp, even though sometimes wet to exoes ears to be where n0 ordinary to thrive on light well-drained soil. Its place ^PF addition to our fodder arable crop wculd thrive, and for this ^ f n l ^ Z & J , e Yet cattle like it. crops. The fodder is not fine; it ism ^'rather ogra hariáli from eyery The crop is propagated by cutting* The stems root uKe ttin should ^ ^ node and also send up shoots from these nodes. Ti soon and send up tered evenly and lightly ~ J ! « d J ^ ^ hich in their turn root at the nodes straight shoots and also long trailing stems. crop in this its rd year appears to and Ld up straight shoots. The ta oot development. Any way t upright in the two previous years. Like every o ass, , and the early cessa£ of the esults in 1894-95, 1395-96 and 1896-97 are noted below for comparison.

Year.	Outturn per Acre (Green Fodder).
	Lbs.
1894-95	50,020
1895-96	37,860
1896-97	27,690

destroyed by the heavy J^Augu^infa£ J \ ^ erge £ woufi have been because planted on ridges. The pUnits^eie This ridge methodofplantmg the case if planted in the ordinary-fashion beds. ^ ? acility for weedmg> has other advantage,^., a saving otseea in sowing furrows or spaces A crop planted on ridgee,oan be kept clean f r ears the y^ ~ »bnllook:hoed or hand- between rows ?emo ea ^ weeded. I notioed in .tonjgx repor ts that lucerne

Probable advantage . m growing Lucerne and Guinea g,ass as a "nuxed crop.

n as a mixed crop remainS bnger healthy if it IS «row bserv 1 ^ . ^ nea Gui graSS It had been revived in O ^ ^ that lucerne, which had become> patchy£u h d ease,^^ ^ n is not manner when the vacant spaces were n lie « I with form a conspicuous feature of Indian husbandry, and the luoeme^meag surprising that such should be ^ ^ J ^ ^ I ^ B mixture represents the ^ ^ commQU pulse and cereal mixture which is so successruny adopted F

grown crops of India and with the common fodder crops of Europe. The practice of growing clovers and grasses mixed together as in England is of course very much akin to that of growing lucerne and Guinea grass together. We have experiments now in progress to decide definitely the comparative value of lucerne alone as compared with lucerne and Guinea grass. There are four plots. Plots 1 and 3 are mixed crop and 2 and 4 lucerne alone. In plots 3 and 4 rats did considerable harm to the lucerne roots in the hot weather. The Guinea grass in plot 3 was not attacked, and the outturn from this plot did not suffer much, that in plot 4 certainly did. Plots 1 and 2 were not damaged in any way, and the outturn results from these plots fairly show relative value of lucerne alone as compared with the mixed crop. I show, however, below the outturn from all lots. The first cut was got between the 19th June and 11th July 1896; there were 8 more cuts obtained before the end of the financial year, the last being got between 4th and 26th March 1897. The results are for 10 months' growth.

Plot.	Crop.	TEN MONTHS' GROWTH.	
		Outturn per Plot of 7 gunthas.	Outturn per Acre,
		Lbs.	Lbs.
Plot 1	Lucerne and Guinea grass ...	5,767	32,954
„ 2	Do. alone	5,024	28,708
„ *3	Do. and Guinea grass ...	5,617	32,097
„ *4	Do. alone	3,765	21,514

* Unreliable for reasons given above.

20. I show below the gross outturn results for the whole year from the four plots and also cost of cultivation and value of produce. The fodder is valued at 120 lbs. per rupee, the rate at which it was charged to the dairy cattle. The plantation was established in the previous year at considerable initial cost for manure, seed, &c. The comparison between cost of cultivation and value of produce this year is, therefore, not quite fair.

Outturn, lucerne and Guinea grass [illegible].

Outturn per Acre.	Value of Outturn per Acre.	Cost of Cultivation per Acre.
Lbs.	Rs. a. p.	Rs. a. p.
41,852	348 12 0	78 4 5

21. The experiments have not yet thrown any light on one point of investigation, *viz.*, whether the lucerne when grown mixed with Guinea grass remains longer healthy than lucerne alone. There has been no sign of disease. It is, I think, clear that the mixed crop will yield more than the lucerne alone as long as both remain healthy, and the advantage of sowing the crops mixed is more than probable for other reasons, an important one being that the risk of loss from mishaps is thus minimized. The mixed fodder is worth, I think, much for horses and probably more for dairy cattle than lucerne alone. The latter fodder can only be fed in limited quantity to [illegible] owing to its tendency to cause tympanites. A mixed [illegible] can safely be given in much larger quantity.

Advantage of growing Lucerne and Guinea grass mixed.

Experiments with Grain Crops.

22. *Bajri (Pennisetum typhoideum).*—Four distinct varieties of this important cereal have been identified throughout the presidency. These were under trial on the farm in the year [illegible] for comparison, *inter alia*, but we believe that each variety can be improved by selecting the best heads of grain,

Comparison of varieties.

each year at harvest time to provide seed tor the following year-a crop. The varieties are:— ,— n" i 'ToKalmiVi 'and Inthejvarnd : ^ in the Kaira

(a) *Bdfro* or giant Bajri, somehmes ^ ^ X o e the seed was district Bhavnagri, indicating P ^ ^ W ^ ^ S a l k s and long thick originally obtained. The varietyha ta1 coai,* n on the farm ^ ^ years and spikes of large grain. It has been grow well distributed rainfall, requires fairfy good land and a.*U*vourabl ^ - as omori ^ ^ the va riet ies If grown under these conditions, its **£™™* fc from the seed store at cannot be questioned. Bajro : 8e ^s ^ ' ^ T a with, I believe, marked Nadiad and from the farm to various parts ot India success. , . . The gtraw is not so

(6) *Mdlbandro* is also, a very superior variety has ^ reputa ^ rf tall aVBajro straw but it is finer.—Tet the t r^ cannot yet ^ frQm per· standing up better in heavy ram than Bajro, DU is certainly superior sonal observation that such is the case ^Y ™ ^ of Gujarat which it in length of spike and size of grain to the' ^D J3 until recently con- otherwise resembles. The cuti vati ?n ofMalb andro for its good oultivation. fined to Boriavi, a village of the Kaira^stnot is probably a spo rom rfc f fthe The variety came originally from ?etla? *a a p e—triyted area of its cultivation common D^shi variety,and o o n ^ r ^ h e ^ e a t-possible ^ & single pla nt< was probably got originally by .selecUon- a of ^ne ya/ieties of grain having There are numerous instances, in Jiuiope, been obtained in this manner. . - , , - , -*a*, ti1P Deshi

(C) The 2 ^ - variety *oi* G u j a r a t ^ ^ ^ X • T ^ ^ h e variety of the Deccan, but I am not quite B«e ^ a ter ^ or gives much fertile, though light, Goradu soil of K^a^aClj3ara shi variet doeg Gn ^e greater yield of grain and straw than *he Deown^e t. If the j ^ ^ı . ^ light comparatively unproductive soils of its distric l the Gujrat yariety afe grown side by side in the Deccan on good lso., with ^ ^ Qther hand in a favourable season shows.greater^vigour *oi:jpc*> aed as it is ^ oor ^ it might be argued that the Deccan va*,nety* ^ u at ^ infall, might, if grown manured soil and unfavourable seasons so in the Deccan than the ^^ under such conditions, show better lesuiib variety.

(d) *A^ Bajni,* a variety . ^*f"*^gjf ^ Z ^ i a t t l y ^jaki and also in the A^ednagar, d not of I« ^^ ^ the bas any special value. Its seed «™ the ears are of The inrolaores which surround ^ . ^ r ^ p ^ S L t - j L " " ^ . Hence the na.,

23.' I have indicated above wbat I believe to be the - p ^ v e j a l n e ^ o f the various varieties. My op.moB .s *^*f"g*° *Z* a l / o f e the soil to make It is difficult on the farm, owing to th > " ^ = r t in the oase of compara. accurate deductions from ^ ' f 1 " " ^ ' " ^ " " ^ differences wbieh have been Th·p^.*.»=o»- .**Z^ST^St*:• comparisons in ^'frections pariBg the Bdjri vanetaes 1S »"» nrimarv obiect is improvement of seed by selec· Lpro^ementofseedby-eW Ihe P ™ ^ 3 . continUousattention. lam hope- tion of each variety, but other· tion. ihIS Will g » t va—ieties can fchus be improved, objects will be kept m turn. ful that even the best vaneties o th as well ^ ^ light The varieties can be tested on good BOU of ^ «J 'te ou ^ nt seas0Q· Also what shallow soil. This has been arranged for m th ous gr wing varieties h&g QQ a ^ or d l . Affect the rank growth of the 7 ^ 1 ^ less vigorous growth of other varieties, nate pulse mixture as compared with' *^ T n» we shall sow common Bazfrseed. In comparison with seed ^ P ^ ^ ^ m i n a t i n g powef. We ought perhaps to The latter will, of course, have good-*ffs*™™^ g § , which is the class of soil on extend our experiments to poor ^ ^ f ^ ; this we cannot manage on the which Bajri is usually grown in toe *V* ^ ^ *m m* ^ farm, because every field is now we ll stock rain selected

24. I am hopeful, if the - ^ ^ ^ ^ S o i e S f o r ouf own require. at harvest will give seea s h this object 1 .Q ^^

Distribution of selected seed. ments and also for distribution. VVic J

the various varieties, sown under the conditions indicated above, will occupy about 8 acres. We expected in the year under report to have had selected seed sufficient for the current season and also a good deal for distribution. But the season was so unfavourable that there was not much available for the latter purpose. Really good heads of grain were only obtainable from one acre The various varieties sown on medium black soil in good condition yielded fairly well. The crop did not tiller and cover the soil so well as in an average season ; but the central shoots grew tall and produced excellent spikes well filled with well-developed grain. I attribute this to the fact that the soil was in high manurial condition, and being naturally of fair depth and good quality it retained moisture far longer than impoverished soil.

Outturn results from good and middling soil contrasted.

25. I contrast below the outturn results from this field and from a field with considerably lighter soil. The latter had in every Bajri. row Tur *(Cajanm indicus)* subordinate to the Bajri. The per acre value of each crop is, of course, considerably enhanced owing to the high market rates prevailing in a famine year. The light soil field was also in good manurial condition and the outturn is considerable. That from similar unmanured land in the neighbourhood was *nil* as regards grain and practically a failure as regards fodder.

Field.	Area	OUTTURN PER ACRE.		Cost of Cultivation per Acre.	Value of Outturn per Acre.	REMARKS.
		Grain.	Straw.			
	Acres.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	
Good soil field ...	1	862	7,689	36 3 3	73 13 6	The cost of cultivation in the first field is heavy owing to cost of manure and expensive hand weeding after the July-August heavy rainfall. First field sown 7th July and reaped 21st October. Second field sown 9th and 10th July and reaped 14th to 31st October. Crop ripened unequally and was harvested as it ripened. Tur for similar reasons was reaped between 27th December and 9th January.
Light soil field ...	4	347 Bajri. 112 Tur.	978	20 2 1	25 11 10	

Varied of Jowari and improvement of seed by selection.

26. *Varieties of Jowdri (Sorghum vulgare).*—Fifty-nine different varieties were grown in 1895-96, the object being to identify the characteristics of each variety, and determine the economic value, in the Poona district, of each varirty in the production of gram and also of fodder. Twenty-five were selected as S best grain varieties, and seed from well-developed heads of grain was sent to *thl* Surat Farm. It is intended to make the improvement of Jowdri seed by selection a speciality there, this crop being a staple crop in that district A small area was also sown with each kind at the Poona Farm. The cron helnVd *h* irrigation in the September-October drought grew particularly well R.f.M.J.J.'s took nearly all the grain. Much larger nu^befs than usual were tiL!to the crop because there was not another Jowari crop with grain in the neighbourhood The crop was of course watched, but to no good purpose. A cultivator watchiW his own crop could have probably prevented such complete destruction hut watching by hired labour is always unsatisfactory.

Jowári varieties at Surafc Farm.

27. The varieties as grown at the Surat Farm did fairly well, some considerably better than others. The si.TM.n, tho ?£aTM^We, was no^ Pp^anlyTadrThe varied commonly grown in the district are dis

It maybe found difficult to introduce* anything better. This ..S yfo W T proved. It is certain that only a few of the many varieties from other district

are likely to prove useful induction, Only those varieties, which promise Well, will be persevered with.

Experiments with other Crops.

28. *Egyptian Cotton.*—Numerous unsuccessful efforts have been made by Government officers and others to introduce into India

Unsuccessful efforts to introduce exotic varieties in

American and Egyptian varieties of cotton. These experiments were primarily for the exotic cotton, and even

feit ary cultivators con iat district, which was at one time extensive, is year by year taking its place. In declining, the indigenous shorter-stapled

the records of experiments in former years there is amp. ; but were exhaustive and

Mr. Tata of Bombay advocates a line of experiment not prev.ously adopted.

Tata of Bombay, who had careiuiv ivation of cott on in f - P J t t failuSs of pamph published 7 a t mtian ft Khar f for India. He pointed out that Egyptian cotton had only been obtained in India crop; whereas he thinks that proper ibons can be obtained in October unless the crop be sown as a Rabi one the eig those existing in Bgyptdnnng May give in India conditions «ew f of growth is practically rain- its cotton-growing season. In Egypt the periou g nd flow irrigation there- less. The crop depends upon the uprising; o >J£ re to depend mostly upon from. In India during the fair season it would also M canal water, irrigation, either expensive well irrigation or V g J el Ful The soil is well as generally expensive. In B y n S Z ben smooth and friable is worked and manured, rid up with the plough into nOge J er inel

Method of cultivation in Egypt.

The f t o w n o g w intQ for irrigation. The seed is sown on the side of the ridge, nation the seedlings are within easy reach ds or 1Q) are planted in each actual contact with the water. A number of seedlings are left, the strongest hole in the first instance, but eventually only see fes prOcrre8s, weeding is and most vigorous growing of course. As we of plantg even- carefully attended to, and the soil of the ridges is so moved g supported by being tually occupy the crest of each ridge. V>% b t 20 times in 8 months, earthed up. In Egypt the crop requires f n J U J f water rings in India on It is probable that ft would require an y retentive land. The light soil. Probably fewer would suffice d f 0 Y continuous irrigation, Presidency in an occasional year without taking much harm.

If Egyptian cotton is induced an irrigate d

Egyptian cotton would as J g tion. The t U e of the sml m a an irrigated crop in India take Voonre determines this. On land suitable for the piL of valuable garden great l o n facilities, expensively culti- crop or atleast would occupy irngation with f TM * TM ' nOW grow. Such W8uital,lefo,such. ?tod « J i S o n , two%t l«-t per crops under favourable conditions are taken i! 1 being worth Rg< 300 per acre annum, the annual produce at f Eo-yptian cotton as an im- and often a great deal more. T h e j of go ngjb=yp practicable> in gated crop on the deep black cotton soils o t c a h Sur ligh il areas in as much as such land is unsuitable for «rigation. There staple crop with Dharwdr and Khandesh now could be irrigated to advan- ties for irrigation and a «./??««rf 8 W o n on such areas would no doubt be taken tage. The°cultivation of B p t h a t the cultivation of this exotic up by ordinary cultivators, (a) if it r favourable conditions was worth was free from risk, and *(b)* d the 7 JL crops, as onions, ginger, tur- as much as or more than that of f i t i v a t i o n of these crops need not meric, sweet potatoes, yams, &c l 8 and with sufficient irrigation necessarily much exceed that of Egyptwj th It may be neglected, the risk of failure or partial failure is so o

30. Mr. Tata points out in his pamphlet that the average outturn of clean cotton per acre in the most favoured district, Broach, is not more than 100 lbs. per acre, estimated to be worth in English currency 3|d. per lb. He estimates the average outturn in Egypt to be 600 lbs. per acre and on account of fine quality the lint is held to be worth 5|d. per lb. In Indian currency, at present rates of exchange, the Egyptian outturn is equivalent to Rs. 225 per acre.

The average outturn of Cotton in Egypt and in India compared.

31. Mr. Tata took much trouble in importing seed last season and arranging for experiments under varying conditions of soil and climate. The Agricultural Department gave him as far as possible a helping hand. I have only seen some of the trials arranged for by Mr. Tata. Neither these nor those arranged for by ihe Agricultural Department gave much promise of success. Mr. Tata is not likely to be satisfied with the results of one season. The experiments will probably be repeated.

Egyptian seed imported by Mr. Tata and various trials arranged for.

32. I saw in December in the Navsari district three fields which had been sown in October with seed supplied by Mr. Tata and in each there were clear indications of more or less complete failure. The seed obtained from Egypt was of first rate quality in respect of germinating power. The seedlings came up strong and vigorous, but very soon the leaves turned brown and had every appearance of being burnt up. Many of the young plants died and the majority of those that survived could not possibly have subsequently produced a healthy, vigorous, growing crop. The tillage was, in none of the fields particularly careful, and in one field, owned by an ordinary cultivator, it was careless.

Experiments more or less unsuccessful,

33. I arranged for trials with the seed supplied by Mr. Tata to the Agricultural Department; (a) at the Nadiad Farm on rich alluvial free working soil capable of growing almost any crop under irrigation; (b) on rich garden land in a village of the Sachin State near Surat. Mr. Seddon, the Administrator, co-operated in arranging for the trial. The cultivator was paid Us. 75 for the use of the land (about \ acre) for tillage and was bound by agreement to prepare and manure the land, sow the seed, weed and water the crop in such manner as he was directed to do by the Assistant Superintendent, Surat Farm, who saw the crop every ten days and had the cultivation operations attended to in strict accordance with Egyptian practice ; and (c) on medium black soil on the Poona Farm.

Trials arranged for by the Agricultural Department. Mr. Tata supplied the seed.

34. In each of the above trials the seedlings came up strong; but as soon as the true leaves appeared, these curled up, got brown and appeared to be burnt by the sun. The growth was slow. A number of seedlings died. Those that survived made very little progress at Nadiad. There the crop was almost a complete failure. It was grown strictly in accordance with the Egyptian method, excepting that the light sandy soil required frequent light irrigation,

The results of these trials described.

35. At Surat I repeatedly saw the crop as it grew. After the check in growth referred to, the plants grew irregularly. Some made very fair progress and even the more backward when about three months old began to show considerable vigour of growth. The plants branched freely and flowered freely; but the bolls came to nothing. Some were affected with boll worms ; others ripened prematurely or rather withered and dried before ripening, and did not open. There was no produce of marketable value.

The experiment at Surat.

36. The Poona Farm crop was the only crop which was in any way successful. It, like the others I have referred to, was sown early in October. The young seedlings were unhealthy for a time but they were freshened in an extraordinary way by the 19th of November rainfall, which at Poona measured about | inch (Rain or fog in Egypt is said to cause considerable damage to

The experiment at the Poona Farm.

the cotton crop). After this the crop made vigorous growth. The leaves were very large and healthy in appearance. The plants branched freely and produced numerous flowers and bolls. The crop had at one time the appearance of yielding very heavily; but as it ripened, boll worm did considerable harm and many of the later bolls withered and dried up in the same manner as at Surat. The lint is long in staple and would be classed as fine in quality if it had not been discoloured to some extent by boll worm. The crop yielded at the rate of 886 lbs. seed cotton (lint and seed) per acre and gave 33'4 per cent, lint, which is 2 per cent, less than good Surat. The crop was sown on the 1st to 4th October, was watered 12 times and was picked between the 13th April and the 10th May. The cost of cultivation, irrigation being partly from a well and partly from the canal, was Es. 78-6-0 per acre. The produce was worth about the*same amount at the average price for Surat cotton, and the yield is less than half the average outturn of Egypt as estimated by Mr. Tata. It is rather extraordinary that at Poona, where no cotton is grown, the Egyptian cotton should have done fairly well, whereas in cotton districts it failed.

Six varieties got for trial from the Eeporter on Economic Products, Government of India<

37. *Varieties of Egyptian Cotton.*—Very small parcels of six varieties of Egyptian cotton were obtained through Dr. Watt, the Reporter on Economic Products to the (xovernment of India. The seed was sown at the Poona Farm in small plots in June 1896. It germinated well and the seedlings throve well until checked in growth by the excessive rain of July-August. When the subsequent drought of September-October declared itself, the plots were irrigated and a light applicaton of liquid manure given to start the plants into healthy growth. Four varieties branched and flowered freely and produced numerous large bolls, *our varieties did well. however becaie affected to some extent with boll worm. The other varieties did not grow so well. The four varieties, which did best, produced large plants 4^ to 5 feet high. These when irrigated appeared to have no dead season. The leaves were green all through the hot weather and in May-June of the current season the plants have made a good deal of new growth and are flowering freely. They probably ought to have been cut down to the ground. This would have caused later new growth and bolls would have formed when there is less risk of damage by rain. All these varieties have been resown on plots of fair size as Kharif crops. Mr. Tata's variety* has been similarly treated. Seed, however, for Eabi sowing has been kept. There is no evidence from these experiments so far that moderate rain on a Kharif crop has any harmful effect. At the same time the exhaustive experiments of former years were believed to have proved that Egyptian cotton was unsuited to the conditions of ordinary cultivation as a Kharif crop in the cotton-growing districts of the Presidency. Personally I believe that *it* has been absolutely proved years ago that exotic varieties of cotton are unsuited to the conditions of Indian agriculture and I believe further that an indigenous variety found suitable for one district might be entirely unsuitable for another. I see little hope of improving Indian varieties except by taking them as we generally find them cultivated, and try to improve them by selection of seed continued from year to year.

38. *Til (Sesamum indicum),*—A field was set aside for this important oil-seed, the object being to compare varieties and identify their characteristics. The comparison is incomplete and will be repeated. Those varieties which are recognized as early varieties did fairly well, whilst those that are generally sown midway between the Kharif and Rabi season came practically to nothing. The September-October drought caused defective germination, and owing to deficient late rain, part of the field was unsown and remained fallow during the year. Each variety was crushed in an ordinary coun* *try-ghani* (mill) to determine the proportions of oil and oilcake obtainable. The work was done under strict supervision by a professional oil-presser working with his own mill. A certain proportion of water was added to the half-crushed seed, the object being to consolidate the cake, so that the oil be £>roperly separated.

Comparison of varieties. seed cr si d in thecoun" t^mm for oii?

Variety.	Weight of Seed.	Weight of Water added.	Oil obtained.	Cake obtained.	Percentage of Oil to Seed.
	Lbs. ozs.	Lbs. ozs.	Lbs. ozs.	Lbs. ozs.	
Red Til	68 10	9 12	21 0	52 12	30·9
White Til ...	103 8	13 8	40 0	71 4	38·1
Black Til... ...	55 8	9 0	17 4	41 0	30·9

39. The seed as well as the cake of each variety was sent to Dr. Leather for analysis. The results are given below. Three varieties having respectively red, white and black seed were sown in July. The white-seeded variety ripened a month earlier than the others. The respective outturns were-

Dr. Leather's analysis of the seed and oilcake of each variety.

	Lbs. per acre.
Red Til	233
White Til	280
Black Til	258

Analyses of Til Seed and Til Seed Cake by Dr. Leather.

	White Seed.	Black Seed.	Red Seed.	White Seed Cake.	Black Seed Cake.	Red Seed Cake.
Moisture	4·87	5·42	5·37	15-87	15·70	10-03
Oil	48·13	46·50	46·20	20-83	20·15	18-6 i
X Albuminoids	22·50	25·81	21·03	28-27	28·73	30-80
Mucilage, &c, -	14·05	9·03	15·87	21-02	21·57	24-13
Woody fibre	4·49	6·52	4·18	5-34	4·37	4-60
+ Mineral matter	5·96	6·69	7·35	8-67	9·48	1174
	100·00	100·00	100·00	100·00	100-00	100-00
X Containing nitrogen ...	3·60	4·13	3·37	4·02	4·60	4·93
+ Do. sand°... ...	0·37	0·66	1·35	0·59	0·81	2·14

40. It will be noticed that all the varieties are extremely rich in oil, the white seed being especially so. The oilcake although rich in albuminoids and oil, and the low percentages of woody fibre indicate the cake from each variety to be easily digestible. The high percentage of oil left in the cake indicates high feeding value, but that the country *ghdni* is a poor contrivance for extracting oil. Hydraulic pressed Til cake would probably contain 8 per cent, oil, certainly not more than 10 per cent.

Jlie seed of all varieties is rich in oil. The country *gka'ni* is a poor contrivance for extracting oil. A high percentage of oil loft in the cake.

41. *Varieties of Sugarcane.*—An effort was made in the year under report to bring under comparative trial on the farm all the varieties of cane known throughout the Presidency. There is only one variety, Pundia, in general cultivation in the Poona district. Few perhaps of the other varieties in cultivation surpass or even equal Pundia for the production of Gul or crude sugar. A significant indication of its value is that its cultivation is gradually extending to districts where comparatively poor varieties were previously in general cultivation. The object of our experiments is briefly to determine the varieties which can be most successfully and profitably grown. The question cannot be decided on hand. Sugarcane like many other cultivated plants does not adapt itself readily to changed conditions of soil and climate. We have proved that Mauritius varieties reported to be exceptionally rich in sugar when grown in Mauritius deteriorated to a remarkable extent when cultivated in India, but improved considerably by acclimati-

Pundia difficult to obtain.

Sugarcane like some other cultivated plants does not adapt itself readily to changed conditions of soil and di-

zation. Such results are not unusual and might have been anticipated. But as oved at the Poona Farm that moving

instances, of materially reducing the, percentag,, d J ^ /&^ This has been not injuriously affecting the weight ^ a » * X s l C various plots on ac- thecase with several Southern Maratha ^iieties· llie va• rkable object lesson. count of difference in vigour of growth ? ^ ^ ™ £ t e M f a i l e d signally. Several varieties in common cultivation in t e bu ^ b d ·'y^ieties from other Two varieties from that district grew paficulai yu-elL |* in extraordinary parts of the Presidency have all thriven well. A few have sno» vigour of growth.

« · When the varieties were ripe, Dr. Leather analysed the juice of each and determined the percentage of crystallizable and ntage of the :om such juice

U,L»l^3,«.,J.i, ^otsolidifyproperly. I t r r u - ^t is kept and e percentage will not bear transport fa, We also tested «.* V«e ^ t o * were small and ot juiee which could be expressed by a good mi'l. "e P rately s at ^ · The com·

«. Each variety w a ^ ^d X ed^ ^ t SS-f riptions similar : ed ^of

Descriptions „ „ •, *·» « - ^ S i L f i W by Dr. Leather in^ othe<•parte,oi fenfor p.blk»t>.» in Ledg.r ;* dia haTe heen taken. These descnptions ut l a Series with » Ml note on the '""' t on tlie cultivation of sugarcane and lèsunie cattionoo, ragag™«. f^teartew'ssprofessional enquiries init>ttoo>£ mistry of the crop and tho G.1 makiing process have been preparedand « Ute published jointly by Dr. Leather and myself in the Agiieultura l Ledger Series.

U. It is unnecessaryMWore, * £ £ j ^ » J £ » n£ l Z

Inferior varieties in general "arieties in th . S , :nfpr;or varietie6 are in gener- cuitivation in some districts there is clear proot that inteiioi v* ·t» va^ieties and better varieties could be al cultivation in some districts and that "OTtei Ad profitably introduced. eould probably be profitably introduced. JJi. -beatnei b

investigations have have T™^^fe T™^^fe/t«^^^Z£%X only about 8 per cent. oan« sugar wlubU er, that the There are numerous gradations beUctn large percentage of gluco se or non· I$ta«iS '^ r S S S T i S ^ which is that Gul made from such juice does not solidify properly.

45 In -uaging the value of the different varie- Ho of dif tS* ?Sef value ties count will be taken of the folding :-

(1) the quantities of manure and of water required to produce a full crop,

(2) the suitability of each variety for cultivation under varying condit.ons of soil and climate,

(3) the weight of cane from a given area when grown under suitable conditions,

(4) whether the cane is better suited for Gul making or raw eating,

(5) the total percentage of juice in the cane,

(6) the total percentage of juice expressed,

(7) the percentage of Gul to cane,

(8, the quality of the Gu!, *I.e.,* whether of good bright colour andsoM,

(9) the adaptability of varieties to produce ratoon crops for one or more years.

46. The comparative trials of varieties are in the current season continued at Poona, but confined to such varieties as have given good or fairly good results. Trials with these good varieties are duplicated at the Surat Farm and there the varieties commonly cultivated in the Surat district are grown in comparison with these introduced varieties,

Comparative trials with varieties continued at the Surat and Poona farms.

47. The following tabulated statement in reference to four varieties in common cultivation in the Southern Marátha Country shows very clearly that their movement to the Poona district has caused probable improvement in one variety and deterioration in three :—

Southern Maratha varieties at Poona. Improvement in one case; deterioration in the others.

No.	Variety.	PERCENTAGE OF JUICE.		PERCENTAGE OF STJGAR IN JUICE.		REMARKS.
		On Poona Farm.	In its own district.	On Poona Farm.	In its own district.	
1	Hullu Kabbu, Bolgaum.	52-6	54-1 to 59-8	Cano Sugar 16-06... Glucose a trace ...	Cane Sugar (14-27 3 14*92 (17*37 Glucose 0*75	A long, very thin, hard cane. Many canes from one root. Poona Farm crop very heavy and new cane in current season very promising. This variety ratoons particularly well.
2	Bctta Kabbu, Belgaum. Wansi, Surat ...	) 57*7 > to) 596	58-3 to 62-1	Cane Sugar 3 C 9-10 (. 9-53 r 1-19 Glucose ... 3 (1*54	) (12-21 >• Cane Sugar < to) (.14-87) (0-43 > Glucose < to) (0-95	A thin, hard cane of uniform thickness. Very heavy crop at Poona Farm. This variety ratoons particularly well.
3	Sana Bile Kabbu, Khánápur (Belgaurn).	60-0	58-2	Cane Sugar 17*38 Glucose 0*68	Cane Sugar 13*31 Glucose 1*09	A fairly thin, hard cane of uniform thickness and very long. Crop heavier than any other at the Poona Farm. This variety ratoons fairly well. New cane in current season very promising.
4	Striped cane in general cultivation in Southern Marátha Country.	70'2	70-6 to 72-28	Cane Sugar 8*87 Glucose 2*12	Cane Sugar . (14-34 3 to (17-37 I 0-79 Glucose ... ^ to (1-48	A soft, thick cane. Yield of cane per acre only middling. Tfie remarkably low percentage of cane sugar and high percentage of glucose in Poona grown cane very striking in comparison with the percentages as found in cane grown in Southern Marátha Country. Ratoon crop very poor at Poona. New crop of current season not very promising.

48. In addition to the varieties referred to in the foregoing table, the f^^wing varieties were considered worthy of further trial at roona as well as at Surat. The percentages of juice to cane and of sugar in juice are with general remarks recorded below :—

Varieties considered worthy of further trial at Poona.

No.	Variety.	Percentage of Juice.	Percentage of Sugar,	REMAEKS.
5	Pundia, Poona ...	68*0 to 71'0	Cane Sugar. **(16-0** < to *t* 165 Glucose ..*A* (*V2* to (1-6	Thick, soft, tall, yellow-green cane. Heavy cropper. Eatoons very well.
6	Red (Mauritius)...	66-75	Cane Sugar ... 12-88 Glucose ... 1-62	Tall, thick, bright, purple-red cane. Yields a very heavy crop* Eatoons exceptionally well.

No.	Variety.	Percentage of Juice.	Percentage of Sugar.	REMARKS.
7	White (Mauritius).	65·7	Cane Sugar ... 14·71 Glucose ... 0·99	Green, thick, tall cane, not so vigorous growing as the red variety. Ratoons very well.
8	White cane from Bijápur.	70·4	Cane Sugar ... 13·0 Glucose ... ·57	A pale, green and yellow, tall, thick, soft cane. Grows a heavy crop. New cane of current season very promising. Ratoon crop poor.
9	Red cane from Bassein (Thána).	57·1	Cane Sugar ... 13·31 Glucose ... 1·22	A dull, ... of current season only middling.
10	White cane from Bágalkot (Bijápur).	68·4	Cane Sugar ... 12·34 Glucose ... 1·94	Very like ... Heavy crop. New crop ...
11	Striped cane, (Ráta Rasdáli) from Halyál (Kánara).	70·1	Cane Sugar ... 8·22 Glucose ... 2·41	Fairly tall, thick, soft cane, irregularly striped, chocolate and pale green. Fairly heavy crop. Crop of current season of fair promise. Poor ratoon crop.
12	Striped cane, (Rasdáli) from Kánara.	68·4	Cane Sugar ... 13·18 Glucose ... 1·49	Very like the last, but crop heavier. Cane taller and internodes longer. Crop of current season of good promise. Poor ratoon crop.
13	Red cane, from Bijápur.	63·0	Cane Sugar ... 13·27 Glucose ... 1·33	Tall, fairly thick cane. Crop heavy. Poor ratoon crop. New cane of current season of fair promise.
14	White cane, from Chikodi (Belgaum).	65·5	Cane Sugar ... [illegible] Glucose ... [illegible]	Pale, green and yellow cane of moderate length and thickness. Poor ratoon crop. New cane in current season of fair promise.
15	Devgadi, from Ratnágiri.	70·5	Cane Sugar ... 11·46 Glucose ... 1·87	Very like Poona Pundia in general appearance. This is a vigorous growing variety. Ratoon crop fair and new crop of current season good.
16	White cane, from Máhim (Thána).	71·0	Cane Sugar ... 12·38 Glucose ... 1·37	A very tall, thick, pale, yellow, green coloured soft cane. Very heavy crop. New crop of current season promises well. Ratoon crop fair.
17	White cane, from Ránebennur (Dhárwár).	64·1	Cane Sugar ... 12·04 Glucose ... 1·48	A tall, pale, green cane, irregularly marked with yellow. Crop not heavy. Ratoon crop poor. New crop of current season middling.

49. The foregoing varieties with ... also under trial at the Surat Fa[rm] ... local variety ... red cane gave such poor results ... have been discarded. One from Khán... only 6·13 per cent. of cane sugar and 2·57 glucose.

Experiments at Surat Farm with all the varieties.

50. A ..., Elephant's Foot (Am... latus).—The cultivation of a small area with Sur... hallu... res... outturn being only ... in a loss,

15,051 lbs. per acre as compared with 27,349 lbs. in the previous year. This was, I think, due to the character of the season.

51. *English Vegetables.*—Cabbages, knolkhol and lettuces, beetroot and carrots, though well grown, were also grown at a loss. It was expected that there would be a ready sale in the Bombay market as usual, but owing to the plague scare and exodus of the people there was very little demand at all. There is a considerable cultivation of vegetables in the Poona and Surat districts specially for the Bombay market, and I fear the returns to ordinary cultivators were disappointing,

52. *Onions (Allium cepe).*—A fine variety of white onion of mild flavour was grown specially in order to provide seed for distribution. Some seed is now available for distribution, and a considerable amount is expected from a crop now growing. The seed will be ready in good time for the main crop of the current season. The object of distributing the seed is to induce the cultivation of a variety suitable for export. The demand for export is considerable and the cultivation of onions is probably extending beyond internal requirements, because they have taken the place of potatoes. The cultivation of potatoes has declined owing to the failure of the crop from " ring disease."

SPECIAL SUGARCANE EXPERIMENTS AT MA'NJRI.

53. The field is about 7 miles from Poona in the centre of an extensive sugarcane area. Neighbouring cultivatois cannot possibly fail to notice results. If we can prove certain methods of cultivation or of manuring to be profitable and advantageous, such methods will be imitated.

Area selected for experiments suitable.

54. During the hot weather of 1896 the supply of canal water was decidedly deficient. New cane planted rather late in the season occupied a portion of the field and suffered severely, a second crop from the root stocks of the previous crop. The ratoon cane owing to its greater root development was not seriously affected by the short water-supply.

Deficient irrigation in hot weather harmed new cane. Ratoon cane not seriously affected.

First Series.

55. *Object.*—To test the comparative values of such manures as are within the reach and means of ordinary cultivators and when the effects of the various manures have been clearly demonstrated, then to determine whether two or more of the manures can be judiciously combined so as to secure economy.

56. The experiments were begun in 1894-95, but the plots were not manured in that year in accordance with any definite standard for reasons given in the report of that year. They were, therefore, unequally manured. Moreover, after a year's experience it was found expedient to modify the original scheme considerably. I give in tabular form the results of 1895-96 and 1896-97. The former crop was newly planted caue; the latter was a ratoon crop.

Beenltbofa years experimenus leooraea.

57. In both years the various manures used each contained 500 lbs. per acre of nitrogen. The percentages of other elements of value are known, and iii years *to* come it may be found that marked differences between the crops of various plots may be traced to the value of elements other than nitrogen. If this can be done, the value of the experiments will be enhanced, and information be gained, which will indicate how two or more manures should be mixed to give the most paying results.

500 lbs. of nitrogen per acre to each plot. Count to be taken of other elements of nutrition.

58. The manures which the cultivators of the Poona district ordinarily use are, poudrette, cattle dung, fish manure from the coast, castor cake and (Pongamia glabra) cake. In both years we have tested and will continue to test in comparison with the foregoing

Several edible oilcakes nsed in comparison with manures in ordinary use.

several edible cakes which are now used for feeding cattle iu India or are largely exported. These cakes can be bought in Poona in ordinary years at a considerably cheaper rate per ton than the castor cake and Karanj cake now soextensively employed as manure. Dr. Leather's analysis shows that the edible cakes contain much higher percentages of nitrogen (the most valuable constituent of manures) than the manure cakes, and our tests indicate that these edible cakes can be employed with economy and success as Manure. Prices are of course determined by supply and demand, and in the current season the prices of all descriptions of edible cake and other concentrated cattle food have risen to the famine level. There is, however, no proper relation between the manurial or feeding values as determined by analysis and market prices. This is particularly noticeable in respect of cattle foods in the current year of famine. A ton of highly concentrated edible oilcake can be bought in Bombay at a lower price than a ton *oikadbi* (jowári stalks) can iu any of the famine districts. The former has many times the feeding value of the latter. Similarly cane cultivators in the Poona district fail to recognize the differences in the manurial values of the manures they use.

Some manures and some feeding stuffs dearer than others if values are gaaged by chemical analysis.

59. The results of our comparative manure experiments are not only intended to show which manures in given quantity are cheapest. They are intended to prove which manures in given quantity are most effective for sugarcane but also which manures are cheapest. It may be that when a particular manure is shown to be cheap, its extended use will soon make it dear, but there will be an advantage to somebody.

Experiments intended to show whi3h manures in giveu quantity are cheapest.

60. Farm yard manure and cattle dung are charged at full local rates, but it is right to notice that these rates are four times as high as cattle dung used for irrigated crops and twice as high as the rates for inferior districts where irrigated crops are not grown. It will probably be found eventually that at out district rates, cattle dung will be proved much the most economical manure that a cultivator can use, because considering its chemical composition it is much the cheapest. Its value for manure will vary with the food given to tbe cattle and the care with which it is preserved with litter and urine. Properly saved farm yard manure will not perhaps be, weight for weight, as valuable as pure dung, but the manure pit will be filled much more quickly with the former than the latter. The dung from poorly nourished animals is considered by ordinary cultivators just as good as that from those highly fed. Both descriptions are with equal readiness used as fuel. In almost all districts the value of cow-dung[1] as fuel is greater than its value as manure, because wood is scant and very dear. In the Poona district this is notoriously the case. Therefore it is not surprising that a cultivator of cane sells the dung of his cattle as fuel and buys poudrette, oilcake, &c, for his crop. It has been suggested that the use of edible oilcake as manure is surely a wasteful proceeding. It is more wasteful from an agricultural point of view to burn the dung of cake-fed cattle and let their urine drain away to waste. Cattle must be fed and the use of edible oilcake as manure must not be considered as robbing Indian cattle of food to enrich Indian soil with manure. Edible oilcake will only be used as manure so long as the increase of produce therefrom more than pays for the cost.

Farm yard manure probably the cheapest manure a cultivator can use.

A plea for the use of edible oilcake as manure.

61. Although the various manures applied in the comparative manure series contained each 500 lbs. of nitrogen per acre, there are very great differences iu outturn between the various plots. This was particularly noticeable in the new cane, not to such an extent with ratoon. Eatoon cane owing to its greater root development is able to get nutriment from a slow-acting manure much more effectively than new cane does in the early stages of growth. At any rate the differences between the plots of *new* cane were in a great measure due to the activity and effectiveness of the various manures. Katoon cane springs into active and vigorous growth at once, and at this early stage there was no appreciable difference between the various plots.

Quick-acting manures gave the best results, especially in the case of new cane.

But in the case of new cane it was clear that some of the manures were far more active than others. How far the action was due to the presence, in the manures, of elements other than nitrogen, can only be conjectured at this stage of the experiments. The practical fact remains that certain manures, *e.g.,* fish manure, poudrette, and some oilcakes had quicker action than other oilcakes and much greater action than cowdung or farm yard manure,

Slow-acting manures caused uneven germination.

62. On plots with slow-acting manures germination was irregular and the young shSots which did grow were obviously starved and checked in growth. This check was never afterwards recovered.

Oilcake made in country *gha'ni* extremely quick acting, Hydraulic pressed cake slow in action for reasons given.

63. Oilcakes as made in Europe are generally considered to be slow in their action as manure. Oilcakes as made in the ordinary country *ghdni* are extremely quick in their action. In India oilseed as ordinarily pressed is ground up into an impalpable powder as the oil IS expressed. The oilcake is consolidated during the process, but before it is applied as manure it is again powdered, and I have no doubt that the minute particles of cake again disintegrate into impalpable powder when brought into cantact with the moisture of the soil. It is easy to understand that a manure in such a fine state of division will very soon show its effects upon a crop. The method of preparing cake in Europe and in the hydraulic press mills of Bombay is quite different. The seed is crushed but not into fine particles. The crushed seed is cooked or steamed. Thus the oil freely escapes from the oil cells. The cooking of the crushed seed would of necessity convert the albuminoids into a much more insoluble condition than that in which they exist naturally. The albuminoids contain nearly all the nitrogen of the seed, and it is reasonable to suppose that the nitrogen as it exists in hydraulic pressed oiU cake does not become available as plant food nearly so soon as that in oilcake made in the ordinary country *ghafni.*

64. The results of the comparative manure experiments which I tabulate below under Series 1 (a) and Series 1 (6) will be better understood from the above explanations,

Period of growth.

65. The new cane was cut in 11| to 12 months after plantation. Those P^ots which germinated well and were dressed with quick-acting n^anure ripened soonest. The ratoon crop was cut 10 to 10^ months after the previous crop was reaped.

Manures applied partly before and partly after planting.

66. In 1895-96 the manure was applied fth before plantation in March and ?th in July. In 1896-97 the ratoon plots were manured with |th of the application in May and fth in June. It is not customary to give manure to a ratoon crop until it has made considerable growth if the previous crop was liberally manured.

Comparative Manures, Series I (J), 1S95-9S and 1890-97.

Plot No.	Manure.	Year of Crop.	Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Weight of Tops per Acre.	Weight of Gul per Acre.	Percentage of Gul to Cane.	REMARKS.
			Tons.	Lbs.	Rs. a. p.	Lbs.	Lbs.	Lbs.		
2	Safflower cake ...	1895-96. New cane.	3·3	500	169 6 0	95,555	12,520	12,320	12-8	Planted 1st April 1895, harvested 28rd to27th Mirch 189l>. Germination very reguW. Cvop Iwl throughout an extremely healthy appearance, the leaves until the crop ripened being of a rich dark-green colour. Irrigated 27 times.
		1896-91 Ratoonj cane.	39	500	185 13 0	71,760	...	8,430	11-7	Harvested 15th, 16th January 1897. Crop looked vigorous and healthy throughout. Irrigated 16 times.
3	Cassia cake (Mhowra) i«assialatifolia).	3 895-96. Kew cane.	8*6	500	323 9 0	72,410	12,980	7,725	10*6	The first application of Bassia cake had apparently a poisonous effect- Only a set here and there germinated, replanted and then germination was quite satisfactory. The top dressing of manure given in July showed no harmful results. The crop from the second planting made steady vigorous progress. It was not fully ripe when harvested. If left longer, the results of the next crop would be interfered with, Planted on 1st April *1*95*, replanted on *Hh* May 1895, harvested :3rd, 28th March 189(5. Irrigated 27 times. The low percentage of Gui to cane indicates that the crop was not fully ripe.
		1896-97. Eatooiu cane.	£•3	500	299 7 0	68,S20	...	7,895	11-5	Harvested lo̅th January 3897, regular germination. Healthy growth throughout. Irrigated 16 times.
	Cotton-seedcake ...	1895-96. New cane.	7-1	500	316 0 0	83,300	14,925	10,280	12*3	The cake was got from a Bombay mill, which, however, has stopped the manufacture, because the percentage of oil got from Indian seed is small and does not pay. The crop had a very thriving appearance throughout. Planted 31st March U 95,1)arvested 28th to 31st March 1896. Irrigated 27 times.
6	Crushed cotton seed...	1896-97. Ratoon cane.	6-5	500	***362 1 0***	73,645	...	9,050	12-3	Crushed eotton seed was substituted for cotton-seed cake, the latter not being obtainable. It is believed that in districts where cotton fc> grown, and where the seed is very cheap, it will probably be found an economical manure for sugar-cane grown iu the same districts. The dark-green colour of the leaves of the cane was conspicuous in comparison with some of the other plots of the series. Reaped J2th, 13th January 1897. Irrigated 16 times. The price paid for the cotton seed is much dearer in Poona than iu cotton-growing districts.
7	Fisk manure ...	1895-96. Ncwi cane.	2-9	500	188 12 0	90,485	14,445	11,990	**13·2**	The evenness of germination and vigour of growth were nearly as conspicuous as in Plot 2. The manure must be ploughed in or dug in deeply ,• otherwise crows, jackals, dogs and pigs are attracted. Crop planted 31st March 1895. Reaped 10th to 17th March 1896^ Irrigated 26 times. The high percentage of Gul to cane is r.> • ticeable.
		1896-97. Ratoon cane.	2-7	500	**164 7 0**	76,845	...	9,050	**11·7**	Reaped 12th and 13th January 1897. Irrigated 17 times.
8	Castor cake ...	1895-96. New cane.	5-9	500	303 10 0	80,770	13,010	9,82C	12-1	Germination and tillering quite satisfactory, but the crop had not t)m thriving, vigorous appearance and healthy colour of the best plots iu the series. Planted *31 st* March 1895, harvested 1 lth to 17th March 1896. Irrigated *2H* times.
		1896-97. Ratoon cane.	6·2	500	292 11 0	79,400	...	9,780	12·3	This plot gave the best crop of tiw whole series. Harvested 11th and 12th January]*807.* Irrigated 17 ti mes.

Plot. No.	Manure.	Year of Crop.	Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Weight of Tops	Weight of Gul per	Percentage of Gul to Cane.	REMARKS.
			Tons.	Lbs.	Rs. a. p.	Lbs.	Lbs.	Lbs.		
9	Karanj cake (Pongamia glabta).	1895-96. New cane.	6-6	500	280 0 0	83,270	10,915	9,770	117	Very little difference in the appearance of this and the adjoining castor-cake plot. Planted 31st March 81*5. Harvested 12th and 37th March]89G. Irrigated 26 times.
		1696-97. Ratoor cane.	5·3	500	203 7 0	70,600	...	8,445	12-0	Reaped 10th and 11 th January 1897. Irrigated 16 time*.
12	Poudrette	1895-96. Nev cane.	2?·3	500	150 8 0	80,720	11,455	10,455	12-9	Results conspicuously good as compared with some other manure*. Our results and chemical analysis indicate that the manure is a cheap, if not the cheapest, source of nitrogen in India even at the Poona price, which is very h'gh. This manure only obtainable at populous centres, costly to transport. Crop planted 30th March 1805. Harvested 13th to 39th March l^JG. Irrigated *2(5* times.
		1896-97. Batooi. cane;	20·1	500	179 13 0	55,405	...	7,410	13-4	The crop was somewhat disappointing. Germination was quite satisfactory, but the crop at no stage of growth had the thriving appearance of the previous year's crop* Harvested S'th and 9th January 1807. Irrigated 16 times.
13	Cattle duug from ordinary fed cattle.	1895-96. Nev. cane.	25'1	500	160 0 0	60,490	12,22C	7,51C	12·4	The results compared with some other plots are poor. Heavy dressing of the same manure was given in the previous year to this plot also with poor results. The inference is that cattle dung is slow in its action. The germination was quite regular, but the crop had throughout a yellow, unhealthy appearance. Planted 30th March Ib95. Harvested 20th and 21st March 1896. Irrigated 27 times.
		1896-97. Ratoor. cane.	18-9	500	127 12 0	70,445	...	8,15'0	11-6	This plot gave much more satisfactory results under ratoon cane than in the previous year. Owing to the well-known lasting effect of cattle dung the crop probably benefited by the unexhausted residues of the same manure applied during the two previous years. Harvested 7th and 8th January 3S97. Irrigated 15 times.
14	Cake-fed cattle manure mixed with urine and litter.	1895-96. New cane.	29-0	500	184 14 0	53,790	11,17E	6,95'0	12*9	The remarks made against Plot J3 apply equally to this plot. Crop planted 30th March 1895. Harvested 20th to 24th March 1898. Irrigated 27 times.
		1896-97. Ratoon cane.	25*09	500	142 12 0	62,205	...	7,87'0	12-6	Ratoon crop more satisfactory than the previous year's crop of *T.evf* cane. It is/however, clear that there are more satisfactory mar.urcs for sugarcane than either farmyard manure or cattle dun?* ^r0? harvested 7th January U97. *I***I,* gated 16 times.
15	Safflower and grounduut cake.	1695-96. New cane.	S-4	500	362 0 0	63,6:0	10,96C	7,90O	12'4	The cake used is a hydraulic pressed cake made in Bombay frou* coarsely ground steamed seed. *01' this reason the cake possibly acts slowly. The results are poor for * cake so rich in nitrogen, and coiffl" pare unfavourably with the other oil cakes, which, however, were an made in the country *gha'ni* and* therefore, probably act more quietly. Planted 30th March *iSvo.* Harvested 1st to 23rd March 18IM> Irrigated ' 7 times.
		1896-97. Ratoon cane.	8-6	500	158 15 0	68,030	...	7,68(>	11-3	The crop looked fairly promism* during the whole period of growtn, but the outturn of Gul is rather disappointing. It may clearly ^ inferred that hydraulic pressea cake made from coarsely ground steamed seed is slow in action ?*e though rich in nitrogen. *Ift T vested 18th and 19th January V- Irrigated 16 times.

67. In 1894 bones could be bought at a comparatively cheap rate and it was thus considered feasible to compare bones with thQ otber ^nu^g use^ taking the percentage of nitrogen as a basis of comparison. But now owing to the extrinsic circumstance there is a keen demand for export, the value of bones has risen to a high pitch, and if compared with other manures on the basis referred to, the cost of the necessary application would be entirely prohibitive for ordinary cultivation. Therefore the plots for bones, dissolved bones, bones and saltpetre, and dissolved bones and saltpetre have been placed in a subdivision of our comparative manure series. I tabulate the results for 1895-96 and 1890-97 below :—

Experiments with bones.

Comparative 3/anures, Series I (#), *1895-96 and 1S96-97.*

Plot No.	Manure.	Year of Crop.	Manure per Acre.	Nitrogen per Acre.	Cost of Manure per Acre.	Weight of Cane stripped and topped per Aero.	Weight of Tops per Acre.	Weight of Gul per Acre.	Percentage Gul to Cane.	REMARKS.
			Lbs.	Lbs.	Its. a. p.	Lbs.	Lbs.	Lbs.		
4	Bone meal...	1895-96. New cane.	3,520	130	113 0 0	83,145	8,875	3,905	12-1	A heavy application of bones (5 tons per acre) was given to this plot in the previous year with pcor results. It might reasonably have been expected that the residue left would have benefited the crop of this year. There is nothing to indicate that such is the case. The action of bones is so slow -that they cannot be economically used as maniuv foi* sugarcane. The crop had the appearance of being starved throughout its growth. Planted 1st April 1896, reaped 25th to 27th March 1890. Irrigated 27 times.
		l^9G-97. Ratoon cane.	3,343	130	l'?2 14 0	30,900	...	3,705	11*9	The results this year with ratoon confirm the above remarks. Reaped 14th January 3897. Irrigated 16 times.
5	Dissolved bones ...	1895-96. New cane.	3,520 Bones dissolved in acid.	130	196 0 0	36,275	8,535	4,950	13*6	Manured with 6 tons per acre dissolved bones in previous year. Crop fair, but cost of such a heavy dressing of manure entirely prohibitive. This year, manure made on farm. Acid of ordinary commercial strength used, 610 lbs. acid to 3,520 lbs. bone meal. The price of the manure is entirely prohibitive for ordinary cultivation in the Poona district. Planted 1st; April 18)5, harvested '-'7thand 28th March 189d. Irrigated 27 times.
		189:5-97. Ratooin cane.	4,404 lbs., dissolved bones Oi' 3,343 crushed bones dissolved in acid.	130	207 5 0	54,815	...	0,365	11-6	Bettor results but not good enough to pay considering the expensive dressing of manure. Reaped 13th and 14th January 1897. Irrigated 16 times.
10	Bone meal and crude nitre.	1895-96. New cane.	3,5^0 lbs. bone mi a^l, 1,V9O lbs. nitre.	250	264 0 0	41,000	10,075	5,015	12-2	One-fifth of the nitre was applied before plantation ; the rest in fouv equal top-dressings given in June, August, October and December. It was believed to bj economical to apply the nitre in top-dressings, because being very soluble it is easily washed away in drainage if not taken up by the crop almost at once. The crop did not In-lie tit to the extent that was expected, and the cost of the manure exceeded the value of the crop. Planted 30fch March 1895. Harvested 30th and 31st March 896. Irrigated ^7 times.
		1896-97. Ratoon cane.	3,343 lbs. bone meal, 1,230 lbs. nitre.	250	255 0 0	50,385	...	4,90O	9-7	Nitre applied in 5 top dressings at intervals as above. The cane only yielded 53'7 per cent, juice, whereas the average of all other manure plots was approximately 68 per cent. Tlu percentage of Gui to cane is very low. I can offer no satisfactory explanation. Again tho cost of the manure about equals tho value of the crop. Reaped 9L1I and 10th January 38U7. Irrigated 15 times.
11	Dissolved bones and crude nitre.	1895-96. New cane.	3,520 lbs. bone meal dissolved Mid 1,290 lbs. nitre.	250	3H 0 0	65,715	11,695	8,435	12-8	Nitre applied as in Plot 10 for similar reasons. It i3 clear that dissolving the bones makes the manure more effective, but the cost is entirely prohibitive. Crop planted 31st March 1895, reaped 29th to 31st March 1896. Irrigated 27 times.
		1896-97. Ratoon cane.	3,343 lbs. bone meal dissolved or 4,406 lbs. dissolved bones, 1,2H0 lbs. nitre.	250	344 0 0	62,905	...	7,843	12'5	Nitre applied as above. Crop reaped 8th and 9th January 1897. Irrigated J5 times

Second Series.

68. *Object.*—To test how long cane can be ratooned profitably.

69. There is clear evidence from our trials that it is risky in the Poona district to take more than one ratoon crop. If new cane is planted on clean land, as of course it ought to be, there is little difficulty in keeping the new cane free of weeds, particularly if the crop is heavy. It is not so easy to keep the succeeding ratoon crop quite clean. In the third year it is well nigh impossible, however careful the tillage may be, to prevent *haridli* and other grasses becoming more or less established. The young shoots of the second year's ratoon come up weaker than those of the first year. The root stocks of the former get overgrown to the extent that the distribution of irrigation water is interfered with.

The 6rst ratoon crop more profitable than new cane ; the second ratoon crop risky for reasons given.

70. Throughout the Poona district two successive ratoon crops are generally taken. The first ratoon crop gets usually a lighter dressing of manure than new cane and the second ratoon crop gets a much lighter dressing and sometimes none at all. It is quite likely that residues of heavy dressings of manure given to new cane and the first year's ratoon would suffice for the second ratoon crop without any direct application. Ratoon cane grown in this way would probably pay even though a poor crop, because the cost of manure is by far the heaviest item in the cost of cultivation. On the other hand, deep-rooted grasses and other weeds might get thoroughly established, and then the field would require to be fallowed before it could again be planted with cane. The cost of fallowing would be heavy.

Two successive ratoon crops generally taken in the Poona district: the first gets less manure than new cane ; the second often none at all.

71. The profit from the first ratoon crop is greater than that from new cane. The preparatory tillage for the former is trifling# Thepe is no expenditure for sets or for planting. These items in cost of cultivation will exceed Rs. 50 per acre. Less irrigation and less manure is required.

Large profits from first ratoon.

72. I tabulate outturn, &c., results from first and second years' ratoon grown on comparative plots. The plots were equally manured to secure fair comparison. Rather heavy dressings of manure were given. In ordinary practice less manure would have applied probably to the first year's ratoon and certainly to the second year's crop. The success of the latter does not, I think, depend much upon direct application of manure if the prerious crops were liberally treated, but rather upon the vigour of the young shoots. If these start early into active growth, and there are no vacancies, the crop soon covers the ground and weeds are suppressed. If otherwise, weeds get the upper hand and the outturn will necessary be poor. A field of second year's ratoon is usually easily distinguished by its patchy appearance.

First and second year*' ratoon crops compared.

73. Outturn, &c, results of the two crops are given below :—

First year'8 Ratoon,

Plot No.	Manure.	Weight of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Outturn of Gul per Acre.	Per-centage of Gul to Cane.	Cost of Cultivation per Acre.	Value of Produce per •ere.	RBVABKS.
		Tons.	Lbs.	Lbs.		Rs. a. p.	Rs. a. p.	
15	Safflower and groundnut cake.	3«3	68,030	7,680	11-3	320 10 0	426 10 0	Previous crop reaped 2'st to 23rd March 1896, Ratoon crop 18 th and 19 th January 1897. Irrigated 16 times. Growth regular.
ai	... Poudrette	22*65	60,300	6,625	10-9	313 12 0	368 1 0	Previous crop reaped on half the plot on 4th March 1896 ; on the other half on 20th March 1896. Ratoon crop reaped on 3rd and 4th January 1897. Irrigated 17limes. Growth patchy in parts.
22	... Do.	22*65	73,580	8,055	10-9	324 14 0	447 8 0	Previous crop reaped, April 2nd to 4th, 1896. Ratoon crop reaped, 20th and 21st January 1897. Irrigated 17 times. Growth regular.

Second year's Ratoon.

Plot No.	Manure.	Weight of Manure per Acre.	Weight of Cane stripped and topped per Acre.	Outturn of Gul per Acre.	Per-centage of Gul to Cane,	Cost of Cultivation per Acre.	Value of Produce per Acre.	Remarks.
		Tons.	Lbs.	Lbs.		Rs. a. p.	Rs. a. p.	
36	Safflower and groundnut cake.	3-6	38,510	4,095	30-6	292 4 0	227 8 0	Previous ratoon crop reaped, 10th to]2th March 1896. Ratoon crop reaped 17th and 18th January 1897. Irrigated 17 times. Growth patchy, good in parts ; poor in other parts.
23	Poudrette ..	22-65	34,530	4,040	117	301 14 0	224 7 0	Previous ratoon crop reaped on half the plot, 6th February 1896 ; on the other half, 20th February. Second ratoon crop reaped January 21st, 1897. Irrigated 18 times. Crop irregular and patchy.
24,	Do. ...	22 65	35,4,40	3,900	11-0	295 8 0	216 10 0	Previous ratoon crop reaped 6th and 7th March 1896. Second ratoon crop reaped 21st and 22nd January 1897. Irrigated 17 timei.

Third Seines.

74. *Object.—To* test light frequent irrigation against heavier frequent irrigation and against the local method of heavy irrigation at lon^ intervals Ordinary cultivators get canal water once a fortnight in the hot weather. Sometimes the interval is as much as 18 days, This is believed to be much too" long.

75. An ordinary cultivator to protect himself makes the water compartments as deep as possible and literally floods his field at each time of watering He knows the advantage *oi* frequent light irrigation; for if he draws the water from a well, he irrigates his sugarcane crop once in 8 days, but gives no more water than the crop needs on account of the trouble of drawing it.

76. Our water experiments have been in progress for three years. It was intended to have comparisons on newly planted cane as well as on ratoon cane in the year under report. The results of the latter comparison are worthy of record, the former are not. The new cane was grown on land which had been purchased by this Department some little time before the cane was planted. The occupant had grown a cane crop in the previous season. It was reaped in February and it was found impossible to get the land ready for replanting before the middle of April. The hot weather was%x.cep. 'ying for the young shoots, and even the plots that o-ot frequent irrigation suffered considerably. Those that were watered loss frequently *{i. e.* as often as the canal was opened to the ordinary cultivator) suffered very severely ; and as I have noted in a former paragraph, a check received at this stage of growth is never afterwards recovered.

Unsatisfactory results with new cane for reasons given.

77. On this new area another line of experiments was also arranged for. It was intended to prove what is the most economical dressing of manure that can be used for sugarcane an ordinary cultivator can readily obtain. The manures selected for comparison were poudrette, farm yard manure, castor cake made in the ordinary *ghdni*, hydraulic pressed castor cake from Bombay mills, and country made safflower cake. Our experiments hitherto have indicated that; to produce a full crop, manures should contain more than 400 lbs. and perhaps less than 600 lbs. of nitrogen per acre. These weights were adopted^ for comparison with each of the nianures named, and in the case of poudrette a lighter dressing containing 250 lbs. of nitrogen per acre° was adopted# The resulfcs as regards the effect of different weights of manures are useless for record, because of the check in the hot

Amg of manure for sugarcane.

Results useless for record for reasonsgiven.

weather and the patchy irregular growth on all plots. It would have been better perhaps to have postponed these trials for a season. The field would thus have been fallowed and the crop planted more seasonably.

78. The differences between the plots which got frequent irrigation and those which did not, were so striking that the outturn results may be noted, though not of course for critical comparison. The water experiments plots were each manured with poudrette containing 600 lbs. of nitrogen per acre. I note below the outturn results from these plots as well as from plots manured with other manures also containing 600 lbs. of nitrogen per acre, the conditions of cultivation being precisely the same in all except the differences in irrigation.

Clear proof of the value of frequent irrigation.

Method of irrigation.	Manure 600 lbs. nitrogen per Acre.	Number of times irrigated in 31 £ months.	Outturn of Gul per Acre.
			Lbs.
Watered with \ ordinary supply of water.	Poudrette	30	7,140
Watered with § ordinary supply of water.	Do.	30	**8,000**
Watered with full ordinary supply of water	Do.	30	7,225
Watered as often as canal was opened to ordinary cultivators	Do.	23	6,050
Do.	Farm yard manure ...	23	4,075
Do.	Safflower cake	23	4,035
Do.	Country *ghdni* castor cake.	23	3,710
Do.	Hydraulic pressed Bombay mills castor cake ...	23	3,325

9. I contrast in the subjoined tabulated statement the results of water experiments of 1895-96 and 1896-97, the crops being new cane in the first year and ratoon in th figures which relate to the former year j type below those of 1896-97.

Lits of water experi- in 1895-96 and 1896-97 ted.

Third Series

Comparative Water Experiments.—Plots \th Acre each.

[New Cane, 1895-96; Ratoon Cane, 1896-97.]

Number of not.	Method of irrigation.	Total Weight of Water per Acre applied.	Equivalent Inches of Rainfall to Water applied.	Weight of Cane stripped and topped per Acre.	Weight of Gul per Acre.	Per-centage of Gul to Cane.	Cost of Cultivation.	Value of Outturn.	REMARKS.
		Tons.		Lbs.	Lbs.		Rs. a. p.	Rs. a. p.	
18	Watered each time with full ordinary supply of water.	8,009	85·2	74,695	8,085	10-8	334 1 0	449 3 0	Cost of cultivating practically the same in each plot j the differences due to a little extra weeding in Plot 20 and on account of the differences in cost of making Gul, the outturn varying. There would be far greater differences in cost of cultivation if the water had been drawn from a well. The cost of canal water is practically the same for each, the differences in cost of appli" cation being very trifling. It will be noticed that the ratoon crop of this year required much less water than the new cane of the previous year.
	32 times for new cane in 1895-96 in 11 months. 23 times for ratoon cane in 3896-97 in 30 months.	**10,507**	**104**	**78,705**	**9,610**	**12-2**			
19	Watered each time with fth ordinary supply of water. Other remarks as above.	6,457	63·9	79,230	8,645	10-9	337 6 0	480 4 0	
		7,8905	**78'1**	**93,095**	**11,190**	**120**			
20	Watered each time with £ ordinary supply of water. Other remarks as above.	4,302	42*6	95,960	7,950	120	333 8 0	441 10 0	
		5,2695	**52*1**	**91,445**	**11,050**	**120**			

80. *Mauritius varieties of Sugarcane.*—Two varieties, one red and the other green, were obtained from the Mauritius Department of Agriculture in 1894. They were reported to yield in Mauritius about 14 per cent, crystallized sugar, which of course compares favourably with the 11 to 14 per cent, of Gul (crude sugar) got from the best known varieties cultivated in the Presidency. The Mauritius varieties throve exceedingly well in the first season but gave very disappointing percentages of sugar. In the second year the ratoon crop from the imported cane grew with great vigour, but new cane planted in the hot weather made very poor progress until the rains set in. But, as noticed above, the local variety is liable to be affected in the same way. In the second year the percentage of Gul to cane was even more disappointing than in the first. Both varieties were about equally poor in this respect. Moreover, the Gul was soft owing to a high percentage of treacle or non-crystallizable sugar and, therefore would neither keep nor bear transport. There was a marked improvement in the year under report.

The behaviour of these varieties since they were imported. The effects of acclimatization.

81. Both varieties have great tillering power and under favourable conditions grow very vigorously—the red variety especially so. The deep dark-green colour of its leaves forms a striking contrast in comparison with indigenous varieties. The red variety is more liable to be lodged by wind or rain than the green variety or any of the varieties in common cultivation in the Deccan. This fact suggested the idea that the Mauritius system of planting should be tried with the Mauritius varieties and such Indian varieties as freely tiller. So far as the trials have gone, the indications are that this method prevents the cane from being lodged. In the Mauritius system of planting, pits, a foot sometimes more in depth, are dug about a yard apart in each direction. Two, three or four sets are planted in each pit and covered carefully with soil. If the pits are deep, they should not be filled up level with the surface until the young shoots make some progress. Otherwise germination is certain to be interfered with, especially on soil of a dense character. If cane is planted deep, the roots get a firm hold of the soil and the canes are supported, so that a heavy crop is not likely to be lodged by wind or rain. The distance between the pits gives room for free tillering. Further experiments are required to determine fully the advantages of the method,

The varieties have certain characteristics which are valuable, others which are not. The Mauritius system of planting.

82. Both the Mauritius varieties flower freely. They have also a tendency to produce side shoots. These more or less abnormal growths are probably disadvantageous. But analysis of the juice by Dr. Leather did not indicate that the percentage of sugar was to any appreciable extent affected.

The varieties flower freely and produce side shoots.

83. There was clear indication in the second year that the Mauritius varieties did not require so much manure to produce a full crop as the local Pundia and for this reason it was considered advisable to manure the ratoon plots in the year under report with comparatively light dressings.

Less manure required than for indigenous varieties,

84. There is this year a renmrkable improvement in the percentages of sugar in the cane and an improvement in the quality of the Gul. This improvement was indicated by analyses by Leather and also by Gul making results. The Gul from the green variety wars particularly bright in colour and hard in texture; and that from the red, though softer, was not unusually soft, and though somewhat dark was not a bad colour.

A remarkable improvement in the percentages of sugar.

85. The following statement compares the Pundia variety of Poona with red and green Mauritius varieties as regards the percentages of juice expressed by a good mill and percentages of cane sugar and glucose in the juice (Dr. Leather s analyses):—

A comparison between the local Pundia variety and the Mauritius varieties.

	Red Mauritius.	Green Mauritius.	Poona Pundia.
Percentage of juice to cane topped and stripped	66-75	65-7	68-0 to 71-0
Percentage of cane sugar in juice ...	12-88	14-71	16-0 to 16-5
Percentage of glucose	1-62	0-99	1-2 to 1·6

The marked improvement in the percentages of sugar in 1896-97 shown by figures.

86. The marked improvement in percentages of sugar in the Mauritius varieties in 1896-97 as compared with previous years is well shown by the following figures :—

Year.	PUNDIA.	MAURITIUS RED VARIETY.	MAURITIUS GREEN VARIETY.
	The percentages of Gul to Cane have varied in comparative manure plotg from	Percentage of Gul to Cane.	Percentage of Gul to Cane-
1894-95	11-2 to 131	9-4	10*08
1895-96		8-7	8-8
1896-97	11-0 to 13-4	10-8	11-2

87. In reporting on these varieties last year I said the results indicated . Exotic vrietie. .hould be that care should be taken in in trod ucfnT into India introduced with some caution, exo. tic varieties or even moving varieties " one in the first instance. Ifc £%%£ ^ another until experime sted after being acclimatized may not mafntain their high varieties even Deccan; but this is not yet proved. The will at least have shown decided improvement i t h L st year, and tion there is further i - U ^ W will be worthy

88. I record Outturn results. each wiety. ^ ^^ &o" ^Sults ' from

Batoon Crops-Bed and Green Mauritius.

No. of Plot.	Crop.	Kind of Manure.	Weight of Manure per Acre.	Weight of Canes stripped and topped per Acre.	Weight of Gul per Acre.	Per-centage of Gul to Cane.	Cost of Cultivation per Acre.	Value of Produce per Acre.	Remarks.
			Tons.	Lbs.	Lbs.		Rs. a. p.	Rs. a. p.	
25 and 26	Green Mauritius.	Farm yard manure.	16*9 (337-5) lbs. nitrogen per acre.	55,240	6,125	11·2	240 6 0	340 4 0	
27 and 28	Red Mauritius.	Poudrette.	f36 (337-5 lbs.) nitrogen per acre.	54,275	6,235	11·5	236 2 0	346 6 0	
29 and 30	Do.	Castor] cake.	4-2 (337-5 lbs.) nitrogen per acre.	78,520	7,837	9·95	341 4 0	435 0 0	Manure costly. Hence high cost of cultivation.

89. The sugarcane experiments were carried out at a net cost to Government of Rs> 1,035 as compared with Rs. 1,830 in the previous year. The expenditure will, 1 think, always exceed income. There are 46 experimental plots. The vacant spaces between plots are 5 feet wide. These with the roadways necessary for easy access to each series of experiments take up about £ of the whole field. The spaces between plots undergo practically the same tillage as the plots, excepting that the former get no manure. It may be accepted that the tillage of the plots and the spaces which divide them must cost considerably more than a field under ordinary cultivation.

Cost of experiments.

GANESHKHIND GARDENS.

90. *Graft Mangoes—The* plantations of graft mangoes in the Old Botanical Gardens, Ganeshkhind, are now extensive. There are about 2,600 trees. Many of the trees are young and are not yet old enough to bear. All the trees are healthy with the exception of those in one plantation. The *very* high river floods of 1895 and 1896 submerged this portion of the garden. (Some trees have died, others have since been unhealthy. Grafts are taken of good varieties annually and the plantations have gradually been extended. Almost the whole available area has been planted. The trees are regularly manured and irrigated, yet the fruit crop, except in occasional years, even from the older trees has been disappointing. Almost every year there is a good show of bloom ; but if there is cloudy weather when the flowers are being fertilized, the fruit drops almost as soon as it is formed. This condition is not peculiar to our plantations. It is common in the district and nearly all over the Deccan. When the trees are all old enough to bear fruit, the plantations will be a valuable property and a good

•ected, especially in good mango years. Meantime the chief

3S. A space round each tree is kept clear and regularly

reater portion of the laud grows good grass. The value of

»rdinary years sufficient to cover the Overseer's and Máli's

nder report the grass crop was as good as in average vears;

3ant and dear during a considerable portion

isiderably more than usual, and income exc

THE DAIRY *AND* THE DAIRY HERD.

91. The financial results are shown in the appended balance sheet. The profit is Rs. 834, as compared with Rs. 1,952 in 1895-

Ffeancial results.

CJ6> The net cost to Government is, however, Rs. 385, because Rs. 1,219 were expended on capital outlays, in improving the dairy and wash room, and their equipment. Milk and butter were sold under a yearly contract to the Commissariat Department at easy prices, thus minimizing profits.

92. A large reserve stock of fodder had been secured, before famine had developed, at a cost considerably higher than usual, but

The up-keep of joung stock cost j m a amme year.

no{ abnormany high. Concentrated food had to be "b0Uglit more or less as required at rates much higher than usual. For this reason the upkeep of the young stock during the year has been very costly. They numbered 102 at the end of the year. Young cattle of any class are worth very little in the open market at present, and young buffaloes, especially young he-buffaloes, are unsaleable at any price. This will continue as long as fodder is scarce. In the valuation due count is taken of the depreciated value of the young stock and full allowance is made for depreciation in value of the older animals.

93. There were three deaths amongst the older animals, two of which were believed to be attributable to snake-bite in the

Health of herd.

Manjri *kuran.* There was considerable loss amongst very young calves early in the year. This was due to diarrhcea from overcrowding. The new byre, which has since been completed, now affords ample accommodation.

94. The dairy produce from 80 animals in milk was sold for Es. 17,048. These animals individually yielded a considerable profit, which was, however, nearly all required for the maintenance of the young stock. Concentrated food and fodder cost Rs. 11,494.

Fodder supply sufficient for the present. Another year of famine, then position very critical.

95. The reserve stock of fodder is sufficient for all the cattle until the end of August of the current year. the rains in July and afterwards are sufficient, no anxiety need be telt about fodder; but if we have another year of famine , the position will be decidedly critical.

The Gir cattle transferred to the Surat Farm.

96. The Gir cattle have been transferred to the Surat Farm and buffaloes were purchased for that farm about the end of the financial year. It was intended to start a dairy at Surat earlier, but when the character of the season had declared itself, it was seen that the fodder supply would be short and that concentrated food would be dear. The supply of fodder at the Surat Farm will be sufficient if there is good rain in July and afterwards.

No feeding experiments for reasons given

97. It was intended to carry out feeding experiments with milk cattle in the year under report'in continuation of those reported last year. we intended to tefit the comparative feeding values of certain green fodders and concentrated foods. Such experiments can only be conducted in India in the fair season. In the year under report, irrigation was almost entirely confined to our perennial crops, and the canal and well water obtainable was insufficient for these. So that we could not grow other fodder crops under irrigation. The contemplated experiments will be carried out in the current season if it proves favourable.

The objects aimed at in maintaining a dairy herd and dairy.

98. In former reports I have detailed at considerable length the objects aimed at in maintaining the dairy herd and dairy. The primary object is to improve the milking capacities of the various breeds that are under trial, *each breed* is maintained pure. I do not believe in crossing pure Indian breeds. Pure bred, well-selected specimens have characteristics which have been acquired by careful breeding for many generations. Crossing deforms these characteristics and produces a half-caste cross-breed. We lost by rinderpest two years ago nearly aUpthe first produce from cows mated at the farm, and we cannot yet point to young animals bred on the farm which are specially good milkers, but we hope to in time.

Objections to crossing.

A beneficial effect of meritiative example.

99. The dairy supplies the Commissariat Department with milk and butter for soldiers in hospitals at ordinary rates ?tnd the general public at rates fixed purposely higher than those charged in private dairies. Dairy machinery has been extensively imported and sold in India. Numerous dairies have been started not only in the Presidency but also throughout India. The export of tinned butter made in Bombay by improved methods is very considerable. So also is the internal trade and the Bombay Agricultural Department can take credit for demonstrating methods which have developed an extensive trade. The Kirkee Government Dairy affords and the Surat Dairy will anord to natives practical teaching in improved dairy methods. .Those who come to learn must work and not be mere onlookers.

Natives trained in improved dairy methods at the farms.

The services of the farm balls given gratis for all healthy cows.

100. The services of the farm bulls are given gratis for all healthy cows in good condition brought to the farm to be covered. The privilege is extensively taken advantage of.

Two pamphlets published.

101. Full information regarding experience gained at the farm about dairy Avntten tor the Agricultural Ledger Series—one on tlie " Management of Dairy Cattle in India " and the other on " Milk and Milk Products." These pamphlets are offered for sale at the Government Central Book Depot, Bombay, at the cost of printing and binding.

SHEEP.

Sheep.

102. I regret to report that the small flock of cross-bred Deccani-Dumba ewes which had done so well for two years developed clear symptoms of liver fluke during the incessant rain of July-August. This disease is always associated with wet swampy pasturage, and probably the two *ndlas* which pass through the Manjri grazing, and which are perennial owing to drainage from the sugarcane fields, make the grazing rather unsafe for sheep. In any case there was a recurrence of the liver fluke symptoms in the current season, and I have taken a few of the best of the ewes and one ram, all apparently healthy, to Kirkee.

SURAT FARM.

103. For reasons reported in paragraph 96 the dairy herd and dairy was only started at this farm towards the end of the financial year.

The initial operations.

104. The dry-crop area which has been taken *on* lease by the Department for a term of years has been brought into condition for experimental cultivation. It has been securely ring-fenced. Overgrown headlands have been grubbed up, and those fields, which were weedy, cleaned. The land is Inam and has been sublet annually to tenants for many years and, although naturally good deep black soil, has not had fair- treatment. It was starved in condition, and a liberal dressing of manure was essential. This has boen got at veiy moderate cost from the Pinjrapole, where many cattle are kept and which is about one mile distant.

Buildings, &c.

105. The farm buildings were completed in July and the two new wells, which command the land intended for irrigated crops, some time afterwards. The well has been fitted with ordinary leather bag lifts, the other with a continuous chain of bucket lifts made in Poona and which answers admirably in the Poona district. The irrigated area grew a crop for green manure in the monsoon and was otherwise heavily manured afterwards, the object being to prepare the soil for growing irrigated crops more or less continuously. The land is deep black, and without such treatment would not grow garden crops well.

The scheme of experiments for Surat Farm given in detail.

106. The farm is now fully equipped in every way. A complete scheme of comparative experiments has been formulated for this f— . It is now partly in progress and will be fully so m the current year it the season is not abnormally unfavourable. The proposed line of experiments is indicated by the cropping scheme which I give in detail as under.

Series J.

Manure rotation experiments with the staple crops of the district.

107. Manure rotation experiments with staple crops of the district, cotton and Jovviri. Cotton the Staple Crops Deshi Variety ; Jowiri the Perio variety, which is probably the best local kind.

The objects aimed at.

108. *Objects.—(a)* To show that it is not good practice to take cotton and Jowari in alternate years without any variation. To show the value of a more extended rotation. *(c)* To show the value of green manure, *(d)* To show the value of growing a leguminose crop subordinate to the Jowari and at regular intervals, *(e)* To test whether a dressing of concentrated manure costing Ks. 10 per acre, applied every second year, pays better than no manure at all. Castor cake is the cheapest concentrated manure in the Surat district and it is selected for the trial. It is believed that an ordinary cultivator, failing a supply of home made farm yard manure, would use bought concentrated manure of the value named, if it was proved economical. *(/)* Finally to prove that by means of a moderate application of farm yard manure with the assistance of green manuring and proper rotation the fertility of black cotton soil can be maintained at a tolerably high standard.

Plots.	Plots J acre each.	
1. Cotton	) Rotated with each other permanently. Cotton plot to be manured with 5 tons farm yard manure per acre.	
2. Jowari		
3. Cotton		Do. do.
4. Jowari and Tur		
5. Cotton		
6. Jowari		Do. do.
7. Til		
8. Cotton		
9. Jowari		Do. do.
10. San ploughed in as green manure		
11. Cotton		
12. Jowari		Do. do.
13. San ploughed in, followed by Tur and Til		
14. Cotton		
15. Jowari		Do. do.
16. San ploughed in, followed by gram		
17. Cotton		
18. Jowari		Do. do.
19. Bare fallow		

The above plots when growing cotton to be manured with the farm made manure which will be preserved with the urine and litter in a properly constructed manure pit and the cattle will be mostly milk cattle fed on cake and other concentrated food to an economical extent.

20. Cotton	) Rotated permanently. Cotton to be manured with Rs. 10 worth of castor cake per acre.
21. Jowari	
22. Cotton	) Rotated permanently. Cotton to be manured with poudrette, the dressing to be equivalent per acre to 5 tons farm yard manure in value or in composition as may be decided upon.
23. Jowari	
24. Cotton	) Rotated permanently. Unmanured.
25. Jowari	

Plots 26 to 50 inclusive .duplicates of above. Plots 1 to 25 will be in one survey number and plots 26 to 50 in another. No survey number is large enough for the double series. There will be 3-feet divisions between plots.

Area of experiment suitable in every way.

109. The areas selected are in every way suitable. The whole of the land of the farm is good black soil which slopes gently in one direction. The plots are long, comparatively narrow and are all of the same length. They are parallel to each other along the line of slope. Any surface wash that might possibly come from higher ground is intercepted by an open ditch made specially for the purpose. The fields have been growing cotton and Jowdri for many years and have not been manured for a number of years. The soil is decidedly in poor condition and, therefore, it has been considered advisable to manure all plots this year, except 24 and 25 and their duplicates, which will be permanently unmanured.

No experiments except those referred to on ordinary dry crops.

110. It is not proposed to have experiments with other manures than those referred to on ordinary dry crops. It would be possible to show that equivalent dressings of concentrated manures would pay in comparison with farm yard manure at its value in ordinary country districts. A cultivator of irrigated crops is forced to apply manures in large quantity to such crops, because it is only a really good irrigated crop that pays well. A middling irrigated crop is probably always raised at a loss. Cultivators of irrigated crops must buy manure, and they will not hesitate to buy such manures as have been proved effective and economical for particular crops either on Government farms or elsewhere. It is, therefore, proposed to confine comparative experiments with concentrated manures entirely to irrigated crops,

Series II.

Improvement of seed by selection of the district staple crops.

111. *Ohject.*—To improve by selection the seed of the staple crops of the district and to produce in time by selection improved pedigree varieties. The two chief dry crops are Jowdri and cotton.

Which varieties of Jowari to be tried.

112. The varieties of Jowdri grown in the district are distinctly fine varieties. It is probable that it may be found difficult to find better or more suitable varieties in cultivation in any other part of the Presidency. One of the best local varieties, Sholápuri, has been, as its name implies, an introduction, It has yet to be proved whether other varieties can be successfully introduced. It is proposed to grow, side by side with local varieties, other varieties from other parts of the Presidency. Sixty such varieties have been identified. It can soon be determined which of these give promise of being useful introductions, and the cultivation of such will only be persevered with. The qualities to be looked for in good varieties likely to suit the district are: large heads of grain with large round grain, pearly white or pale yellow in colour; stout stalks which root well and thus take a firm hold of the soil and, therefore, not liable to lodge or fall down during high wind or heavy downpours of rain; non-liability to rust and smut or other common fungoid disease.

Comparative trials with Cotton to be chiefly confined to local varieties.

113. Experiments in the past have conclusively shown that the improvement of Indian cotton is not likely to be brought about by the introduction into any district of exotic varieties or even of varieties indigenous to other parts of India. Cotton tends itself to stubbornly to any change of this sort, and it is more than probable that varieties found generally cultivated in any particular district are the varieties which suit the district best and pay the cultivator best. The *Deshi* of Surat is probably the best long-stapled variety in cultivation in India. In parts of Broach another long-stapled cotton *(Goghdri),* though not yielding such fine quality of lint as the Deshi, is in general favour with the cultivators and is gaining ground because the plant is hardy and vigorous growing. The crop yields well and the proportion of lint to seed is particularly high.

The plan of experiment described. Improvements by selection of seed.

114. We propose to confine attention chiefly to these two kinds of cotton and it will be the object both as regards the varieties of cotton and of Jowari to grow as good crops as possible by careful tillage and liberal applications of ordinary manure. The principal object, however, in growing the different varieties will be to improve them by seed selection. Each year at harvest time, seed sufficient for the following year's crop and perhaps for distribution will be selected in the field from the mature crops. The best heads of grain and the best bolls of cotton will be selected from the most robust and vigorous plants. It has been considered expedient to set aside particular areas for these trials. Three survey numbers together measuring about 18 acres have been selected. Cotton one year and Jowari next is not good rotation. It has been decided to add Til *(Sesamum indicum)* to improve the rotation and for like treatment as regards the improvement of seed. The crop is of recent introduction into the district and is in favour not so much because it pays well but as a good rotation crop with cotton. It can be sown seasonably half way between the kharif and rabi seasons Thus there is a good opportunity for periodically thoroughly cleaning the land. There are three distinct varieties, if not four, of Til, and one variety was proved this year on the Poona Farm to yield more seed per acre than the others, and the seed when pressed in the country *ghdni* gave a considerably higher percentage of oil than the others. The variety referred to is not the kind now grown on the Surat district. By selection of seed from year to year any of the varieties can probably be much improved. The scheme of experiment will thus be :—

Cotton, Jowdri Til.

Rotated with each other; land thoroughly tilled and liberally manured ; three survey numbers of nearly equal size are allotted; area about 18 acres, apportioned as under :—

First field ... 7/3 acres, Goghdri cotton.
... 7/8 acres, Deshi cotton.

Second field ... { 2 acres, Perio Jowári. *\
2 acres, Sholápuri Jowári. ^The best local varieties.
2 acres, Chapti Jowdri.)

Third field ... 2 acres, white Til.
2 acres, red Til.
2 acres, black Til.

115. The introduced varieties of Jowdri will be grown on comparatively small areas probably for several years. If, when thoroughly tested, any variety proves to have special value, its cultivation will be extended. The best heads of grain will be saved for seed each year.

As introduced varieties are confined to land areas in the first instance.

Series III.

116. The farm is intended to grow to some extent fodder crops suitable for a dairy herd of Surat buffaloes and Gir cows. Apart altogether from the important question of improving these breeds, the question of producing the most suitable fodder crops as food for the cattle is important. The fodder to be cut green as required, or cured and stacked.

Proposed trial of experiments with fodder crops described.

117. On the Poona Farm we have found two indigenous varieties of Sorghum to be excellent fodder crops, the Sundhia of Gujanit, and the Nilva of the Deccan. Similarly two exotic Sorghum introductions from America have also proved high class fodder varieties. We do not yet know whether these will succeed equally well on the Surat Farm; but if they prove successful on small areas in the first instance, they will be more extensively cultivated afterwards. All these varieties mature with great rapidity. We have had at Poona stalks 11 feet high in flower in about 65 days after sowing, the stalks being so thin that the fodder is of exceptional fine quality, and can be fed with no wastage. It is believed that, if sown immediately after the first fall of rain, the fodder crop can be harvested and fed green so early in an average season that a second crop of cram, Jowari, Tur, or Til or other rabi crop can be taken in the same season. An effort will be made to show that this practice can be successfully adopted.

The varieties of Sorghum which will be tested as fodder crops.

A second crop in the same year probably possible.

Series IV.

118. It is well known that certain common diseases in crops owe their origin to disease germs which contaminate the seed. These germs can be destroyed by pickling the seed before sowing with certain re-agents. Yet the vitality of the seed is in no way affected. Sulphate of copper (1 to \ per cent, solution), stale stable urine, or water at a temperature of 135 1. to 150° F. can each be successfully employed. The damage done by smut in Jowari and boll worm in cotton throughout the Surat and Broach districts is extensive and increasing. These diseases and others can at least be held in check by using clean pickled seed. That has been often proved and requires no demonstration. It might perhaps be advisable to show the effect on Jowari of using pickled and unpickled seed on adjoining plots, and this has been arranged for. But with this exception all seed used on the farm will be pickled, and a comparison between the farm crops and those in adjoining fields can be made. As regards boll worm in cotton, an affected crop grown from affected seed would be a source of danger to surrounding areas. Therefore it would be unwise to have comparative plots under treatment and non-treatment. Objection may be taken to the hot-water treatment, because an ordinary cultivator does not own nor can he be expected to use a thermometer. It is really the most simple treatment of any, for it well water and boiling water are mixed in equal proportions, the resulting mixture will be hot enough, but not too hot for the purpose required. Well water may vary in temperature from 60° to 80° F.

The prevention of fungoid and other harmful diseases to plants.

Certain re-agents to be used to prevent fungoid diseases.

1 gallon at 60°F. 1 ... gallons > 136° F.
1 gallon at 212°F. }
1 gallon at 80°F.) ... gallons; 146° F.
1 gallon at 212°F. j

Irrigated Crops.

119. About 11 acres of the farm are commanded by three wells. The land is black with a porous layer of white earth at a depth of 4 to 5 feet. The soil is not, therefore, of the most suitable description for growing irrigated crops. It is not, however, unsuitable, and will become more suitable as its condition is improved by applications of manure. A heavy crop of San *(Crotolaria juncea)* has been ploughed in as green manure and a heavy dressing of farm yard manure has been applied, the object being to improve the texture of the soil so that it will be suitable for almost any description of irrigated crop. For a year or two, green manure and farm yard manure will be the only kinds of manures used. Afterwards the comparative values of such concentrated manures as are within the reach of ordinary cultivators, will be fully tested on the numerous descriptions of garden crops so extensively grown in the neighbourhood of Surat.

Unsuitability of soil for irrigation. Means of improvement.

120. Sugarcane is an important crop in the district. There are 7 varieties grown near Surat. In the current season we have these under cultivation, side by side in fairly large areas and small plots. Some of these may prove to be useful introductions. Some of the irrigated crops which have been obtained from other parts of the Presidency and from Mauritius. Some of these may prove to be adopted.

121. In our irrigated area, in the current year, a few of the more important market garden crops of the district are being grown. The crops under trial are, Surans, ginger, turmeric, brinjals, chillies and yams, all of which are ordinarily successfully grown on land somewhat similar in consistence to ours. As the land improves, other irrigated crops can from time to time be grown and the effects of the various available concentrated manures thoroughly tested. Improved varieties can probably be introduced, and it can, at least, be demonstrated that the fungoid diseases and insect blights so common in irrigated crops can be prevented or held in check by well-timed treatment. A portion of the irrigated area will be under Guinea grass.

122. The irrigated area slopes to one corner, which lies a little low. Two rice beds have been dug out here, the situation being most favourable for rice cultivation.

Rice.

POONA FARM ACCOUNTS.

123. The appended balance sheet shows that the net cost to Government has been Us. 2,716 as compared with Rs. 1,853 in 1895-96. The income is unduly swelled this year by the enhanced value of grass from the Old Botanical Gardens, Ganeshkhind. On the other hand the abnormal character of the season caused more or less disaster to all arable crops, and there were no rabi crops except from a very small area irrigated by canal water the supply of which was deficient.

ESTABLISHMENT.

124. I have again to report good conscientious work by my Assistants Messrs Kelkar, Kanetkar and Kulkarni. The clerks at the Poona and Surat Farms' both Diplomates in Agriculture, take a full share in outdoor work and will, with training, be in time fitted for more important posts if they continue to show good work. I have been satisfied with the work of the Overseer at Manjri. He looks after the young cattle and supervises the cultivation operations in the experimental sugarcane.

I have the honour to be,
Sir,
Your most obedient servant,

J. W. MOLLISON,
Deputy Director of Agriculture,
Bombay Presidency.

TABLE I.

Balance Sheet, Poona Farm (Old Botanical Gardens, Ganeshkhind, includedJ 1896-97.

Receipts.	Es. a. p.	Rs. a. p.	Expenditure.	Es. a. p.	Es. a. p.
To Sale-proceeds of farm produce, 1896-97—					
Grains	190 7 5		By Assistant Superintendent's pay and horse allowance	1,320 0 0	
Fodder crops	1,795 0 2		„ Establishment's pay	568 6 11	
Vegetables	67 2 0				1,888 6 11
Fruits	10 0 0		„ Travelling allowance	.....	93 0 0
Sugarcane...	35 8 6		„ Stationery, serrice stamps, &c.	.....	93 5 9
Gul	137 10 3		„ Eent of land „...	.....	152 0 0
Miscellaneous	87 15 4		„ Farm labour and cost o£ upkeep of work cattle,	.....	2,519 11 8
		2,323 11 8	„ Skilled labour	.....	85 0 3
„ Value of produce of 1896-97 unsold <m 31st March 1897—			„ Purchase of manures	.....	22 4 3
A. Since sold —Grains	20 14 5		Do. seeds for sowing	.....	211 3 7
Vegetables	27 2 6		Do. dead stock	.....	155 2 6
Fodder	52 7 0		Do. furniture	.....	30 0 0
Oil	13 0 0		„ Miscellaneous outlays	.....	246 5 1
Miscellaneous *-.. ...	*2* 4 0		„ Petty improvements	.....	204 4 2
		115 11 11	„ Purchase of live stock	.....	200 0 0
B. On hand—Grains	24 12 3		„ Irrigation charges	.....	266 12 0
Cotton, ...	5 5 4		„ Net decrease in live stock	46 0 0	
Onions, &*c.*	65 15 11		Do. in dead stock	57 12 8	
		96 1 6			103 12 8
			„ Old Botanical Gardens, Ganeshkhind—		
„ Guinea-grass, Lucerne and Sugarcane — Value of growing crops and established plantations	.....	260 0 0	Wages for Overseer and Mális	746 5 7	
			Hay-making expenses	397 7 4	
„ Ganeshkhind Old Botanical Gardens —			Miscellaneous expenses	7 12 0	
Sale of mangoes	45 0 0		Irrigation charges	124 14 0	
Fuel	11 0 0				1,276 6 11
Grnss .., ...	1.979 6 0				
		2,035 6 0			
To balance, being net cost ...	.....	2,716 13 0			
Total ...	.....	7,547 11 9	Total ...	.....	7,547 11 9

TABLE II.

Dairy Balance Sheet for the year 1893-97.

Receipts.	Bs. a. p.	Amount. Rs. a. p.	Expenditure.	Rs. a. p.	Amount. Rs. a. p.
To Sale of milk and butter, the produce of farm cattle ...	17,043 4 10		By Overseer's pay } „ Herder's pay- } Stock Farm, Mânjri	180 0 0 217 8 0	397 8 0
„ Sale of milk tins and jars ...	14 8 0		„ Concentrated food bought	6,934 12 10	
„ „ live stock, &c. ...	249 11 6		„ Fodder bought	3,237 14 10	
„ „ manure	119 0 0		„ Rent of grass lands	2690 0	
		17,431 8 4	„ Hay-making expenses	1,061 11 11	11,494 7 7
„ Butter on hand on 31st March 1897. ...	.....	69 2 0	„ Labour...	2,777 11 5	
„ Fodder on hand	.....	946 0 1	„ Water-rate	36 0 0	
„ Increase in value of live stock. ...	.....	205 0 0	„ Cost of repair and incidental outlays for management of dairy and dairy herd	1,976 7 2	
			„ Purchase of dairy utensils, &c. ...	65 15 0	4,790 2 7
			„ „ of live stock	624 7 0	
					690 0 0
Total ...	.....	18,651 10 5	„ Butter on hand on 31st March 1896...	.....	415 •
To Balance being net cost ...	.....	385 7 3	„ By extraordinary expenditure— Improvements in the equipment of the dairy and wash-room	.....	1,219 0 0
Total ...	.....	19,037 1 8	Total ...	.....	19,037 1 8

TABLE III.

Balance Sheet of the Mânjri Sugarcane Experiments for 1896-97.

Receipts.	Rs. a. p.	Amount. Rs. a. p.	Expenditure.	Rs. a. p.	Amount. Rs. a. p.
			By Overseer's pay. ...	.....	180 0 0
To Sale of Gul. ...	.....	3,374 6 0	„ Labour.	1,165 13 1	
			„ Purchase of sugarcane sets ...	300 10 4	
Total ...	.....	3,374 6 0	„ Gul-making expenses ...	416 2 0	
			„ Purchase of dead stock ...	69 9 9	
To Balance being net cost ...	.....	1,035 6 9	„ „ of manures ...	1,897 1 4	
			„ Miscellaneous. ...	172 8 3	
			„ Irrigation charges. ...	408 0 0	
					4,229 12 9
Total ...	.....	4,409 12 9	Total ...	.....	4,409 12 9

TABLE 17.

Valuation Statement.

Description.	STOCK OK IIAKD OK 31ST MARCH 1890.		STOCK *OH* HAND oir 3181 MARCH 1897.		* Increase.	Decrease.	Remarks.
	Number.	Amount.	Number.	Amount.			
		Rs, a. p.		Rs. a. p.	Rs. a. p.	Es. a. p.	
Working bullocks	4	165 0 0	8	320 0 0	155 0 0	... ..	
Sheep.	4	165 0 0	8	320 0 0	155 0 0	... ..	) Net decrease
	3 43	745 0 0	94	244 0 0	.....	201 0 0	j Rs. 46.
Dead Stock —							
Farm implements	...	2,274 J2 2	...	2,202 7 1	.....	72 5 1	
Office furniture	...	354 12 0	...	160 4 5	14 8 5	.....	
	...	2,429 8 2	...	2,371 11 6	14 8 5	72 5 1	**Net decrease Rs. 57-12-3.**

TABLE V. .

Dairy Herd, 1896-97.

Description.	Strength on the 1st of April lbye.	IKCBKASB.			DBCREASI.				Strength on the let April 1897.	VALUATION.		Increase or Decrease during 1896-97.
		Purchased or transfer-red.	Born.	Total.	Sold.	Died.	Trans-ferred.	Total.		1896.	1897.	
Cows.												
tud bulls	5	4	...	4	.~	...	2	2	7	325	405	+ S0
Cows	26	11	...	11	1	...	3	4	33	1,645	$•15	+ 270
Htifers	2	8	...	8	...	...	3	3	7	90	260	+ 370
Cow calves	11	1	11	12	...	4	20	24	19	585	240	-345
Bull calves	26	...	16	16	2	5	9	16	26	355	345	—10
Total .	90	21	27	51	3	9	37	49	92	3,000	3,165	+ 165
Buffaloes,												
Bull buffaloes...	1 3	...	...	...	*..	...	...	...	3	180	170	—10
She buffaloes	51	13	...	13	1	2	34	37	47	4,190	4,080	-ISO
lltifers	5	12	...	12	...	1	...	1	36	175	613	+ 438
Mie buffaloe calves	32	..	17	23	...	13	17	30	25	4F5	227	—25S
Eull buffaloe calves	G	5	38	23	11	9	...	20	9	30	30	...
Total ...	97	36	35	71	12	25	31	68	100	5,060	5,100	+ 40
Dairy cart horses	2	M :	...	...	...	...	...	...	2	150	150	...

Review by the Acting Survey Commissioner and Director of Land Records and Agriculture, Bombay.

No. ^ OF 1897.

Poona, I7th July 1897.

Submitted to Government.

2. The quick-growing quality of Sundhia and its consequent value in a year of drought are worthy of particular attention. Enough is certainly demonstrated regarding this sorghum introduced from Egypt to justify a distribution of it to

3. The observations (paragraph 14) regarding satisfactory jowári crops on the farm lands are very suggestive. In the course of my famine tours the inferiority was conspicuously associated to well-irrigated but attributed to the difficulty of obtaining water when required and other causes not to the unfitness of the land for the particular crop. At the same time it is believed that the jowári crops grown on the lands commanded by the Nira Canal were on the whole equally satisfactory, whether they were taken in rotation with sugarcane or not. In the former they were grown must have been habituated to irrigation. We have the same defect in certain well-irrigated jowári crops in the Karmala taluka. The conclusion to be drawn is that the special advantage to jowári crops in the well over canal irrigation has not been demonstrated, and the ill-success of the crop where observed may be due to many causes which remain to be investigated, such as the succession in which it was taken, the character of the soil and, in such tracts as Uruwpur, often the sufficiency and timeliness of the supply of water.

4. It is satisfactory that the farm was called on to supply Guinea grass shoots. The experiments in the combined cultivation of Guinea grass and lucerne seem to show, as far as they have gone, that the mixed crop will yield better than either crop alone. But the results of further experiments must be awaited. The importance of growing lucerne in ridges ought to be made widely known.

5. The interesting paragraphs on the experiments with Egyptian cotton indicate the probability that Mr. Mollison is right in his conclusion that nothing more can be done in India with this variety of exotic cotton than with the others which have been tried. At the same time Mr. J. N. Tata, who has been supplying us with seed, and has shown much interest in the subject, is still sanguine of success. He was given an advance copy of Mr. Mollison's remarks, and in reply expressed his appreciation of the experiments, and readiness to supply us with more seed for the coming season. The Department has been fortunate in securing the co-operation of a gentleman of such known enterprize and intelligence as Mr. Tata. The Sachin State and its late Administrator, Mr. Seddon, should be thanked for their help in conducting one of the most thorough of these experiments. I am glad that they will be tried once more in a season which it is to be hoped will be, in the Deccan at least, more nearly normal.

6. The results of the experiments with til seed are interesting. They demonstrate the richness of the white variety in oil, the nutritiousness of the cake, and the inefficiency of the native oil press for the expression of oil. I have forwarded a copy of the report to Messrs. Mylne and Thompson, the inventors of the Behea sugar mill, to ask them whether they have given attention or can make any suggestions for the improvement of the ordinary oil mill, and inquiries will be made in other quarters with the same object.

7. The experiments with different varieties of sugarcane are very interesting. But as they are to be published at length in the joint report of Dr. Leather and Mr. Mollison, they need not be reviewed here. There is hope of valuable practical result in the ascertainment of the most productive varieties.

8. The bad season prevented the elephant's foot succeeding to the extent anticipated, and the fall in demand due to the exodus from Bombay due to plague

prevented the ready sale of some excellent vegetables grown on the farm. The cultivation of these crops, together with the enterprise and judgment shown in the selection of good varieties, was exceedingly creditable. At a time when at the Empress Gardens similar plots were dismal from weeds and untidiness, Mr. Kelkar's beds were like a new pin for trimness and cleanliness. One of not the least valuable things which Mr. Mollison has been doing has been the training of students, who have worked under him, into admirable practical workmen. He succeeds in imparting to them some of his own enthusiasm, and drills them into a promptitude and carefulness in attention to orders, and thoroughness in out-of^ door work that is not commonly attained,

9. The next section of the report deals with the special sugarcane expert ments at M&njri. This is the third year of the experiments, and has an interest of its own. as showing the behaviour of the crop in the ratoon stage, as compared with the first year's crop grown from sets. As originally indicated, these experiments will have to be continued for at least five years before conclusive results can be shown. The experiments with which the present report deals are of three classes, The first and principal class, to test the efficacy and cheapness of various manures, the second, to test the number of years during which cane can profitably be ratooned, and the third, to ascertain the most effectual and economical system of irrigation. Under the first series there are already indications that the economy and efficiency of edible oilcakes as a manure for sugarcane will be demonstrated. In the third series also the conclusion is foreshadowed that the timeliness, still more than the quantity of water supplied, is the foremost desideratum in the irrigation of sugarcane. The complete establishment of the conclusion that frequent waterings will enable a crop to do well on a small supply may entail important alterations of practice, both in the Irrigation Department, and among cultivators.

10. The experiments with Mauritius cane show that the percentage of Gul and sugar in the ratoon crop approach more nearly to the percentages in the best local varieties than had been expected from the great differences found in the new canes of the two species. Before, however, any final conclusions are drawn, further experiments must be awaited,

11. The unfavourable financial results of the farm and dairy are of course due to the difficulties of the year finder report. The dairy would certainly have shown a heavy loss but for the admirable foresight shown by Mr. Mollison in his arrangements for fodder, the supplies of which were so ample that no purchase from outside was required after fodder had become dear. It is to be noted also that, despite the scarcity, the price of milk and butter supplied to the hospitals was not raised; as perhaps in strict justice it might have been, if it had been desired to show a brilliant book result in the farm accounts, But as the transactions really involve little else than a book transfer between two Government departments, it was not thought worth while to do tKis.

12. The experiments at Mtfnjri cost Rs, 1,105. As Mr. Mollison remarks, it is inevitable tbat some cost should be incurred. The deliberate cultivation of some plots with manures, or after methods, the profitableness of which is most uncertain, and the extra arrangements required to secure uniformity and exactitude in the carrying out of the numberless details and specialities of experimental work, make it inevitable that the expenditure should largely exceed that which would be incurred by an ordinary cultivator.

13. The value of the dairy has often been alluded to as an example, and as the origin of a new industry in India. The slower work of improving the milking powers of suitable breeds is being steadily carried on. Some time must necessarily elapse before the Government farm can announce, as it hopes to do$_3$ the appearance of " record " milkers. Mr. Mollison indeed believes that but for the carrying off of the selected cows in calf by rinderpest, we might already have made our mark, and I am sanguine that we shall do so before long. An extended scope for the improvement of milch cattle is being created at Surat, where the nucleus of the dairy herd is composed of the Gir cows kept up to the present at Poona.

14. The report in its last section describes fully the scheme of experiments introduced on the Surat Farm, which came under the control of the Depart-

ment and the Superintendent in April 1896. There are the following series of experiments :—

I. *Manurial, on dry crop.* The chief object being to ascertain the best rotation for the cotton and jowári crops which form the staple of the black-soil tracts of southern Gujarát. The present rotation of jowdri after cotton is suspected of being defective.

II. *The improvement of staple crops by selection of seed.*—This, in my opinion, is one of the chief practical benefits which can be conferred by a Governmeut farm. The crops selected are jowari, cotton and til. In the case o£ cotton, the end in view will be to establish a variety of long and ttllty Staples but oi sufficient hardiness and adaptability to the soils and climate of the country to pay the cultivator to grow it* The attempts to get the finer cottons grown in India have hitherto consisted of the introduction of exotics, chiefly American and Egyptian. These attempts have failed simply because the plant deteriorates, and yield is not sufficient to pay the cultivator. Thus the general experience, (with however notable excep* tions, as in the case of sugarcane,) shows that exotic crops are unlikely to pay in India better than exotic cattle, and improvement is expected from selection rather than from importation.

The remarkable superiority of white til over the other varieties, which was discovered to exist on the Poona Farm, shows that there may be a great deal to be done with this crop by selection.

The cultivation of these crops in succession will give an opportunity of testing on a large scale a rotation recently introduced into the district.

III. *A large variety of fodder crops* are to be grown in order to discover the most prolific and best adapted for the country.

IV. *Experiments in pickling and immunising seed against attacks by fungoid pests.*—A particularly interesting experiment will be with seed steeped in hot water, a method which, if it prove effectual, as is expected with some confidence, will commend itself to the rayat for its simplicity.

V. The *irrigable area* is being utilised for sugarcane, market garden crops, and rice. In the case of sugarcane the aim will be to discover the best varieties on the same lines as at Poona.

15. Mr. Mollison's supervision of the farms and experiments has been as usual most intelligent and thorough, and the results are presented in a full and interesting report. The Assistant Superintendents and establishments, too, have worked quite satisfactorily.

J. W. P. MUIR-MACKENZIE,
Acting Survey Commissioner and Director,
Land Records and Agriculture.