

ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

BOMBAY PRESIDENCY



FOR THE YEAR 1918-19

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No. 12628 of 1919.

From

DR. HAROLD H. MANN, D. Sc.,
Acting Director of Agriculture, Bombay,

Poona;

To

THE CHIEF SECRETARY TO GOVERNMENT,
Revenue Department,

Bombay.

Poona, 11th October 1919.

Sir

I have the honour to submit herewith the Annual Report of the Agricultural Department for the year 1918-19.

CHAPTER I.

ADMINISTRATION.

2. During the year the expenditure of the Department amounted to Rs. 12,57,000* against Rs. 9,90,000* during the year 1917-18. The increase in expenditure was mostly due to the occurrence of severe famine, and also to expenditure in connection with the scheme for the increase in food production during the year. An account of the activities of the Department in these directions is shown below. The above total also includes expenditure allotted by the Government of India in 1917 from the profits of its wheat operations and amounting during the year to Rs. 15,830 as follows:—Rs. 10,500 spent on potato-growing and storing investigation, Rs. 1,780 on a dairy at Sukkur in Sind, Rs. 3,250 on the Veshvi Agricultural School, and Rs. 200 on experiments on making *gul* from the toddy palm. The receipts went up from Rs. 2,01,000 to Rs. 2,86,650 being a rise of Rs. 85,650. So that the net cost of the Department was Rs. 9,70,350 as against Rs. 7,89,000 in the previous year.

The permanent advance of Rs. 50,000 made by Government for financing quasi-commercial transaction was in full use during the year, and is being employed more and more by the officers of the department, chiefly in connection with propaganda work, and also with the putting down of bores for water, and the establishment of pumping plants. The following table shows the extent to which this provision has been used in the last five years:—

Year.	Advances on April 1st.	Fresh advances in the year.	Total.	Recoveries during the year.
	Rs.	Rs.	Rs.	Rs.
1914-15	13,807	49,007	62,814	36,591
1915-16	26,223	47,665	73,888	47,368
1916-17	26,520	43,174	69,694	38,171
1917-18	31,523	35,943	67,466	30,373
1918-19	37,093	88,213	75,306	35,756
1919-20	39,550			

Grants were received from the Sir Sassoon David Trust Fund during the year, amounting to Rs. 28,000. These grants were made for the following purposes:—

(1) Scholarships at the six Vernacular Agricultural Schools.	Rs. 3,000
(2) Building grant for the Lord Willingdon Vernacular Agricultural School, Veshvi (Alibag) ...	10,000
(3) Building silos for fodder storage ...	5,000
(4) Development of sugarcane industry on new canals ...	10,000
	<u>28,000</u>

* Figures as communicated by the Accountant General. The figures in the last year's report were arrived at from the Departmental registers.

3. Three of the four Deputy Directors, Messrs. Henderson, Gilbert and Gonehalli were absent throughout the year, and Mr. Main, the only one of the permanent Deputy Directors who remained, went on six months' leave in May 1919. Dr. Burns, Economic Botanist was on military duty till January 6th, 1919, and went on leave for the remainder of the year a few days afterwards. Mr. Schutte, the Agricultural Engineer, devoted a great deal of his time in the early part of the year to work for the Munitions Board as Deputy Controller of Agricultural Requirements, Mesopotamia (August 13th, 1918 to February 28th, 1919) and went on leave on April 26th, 1919. I myself took charge of the work of the Director of Agriculture on November 25th, 1918, Mr. Knight taking my place as Principal of the Agricultural College. So that nearly all the senior staff of the department were away from their usual work during the whole or part of the year. This has much handicapped the operations of the department, though the officers who acted in their places have worked with enthusiasm and success. The acting arrangements have been as follows:—

Office.	Permanent Holder.	Acting Officer.
Director of Agriculture.	Mr. G. F. Keatinge, C.I.E., I. C. S.	Dr. H. H. Mann.
Work done by Deputy Directors of Agriculture.	Mr. T. F. Main, B. Sc.	Mr. Gul Mahomed.
	Mr. G. S. Henderson, B. Sc.	Mr. P. C. Patil, L. Ag.
	Mr. T. Gilbert, B. Sc.	Rao Saheb M. L. Kulkarni.
	Mr. V. H. Gonehalli, M. A. (Cantab.)	Mr. V. G. Gokhale, L. Ag.
Principal, Poona Agricultural College.	Dr. H. H. Mann, D. Sc.	Mr. J. B. Knight, M. Sc.
Agricultural Chemist.	Dr. H. H. Mann, D. Sc.	Mr. D. L. Sahasrabudhe, B. Sc. (from June 1, 1919).
Economic Botanist.	Dr. W. Burns, D. Sc.	Mr. S. L. Ajrekar, B. A.
Agricultural Engineer.	Mr. W. M. Schutte.	Mr. G. Thiselton-Dyer, M.A., A.M.I.C.E.

Mr. J. B. Knight, M.Sc., remained as Professor of Agriculture and Mr. H. M. Chibber, M.A., as Plant Breeding Expert to Government throughout the year, the latter being admitted into the Imperial Agricultural Service from January 1st, 1919.

The following new positions were sanctioned during the year:—

- Deputy Director of Agriculture for Gujarat.—To this position Mr. Bhimbhai M. Desai, one of our most experienced workers in that division, was appointed from 1st April, 1919.
- Deputy Director of Animal Breeding.—To this position Mr. E. J. Bruen was appointed, but he did not take charge till after the end of the year under report.
- Inspector of Agricultural Schools.—Mr. K. M. Pawar, B. Ag., the most experienced of our head masters, took charge of the duties of this position on June 5th, 1919.

4. In November 1918 the Director of Agriculture ceased to control the Co-operative Department, the Civil Veterinary Department and the Bombay Veterinary College, all of which now report direct to Government. This has allowed a greater concentration of attention on the work of the agricultural department proper.

CHAPTER II.

FOOD PRODUCTION AND FAMINE.

5. The work of the agricultural department during the year under report was dominated (1) by the general shortage of food in the world in 1918,

leading to the formation of the Food-production Committee in June, and its activities during the rest of the year, and (2) by the long, almost unprecedented, drought resulting in very severe famine both of food and fodder from September 1918 to the end of the year under report. It has been necessary to divert a good deal of the energy of the department from its normal channels into the work of dealing with these two great needs.

6. The Food-production Committee was formed in connection with the War Purposes Board in June 1918 with the Honourable Mr. G. F. Keatinge as Chairman. The whole of the correspondence in connection with the work of this committee was done in the office of the Director of Agriculture, and so far as it was effective a great deal of the execution of its resolutions were carried out by the agency of the officers of the agricultural department. From the point of view of this department the most important work recommended by the Committee and approved by Government was (1) the distribution of concentrated manures for the wheat and jowari crops at somewhat below cost price, (2) the stimulation of the full use of irrigation wells in villages where they exist, (3) the recommendation of the extensive growing of food crops instead of other crops like cotton where the area of the latter is very high. The district staff of the Agricultural Department entered with energy into the work represented by these resolutions, but the long and unexpected drought, together with the terrible scourge of influenza in September and October 1918 made the efforts less effective than they would otherwise have been. It was quickly evident indeed that the distribution of concentrated manures including oil-cakes would have to be confined to irrigated lands in most of the province, that nearly all usable wells would be used, and that the growing of food or fodder crops where possible would need little stimulation. But in spite of the difficulties the use of concentrated manures and particularly of oil-cake was introduced with much success on rabi crops—particularly *rabi Jowar* and *khapli* wheat. In some tracts, as a result, a demand has sprung up for such manures, and will probably be permanent. The most successful efforts were undoubtedly in the Deccan canal and other irrigated areas, where oil-cake manures to the following amounts were distributed :—

	Rs.
Central Division	14,231
Southern Division	730
Khandesh and Sholapur Districts	3,141

7. But all efforts devoted to production of larger quantities of food than usual were soon diverted to the production of food and fodder crops in sufficient quantity to keep men and animals alive, as a result of the long continued drought. By the middle of July the situation on account of failure of the monsoon became threatening and by the end of August it became evident that the *khari*f crop had failed over a great part of the area. Everything then depended on the arrival of the September and October rains in good amount. These failed, however, almost everywhere, and it became evident that a serious famine must result. Except in lower Gujarat, and to a less extent in Khandesh and in Sholapur, the season was unsatisfactory, and it was clear that the other activities of the department must be considered as secondary, and all possible strength concentrated in doing what lay in its power to meet the situation. Almost all the officers of the department fully realised this and devoted themselves heart and soul to carrying out the lines of work decided upon.

8. The first of these lines of work was to lend out all the pumps and engines belonging to the department for irrigation purposes for growing fodder crops, and to arrange as far as possible, that existing installations were fully utilised. Beyond this, Government made a special grant of Rs. 92,434 for the purchase of additional pumping sets for famine purpose and for working of all the pumping sets and made provision (Rs. 1,12,963) for four special installations respectively in the Narbada (two installations), Godavari and Krishna Rivers to be worked by the agricultural department on a system of sharing the fodder produce with the cultivators. The Nangaon plant (Poona District) (which has been rather a white elephant for some years) was this season worked day and night and irrigated 411 acres. The pumping installations managed by the department through the famine numbered twenty and were as follows :—

1. Shirol, Khed, Poona.
2. Bhambora, Karjat, Ahmednagar.
3. Nangson, Dhond, Poona.
4. Agarkhed, Indi, Bijapur.
5. (Bhide) Vadgaon, Haveli, Poona.
6. (Athavale) Bibyachiwadi, Haveli, Poona.
7. Modibag, Bhamburda, Poona.
8. Dapuri, Haveli, Poona.
9. Chinchwad, Haveli, Poona.
10. Malegaon, Nasik.
11. Nasrapur, Poona.
12. Patas, Poona.
13. Manjri, Haveli, Poona.
14. Rajewadi, Bhore, Satara.
15. Umbergaon, Thana.
16. Hiroj, Sholapur.
17. Retra, Karhad, Satara.
18. Gondegaon, Niphad, Nasik.
19. Zadeshwar, Broach.
20. Nikora, Broach.

On the whole about two thousand acres of fodder crops were irrigated and produced about two crores of pounds of green fodder which would not otherwise have existed or enough to keep seven or eight thousand head of cattle through the whole of the famine. The disappointing thing about a number of these pumping installations was the unreadiness of the cultivators to take full advantage of the water when available. Some sets of plant (as for instance at Bhambora on the Bhima in the Ahmednagar District) worked to far less than their full capacity. This is probably due largely to the unusualness of the offer made, and I anticipate that when a famine occurs again and the same facilities are available, every drop of water that can be used will be employed for irrigation. The exact cost of green fodder produced is available on four of these pumping installations and is as follows excluding the cost of the engines, interest and depreciation.

Place installed.	Yield per acre of green fodder.	AREA	Yield	*Total cost per 1,000 lbs. fodder.	Total cost per 1,000 lbs. of Government share of fodder.
		Cost for pumping per 1,000 lbs. fodder.	per 1,000 lbs. fodder.		
	Lb.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Broach (Narbada) ...	12,500	3 11 0	10 1 0	15 2 0	15 2 0
Nikora (Narbada) ...	7,525	10 2 0	17 9 0	35 2 0	35 2 0
Gondegaon (Godavari).	9,166	1 7 0	5 7 0	10 14 0	10 14 0
Retra (Krishna) ...	8,000	9 9 0	15 4 0	30 8 0	30 8 0

At Retra and to a less extent, at Nikora, the engines employed, brought in a hurry, were not very efficient, but taking the other cases the cost of pumping was very low. This experiment shows what can be done even in an emergency. The weak point was that at the beginning of the famine suitable sites for pumping were not known to anyone, the matter was rushed on the cultivators in a hurry and that the machinery had to be purchased when prices were very high indeed and when all available was second hand. If only a regular survey of the rivers is made and suitable sites fixed beforehand, the cultivators educated to the use of water and to the arrangements which would be proposed, and engines and pumps rushed to those spots in November of a famine year, instead of in February, March and April as in the past season, the success of the method of producing large quantities of the best type of cheap fodder would be assured. Under these circumstances two crops could be produced between November and the following June and would be invaluable.

9. The second line of work, on which attention was concentrated on famine account, was that of shallow boring. All the boring machines belonging to department even though they were old and had previously been almost scrapped were got out and concentrated as far as possible in those famine districts where bores have given the best results in supplementing the water-supply in wells. It may at once be said that up to the present in all our experience the best results have been obtained in Upper Gujarat and in the Thana District. In the Deccan and Karnatak while water sufficient for domestic purposes can generally be obtained on a well selected site, the amount tapped by boring to greater depth than those reached by an ordinary well is not usually sufficient for irrigation. For the reason the machines were concentrated during the famine in the districts where it was

* This excludes the cost of land and labour, which the cultivators gave in exchange for one-third or one-half of the crop in different cases.

practically certain that water could be obtained. Two hundred and thirty-nine bores were made during the year. Of these one hundred and fifty-six were successful, success being considered to have been reached when five hundred gallons per hour in sand or two hundred gallons per hour in rock boring have been yielded by the bore. Of the bores completed, 85.6 per cent. were successful in Gujarat, and 89 per cent. in Thana. No boring was done in Sind, owing to the necessity of concentration in the famine areas. The 156 successful bores yielded an aggregate of 3,35,000 gallons of water per hour from the bore in the dry season, or enough to irrigate between five and six hundred acres of fodder crops through the hot weather. The average yield of water for each successful bore is shown below :—

	Yield per successful bore,
Upper Gujarat	2,778 gallons per hour.
Thana	1,577 " "
Kolaba	1,475 " "
Ratnagiri	747 " "
Dharwar	252 " "
Bijapur	600 " "
Belgaum	250 " "

The value of boring for agricultural purposes thus differs widely in the different parts of the Presidency, and it is only occasionally that one of the shallow bores (to 200 feet) that we make gives an amount of water of real value for agriculture in the Deccan or Karnatak.

10. The recent famine has been pre-eminently a famine of fodder and hence it was quickly obvious that any new and unusual resources in the way of fodder should be utilised as far as possible. The most important of these was prickly pear, which had been used as fodder at Dhond for a number of years by Rev. A. Norton and had been successfully fed to animals on a large scale in the Ahmednagar Famine of 1912. Based on that experience, and on the careful results recorded at that time by Mr. Horne (Bulletin of the Bombay Department of Agriculture No. 58 of 1913) the Collector of Ahmednagar and the Revenue Officers in Poona commenced using the fodder in large quantities. The real success of its use in the present famine has however depended on the abandonment of any kind of lamp for burning the thorn from the fodder and the substitution of the ordinary blacksmith's forge for the purpose, which was suggested by the Agricultural Department in December and came into general use in the succeeding months. The new fodder was at first unpopular and rightly so, for if not used with care, the animals are injured and die. But with greater experience, these difficulties were overcome and at one time there were 40,000 cattle living on prickly pear in the Ahmednagar District alone. At the end it became so popular that if a forge for the preparation of the fodder were put down in a famine tract, a demand for thousands of pounds per day would rise at once, as we found that it could be prepared and sold at five annas per one hundred pounds. Much help was given throughout to district officers by supplying burning apparatus, by keeping it in repair, and by keeping for three months a continuous training school for men intended to prepare the prickly pear for use. The whole experience as regards prickly pear as a fodder is being put together as a bulletin of the agricultural department and will shortly be issued. In Gujarat the fodder supply was supplemented by 17 lakhs lbs. of good fodder much better than the coarse forest grass, by the chaffing of jowar stubbles left in the fields in the coast talukas of the Surat District which would otherwise have been wasted. The stubbles were chaffed by power chaff cutters set up at four places on the Railway line and sent to other parts of Gujarat. The scheme sanctioned for the purpose by Government proved successful but owing to long railway transport and heavy packing charges of double gunny bags on account of the voluminous nature of the fodder it did not pay its way.

Many other unusual fodders were used by the people during the recent famine as has always been the case in similar visitation. It would require almost a book to give even a list of these, but among new materials I may

mention the very successful use of the sliced stalks of the plantain (Banana) plant, which have been fed to buffaloes and bullocks with great success, up to an amount of 35 pounds per day per head.

11. The next line of famine activity was the extensive stimulation of the production of fodder during the famine. The various Collectors at my suggestion, gave special facilities for the cultivation of river beds where the moisture was sufficient to produce a fodder crop. Large quantities of fodder seed for use in the cold and hot weather, chiefly maize, sundhia jowar, hundi and kalbondi jowar, etc., were purchased and distributed to cultivators with wells. The sale was made much easier by concession of 25 per cent. of the price given by the Bombay Famine Relief Committee for seed purchased through the Agricultural Department. No less than 68,500 pounds of such seed were distributed in the Central Division and 1,66,000 pounds in Gujarat. In many of our districts the activities so far described absorbed almost the whole of the time and energy of the district staff.

12. In spite of all that was being done to save cattle, it became evident that there were a large number of good cattle, which would die if they were not actually purchased from the cultivators, kept during the famine, and resold after the famine was over. In order to see whether it was possible to save these cattle without serious financial loss an experiment was carried out under Professor Knight, to purchase such cattle outright, keep them in camps and sell them when fodder again became available. 1,046 cattle were purchased in a starving condition. Many of them could hardly walk. These were restored to health and condition, being fed after the first few days on a ration consisting of 80 per cent. of prickly pear, a little dry fodder, and a small quantity of cotton seed. They have now all been sold to cultivators and no loss is anticipated to Government on the whole scheme.

13. In the early stages of the famine it became probable that when the rains came a serious shortage of certain kinds of seed would occur, and in some cases it seemed likely that valuable strains of seed would die out, particularly of rice, bajri, jowar, wheat, potatoes, etc. Government made therefore special grants amounting in all to Rs. 1,66,000 for the purchase and storage of such seed. These stores have formed a most valuable resource, and will be wholly distributed in the present *Kharif* and *Rabi* seasons. I must particularly call attention to the value of the work in the case of potatoes, where about two thirds of the acreage grown in the Poona District in the *Kharif* season of 1919 has been planted with seed stored by the Agricultural Department; otherwise the crop (as the same variety cannot now be imported from Italy) would almost have disappeared.

14. In order to make cultivation possible in the absence of cattle, the steam plough belonging to the Agricultural Department was made available in the Ahmednagar District during April and May, but was not much welcomed by the cultivators as an implement for ordinary cultivation. A Moghul tractor was also purchased, and did good work on a limited scale. In anticipation of a serious difficulty in getting the land cultivated in the *Kharif* season, a large number of implements to be worked by hand, on the lines of those suggested by Mr. Mollison after the last big famine, were prepared and their use extensively demonstrated in the famine districts, before the beginning of the monsoon. They were not however widely adopted and on the whole, it is astonishing how, in spite of the very great mortality among cattle, the cultivators have been able to get their crops into the ground this year with comparatively little delay.

15. On the whole, the experience of the recent famine indicates what a great deal can be done on the agricultural side both before the famine and in its early stages to minimise the very great loss of cattle, and to increase production in spite of the long drought. This year we were largely unprepared but it is hoped that measures may be taken in the immediate future which will not only mitigate the effects of a famine, but also enable us to utilise the small amount of rain that falls in a famine year to much greater advantage than is done at present.

CHAPTER III.

CROPS.

16. Of the very many investigations on the improvement of crops and their cultivation on hand, it will be only possible to refer to a few in which progress has reached a definite point during the past year. The first of these is *cotton*, always one of the principal objects of investigation in Bombay. At the present time as the result of many years of work, it may be stated that the following is the position.

In the Bombay Karnatak, we have succeeded in breeding two or three types of Kumpta cotton which possess qualities raising them considerably above the ordinary Kumpta cotton in use both from the point of view of the cultivators and of the trade. One of these in particular, which we term Dharwar No. 1, has now been produced in quantity sufficient to plant 5,000 acres, and its further extension will take place by its own merits. It gives an increased yield over ordinary Kumpta cotton of nearly 10 per cent., its ginning percentage is higher by 2 per cent., and the quality of the cotton was reported on by the experts of the Cotton Contracts Board, Bombay, this year as follows:—

“The sample in spite of some ‘neppiness’ and want of silkness is a very excellent cotton, which if it continues to maintain its present characteristics and its superiority in yield should have a great future before it.”

The general cultivation of this type of cotton in the Kumpta growing districts of the Bombay Presidency would mean, I calculate, an increase in value of Rs. 26 lakhs per annum on the crops grown and I hope that this consumation will be reached in a very few years. Further selection is being carried on each year, and so the quality will at least be maintained if not improved. Other promising strains of Kumpta cotton are also in hand, and may replace the one already mentioned in certain areas. An improved Dharwar American cotton has also been obtained by selection, and will be available next year in sufficient quantity to plant 5,000 acres likewise and a pure selected Cambodia cotton seed will be similarly at the service of the cultivators to an equal extent in two years' time. We can, therefore, see as the result of our efforts in the near future, a position in which the whole of the Bombay Karnatak cotton tracts can be supplied with strains of pure, high yielding, high ginning cotton of staple above the average,—whether the conditions suit best the growing of Kumpta, Dharwar American or Cambodia cotton. The spreading of these improved types will be done largely, in association with co-operative societies and a scheme is now before Government which will allow of the organisation of this on a larger scale than hitherto.

In Khandesh and the adjoining tracts where “Neglectum” cottons are grown, little fresh investigation has been undertaken and energy has been chiefly devoted to the maintenance and extension of the so-called ‘N.R.’ cotton produced by the agricultural department, which has become so exceedingly popular all over Khandesh. Our seed farms at Jalgaon and Dhulia can only produce a limited quantity of the seed, but we have now 29 registered seed growers who multiply the seed from our farms, and this work is now taken up largely by co-operative seed societies. The present year shows 900 acres under cotton grown essentially for seed, which will produce seed capable of sowing 20,000 acres next year,—and if all is used for the purpose, our seed would cover the country in three or four years. This season the demand for farm seed was far beyond our power to supply and the rates the people are likely to pay are considerably higher than that for other seed. I think, however, that we can go much further yet in the improvement of Khandesh cotton and I intend that vigorous efforts at further selections shall be continued and extended, so that we may get a strain which shall combine higher quality with the high yield and high ginning percentage of the N. R. cotton.

In lower Gujarat—Surat and Broach—the cotton position has been going from bad to worse, and the original Broach staple, one of the best in India, has been very rapidly swamped by other types of much inferior quality, but of higher ginning percentage. This reached such an alarming stage in 1918 that

it was evident that something must be done. In parts of Surat and Broach, more than 80 per cent. of the plants in the fields were in some places of the inferior 'Ghogari' type. In the meantime, we had succeeded in selecting and maintaining partly on our farms and partly in two or three groups of villages, pure and improved types of cotton suitable on the one hand, for the Navasari, and on the other, for the Surat areas. In fact, except for a few cultivators, the Agricultural department were at the beginning of the present year the only holders of any considerable quantity of pure Gujarat staple seed. The extremely unsatisfactory character of the last year's cotton from these districts, due to the drought in addition to the impurities, had alarmed the trade and the latter has willingly co-operated with us in an attempt to retrieve the situation. A committee of the trade and the agricultural department has been formed in Surat, and the pure improved seed has been now distributed in five groups of villages to the extent of about 6,000 acres. This has been made possible by the special appointment by Government of a Cotton Superintendent and assistants to distribute the seed, examine the fields at every stage, and finally to supervise the harvesting and ginning. The trade committee's co-operation will be essential when the sale of the *kapas* and its ginning comes on. By the means now in use, we hope to have pure selected seeds for 60,000 to 70,000 acres in hand next year. In the meantime selection is being continued, and Mr. M. L. Patil, who is in charge of the work, hopes to have a selection better than that now in use, to distribute on a small scale in the Surat area either in 1920 or in 1921.

In Broach itself the selections so far made have not been good enough to distribute on a large scale, but work is being continued. In Northern Gujarat little work has, as yet, been undertaken.

In Sind experiments with American cotton were in progress. Comparative tests of old Triumph and Punjab F. 4—two of the four varieties of American cotton were made on a fairly large scale on the Mirpurkhas Seed Farm and the latter was found to yield better than the former. Owing to the favourable season none of the American cottons developed red leaf blight but in a year favourable to this disease like the one of 1917-18 F.-4 showed remarkable resistance to red leaf blight to which Triumph fell an easy prey. 62,000 lbs. of F.-4 cotton seed have been given out for sowing to cultivators on the Jamrao Canal and in North Sind. Work with the isolation of superior strains from Deshi or Bhilsah cotton has sufficiently progressed to enable comparative tests of the four principal types found in it being made on a field scale in 1919-20.

17. *Sugarcane* is the crop to which, next to cotton the greatest attention has been devoted. But the work done in the year under report has been small, owing to the famine which forced us to convert a large part of our principal centre (Manjri Farm) into a fodder growing farm for the time being. This farm has however become a recognised centre for experimental work all over Western India, and the home of the latest and most improved methods for use in the Deccan tracts. During the present year an account of three years' work on the Manjri Farm has been issued. It shows how new varieties of cane of great promise have been evolved or tested there, how far more economical methods of cultivation and manuring have been found than those normally in use. These more economical methods lead to a saving of expenditure of Rs. 100 per acre and if these were universally used with the cane grown on the Deccan canals would mean a saving of Rs. 28 lakhs per annum to the cultivators without loss in yield or quality. The methods now worked out for green manuring cane with san-hemp promise to lead to a further great saving in cost of production. The use of sulphate of ammonia for topdressing cane is spreading, and it only needs more local demonstration centres in the various canals and other sugarcane growing areas to make the new methods rapidly become absolutely general.

We have such local demonstration centres at Saval-vahir near Kopergaon on the Godavari Canal, at Arbhavi on the Gokak Canal, and a small station near Amalsad in lower Gujarat. In these the methods worked out at Manjri, with such modifications as are necessary to make them suitable in other places, are used and occasional experiments in other directions are undertaken. At Saval-vahir the Manjri farm methods have been brilliantly successful and our crop was the

best in the valley though produced at Rs. 94 per acre, otherwise have been the case. grown by the cultivators. Here the Java method, however, prepared there, of which minimum amount of water promises to be very possible to increase this farm likely to be waterlogged. In the Konkan, where cultivation are not nearly so advanced, the principal most suitable varieties and to ascertain to what extent taken up in tracts which high manuring. Striped Mauritius cane has great value and a scarcity of any kind concentrated manures can now be and is recommended that splendid silage can be

In Sind sugarcane was under trial on the Sukkur method. The former comparative tests were made with striped Mauritius. Now, it is a matter of Lahoni, a local variety, on the Poona method. The first trial, and the Sassoon and yielded well and were found suitable for *gur* making. A grant of Rs. 5,000 quality the canes from stalks (roots) were equal to those from Mauritius demonstrate the use liability to borer attacks further trials are required. On the rapid in the near Mauritius sown in March was badly affected by borer and it the date of sowing to see if the borer attack can be avoided.

18. *Rice*.—Work on the improvement of rice crop and the control of the has been carried out for a number of years, and has resulted in the work has been understanding of the meaning of the process of *rab*, and dealing with successful *rab* substitutes. It is now moreover clear that if *rab* materials are deficient, the same result can be obtained by adding a small quantity of manure or sulphate of ammonia to the *rabbed* seed beds, a discussion of the results as have promises to be of great importance where *rab* materials are deficient. Green manuring with *san*-hemp promises to be very important and valuable on poorer lateritic soils of Ratnagiri, though not yielding such good results as the richer lands of Kolaba. The use of green leaves as manure to the rice crop has proved very successful all over, and well selected concentrated manures almost uniformly pay on rice in the Konkan. At Kumta, where those are not used, an application of bone meal or of fish manure has increased the yield of rice by 100 per cent. at once, and this undoubtedly offers a great chance of increasing the profit to the cultivators of that district.

The problems of rice are, however, so different from those of other crops, and we have had so many disappointments with it, that it was decided this year to start a regular rice research station for the closer study of the rice plant and its problems. This has been placed at Karjat in the Kolaba district, and if the situation proves suitable, proposals will be made for making it a regular centre for this work, at any rate for a term of years. At this centre, also, has been located the work of the Plant Breeding Expert on the development and selection of new and improved strains of rice. He has selected the *kolumba* rice of the cultivators as the chief basis for his work, and already there is promise that from this he will be able to obtain much higher yielding strains than the mixture at present in use.

19. *Wheat*.—The Plant Breeding Expert appointed at the end of 1917 has decided to devote his principal attention to work on rice and wheat. So far as wheat is concerned he has only made a start, but he proposes to base his work on selection from the wheats now grown in the Deccan, for the Pusa selections, so successful in North India, do not seem to be suitable for Peninsular India.

In Sind, where the introduction of improved wheats forms one of the chief activities of the Agricultural department, a large seed farm for the maintenance of the best types is being established in Upper Sind. So far several of these types of wheat, imported from Northern India, have done very well indeed. Both 'Pusa 12' and 'Punjab 11' have very great promise. The Deputy Director reports that in Upper Sind Pusa 12 is fast gaining in popularity, largely because of its ripening earlier than the local wheat. 'Punjab 11' is hardy enough to thrive on a poor soil provided three or four waterings are given to the standing crops, and, being awned, is not much subject to attack by birds. Work on the isolation of the better strains from the local Sind wheats is proceeding.

20. *Potatoes*.—A good deal of concentrated work has been done on potatoes, chiefly in the northern part of the Poona district, during the last three or four years, partly as a result of a special grant from the Government of India;

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of a Bombay business house,—the Union it was evident that something more than 80 per cent. of the more of the inferior 'Ghogari' type ing and maintaining partly on villages, pure and improved Navasari, and on the other, for cultivators, the Agricultural year the only holders of any The extremely unsatisfactory districts, due to the drought and the latter has willingly situation. A committee been formed in Surat, of five groups of villages and assistants to distribute finally to supervise co-operation will be By the means now 70,000 acres in hand and Mr. M. L. Pat

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Fodder Crops and Fodder Grasses.—Fodder crops have had special either best during the present year, on account of the famine, but most of the In has consisted in trying to grow as large crops as possible for the special occasion. In fact the yields of fodder which can be obtained are very much higher than is usually considered good. At Surat, for instance, no less than 49,000 lbs. of green jowar fodder per acre were obtained in two crops. The crops of maize grown at the Manjri farm must have been equally good.

So far as new fodder crops are concerned, I may refer to *marvel* grass (*Andropogon annulatus*) which promises to have a great future in Western India, to *para* grass (*Panicum muticum*) which promises to prove very suitable for water-logged situations, and to the elephant grass (*Pennisetum purpureum*) from South Africa which shows signs of being a very large yielder. *Shevri* (*Sesbania aegyptiaca*), a leguminous fodder plant commonly used in the Deccan, has now been proved at Manjri to be capable of giving very large yields when cut much lower than is usually the case. It will, I think, when used according to the new method, be a distinct increase to our fodder resources. I hope to publish a bulletin on this matter during the coming year.

I must not omit to mention that *berseem* is now thoroughly established as a fodder crop in Sind, and the average yield on the Sukkur farm has been 43,000 lbs. of green fodder per acre in the season. Sown in September, it yields six cuttings by the May following. It grows very well everywhere in Sind where it has been tried and where water is available, and the conditions for success are described in a bulletin on the subject (Bulletin No. 91 of 1919) issued during the year. This crop is under experiment in the Presidency proper, with some promise of future use.

The Economic Botanist and his assistants have been for a number of years studying the fodder grasses of the Deccan, and particularly of the shallower lands, with a view to getting grasses which can be spread widely over such lands to improve their grazing value. A mixture of grasses has now been obtained by means of which splendid crops of grass can be grown, and the spear grass eliminated from such areas. An account of this work will, if all is well, be published in the coming year.

While dealing with fodder crops, I may refer to the fodder growing and storage operations at Kopergaon. There we have a hundred acres of land exclusively devoted to the growing of fodder crops and a shredding and power baling plant for preparing the resulting *kadbi* for storage. The idea of the farm was to store *kadbi* against a famine year. Most of our store was taken, however, by the Military department for Mesopotamia in December 1917, so that it did not

serve as large a purpose this year as would otherwise have been the case. Nearly four lakhs of pounds of dry fodder were, however, prepared there, of which three and a half lakhs of pounds were distributed to cultivators, cattle camps, and others in the famine. It is hoped that it may be possible to increase this farm and establish others similarly equipped.

The extension of the use of silos is now seriously taken up in tracts which have an excess of green fodder at one part of the year and a scarcity of any kind of fodder at another time. We have already proved that splendid silage can be made in the Deccan and that, if well made, 65 per cent. of the original green weight can be taken out after four or five months, and we have now a pattern of a silo that will suit, I think, the conditions of our cultivators. Now, it is a matter for placing demonstration silos in many parts of the country, and the Sassoon David Trustees have come forward in the past year with a grant of Rs. 5,000 towards doing so. It will take many times this amount to demonstrate the use of silos over the country, but I hope that progress will be rapid in the near future.

22. *Fruit crops.*—The work of fruit crops is under the control of the Economic Botanist, and for the last few years fairly extensive work has been undertaken on methods of cultivation, propagation, manuring and dealing with diseases of mangoes, citrus fruits, guavas, *papayas*, figs and grapes. The very valuable work done does not lead itself to summary, but such results as have been pushed to a conclusion will shortly be published. Work with fruits must necessarily be slow, and it is only rarely that a whole industry can be converted from a dying to a flourishing condition in a few years. This has, however, happened in the case of grape-growing industry of Nasik and Ahmednagar as a result of the introduction of spraying against the grape vine mildew by the Agricultural department.

23. *Artificial manures.*—I have referred in the case of several crops to methods of manuring which have proved to be very profitable, but in addition to the experiments on the farms of the Agricultural department we have an organisation for experiments with artificial manures on various crops in the fields of the cultivators. By means of these we have been able to work out formulæ for manures which have proved, by repeated trials, profitable in the case of tobacco, potatoes, onions, chillies, bananas, cotton and sugarcane. During the last year a bulletin containing these results has been published and is now available. It is a considerable advance to be able to give formulæ for all these crops which under our conditions, can be relied upon to give good and paying results.

CHAPTER IV.

ANIMAL HUSBANDRY.

24. With the appointment of a special expert in animal-breeding the work of the Agricultural department enters on a new phase. But up to the present the work done has been considerable. The Chharodi herd of Kankreji cattle is one of the finest in India and under the Civil Veterinary Department it has continued to improve and bulls have been given out on the premium system. It is hoped that now opportunity will occur for more rapid improvement still. At Surat a very fine small herd of Kankreji cows bred essentially for milk exists, and forms perhaps the best milking herd of this breed in India. At Tegur in the Dharwar District, we have a very excellent example of the way in which the poor cattle of the *mallad* tract can be graded up by good feeding and a first class Mysore bull.

The immediate programme is to extend operations to the Mysore breed at Bankapur (Dharwar) where a farm and herd will be established in the current year. The Shirpur Agricultural Association in Khandesh has, with great zeal, established the foundation of a herd of the Tapti *khallari* breed in the Satpuras, and with this we must heartily co-operate. It is our ambition to hold herds of all the really valuable breeds in the Bombay Presidency.

The question of milk supply for cities has become more acute than ever during the last year, owing to the famine and the consequent death of many

animals, and to the very heavy prevalence of rinderpest and foot and mouth diseases. The famine and rinderpest ruined, for the time being, the scheme for milk collection, and transport to Poona from Talegaon, started as an experiment in city milk supply from distant villages—but it will be re-commenced about November and definite results will be available before the close of the current year.

25. As the control of animal-breeding, and the distribution of premium bulls was in the hands of the Civil Veterinary Department all through the year under report, I leave it to that department to report on the work done in these directions.

CHAPTER V.

CROP ENEMIES, PESTS AND DISEASES.

26. The enemies with which the cultivators in India are faced are many. Some of them are not recognised as such, others are only too obvious. Of the latter class are the wild pigs which form a perennial source of trouble over almost the whole of western India. Other animals do an equal or even greater amount of damage in places, but pigs are an obvious enemy everywhere and especially with some of the most valuable crops. Sugarcane is often ruined. In many places groundnut planting is impossible. I have seen a magnificent crop of potatoes almost completely spoilt. The question of dealing with them is, therefore, a most urgent one. We have succeeded in doing so by means of pig proof fencing, and more extensive trials on a larger scale will, all being well, be undertaken in the present year to see how far the very large expense involved in this pays the cultivators. We have, moreover, during the last year, undertaken a pig killing campaign in the Nira Valley with the co-operation of the cultivators in order to see how far it would pay to keep organised parties of men with dogs and guns for the purpose. A special report will be made to Government on this subject, but it may be said that the cultivators helped in the scheme enthusiastically, and profess themselves willing to bear at least a portion of the cost if it is continued. The pigs destroyed cost Rs. 6 per animal, but when it is recognised that many of them were full-grown females the cost will not perhaps be considered excessive. In a similar effort in Kanara, conducted by the local people under the patronage of the Collector, we have lent a number of guns, and are awaiting the result.

A successful campaign for the capture of wild cattle damaging the crops in the wilder tracts of Nasik was undertaken. The operations continued for twenty-five days, the animals being driven into *khedas*. Two or three herds were broken up, but the *khedas* have been left standing and if there is any need the work will be re-commenced in the next hot weather.

27. Turning to insect pests, it cannot be said that the past year has been a bad one, but even in an ordinary year the damage done by them is enormous. If we only take the loss due to the rice borer, the sugarcane borer, the various fruit flies, and the grasshoppers, especially the rice grasshoppers, it probably reaches several crores of rupees per annum. Work is being carried on energetically in the study of some of these pests by the three assistants employed for the purpose, and considerable progress has been made. It has been shown that the damage by the sugarcane borer can be almost entirely eliminated by a proper choice in the time of planting, and a bulletin will be issued immediately on this matter. The very serious grasshopper pest in the rice at Belgaum is now, after several years' campaign in co-operation with the cultivators, fully in hand, and it only needs continual watchfulness to prevent its ever being a serious pest again. The potato moth, a very serious pest of potato storage, is now recognised by the people in the principal potato district as being a conquered enemy. The aphid of lucerne, perhaps the worst pest of that plant in Bombay, can be checked, and a leaflet on the subject has been issued in the last year.

Two or three pests are under special study at present, and though it is not possible to say that they can be met, yet progress is being made. The fruit flies of mango, oranges and other fruits are a formidable problem everywhere, but Mr. Kasargode is getting together a mass of data here which we hope will

lead to success. The rice borer of the Konkan is one of the most difficult of pests to meet, and one moreover which is extraordinarily destructive. I think it may be said that we are getting nearer a means of checking this pest. The jassid hopper of the mango is ruining the mango crop both in the Presidency proper and in Sind, and though it seems probable that it can be checked by spraying with fish oil resin soap, a good deal more work on the subject is needed:

28. Plant diseases caused by fungus parasites are many and very destructive. Two or three very great successes in dealing with these can be claimed for the Agricultural Department, and work in extending the use of these remedies has continued in the year under report. The use of spraying against the mildew of the grape vine has been already referred to, as having raised a dying cultivation to prosperity again. The annual campaigns against the Koleroga of the betelnut palm in the Ratnagiri and Kanara districts have been continued in the year under report, with great success. The use of this method is now established. The employment of seed treatment of jowar against smut is not yet general but is perfectly successful, and only wants energetic pushing in the various districts which it will get with a return of normal conditions after the famine.

Further study of various other grain smuts is proceeding, as well as of the storage rots and other diseases of potato. The study of the very curious 'Khas' disease of jowar in Sind will be taken in the present year.

CHAPTER VI.

AGRICULTURAL EDUCATION.

29. The Agricultural College at Poona continues to be increasingly popular. As indicated in the previous reports, the larger part of the college buildings were taken for hospital purposes by the Military authorities in 1916, but in spite of its being conducted in very cramped quarters the college continued to attract an increasing number of students. In the early part of 1919, the college buildings again became available, and there has been an immediate very large increase in the number of students. The actual attendance rose from 137 to 170 this year, and though a portion of this rise is due to the re-establishment of the short one year course at the college, which had been suspended during the war, yet it means that the position of the college is now established. This is also shown by the growing demand for the graduates who leave the college. An increasing number of these now, on passing out of the college, go and manage their own farms. And for the rest, they are in demand by private firms, by various public departments such as the irrigation and co-operative departments, by Native States for agricultural work, as well as by the agricultural department of our own Presidency. In spite of the fact that the number of students who passed out this year (31) is higher than in any year (except two) in the history of the college, there is a dearth of agricultural graduates which we find it hard to fill.

30. During the year special grants for the development of the agricultural college were made by the Government of India as follows:—

	Rs.
Purchase of additional land for extension.	95,000
Building of an Insectary	10,000
Improving the equipment of the chemical and botanical departments	20,000
	1,25,000

The improvements provided for by these grants were much needed and are in course of being arranged. It must not be supposed however that this is the end of the expenditure on the college. The college must increase much in size and must extend its activities in new directions and proposals have now been made for arrangements to provide for 250 students, and to give more specialised courses in dairying, in horticulture and in several other directions which are not possible at present.

31. During the year one new vernacular agricultural school was opened at Veshvi near Alibag by taking over the buildings and equipment of Sardar Bivalkar's school there. We have now therefore five such schools, four in the

Presidency and one in Sind. The buildings for the new school at Godhra in the Panch Mahals are now ready, and it will be opened very shortly. And in addition it has been made possible to open three further new schools, probably during the current year, by a special grant of Rs. 1,20,000 from the Government of India towards the initial expenditure. These will be situated at Niphad (Nasik), Bagalkot (Bijapur) and probably near Karad (Satara). There is constant repetition, wherever I go, of the demand for more schools of this type. I have been only recently approached by deputations from four or five more districts for such schools, and I sincerely hope that further developments will be possible very soon. The biggest trouble is to get good and suitable teachers and we have accordingly made provision for training teachers for this work at Loni, the original and largest school.

The increase in the number of these schools and the projected further increase has necessitated the appointment of an Inspector of Agricultural Schools during the year. To this position, Mr. K. M. Pawar, B. Ag., has been appointed, the first head master of this type of school in the Presidency. His duties at present combine those of inspector and organiser, and with the projected new schools on hand, he finds full scope for activity.

The school in Sind, at Mirpurkhas, has not been a great success, and the number of boys there tends to diminish. It is obvious that it does not quite fulfil the want of the people or necessities of the case. The Deputy Director of Agriculture in Sind has put forward a scheme for development on slightly different lines, and I hope to examine the whole question on the spot in the very near future.

CHAPTER VII.

AGRICULTURAL ENGINEERING.

32. I have already (see paras 8 and 9) in speaking of the famine activities of the department, referred to the work in pumping and boring done by the Agricultural Engineer and his staff. This work, which appeals as directly to the cultivators as any done by the department,—and more directly than most—is a normal activity directed into famine channels in the present year. It affords us one of the most effective methods of approach to the cultivators, and without it the means, in the department's hands, of influencing the cultivators would be much reduced.

33. The third section of the activities of the Engineer's Department is that of organising mechanical cultivation on behalf of the cultivators. One of our steam ploughs was, however, taken for use in Mesopotamia by the Munitions Board, during the year,—leaving us with only one set of tackle. The famine destroyed the opportunity for the normal use of this, that is to say, for clearing new land or for dealing with land hopelessly infested with deep rooting weeds. And rather to our disappointment there was little demand for its use for ordinary ploughing in the famine tracts, where many cattle had died, in preparation for the present monsoon. In the coming year this tackle, will, all being well, be fully employed on deep ploughing in the Dharwar District.

The possibilities of motor tractors in Western India needs testing, and if successful we must find out the best type. With this in view one tractor has been obtained and has already done some work in the Deccan, and three other types have been ordered. Full tests will be made during the coming cold weather, and it is hoped that we shall come to some definite conclusions early in 1920.

In general I may say that the department of the Agricultural Engineer must expand. Assistance in pumping for agricultural purposes is much appreciated. The demands for boring are increasing every year. Mechanical cultivation has possibilities of going ahead far beyond anything which can be seen at present. All this will need great energy and organising capacity, and is beyond the power of one agricultural engineer, however well qualified. It must be undertaken if progress is not to be seriously held back.

CHAPTER VIII.

PROPAGANDA.

34. All the work of the agricultural department finds its natural end in being able to get the discoveries of our experts and workers put into practice by the cultivators and farmers of our presidency. Hence the efficiency of our propaganda work measures the real utility of all the experimental energy expended. We have hence, a considerable staff engaged on this work, though it is not nearly as large as we can profitably employ. It is controlled by the five deputy directors, who have under them divisional superintendents, and agricultural overseers in most of the districts now. Through them we are able to reach some parts of the districts, but our staff is still spread very thin, and needs very much supplementing when suitable men are available.

35. I must refer to the Deputy Directors' accounts of their work appended to this report, for a detailed account of the work undertaken. It is done by means of depots all over the districts for the hire of implements, by demonstration farms and plots in many parts of the country, particularly in the Central Division, by personal work by the overseers themselves especially in the distribution of seeds, manures, implements or material for the prevention of plant diseases and by shows and demonstrations, though these last were suspended in the past year owing to the prevalence of famine.

Agricultural associations have been organised in many parts of the country, and many of them have done excellent propaganda work. We are much indebted to the devotion of local men who take a great interest in agricultural development and also the local officials who help much in the matter. These associations have been specially successful in Khandesh, and in some parts of the Southern Division (Dharwar, Athni, Chikodi, etc.). Three of the most important of these carry on agricultural magazines in vernacular. The Deccan Agricultural Association continues to bring out the monthly 'Shetki and Shetkari' in Marathi. The Dharwar Agricultural Association publishes the 'Vakkaligaru Vakkalitanavu' in Kanarese, and the Broach Agricultural and Industrial Association issues quarterly the 'Gujarat Agricultural and Industrial Quarterly' in Gujarathi. A monthly Marathi magazine with special reference to Konkan conditions has recently been started at Alibag under the patronage of the department. As regards agricultural associations in general I am convinced that much more use can be made of them than is done at present, and that they can be much better organised. They usually represent real keenness and contain the best cultivators in the country. I hope to place the proposal in this matter shortly before Government.

36. The following publications have been issued by the Agricultural Department during the year under report:—

Bulletins.

No. 91 of 1919.—The cultivation of berseem in Sind; Experiments at Sukkur.

(In Press.)

No. 92 of 1919.—Classification and description of the Jowars of the Bombay Karnatak.

No. 93 of 1919.—Palm Gul manufacture in the Bombay Presidency (principally Date Palm),

Leaflets (with vernacular versions.)

No. 6 of 1918.—Increasing the production of irrigated wheat and jowar.

No. 7 of 1918.—Prickly pear as fodder.

No. 8 of 1918.—The Ring or Bangdi disease of potato.

No. 9 of 1918.—The cultivation of Cape Gooseberry or Tiparee.

No. 10 of 1918.—Maize as an emergency fodder crop.

No. 11 of 1918.—Fodder crops for the hot weather.

No. 1 of 1919.—Plantain stalks as fodder for cattle in famine years.

- No. 2 of 1919.—Prickly pear as fodder. (Supplementary to leaflet No. 7 of 1918; revised leaflet issued on the authority of the Director of Agriculture, Superintendent, C. V. D., the Collectors of Poona and Ahmednagar and Rev. A. Norton, Dhond).
- No. 3 of 1919.—Cultivation of cambodia cotton as a Mungari (kharif crop) in the light red lands of the Southern Maratha Country.
- No. 4 of 1919.—Lucerne Aphis.
- No. 5 of 1919.—Diarrhœa in cattle (issued under the authority of the Superintendent, C. V. D.).

Beyond these the members of the staff have contributed very much to the vernacular agricultural magazines, to the Agricultural Journal of India, and to other publications.

CHAPTER IX.

CONCLUSION.

37. The famine has been the dominating factor in the year's work of the agricultural department, and most of the staff have risen to what was undoubtedly a great strain, but also a great opportunity. The other work has been considerably blocked by the special needs of the last season, but is being taken up again with energy now that the new season promises abundant harvests. I wish, however, to place on record my appreciation of the arduous and successful work accomplished by many of the agricultural staff during the last year, when for the first time since the agricultural department was reorganised on a fairly large scale we had to meet a really extensive famine and all that this means.

I have the honour to be,

Sir,

Your most obedient servant,

HAROLD H. MANN,
Ag. Director of Agriculture.

APPENDIX A.

REPORT OF THE POONA AGRICULTURAL COLLEGE FOR THE
YEAR 1918-19.

1. This is the eleventh report of the Poona Agricultural College as a separate institution. Most of the College buildings continued to be used by the Military Authorities as a War Hospital throughout the College session. From April 1st the hospital was discontinued and the necessary alterations in the buildings begun. We were able to move in May and began our new session in the buildings. The temporary huts erected for additional hospital accommodation and the bungalow of the Professor of Agriculture are still in charge of the Military Authorities.

The difficulties of carrying on the College without the buildings has been dwelt on in previous reports and much credit is due to staff and students for the uncomplaining spirit in which they carried on their work in the face of these difficulties and inconveniences. All rejoice now that peace has come and things at the College are resuming their normal course.

By its steady growth, the College has now reached a size that taxes the accommodations of hostel, laboratories and equipment. With regard to the first, the rooms of the hostel are completely full and an overflow has been accommodated in one of the temporary huts kindly loaned by the Military authorities.

COURSES.

The second batch of graduates who have been able to take the advantage of optional courses was graduated in April.

The election of optional was as under :—

Name of optional.	B. Ag.	Diploma.
(A) Agricultural Economics, Land Development and Intensive farming.	14	4
(B) Stock breeding, feeding and management including dairying.	4	...
(C) Advanced applied Botany	1	1
(D) Advanced Agricultural Chemistry	6	...
(E) Advanced Agricultural Entomology	2	...

While the new syllabus for these courses leaves much to be desired still the system of offering optionals is working quite satisfactorily. Some caution is necessary to maintain all the optionals on the same grade otherwise there is danger that choice will be made in what is considered the easiest course.

In the Agricultural optional the principle of specialization was carried still further in intensive farming and the candidates were offered six types of Agriculture for the specialization as follows :—

- (I) Sugar-cane growing and *gul* preparation, including chemistry of sugar-cane ;
- (II) Rice cultivation ;
- (III) Cotton growing including classing and selection ;
- (IV) Wheat cultivation ;
- (V) Vegetable growing ;
- (VI) Spices and Narcotics.

The sugar-cane was the favourite of the year and eight men selected it. Cotton stood next with six candidates. Special tours and special reading courses were arranged for each group. It is felt that the men in their special lines are at least one year ahead of the former B. Ags. All lectures were common to the whole of optional A, but only by tours, field work and reading, were the special men given extra instruction, demonstrations and practice in cultivation of their chosen crop.

COLLEGE STAFF.

Several changes occurred in the staff of the College during the year. Dr. Mann was Principal till November 25th when he was called to act as Director of Agriculture. He was on deputation for advising Messrs. Tata Iron and Steel Works at Sakchi from September 20th to November 11th during which I held charge. Since November 26th I have been acting Principal in addition to my usual duties.

The Agricultural Chemist's charge during Dr. Mann's deputation was held by Mr. Tamhane, M.Sc., Senior Laboratory Assistant. But when Dr. Mann assumed the Director's duties, he retained charge of the Agricultural Chemist's office and completed the teaching of that session. On June 1st, 1919, Mr. D. L. Sahasrabudhe, L.Ag., B.Sc., was appointed to act as Agricultural Chemist.

Dr. W. Burns relinquished his commission in the India Army Reserved and joined the College on January 6th. He was granted six months' leave from January 15th. The arrangements made while he was on Military duty for carrying on his work were again adopted during his leave, *viz.*, Mr. S. L. Ajrekar acting as Economic Botanist and Professor of Botany, Mr. G. S. Kulkarni acted Assistant Professor of Mycology.

The Assistant Professor of Physics and Mathematics, Mr. S. S. Godbole, was obliged to take leave from August 15th owing to ill-health and has not yet been able to rejoin. Mr. N. V. Kanitkar acted in this capacity during the remainder of the year.

Mr. G. B. Patwardhan was confirmed in his appointment as Assistant Professor of Botany on January 1st, 1919.

Mr. G. K. Ranade, Assistant Professor of Agriculture, was on privilege leave from June 1st to August 31st and Mr. K. M. Pawar acted.

Mr. B. M. Desai, Assistant Professor of Animal Husbandry, acted Deputy Director of Agriculture from October 26th to February 26th and Mr. B. P. Wagholkar was called from Jalgaon Farm to act for Mr. Desai. Upon the expiration of Mr. Desai's acting service as Deputy Director he was sent on special famine service to Gujarat and Mr. Wagholkar officiated as Manager of the Dairy.

We regret the death of Mr. F. Gracias who passed away on September 27th, from influenza. He was succeeded by Mr. B. B. Joshi as Lecturer in Veterinary and the services of Mr. S. N. Nadgir were secured from the Civil Veterinary Department as demonstrator in Veterinary Science.

Under the new arrangement of posts for the Agricultural and Animal Husbandry Branches, which established a lectureship and two demonstrators in each, the following appointments were made:—

Animal Husbandry.—Lecturer, Mr. H. G. Baluch; Senior Demonstrator, Mr. B. B. Jamaspjina; Junior Demonstrator, Mr. V. G. Desai.

Agriculture.—Lecturer, Mr. V. S. Kulkarni; Senior Demonstrator, Mr. H. M. Desai; Junior Demonstrator, Mr. A. A. Vasavada. Previous to this Mr. K. M. Pawar as Superintendent, Agricultural College Farm, had assisted in the lectures.

In the Chemical Branch vacancy as lecturer in chemistry caused by the appointment of Mr. N. V. Kanitkar doing duty as acting Professor of Physics and Mathematics was given to Mr. V. G. Patwardhan, B. Ag., B.Sc.

STUDENTS.

The number of students of the entering class is about the same as in two preceding ones. But the large Junior B.Ag. and Senior B.Ags. classes together and 23 Short-course students brings the total to the highest figure yet reached. Actual details for last seven years are given below:—

	1913.	1914.	1915.	1916.	1917.	1918.	1919 July.
First-year students ...	43	36	35	54	58	61	60
Second-year students ...	25	31	29	23	36	39	46
Third-year students ...	26	27	31	35	23	35	38
Short-course students ...	15	22	27	Not held	Not held	Not held	23
Special and post-graduate students.	1	1	2	3	7	2	3
Total ...	110	117	124	115	124	137	170

The figures show the progress of the college.

The students during the last five years come from the following places :—

	1915.	1916.	1917.	1918.	1919.
Bombay Presidency { Deccan	20	14	9	19	27
{ Southern Maratha					
{ Country and Konkan	45	44	50	42	49
{ Gujarat	35	29	36	36	43
{ Sind	7	9	9	7	7
Assam	1	1	1	1	3
Central India	3	3	1	3	3
Nizam's Dominions	3	4	6	6	8
South India and Ceylon... ..	7	6	5	13	16
Burma	1	2	5	6	7
United Provinces	2	3	2	2	1
Berar ... ..	...	...	...	1	...
Bengal ... ..	...	...	...	1	4
Central Provinces ... ..	...	...	...	...	5

The number of students from the Deccan which had declined has now recovered.

Arranged according to communities as follows :—

	1915.	1916.	1917.	1918.	1919.
Brahmins	55	49	55	61	68
Marathas	5	4	4	6	16
Lingayat	4	3	2	2	1
Patidars (Gujarat)	3	4	10	13	12
Jains ... ..	...	...	...	...	6
Other Hindus ... ..	...	...	...	...	33
Mahomedans	12	10	8	4	9
Parsis	15	15	12	7	5
Christians	1	1	...	...	7
Ceylon students ... ..	...	...	...	...	6
Burmese ... ..	...	...	...	...	7
Others	29	29	33	44	...

These students may be divided into three classes:—

(a) By far the larger number are qualified to study for, and intend to take the agricultural degree of the Bombay University. The qualification on which the Bombay University insists namely the Previous Examination or its equivalent, is insisted on in the case of practically all students from the Bombay Presidency itself and no student can, of course, appear for the University Agricultural degree without it.

(b) The second class consists of a few students who are not admissible to the University Examinations, but who are taking the regular course, along with the first class of students. These exceptions arose from the fact that it had been decided by Government to allow scholars to be received from Sind who have only passed the Matriculation Examination, provided that they were to receive the same course and pass by the same standard as the University demands. Under the ruling, students have been received every year since 1908. At the same time some applications were received from Government in India and Ceylon to be allowed to send students and from private persons outside the Presidency for admission to the college, where the applicants were not fully qualified for the University Course. Where there was evidence to show such students could properly follow the course a small number have been admitted.

	Admitted in 1915.	Admitted in 1916.	Admitted in 1917.	Admitted in 1918.	Admitted in 1919.
Nizam's Dominions ... ..	...	1	2	1	...
Sind	1	1	...	...	...
Bombay Presidency and Native States subordinate to it	2	5	...	3	...
Ceylon ... ..	...	1	1	2	1
United Provinces ... ..	...	2	...	...	...
Central Provinces ... ..	...	...	...	...	1
Coorg ... ..	...	1	...	...	...
Madras Presidency ... ..	...	1	...	2	...
Burma ... ..	...	...	...	...	2

(c) In the third place we have the Short-course students already referred to, which was reopened in June 1919.

In addition to these three classes we are occasionally requested to undertake the training of men for special purposes. We admitted in 1916 a young man in training for botanical work under the department of Agriculture, Burma. We also have men doing post-graduate or special work in botany, chemistry and dairying.

UNIVERSITY AND OTHER EXAMINATIONS.

At the University Agricultural Examinations held in 1919 the number of candidates shown in the following list were presented with results as indicated.

	Sent up.	Passed.	Failed.	Percentage of passes.
First Examination in Agriculture ...	50	38	12	76
Bachelor of Agriculture Examination ...	30	27	3	90

A special college examination of the students (referred to above) not entitled to take the University Examination, was held in April 1919 with the following results:—

	Presented	Passed.	Failed.
First Examination in Agriculture ...	4	3	1
Final Examination for Diploma in Agriculture ...	5	4	1

The number of students who passed through the regular course at the College and succeeded in obtaining the University Degree or the College Diploma (which is of similar standard and represents the same character of man) is as follows during the past eleven years:—

Years.	Degree.		College Diploma.		Total.		
	Entered.	Passed.	Entered.	Passed.	Entered.	Passed.	Percentage.
1909 ...	34	26	...	...	34	26	76.4
1910 ...	39	36	...	...	39	36	92.3
1911 ...	22	20	5	5	27	25	92.2
1912 ...	27	22	1	1	28	23	82.1
1913 ...	19	14	4	3	23	17	73.9
1914 ...	23	18	3	3	26	21	80.7
1915 ...	21	20	6	5	27	25	92.5
1916 ...	29	23	2	2	31	25	80.6
1917 ...	30	30	5	5	35	35	100.0
1918 ...	20	18	1	1	21	19	90.4
1919 ...	30	27	5	4	35	31	88.5

SCHOLARSHIPS.

The number of scholarships offered by Government at this College is now fifteen per annum. Candidates, who have passed the Previous Examination of the Bombay University or obtained the certificate from the Principal of an Arts College, which the Bombay University now accepts instead of that examination are selected by the Director of Agriculture in consultation with the Principal of the College. These scholarships are given by preference to the sons of cultivators and are awarded for three years. The Director of Agriculture is empowered to give an additional year's scholarship to a limited number of Matriculates available in an Arts College while studying for the First Arts certificate.

During the last six years scholarships have been awarded to candidates from the various districts as follows :—

	1914.	1915.	1916.	1917.	1918.	1919.
Deccan	2	...	3	3	3	5
Southern Maratha Country ...	4	5	5	7	2	4
Gujarat	4	2	2	3	6	5
Konkan	5	6	3	2	1	2

The students from Sind have been on a different basis. They have been appointed by the Commissioner in Sind and were not required to have passed the Previous Examination in every case. We have now at the College two such scholars from Sind in the Third year. In the spring of 1918 it was decided in future to send Sind scholars to the Lyalpur Agricultural College instead of to Poona.

Other Governments and the public bodies have utilized the college for the training of scholars. The number so admitted since 1912 has been as follows :—

	1914.	1915.	1916.	1917.	1918.	1919.
Baroda Government ... ..	...	1	...	1	...	...
Aundh State ... ..	...	1	...	...	...	...
Rajpipla State ... ..	...	...	...	...	1	1
Junagadh State ... ..	...	...	3	3	...	...
Dewas State	1	...	...	...	...	...
Indore State	1	...	1	...	...	...
Mysore State	1	...	...	...	...	...
Porbandar ... ..	...	...	...	...	...	1
Burma ... ..	...	...	1	4	1	...
Cochin ... ..	...	...	...	...	1	1
Ajmere Merwar ... ..	...	...	...	...	...	1

LIBRARY.

The growth of the college library is very satisfactory. Eleven years ago it did not exist. On the separation from the College of Science being completed, a number of books (chiefly old and out-of-date) on Agriculture, Botany, and Veterinary Science were handed over to us and formed a nucleus for the future. A special grant of Rs. 6,000 per annum was made in 1909 for library purposes, and was continued during the following years. Since that time the annual grant has been Rs. 2,500. With the funds thus made available and a number of presentations of books, the library has rapidly increased. The number of books in it at the end of last ten years has been as follows :—

1908-09	1,182	1914-15	7,638
1909-10	2,780	1915-16	8,390
1910-11	4,000	1916-17	9,143
1911-12	5,040	1917-18	9,853
1912-13	5,943	1918-19	10,191
1913-14	6,840		

It is freely consulted not only by college students but by gentlemen from all parts of the Presidency, and every effort is made to make it increasingly useful to the public. It is now known and valued in every part of the Bombay Presidency at least.

COLLEGE DAIRY.

During the year the Government Civil Dairy at Kirkee has been under the control of the college and the Manager of the Dairy is Assistant Professor of Dairying. This has been used for several years as a teaching centre, in future it will be available in greater measure than hitherto, as this is now recognised as one of its primary functions.

VETERINARY DISPENSARY.

The District Veterinary Dispensary at Bhamburda has as usual been carried on as a College Dispensary for the year. Charge of the Dispensary was in the hands of Mr. F. Gracias, G.B.V.C., till his death and afterwards by Mr. B. B. Joshi, G.B.V.C., assisted by Mr. S. N. Nadgir, G.B.V.C., as Resident Veterinary Officer.

The total number of patients treated during the year under report was 2,051 as against 2,059 reported last year. Of the total, 416 were in-patients, and the remainder 1,635 were treated as out-patients as against 328 and 1,711 respectively, of the previous year's report.

The daily average attendance of both in and out-patients was 14.99 and 23.00 respectively, as against 14.58 and 21.20 respectively, of the preceding year.

Free patients numbered 1,043 this year as against 1,092 of the previous year and private patients came up to 1,008 and their treatment was paid for as against 917 of the preceding year.

Agricultural and non-agricultural animals treatment during the year totalled 1,106 and 945 respectively, as against 1,208 and 831 respectively, of the last year.

Twenty-two cases of rabies were brought to the Hospital suspected for the disease during the year as against twenty reported last year. Out of the number twelve were positive and the remainder ten were negative.

Twelve castrations were performed during the year as against ten last year. Of the number two were ponies, eight bulls, one ram and one dog.

Forty-four outbreaks of epidemic diseases were attended in the Haveli and Mulshi Petha during the year under report as against 82 outbreaks attended last year. There were 25 rinderpest, 14 foot and mouth disease.

Hæmorrhagic Septicæmia and one of Pseudopericarditis in fowls and one of contagious Pustular Dermatitis in goats. Reference to John's disease being discovered amongst the College dairy buffaloes has been made in the report of the last year. Since then some suspected cases have been observed amongst cows and two of which were confirmed during June 1919.

The Veterinary Assistant gave valuable help in selecting and caring for the bullocks of the College cattle camps.

COST OF WORKING THE COLLEGE.

The working cost of the College appears in the following statement. It should be noted that as nearly the whole staff have other duties than teaching, it becomes impossible to give the exact cost in this respect, hence estimates have been listed.

Statement showing items of the cost of the Agricultural College for 1918-19, including Veterinary Dispensary.

	Rs.	a.	p.
1. Teaching staff (estimate for time devoted to teaching and preparation only)	36,981	8	0
2. Establishment	2,414	15	2
3. Apparatus	2,693	12	0
4. Scholarships	9,075	0	0
5. Net cost of College farms and dairy	38,210	6	3
6. Travelling for educational purposes of staff establishment and students	3,928	1	1
7. Miscellaneous	2,988	4	7
Total expenditure	96,291	15	1
Credit recoveries—			
	Rs.	a.	p.
College fees	425	0	0
Hostel rent	2,190	0	0
Veterinary fees	200	0	0
	6,615	0	0
Net cost	89,676	15	1

as the number of students for the year was 137, the average cost per student is approximately Rs. 654 per year.

J. B. KNIGHT,
Acting Principal,
Poona Agricultural College.

APPENDIX B.

REPORT OF THE MARATHI AGRICULTURAL SCHOOL,
LONIKALBHOR, POONA DISTRICT, FOR 1918-19.

Origin and objects.—It will be remembered that this school was started in 1910 in Poona as a result of a keen demand for a good practical Agricultural training in vernacular to farmers' sons who could not afford to get sufficient English education beforehand to go to Agricultural colleges where excellent arrangements were obtainable for higher Agricultural training. The school was started as a free Agricultural boarding institution where practical farm work along with other training could be given with the final object that boys passing out should go back and improve their own estates at home.

The course is one of two years and students who generally possess certain extent of land and have at least passed the fourth Marathi standard are admitted provided they are between 14 to 17 years of age.

Location.—When it started it was located near the Agricultural College, Poona, till permanent lands and buildings were ready for it. It was removed in November 1913 to its present permanent location in the jurisdiction of the village of Lonikalbhor about ten miles from Poona. This tract abounds in a variety of garden cultivation typical of this side such as a number of profitable vegetables both indigenous and foreign and vast areas of sugarcane, and this is a great advantage as it affords a nice field for demonstration. The other advantage is that the school gets a rural atmosphere which is an essential feature such a school should not miss.

There are specially constructed buildings for the school. The main building is like a substantial Deccan cultivator's *Wada* with a spacious quadrangle in the middle, the students and staff residing in close neighbourhood. This fact facilitates close personal supervision over the boys. The number of buildings is slowly increasing in accordance with new branches of work which have been also taken up. During the year under report a good *pucca* silo measuring about 11 feet in height and 10 feet in diameter has been constructed at a cost of Rs. 450. This has cost a little more than it ought to in usual years due to the fact that the cost of labour and building material has run very high. The result of silaging has been very promising indeed. A total quantity of 17,768 lbs. of green maize was put in and a net silage of excellent colour weighing about 13,743 lbs. was received back. This works out at about 76.5 per cent. A practically new *pucca* Dutch Barn of moderate means has also been constructed. The existing buffalo shed has been substantially repaired and a decent *pucca* fodder trough has been added.

The sanitation of the estate has also been vastly improved by the construction of a long system of *pucca* concrete drains round the main buildings. This will reduce to a large extent the stagnation and soaking of rain water round the buildings and consequently help a good deal to keep up the healthy nature of the estate. Other improvements to some buildings have also been sanctioned and it is hoped will be taken up soon.

The Farm.—The farm land was originally a resigned piece of land overgrown with Babhul trees and shrubs and then gone into the class of forest land. This was specially taken up with a view to demonstrate what could be done with perseverance and skill in land management to improve and reclaim to advantage an area of apparently no agricultural value. The land on the whole has now very considerably improved and is now growing fairly good crops. The addition of humus specially in the form of crops of Sann Hemp (*Crotalaria gentia*) plowed under the soil and also farm yard manure coupled with timely and thorough soil tillage have been the only methods so far adopted. During the year about eight acres of land have been levelled and laid into terraces. A further area of about 3 acres will be taken in the next year and treated the same way. Almost the whole land is now under terraces except a few acres which will, as said above, be taken up soon.

The whole area is irrigable by the Mutha Left Bank canal and a small portion by a n Oil engine and pump set up at the school for teaching boys.

Owing to indifferent rains in 1917-18 and failure of rain in 1918-19 the whole farm area had to be irrigated by the canal water or we would have had no crops at all. This has meant very considerable strain on the students and staff and also the soil.

Boys.—The boys at present number 45 and are derived from the various Districts as under :—

District.	First year.	Second year.
Poona ...	1	2
Ahmednagar ...	2	2
East Khandesh ...	15	1
West Khandesh ...	1	1
Sholapur ...	1	0

District.	First year.	Second year.
Nasik ...	1	2
Bijapur ...	0	1
Thana ...	0	1
Kolhapur State ...	2	0
Sangli State ...	0	1
Ramdurg State ...	1	0
Nizam's State ...	0	1
Berars ...	2	3
Central Provinces ...	1	1
Total ...	29	16
Total of both years ...	45	

Arranged according to castes the boys stand as follows:—

Brahmins ...	21
Non-Brahmins ...	24
(including Marathas 18, Kunbis 2, Teli 1, Gosavi 1, Gurav 1, and Mali 1.)	
	45

The number of applications for admissions has been increasing year by year. The above is the result of a selection out of the various applications. Enquiries for admissions keep coming on even till the end of July but have to be informed to apply next year. The points observed in selection of boys mainly are that they should belong to substantial but actually cultivating or land-holding classes, provided of course that he possesses the other necessary qualifications of age and previous education, etc.

Help from outside.—The school was supported by a number of District Local Boards and during the past seven years the following subsidies have been received:—

	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.	1917-18.	1918-19.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
West Khandesh ...	...	...	...	54	...	54	...
East Khandesh ...	72	...	72	216	432	432	432
Poona ...	720	...	...	792	144	144	144
Nasik ...	216	288	...	788	500	500	500
Ratnagiri ...	216	...	...	144	216	72	...
Satara ...	432	504	288	72	72	216	144
Sholapur ...	420	504	288	72	...	216	216
Ahmednagar ...	...	840	72	144	288	360	360
Thana ...	72	144	72	...	72	...	...
Bijapur ...	72	...	...	...	...	...	...
Kolaba ...	72	...	...	...	...	...	...
Belgaum ...	...	72	144	72	72	72	...
Total ...	2,292	2,352	936	2,354	1,796	2,066	1,796

The course of instruction.—The curriculum has remained as before. It involves as explained last year at least half the working time of each boy being spent in farm work, in gardening or other practical work. The boys do all the work on the whole estate.

The first year boy learns the manipulation of all the farm implements and tools both indigenous as well as introduced and kept at the school and also acquaints himself with all other farm operations so that by the next year he should be able to do all necessary work on his allotted areas. The second year boys have a plot of about 10 gunthas of land allotted to each on which they grow a variety of dry and irrigated crops. Except on occasions which require help or when certain important operations such as transplanting, etc., are to be demonstrated and got done by all, each boy works on his plot quite alone. He is made to feel that he is solely responsible for his crop. Each boy also keeps a diary of daily work and a plot sheet wherein he jots down the work done and the charges incurred. This helps him at the end of the crop to find out his profit or loss.

The subjects taken up are:—

(1) The principles of agriculture; (2) Nature study mainly taught practically including elementary Botany and Entomology in relation to crop growing; (3) Agricultural Arithmetic, mensuration and elements of surveying; (4) Reading and writing vernacular; (5) Physical geography including elementary climatology; (6) Village Life including Sanitation, Secondary occupations and (7) Citizenship which includes questions as to the rights of farmers, local and village Government in this part of India, obtaining money by *takavi*, Co-operative credit.

Usually Saturday mornings are utilized for taking trips to neighbouring farms and villages round about having typical fruit and vegetable gardens, etc. In the Christmas holidays each year the second year students take a more extensive tour through some part of the Bombay Presidency. During the year under report they had a very interesting and very instructive tour to Jambhul, Bassein, Bombay, Amalsad, Surat, Jalgaon, Nasik, Kherwadi, Kopergaon, and Rahuri where they studied the various kinds of vegetable, fruit, and the dry crops of those tracts. Such a tour has been found to be very essential towards giving the boys a broader outlook and instilling a spirit of love for new things and ambition to do better.

There is a small poultry yard started in 1917 and continued. It contains at present only country birds. In a few days time we will have a pen of white Leghorns which will be kept pure. - A special run and house, etc., are almost ready to receive them.

The course of studies and work is a hard and practical one and unless a boy is ready to do every kind of work with his own hands and engage himself in what is usually supposed menial occupation he does not want to stop. So there is sometimes a leakage at first. Nevertheless it is essential to maintain this tone if at all the school is to serve the purposes for which it is intended. The number of applications has, like last year, been much greater than we could admit.

Health of the Estate.—Leaving aside small ailments at the start on account of change in climate, etc., there has been no other trouble of sickness except the world-wide epidemic of Influenza. Nearly all boys, servants and others had an attack. But thanks to the almighty one and all recovered. Mention must be made of the special trouble the College Doctor took at this time. The epidemic days were a great trial to the members of the school staff indeed.

Examinations and results.—At the end of the school year in April 1919 the boys underwent a thorough examination from Messrs. B. P. Wagholkar of the Agricultural College Dairy and V. G. Patwardhan of the Agricultural College. As a result 23 certificates were granted to boys who had completed their two years training and passed the final year's examination. The examiners' remarks were as follows:—

“On the whole it seemed that the teachers had taken pains to explain the subjects but the calibre of the majority of students to grasp their principles (especially with regard to nature study) was found to be rather low though some of the grown up students were intelligent enough to understand them.

The students were specially quite well up in the practice of Agriculture. They showed to have gained the benefit from the Agricultural Tours with respect to the comparative study of crops. They knew the use of the usual Foreign implements thoroughly but owing to the lack of some indigenous implements such as the Deccan plow, hoes etc., comparative study was slightly defective.

B. P. WAGHOLKAR.

V. G. PATWARDHAN.”

Nearly a hundred and twenty students have by now passed out from the school. Many of them are farming on their own lands, some are engaged in the Agricultural Department, some in Agricultural Associations. An effort is made to keep in touch with as many as possible. A reunion of old boys was held this year. A special meeting where-in were considered several difficulties the boys meet with in their vocations and suitable solutions given, was held under the chairmanship of Mr. Pawar, the late Head Master of this school. It is proposed to make this a special annual event whereby we shall be able to keep in close touch with the work of all the past students. On the day of declarations of results the school held its Annual Social gathering. Various competitions were on and a number of prizes were distributed. Professor V. B. Naik, M. A., of the Fergusson College and Superintendent of the New English School of Poona, addressed the boys and exhorted them to try and do their farming intelligently and carefully and thus increase the resources of their country.

The Staff.—The School Staff have worked with commendable zeal and efficiency throughout the year.

HAROLD H. MANN,

Acting Director of Agriculture.

THE BALANCE SHEET.

<i>Receipts.</i>			<i>Expenditure.</i>		
Received from	Amount.		Spent for	Amount.	
Poona Treasury	...	13,752 2 10	Boarding expenses	...	5,081 13 5
Principal's Office	...	500 0 0	Conservancy	...	177 0 0
Sale-proceeds, and recoveries	Mis. ...	1,164 10 1	Cultivation	...	759 13 0
Plow hire	...	148 7 0	Draining and Levelling	...	200 0 0
Local Board Grants	...	1,796 0 0	Food grain and Fodder	...	670 0 0
			Fruit and vegetable Garden	...	100 0 0
			Miscellaneous Expenditure..	...	550 0 0
			Oil Engine and pump	...	300 0 0
			Petty construction	...	1,490 0 0
			Purchase of books	...	20 0 0
			" Furniture	...	15 0 0
			" Implements	...	99 15 10
			Livestock purchase	...	451 0 0
			Manure purchase	...	498 3 9
			Poultry farming	...	150 0 0
			Student's tour...	...	153 4 0
			Workshop	...	470 15 0
			Water supply	...	131 3 0
			Pay of the school Establish- ment	...	2,522 9 4
			T. A. of	...	365 11 4
			Postage	...	44 1 0
			Remittances to the Poona Treasury	...	2,609 1 1
Total	...	<u>17,361 3 1</u>	Total	...	<u>16,861 3 11</u>

HAROLD H. MANN,
Acting Director of Agriculture,
Bombay Presidency,
Poona.

APPENDIX C.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE,
GUJARAT DIVISION, IN 1918-19.

This Division consists of the five districts of Gujarat, *viz.*, Surat, Broach, Panch Mahals, Kaira and Ahmedabad.

As the charge of ten districts with one officer was considered to be very heavy representations were made to Government from time to time for splitting it up into two charges and giving them in charge of two separate Deputy Directors by creating one more post of a Deputy Director; but owing to some reason or the other it was not found possible to do so in past years. In the beginning of November 1918 Mr. P. C. Patil, Deputy Director of Agriculture, N. D., went on three months' privilege leave, and I was appointed to act in his place. During these three months along with the other ordinary work, the work in connection with the famine was so much developed in Deccan and Gujarat, that on Mr. Patil's return from leave it was considered desirable to have a separate officer to look after the work in the five Gujarat Districts, and on my being relieved from the acting post, temporary arrangements were made by the Director of Agriculture to place me in independent charge of these five Districts with the designation of "Special Agricultural Famine Officer, Gujarat", till Government notified my appointment as Deputy Director of Agriculture for this Division in the middle of August 1919. Thus I hold an independent charge of this Division from the month of November 1918.

The following Agricultural Stations with the subordinate staff at present exist in this Division :—

No.	Name of the Farm.	Area.	Staff on the Farm.
		A. g.	
1	Surat	292 15 (156 0 arable)	1 Superintendent (Graduate). 2 Graduate Fieldmen. 4 Non-graduate Fieldmen.
2	Nadiad	44 0 (37 0 arable)	1 Overseer (Non-graduate). 1 Non-graduate fieldman.
3	Dohad	57 22	1 Superintendent (Graduate). 1 Graduate Fieldman 1 Non-graduate Fieldman.
4	Broach	24 19	Managed by the District Agricultural Overseer, Broach, under supervision of the Divisional Superintendent of Agriculture, N. D.
5	Sunev Plot	4 0	Do. do.
6	Amalsad Sugarcane Farm	19 12 (11 25 arable)	1 Overseer (Non-graduate). Under supervision of the D. S. N. D.
7	Nadiad Agricultural Association Plot	2 0	1 Overseer (Non-graduate). Under supervi- sion of the D. S. N. D.

In addition to the work on the above farms and the districts, a special man for cotton breeding, etc., is maintained. The Entomological Assistant's post has been allotted to this Division.

The following statement shows the total strength of the superior staff working under the Deputy Director of Agriculture in this Division :—

No.	Name of the post.	Gazetted or Non-gazetted.	Remarks.
1	Divisional Superintendent of Agriculture, N. D.	... Gazetted.	
8	Superintendents of Farms	... Non-gazetted.	
1	Cotton Fieldman	... Do.	
1	Entomological Assistant	... Do.	
6	District Agricultural Overseers and Graduate Fieldmen	... Do.	
9	Non-graduate Fieldmen on Farms and in Districts	... Do.	
8	Graduates under training	... Do.	
	<i>Temporary.</i>		
1	Cotton Superintendent	... Gazetted.	
4	Graduate Assistants	... Non-gazetted.	

In addition to the above, there are 4 permanent Kamgars and several Depot-keepers and ploughmen engaged for demonstrational purposes, etc.

The work summarized below is divided into five parts :—

I.—Work on Agricultural stations.

II.—Special work in cotton breeding and the work of the Entomological Assistant.

III.—Work of the temporary establishment in cotton.

IV.—Work in the District.

V.—Special work in the Famine.

I.—Work on Agricultural Stations.

(1) SURAT AGRICULTURAL STATION.

Seed Selection and Plant Breeding.

Cotton.—Out of the two selected strains of cotton, *viz.*, Selection I-A and Selection II reported in the last year's report, Selection II was rejected and only Selection I-A is kept up as it proved to be superior to Selection II and the Deshi Broach in point of yield, high ginning percentage and staple. Almost the whole area of 64 acres and 12 gunthas under cotton on the Farm was sown with this variety which produced on an average 405½ lbs. of seed cotton per acre even though the season was unfavourable. All the seed secured from this area was distributed in a compact area of the villages round about the Farm, and the resulting seed 80,355½ lbs. from this group of villages was secured and distributed in five groups of villages. The total area sown with the seed comes to 6,008 acres during the current season.

For the purposes of demonstration, this variety was tested side by side with the bazar seed and the yield from this was 20 per cent. higher than that of the bazar seed.

Jowar.—In this case the Farm selected seed in a year of scanty rainfall showed its superiority to a greater extent over the bazar seed. In the case of Perio jowar, the average yield gave an increase of 45 per cent. in grain and 59 per cent. in net profit; while in the case of Chapti the increase in grain was only 6 per cent. although the increase in net profit was 25 per cent. The demand for Farm jowar seed is increasing every year as will be seen from the fact that this year 5,468½ lbs. of jowar seed of all varieties was distributed as against 2,085½ lbs. distributed last year.

Manurial.—The same manurial experiments as those of last year were continued during the year under report, and though the season was not favourable, they go to prove the same results, *viz.*, that the periodical application of poudrette and night-soil increases the yield of jowar and cotton to a great extent. Similarly, top-dressing jowar with commercial fertilizers increased its yield by 26 per cent., but owing to the high prices of these fertilizers the cost of application becomes prohibitive.

Fodder Experiments.—In the Athwa area, we are growing fodder jowars since some 4 years past on about 6 acres. A piece of land measuring 3 acres is being sown with these jowars since last 4 years and the crop of Perio jowar on this yielded during the year 49,027 lbs. green weight per acre in two cuttings,—a fact showing what could be achieved even in a year of drought with better methods of tillage and manuring.

In the year under report ensilage was made as usual in 2 pucca masonry silos. Jowar was the material used for this purpose in both the silos, and the percentage of useful silage to the green weight was 63·7 and 50·7 in the two cases. The less amount of good stuff was obtained in the latter case because of the silo pit being very old and cracky which allowed an access of moisture and air in the pit. The cost of ensilage was Rs. 11-5-3 and Rs. 15-2-9 per 1,000 lbs. in the two different cases respectively. The higher cost as compared with that of the last year is due to higher wages, irrigation and heavier manuring during the year. The ensilage is being fed to dairy and work cattle during the hot months with good results.

The Kankreji Breeding Herd.—A herd of Kankreji animals is maintained chiefly for the purpose of breeding good animals. The strength of the herd on 1st April 1919 was 102 as against 112 on the same date of 1918 and the total milk yield from 38 cows was 84,277½ lbs. as against 73,245 lbs. from 33 cows of the last year. Out of these, 6 cows were reported to be poor yielders; 5 of which were subsequently sold off and one was simply retained in the herd with a view to watch the performance of her progeny by a particular sire. One heifer calved during the latter part of the year and has not done well. Excluding these seven, the total milk yield of 31 cows amounted to 80,287½ lbs. giving an average of 2,589 lbs. 14 ozs. per cow per annum as against 2,674 lbs. 9 ozs. of the last year. The slight fall in yield is in fact due to several factors peculiar to the year under report, which are summarized below:—

- (1) Deficiency of green forage for the cattle.
- (2) The cattle had to be kept mostly on Jowar Kadbi on account of the general scarcity of hay.
- (3) Feeding of chaffed stubbles for some time.
- (4) A cow had to suckle twins and hence her milk yield was much less than normal.
- (5) The influenza epidemic which necessitated frequent changes in milking hands; etc.

It will be interesting to note here that an old cow in her 9th lactation tops the list of high yielding animals, with 4,255½ lbs. Cow Bhuli in her first calving seems to be a good yielder, and curiously enough shows the highest yield of 491½ lbs. in the 10th month after her calving.

During the year under report there were 10 births and 5 deaths as against 19 births and 5 deaths during the past year. 36 animals in all were sold during the year for a total sum of Rs. 4,916-4-0. Out of these 15 bulls sold to the Java Government fetched Rs. 4,000 which gives an average of Rs. 266 per head. Of these 4 were below 18 months of age. The rest comprising 3 stud bulls were given to cultivators on moderate terms, and 18 very old and undesirable animals were sold off for Rs. 535. The demand for the Farm bred animals has so much increased of late that it is not possible to meet it wholly.

(2) DOHAD FARM.

Though some of the Farm crops have yielded fairly well, it is not advisable to take any account in this summary, as it was a very bad famine year in the tract and as the Farm crops were irrigated from the Muvalia Tank during the rainy season,—a facility which was not available to other cultivators of the tract.

However, the selection work in wheat was continued on a plot, specially hired on the right bank canal, as the left bank canal which fed the Farm failed to give any irrigation water from October, in order that the strains and the acclimatised seeds of past years may be preserved.

During the year under report the Farm has taken up a very important line of work, *viz.*, that of imparting agricultural knowledge both practical and theoretical to the boys of the Government Primary Vernacular Bhi School with the approval of the Educational Department. A curriculum of short course was drawn up for the boys of the VI and VII standards of this school which is just in the neighbourhood of the Farm. One lecture in theoretical and two in practical agriculture are given per week to the boys of each of the above two standards.

These classes were commenced only from 24th January 1919. The number of boys attending the short course is 7 from standard VI and 14 from standard VII. The experiment is a new one and its progress will be watched carefully.

(3) TEMPORARY PLOTS.

There are three plots in all, *viz.*, (1) Amalsad Plot, (2) Broach Farm and (3) Nadiad Agricultural Association Plot. On the first two of these, special experiments are carried on.

(1) *Amalsad Plot.*—This is situated in the best garden tract of the Surat District, where many of the valuable garden crops are grown. As laid down in the last year's report, the main object of this Farm is to check red rot by any means in the local Malbari cane (which is an early ripening and good yielding soft cane and for which the cultivators have a fancy) by investigating its causes; but if the efforts are not crowned with success, then to try to introduce superior varieties of sugarcane which are more or less red-rot resistant.

Out of the nine varieties tried, *viz.*, (1) Malbari, (2) Pundya, (3) Stripped Mauritius, (4) Bangdya, (5) Bassein Red, (6) J. 247, (7) Manjav, (8) Red Mauritius, and (9) Khar'ya; Stripped Mauritius and Manjav seem to be promising ones. Of these nine varieties, Bassein Red, J. 247, Manjav and Red Mauritius were not at all affected with red rot; while Stripped Mauritius had only 15 per cent. as against 55 per cent. in Pundya which tops the list, giving the highest yield of *Gul*; while Malbari had none at all in the different plots, as it ripened earlier than all the rest before the disease made its appearance.

The results are not worth mentioning, as the season was very unfavourable with only one-third of the rainfall of the tract.

(2) *Broach Farm.*—As stated in the last year's report the analytical work in Goghari and Broach Deshi cotton was continued, and even though the season was very unfavourable with only one-third the rainfall of its normal average, the Farm was fortunate enough in preserving the fixed superior strains isolated last year and of further selecting unit plants from Lalio, Wagad and Goghari, as the famine conditions further north were even worse than those of Broach. 18 Strains of Lalio, 35 of Wagad and 8 of Goghari were isolated for further trial.

II.—Work done by Special Assistants.

Cotton Branch.—On the Surat Agricultural Station the selected strains were compared with Surti-Deshi and the work of unit selection was continued to secure if possible a further improvement. The mass selected sample of Selection I-A has maintained very high ginning percentage as compared with that of the Deshi. If the higher yield of seed-cotton, the higher ginning percentage and the higher valuations of lint are taken into account in Selection I-A, it would yield extra profits of Rs. 45-6-4 (roughly 29 per cent.) over the Surti-Deshi.

The season was exceptionally early for cotton and the ginning percentage was high.

Out of the unit selected strains, 4 of Selection I-A, 5 of Selection II, 10 of 1027 A. L. F. and one of 1018 P.G. have been retained. Out of these strains the seeds of the important strains are being tried this year on a large scale.

It will be interesting to observe that a strain from 1027 A. L. F. with a staple superior to that of Navsari and almost equal to that of middling American, combined with high ginning percentage, has been evolved in the last three years. It will be further tested for comparing the yield on a field scale. This seems to be a promising strain for the Navsari tract.

Selection of unit plants of Lalio, Waged and Goghari was continued at Broach, as there was famine in the Ahmedabad District. 13 Strains of Lalio, 35 of Waged and 8 of Goghari have been isolated for further trials.

Examination of the composition of cottons obtained in the several Gujarat Districts was made as usual from 55 samples collected at different ginning factories. The results of analyses indicate the following observations:—

Ahmedabad District.—24 Samples were examined. In Lalio cotton the highest mixture of Goghari was nearly 72 per cent. Excepting the samples from Viramgam, a considerable mixture of Goghari was found in the samples passed as Waged. One sample of Mathio from Ranpur showed as high as 80 per cent. of white flowered variety.

Kaira District.—7 Samples were examined: Pure Neglectum from Malva side appears to have been brought for mixing. A sample of Kanvi showed 4 per cent. mixture of Neglectum. The local Kanvi is showing an increased percentage of Goghari.

Broach District.—13 Samples were analysed. The lowest percentage of Goghari observed was 65.38. This certainly shows that its mixture is increasing rapidly, and practically the whole crop is now of Goghari with a sprinkling of Broach-Deshi.

Surat District.—11 Samples were examined. All showed a mixture of Goghari varying from 4.21 to 18.18 per cent.

On examination of the standing crop of cotton of several villages of Bardoli Taluka, it was observed that pure Goghari was grown to a large extent in some of the villages. The seed was brought from the Broach District and the resulting local produce from introduced seed was separately ginned for securing seed for further sowings.

Organized efforts are being made this year to check the further spread of this variety in the Surat District.

Entomological Branch.—The services of the Entomological Assistant were partly utilized in Famine duties at Broach and partly in preserving and storing large quantities of rare and valuable seeds of cereals, pulses, oilseeds and cotton varieties. He also attended the biennial Entomological Conference at Pusa. The account of the more important pests that were treated by him is as follows:—

Katra (Hairy caterpillar).—This pest was more prevalent on maize crop in the District of Panch Mahals. It was checked considerably on the Dohad Farm by the use of light traps and bagging. As many as 3,192 Katra moths were entrapped by light traps and 92,000 hairy caterpillars were bagged and destroyed. Tachinid Fly parasites and predacious wasps were investigated and encouraged. In the District, bagging demonstrations of catching hairy caterpillars were made and bags were supplied to the cultivators.

Jowar Moth borer.—This pest was rather more or less prevalent on Jowar crop in the District; but on Government Farm it was very insignificant. The removal of affected shoots in the early stage of the crop was resorted to.

Aphis.—This being a year of drought, the pest was very common in the District on several crops. On Government Farms the colonies of Aphis on Jowar crop were sprayed with an Incosopol solution in the proportion of 5 ozs. to 4 gallons of water, which was successful in killing most of the colonies. Lady bird beetles and other predacious insects were also found to keep the pest in check.

Ratadia disease of Jowar.—This pest generally becomes more prevalent in Surat District on Kharif Jowar in a year of drought. This is caused by the colonies of very small mites. A spraying demonstration of Incosopol and sulphur in the proportion of 4 ozs. Incosopol, 2 ozs. of sulphur sublimed powder and 4 gallons of water was made in an area of one acre of Jowar crop at Vijalpur in Surat District, which was successful in annihilating most of the colonies of mites. The cost of such a spraying came to Rs. 2-5-0 per acre.

Cotton pests.—Two pests were more prevalent on cotton during the year. In the beginning the crop had caterpillars on top shoots which were greatly controlled on Government Farms by nipping off affected shoots. As many as 18,000 affected top shoots of cotton were nipped off and put in parasite boxes for the parasites to emerge and do their beneficial work.

As for the Boll-worms, Bhinda was used as a trap crop, but it did not thrive well due to a scanty rainfall, however, affected shoots and pods were removed from time to time and destroyed.

An Entomological exhibition was made at Godhra during the year, and the life history and remedial measures of common pests were explained to the cultivators with the help of the magic lantern slides.

Vernacular and High School boys of the Surat City and surrounding village schools were shown the entomological museum and explained the insect life for Nature study.

III.—Work of the temporary Establishment in Cotton.

There was a cry from the trade and the public since long that the mixture of Goghari cotton is increasing every year in the best Surti-Broach cotton tract of the Surat District. During the year under report, having received reliable information about the growing of Goghari cotton by some villagers, in the heart of the well-known Navsari tract growing the best Surti-Broach cotton, and fearing that if no prompt action is taken the whole tract will be hopelessly mixed with Goghari, I deputed the Cotton Fieldman to make full enquiries and report in details on the reported Goghari introduction. This report which confirmed the statement in an alarming degree, was forwarded to the Director of Agriculture who took prompt action in the matter in anticipation of Government sanction. In this connection he visited Surat twice and formed a representative Committee of traders and gin-owners to assist the Department in checking the further spread of Goghari cotton in this tract by increasing and distributing the seed of one of the best strains of the Surat Farm improved cottons, thus eliminating the local mixed seed of the tract. For this purpose, Government was pleased to create a special temporary staff of one Cotton Superintendent (Gazetted) with four Graduate Assistants. Every trial was made to secure as much seed of this strain, *viz.*, Selection I-A, as possible. During the current season 80,355½ lbs. of seed was secured and distributed in five groups of villages. The total area sown by this seed is 6,008 acres. It is intended to buy all the resulting seed from the above area and distribute it on a large scale in this tract.

The above staff is employed in supervising and controlling all the operations, *viz.*, (a) of distributing seed, (b) of sowing, (c) of watching the growth and observing other peculiarities of soil, climate and cultivation, and finally (d) of collecting the resulting produce, getting it ginned, and securing the seed for future sowings.

Necessary alteration in the above lines of work will be made, if experience requires it.

IV.—District Work.

This section covers a large range of an important propagandistic work and is mainly carried on by the Divisional Superintendent and his staff. This may be divided into the following sub-heads:—

- (1) Agricultural shows and demonstrations.
- (2) Agricultural depôts.
- (3) Demonstration plots.
- (4) Distribution of seeds, implements, etc.
- (5) Special work.
- (6) Agricultural Associations.
- (7) Publication of agricultural matters.

(1) *Agricultural Shows and Demonstrations.*—As usual shows and demonstrations were proposed to be held in the Division, but owing to famine all of them were dropped except the one at Godhra which was held along with the District Darbar as desired by the Collector. It was attended by 750 cultivators of all calibre from the whole District who seemed to be very much impressed and interested in what they saw. The Show was arranged on some such similar lines as those of last year.

(2) *Agricultural Depôts.*—During the year under report, four more depôts than those reported in the last year's report were opened.

Of the above depôts, one at Thasra was closed in August 1918, and the other two—one at Matar and the other at Lasundra—were closed towards the end of February 1919, as they did not work at all.

It was intended to transfer these depôts to some other promising centres, but on account of Famine conditions the idea was postponed, and the Depôt-keepers' services were utilized in the famine operations.

The following statement shows the value of implements stocked and the amounts of hire earned:—

Name of Depot.	Taluka.	District.	Implements.		Hire collected during.			Hire charges earned during 1918-19 from each Depot.
			No.	Value.	1916-17.	1917-18.	1918-19.	
1	2	3	4	5	6	7	8	9
				Rs. a. p.		Rs. a. p.	Rs. a. p.	Rs. a. p.
1. Matar	Matar	Kaira	6	289 0 0	Opened in April 1917.			43 18 0
2. Thasra	Thasra	Do.	3	114 0 0	Do			5 4 0
3. Lasundra	Do.	Do.	7	308 0 0	Do.	256 0 6		116 15 0
4. Prantij	Prantij	Ahmedabad	5	180 18 0	Do.			2 0 0
5. Godhra	Godhra	Panch Mahals	21	336 0 0	Do.			21 13 0
6. Dohad	Dohad	Do.	26	351 4 0	Do.		293 12 0	18 9 0
7. Jamiatpur	Daskroi	Ahmedabad	4	144 10 0	Opened in October 1918.			0 2 0
8. Naroda	Do.	Do.	2	58 4 0	Do.			2 6 0
9. Halol	Halol	Panch Mahals	13	324 11 0	Opened in July 1918.			11 14 0
10. Bulsar	Bulsar	Surat	...	220 0 0	Do.			.....
		Total	...	2,271 10 0	.....	256 0 6	293 12 0	293 12 0

The amount of the hire earned during the year shows an increase of Rs. 37-11-6 over that of the previous year.

(3) *Demonstration Plots.*—In the year under report 37 plots were arranged for in this Division. But owing to famine 24 failed to give results worth noting, of which nine were of sugarcane which was fed to cattle as fodder by their owners.

The following list shows the distribution of the plots in the different districts of Gujarat:—

Name of the district in which the plots are situated.	No. of plots.	Area.		Object of demonstration.
		Acres.	Gunthas.	
1. Surat	4	2	35	For varietal, manurial, rotational, deep-ploughing, etc., experiments.
2. Kaira	5	4	20	
3. Panch Mahals	20	61	10	
4. Ahmedabad	8	2	14	
Total	37	70	39	

(4) *Distribution of Seeds and Implements.*—In the year under report 200,179 lbs. of castor seeds and other seeds and implements worth Rs. 2,441-4-3 were distributed. The following statements show the distribution in each case:—

Cotton Seed Distribution.

	1915-16.	1916-17.	1917-18.	1918-19.
	Lbs.	Lbs.	Lbs.	Lbs.
Agricultural Stations	11,964	39,998	34,751	43,266
Depôts in Gujarat	38,956	38,593	65,129	39,308

Distribution of other seeds.

	1915-16.	1916-17.	1917-18.	1918-19.	
	Lbs.	Lbs.	Lbs.	Lbs.	
Agricultural Stations	9,609	20,536	55,123	52,639	The figures in the column for 1918-19 include— 5,468 lbs. of Jowar varieties. 11,045 " Sundhia Jowar seed. 21,612 " Maize seed. 10,820 " Sun seed.
Depôts in Gujarat	3,037	6,438	56,495	147,540	
	12,646	26,974	111,618	200,179	128,000 " Sundhia seed. 14,155 " Castor seed. 2,070 " Gram seed.

Prior to the failure of the season, it was decided to distribute castor and wheat seeds at certain concessions in order to encourage their cultivation. 1,021 lbs. of castor seeds were already distributed in the southern Talukas of the Surat District. Accordingly, 288,000 lbs. of wheat seed was also stored in Dohad for distribution to Bhil-cultivators on the Tagavi system as was done last year. But as rains failed, Rabi sowings could not be done, and the whole of the seed stored was sold off at a clear profit of Rs. 750 to Government.

The increased distribution shows the increased attention paid by the cultivators to the Departmental work.

Distribution of Implements.

		1918-19.	
		Rs.	a. p.
At Agricultural Stations	...	1,149	18 9
At Depôts in Gujarat	...	1,291	6 6
		2,441	4 8

(5) *Special work.*—The scheme organised in 1914-15 to distribute improved cotton seed and market its produce by a joint sale Committee was continued and 15,173 lbs. seed of Selection I-A was distributed in the Athwa group as detailed below :—

Village.	Variety.	Quantity of seed.	Area.
		lbs.	A. g.
1 Althan	Selection I-A	2,968	164 14
2 Bhatar	Do.	1,244	108 35
3 Bharthana	Do.	5,920	431 7
4 Athwa	Selection II	884	51 6
5 Umra	Do.	2,622	100 0
6 Piplod	Do.	1,634	166 26
7 Bhimrad	Do.	582	67 9
Total seed		15,173	1,134 17

The Divisional Superintendent with the Committee as usual arranged to sell the resulting produce to Messrs. Hatimbhai and Company's Mills at Surat on the same terms as those usually offered by the Hon'ble Mr. Purshottamdas of Messrs. Narandas Rajaram and Company, as the latter was unwilling to carry on the transaction. But after selling the first lot of 47 Bhars 16 maunds and 10 srs. (=43,482 lbs.) and getting it ginned, the Committee disagreed and was dispersed by the Divisional Superintendent, allowing the cultivators to sell off their produce wherever they liked. By the time I got this information, some of the villagers sold off their cotton about 65 Bhars (=59,280 lbs.) to a Gin-owner Mr. Kapadia, and others were going to follow suit, had it not been for my running down from Broach and persuading those that had not sold to hold off their sale till I could arrange their sale. An auction sale of the remaining produce was arranged for which brought Rs. 30 per Bhar more to the cultivators and the resulting seed was secured from the buyers at market rate. Mr. Kapadia was approached with a request to heap the Kapas that he bought separately and sell the seed to the Department at market rate which he kindly accepted. The ginning at both these places was done under the supervision of the Department which was thus able to secure about 80,000 lbs. of seed just enough to sow about 6,000 acres, and a critical situation was saved.

(6) *Agricultural Associations.*—There are 12 Agricultural Associations, in all, of which three are District Agricultural Associations, and the rest nine Taluka Agricultural Associations. Of these, the one at Broach published a quarterly magazine with a large circulation. The Nadiad one owns a Farm and those in Panch Mahals organised a show and are maintaining Depôts for implement hiring.

(7) *Publication of Agricultural Matters.*—A quarterly Agricultural Magazine is regularly published by the Broach Agricultural Association and 1,312 copies are issued. The agricultural matter published is mostly supplied by the Gujarat staff. An article on famine fodder of the Nalkantha was written by Mr. Pathak, District Agricultural Overseer, Ahmedabad, for the Pusa Journal.

V.—Special Famine Work.

Hopes were entertained by all that the situation will be saved by late September and October rains, and no great move was made to combat the impending famine. But when those hopes were not realized, efforts were made to collect and distribute seed of Sundhia Jowar (*Andropogon Sorghum*) and other seeds such as Maize, lucerne and other fodder Jowars for growing fodder in famine-stricken parts where irrigation facilities

existed, either from wells or rivers. Later on when these conditions developed into severe famine conditions, all the staff that could be spared from the Farms and District was utilized in special agricultural famine operations undertaken by the Department. Towards the end of January 1919 a Special Agricultural Famine Officer was appointed for Gujarat with independent charge of the Gujarat Districts. These operations may be subdivided into:—

- (a) Procuring and selling seeds of fodder crops at concession rates and at cost price.
- (b) Growing Sundhia fodder jowar on the Nurbada Bet lands under Departmental control.
- (c) Purchasing and stocking seeds of those varieties which are likely to go extinct or are not within easy reach of the cultivators.
- (d) Demonstrating the use of Prickly Pear as fodder wherever it could be had in large quantities.
- (e) Chaffing and supplying Jowar stubbles as fodder to the affected parts.

(a) *Procuring and selling seeds of fodder crops at concession rates and at cost price.*—People having realized famine conditions at once tried to grow fodders under irrigation wherever possible. But the prices of seeds went so high as to be out of reach of ordinary cultivators. But the Bombay Famine Relief Committee came to their relief and gave a concession of 25 per cent. on the cost price for poor cultivators. Thus the total seed distributed at 25 per cent concession came to 1,802 Maunds (=72,080 lbs.), and the total amount of concession given amounted to Rs. 2,496-10-0. In addition to the above 57,120 lbs. of Sundhia seed and 21,612 lbs. of maize and other seeds were sold at cost price to well-to-do cultivators and others.

(b) *Growing Sundhia Fodder Jowar on Bet lands at Zadeshwar and Nikora on the Nurbada River.*—This was a totally new scheme suggested, which could, if successful, supply a very nourishing fodder near at hand at a comparatively low price as compared with the forest grass. The scheme was sanctioned very late, and with the greatest exertion day and night that the Department succeeded in growing a total area of 2.0½ acres at a cost of Rs. 29,292-1-6. The total yield of green fodder was 2,433,077 lbs. and it realized Rs. 17,110-11-7. Had the scheme been taken up from October-November, the results would have been a financial success. A separate report has already been submitted to Government by the Director of Agriculture with his No. 10006, dated 9th August 1919.

(c) *Purchasing and stocking seeds of varieties likely to go extinct or which are not within easy reach of cultivators.*—16,000 lbs. of Bhavnagari Bajro seed was purchased and stocked at Nadiad. Almost the whole of this has been distributed. 480 lbs. of Sutarsal rice, 640 lbs. of Kamod rice and 2,495 lbs. of Jirasal rice—the produce of the Dohad Farm was reserved and distributed as seed.

(d) *Demonstrating the use of Prickly Pear as cattle food.*—There is not much of prickly pear in this Division, but wherever it was found to be in sufficient quantities, e. g., Jambusar Taluka of the Broach District and in the Panch Mahals, demonstrations of how to prepare its fodder were held and several cattle in both the above tracts were mostly fed on it.

(e) *Chaffing and Supplying Jowar stubble as fodder to the affected parts.*—In addition to the above remedial measures taken to supply fodder, a trial was made to collect Jowar stubbles (which ordinarily go to waste) and supply to the affected parts with the chaff of these stubbles. The cultivators of South Gujarat where Jowar had overgrown in height, only cut and removed the tops of Jowar plants of convenient length and allowed the stubbles varying in length from 4 to 6 feet to remain in the fields. These stubbles were first purchased, chaffed and fed to Amalsad and Surat Farms bullocks for several days. When it was found that these well-fed cattle ate and lived on this stuff, the matter was brought to the notice of the Director of Agriculture who consulted the Commissioner in the matter and being assured by him, as regards the demand and supply of waggons ordered the operations on a large scale for supplying the stuff to the famine-stricken districts. Accordingly, several power chaff-cutters were put at different stations on the B. B. & C. I. and T. V. Railways, and a total quantity of 1,754,189 lbs. of chaffed stuff was supplied to the famine-stricken parts in Gujarat north of the Nurbada River. A detailed report will be separately submitted as soon as the accounts are adjusted with the persons to whom the stuff was sent.

Mr. Khandubhai Bhagwanji Naik, District Agricultural Overseer, Panch Mahals, has worked very hard and intelligently in conducting the famine operations in his District, specially in distributing seeds both of fodder crops and others, and in assisting the Collector in his grass operations, and he deserves to be specially mentioned for all that he has done in this Famine.

BHIMBHAI M.,

Surat, 15th September 1919.

Deputy Director of Agriculture, Gujarat.

APPENDIX D.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE,
CENTRAL DIVISION, POONA, DURING THE YEAR 1918-19.

The charge of Northern and Central Divisions was held by me till the 24th of October 1918 when I went on leave for three months. Mr. Bhimbhai M. Desai, the Divisional Superintendent of Agriculture, N. D., acted in my absence. On return to duty I continued in charge of the Central Division only, Northern Division being kept with Mr. Bhimbhai M. Desai as Special Agricultural Famine Officer, Gujarat. Mr. V. K. Kogekar continued to act as Divisional Superintendent of Agriculture, C. D., except when on leave for 1½ months from 4th May to 18th June 1918 when Mr. Athalye acted as Divisional Superintendent. Mr. G. N. Shasrabuddhe held the charge of the Canal Division throughout the year except when on leave for two months from 19th September to 19th November when Mr. S. B. Jadhav acted for him as Sugarcane Expert.

The following summary of work deals only with the work done in the Central Division, the work in the Northern Division being separately reported on by Mr. Bhimbhai M. Desai.

Due to scanty and ill-distributed rains in the season, both Kharif and Rabi crops in most parts of the Division did not come up well. In Khandesh and Western parts of Nasik District some crop was harvested; Ahmednagar, Eastern part of Nasik, and whole of Poona and Ahmednagar Districts were very bad. The season told on the outturns of the Government farms as well.

The whole staff in the Division was practically put on famine work which will be described hereafter.

The summary is divided into work on:—

- (i) Crops.
- (ii) Extension work.
- (iii) Famine work.
- (iv) Miscellaneous work in connection with Famine.
- (v) Remarks.

(I) CROPS.

Cotton.

The general organization for the supply of N. R. cotton seed, described in previous reports, has been followed. Pure stock seed is produced on the Government Farm at Jalgaon (East Khandesh). To multiply the seed on as large a scale as the staff can handle, it is grown on 29 registered seed growers' plots. To supplement Departmental activities in this direction Jalgaon Farm seed is also supplied to 10 seed growers of the Agricultural Associations and 17 seed growers of the Co-operative Seed Societies in Khandesh, care being taken to purify crops belonging to all such seed growers.

The farmer has been getting more outturn per acre as the variety is more prolific. He is obtaining better price for his kapas due to its higher ginning and whiter colour. With the recent growth of the Co-operative Cotton Markets encouraged by the Revenue and Agricultural Departments and looked after by the Co-operative Department Cotton, especially N. R. is beginning to fetch still higher prices to the cultivator taking his seed-cotton to such Co-operative markets.

During the year under report 42,544 lbs. of pure stock seed was produced on the Jalgaon Farm. All this was used for multiplying the seed as above described. After leaving part of the produce to the seed growers about 59,149 lbs. of seed was received back from them for general distribution among the farmers. The total distribution of N. R. Cotton seed during the year under report amounted to 101,069 lbs.

Mass selection.—With a view to continue selection of seed and to sow only the selected seed on the Seed Farm every year, seed from high yielding and better ginning plants from the crop of the seed grown from previously selected plants, is collected sufficient for a small plot, the seed from which is multiplied in subsequent years in large plots to supply the requisition of the whole farm. This is done year after a year since 1915-16, as a result of which our mass selected N. R. gins ½ to 1 per cent more than ordinary N. R. This has influenced the ginning percentage of Farm cotton which ginned last year 40%.

Unit selection.—With a view to find out still higher ginning strains in N. R. unit selection work is also undertaken during the last three years. This work was commenced with 100 plants selected by observation for better yield and high ginning. For further

work actual ginning and weight of seed cotton from each of the selected plants, are taken. The following plants kept for 1919 show decided increase in ginning:—

I.—Unit selection of 1916-17.

Plant No.	Ginning per cent. 1916-17.	Ginning per cent. 1917-18.	Ginning per cent. 1918-19.
1	37.40	45.83	40.0
3	42.91	45.45	43.24
4	41.07	45.45	42.10
8	40.89	50.0	41.66

II.—Unit selection of 1917-18.

Plant No.	Ginning per cent. 1917-18.	Ginning per cent. 1918-19.
1	44.44	37.40
2	42.85	39.60
3	34.61	42.91
4	33.33	41.07
5	44.44	43.0
6	48.00	40.72
7	43.24	43.29
8	38.63	40.96

III.—Unit selection of 1918-19.

Plant No.	Ginning per cent. 1918-19.
7	38.10
15	38.28
57	38.0
63	38.10
66	38.40
69	38.28
73	38.22

Four types of N. R., separated according to colour of the seed and adhesiveness of lint on to the seed, tried for the last three years show that the colour of the seed is not a constant factor in N. R. Types showing different shades of colour in seed showed no difference in yield nor in ginning. The loose seeded type, however, has ginned 45% against 37 to 40 in case of ordinary N. R. for the last two years and it is now put on a field scale for comparison at Jalgaon with N. R. and other cottons, the trials of which have come to a stage when they have to be confirmed on a field scale. The following statement shows ginning of these types.

Name of the type.	Ginning per cent.		
	1916-17.	1917-18.	1918-19.
1 N. R. green seeded	38.05	35.51	35.45
2 N. R. black seeded	40.97	38.06	38.25
3 N. R. loose seeded	38.86	45.20	44.68
5 N. R. general	37.50	37.50	38.00

Comilla Bani crosses.—Number of Comilla Bani crosses were made about ten years ago. These were grown year after year till last year when out of a number of crosses only seven were taken as fixed. These were carefully gone over by the Imperial

Cotton Specialist last year who took them as practically fixed. The following shows the outturns, ginning and valuation of these seven crosses tried on field scale (4 on 20 guntha and 3 on 10 guntha plots each).

Serial No.	Name of cross.	1916-17.			1917-18.			1918-19.			Remarks of the cotton supervisor on fibre for 1918-19.
		Yield per line.	Ginning per cent.	Valuation per Bombay Khandi.	Yield per line.	Ginning per cent.	Valuation per Bombay Khandi.	Yield per acre.	Ginning per cent.	Valuation per Bombay Khandi.	
1	B I P 3 ¹² .	Lbs. Tolas. 4 8½	37.7	480	Lbs. 8½	35.87	450	Lbs. 290	35.80	490	Soft and long like Broach with good ginning.
2	B I P 4 ^{3/12} .	8 10	36.33	460	8½	36.56	440	254	36.58	440		Soft and long like Ghogari with good ginning.
3	B VI 1 ¹ ...	6 5	37.5	475	7½	30.17	400	190	30.20	440	Soft and long like Ghogari with fair ginning.
4	B IV 5 ^{2a} ...	4 15	34.6	475	8½	35.04	300	156	35.25	470	Do. do.
5	N. R. ...	5 0	39.6	370	8½	38.47	360	324	39.00	370	Shorter than Khandesh.
	Broach ...	...	...	490	...	...	490	...	...	475	
6	B XI 6 ^{2/10}.	...	...	...	...	...	Surat.	180	36.36	...	Soft and long like Broach with fair ginning.
7	B XX 14 ¹⁶.	...	...	...	...	...	...	232	36.60	Not valued.	Do. do.
8	B IV 5 ^{2a2}.	...	...	...	...	...	...	140	36.90	Not valued.	Very soft and long like Broach with good ginning.

The table shows that the valuation of the first four is as good as of Broach; ginning of 8th, 7th, 2nd, 1st, and 4th is good. The yield of 1st, 2nd, is fair. It therefore seems that 1st, 2nd, 7th and 4th are likely to do well in Khandesh. The important crosses are therefore transferred to the Superintendent, Jalgaon Farm, for trial on field scale in one acre plots. It is contemplated to gin these separately and send bales (instead of samples) of lint for valuation.

Tata and sons have kindly valued the samples on 7th March 1919 sent to them as under.

Basis of valuation:—

	Rs.
(1) Surat ...	525
(2) Bani Hinganghat ...	520
(3) Fine Broach ...	475
(4) Fine Khandesh ...	390

No. 1—B. I 4^{3/12} If the seed is grown of Bani cotton grown on Khandesh soil, it has deteriorated. But if Bani is crossed with Khandesh, Khandesh has improved a good deal. Value at Rs. 440.

No. 2—B. II 3¹² This is superior to No. 1, staple being longer and the fibres also very strong. It has greatly attained the characteristic of Bani, Value Rs. 490.

No. 3—B. VI. 1¹ This is almost same as No. 1. Value Rs. 440.

No. 4—B. IV. 5^{2a} This is superior to No. 1 and 3 but a bit inferior to No. 2. Value Rs. 470.

No. 5—N. R. Khandesh:— This is pure Khandesh but staple is shorter even than ordinary cotton grown in the District. Value Rs. 370.

Crude night soil:—Crude night soil as usual gave good results; the use of it is extending and it is being utilized near several Taluka Towns as Jalgaon, Bhusawal, Pachora and Chopda. While at Erandole and Amalner night soil is made into Poudrette. Near Chalisgaon and Bhadgaon Bhil cultivators make Poudrette.

Sugarcane.

The work on Sugarcane in the Central Division consists of (1) Demonstrations of growing sugarcane more economically and profitably and (2) Experimental work as cultural, manurial and varietal experiments.

The sugarcane plot at Kopargaon was splendid and we could harvest good crops. There was hardly any such plot in the valley. While looking to the outturns however we have to remember that with cultivators' farms our farm also suffered due to breach in the canal when we could not get water for 23 days.

For demonstration two plots, of 30 gunthas each, one planted and manured according to the practice of the irrigators on Godavari canal and another plot treated as advocated by the Agricultural Department, were planted. In the latter plot planting was done 5' apart giving concentrated manure, in three doses, first two containing more quick acting manure, the total quantity of nitrogen in concentrated manure not exceeding 150 lbs. per acre. Interculture and earthing up of cane in this plot was done by implements. The results of these plots calculated per acre are given below.

Method.	Outturn per acre.		Cost of cultivation in Rs.	Net profit (+) or loss (-)	Remarks.
	Weight of outturn.	Value of outturn.			
Local method ...	Lbs. 9,884	Rs. a. p. 1,188 12 8	Rs. a. p. 791 12 8	Rs. a. p. 351 15 0	The cost of cultivation includes rent of land, supervision charges, interest on outlay, etc.
Improved method ...	10,880	1,824 11 0	687 4 0	686 8 6	
Difference in favour of improved method.	1,548	190 14 9	94 9 8	284 4 6	

The improved method saves especially in manures, seed and after cultivation and increase outturn. The method is being pushed in the Canal Division through special staff.

In the manurial trials, groundnut cake and ground cake with Ammonium Sulphate have given very good results (for particulars see Kopergaon Farm report).

Sugarcane class was held on the farm especially for the benefit of the Secretaries of the Co-operative Credit Societies.

Java method of planting cane.—In the District this method gave very encouraging results in a partially water-logged field at Velapur (Godavari Canal) with Khadya cane. A deep drain was cut round the plot and the crop was irrigated only when it was absolutely necessary, only seven waterings being given throughout the season.

The total outturn per acre was 7,817 lbs. of gul. The value of this at Rs. 28-9-0 per palla (250 lbs.) came to Rs. 893-1-6. The cost of cultivation including water charges (at Rs. 22-8-0 per acre) came to Rs. 425-1-0, leaving net profit of Rs. 468-0-0 per acre.

Fodder.

Fodder growing at the Fodder Farm, Kopergaon.—In Kharif season Nilwa was grown on a large scale. From 70 acres and 30 gunthas, 2,44,152 lbs. of dry fodder and 9,669 lbs. of grain were obtained. The net profit per acre after paying the cost of cultivation including water charges came to Rs. 91-10-1.

In hot weather 32 acres 3 gunthas were put to Maize, Sundhia and Hundi fodder. This supplied 9,034 lbs. of dry and 161,267 lbs. green fodder. The net profit per acre came to Rs. 10-8-8.

(1) *Perennial crops.*—Lucerne, in its second year, supplied about 37,000 lbs. of green fodder and left a net profit of Rs. 110-7-4 per acre.

(2) Shevari is found to do well and when established it gives good outturns.

(3) *Marvell grass.*—This supplied 8,000 lbs. of green grass per acre and left a net profit of Rs. 50-9-8.

Manuring.—Ammonium Sulphate, groundnut cake and farm yard manure were tried in duplicate plots on jowar for fodder. Both Ammonium Sulphate and groundnut cake have left more profit than in the case of farm manure and no manure, Ammonium Sulphate being more profitable than groundnut cake.

Baling and shredding.—The machine was worked 56 days (about 6 hours a day) and produced 7,771 bales weighing 3,90,753 lbs. The average daily output was 139 bales weighing 50 lbs. each. The work is hard and the dust produced suffocates workers; hence work has to be stopped for giving the workers rest after every hour. The cost of baling including wires came to annas 3 and pies 7 per bale (i. e. 51 lbs.)

Distribution of fodder.—The farm served a very useful purpose in as much as it supplied during the year under report 352,951 lbs. of dry fodder over and above its own requirements and the neighbourhood as also the cattle camps received very timely help from this farm. The farm in addition supplied about 7,000 lbs. of fodder seeds for distribution.

(II) EXTENSION WORK.

This work covers a wide range and is increasing in popularity and extension. The work is carried through Divisional Officers and Agricultural Overseers. In some parts this kind of work is further supplemented by the Local Agricultural Associations and Co-operative Societies under the advice and supervision of the Departmental Officers.

Extension work, in the Division, is divided into

- (1) Agricultural Depots.
- (2) Seed growers plots.
- (3) Demonstration plots.
- (4) Distribution of seeds, manures and implements.
- (5) Shows and Demonstrations.
- (6) Agricultural Associations.

(1) Agricultural Depots:—These serve a very useful purpose. The depots stock and hire out improved implements and serve as Departmental agencies for sale of seeds, manures, implements, etc., at cost price.

In the following list of depots, value of implements stocked, and amount of hire earned are given:—

Serial No.	Name.	Taluka.	District.	Implements.		Hire collected during			Hire charges earned during 1918-19 from each depot.
				No.	Value.	1916-17.	1917-18.	1918-19.	
					Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
<i>Division Proper.</i>									
1	Vadgaon ...	Haveli ...	Poona ...	20	653 7 6				53 13 0
2	Loni ...	Do. ...	Do. ...	11	544 12 9				139 1 0
3	Collega Farm.	Do. ...	Do. ...	6	275 5 5				44 3 0
4	Mandavgaon.	Sirur ...	Do. ...	14	481 12 0				173 10 6
5	Peit ...	Khed ...	Do. ...	3	93 6 5				9 2 0
6	Pandeshwar ...	Purandhar ...	Do. ...	6	189 1 0				10 7 6
7	Newasa ...	Newasa ...	Ahmednagar ...	21	949 14 10				146 8 3
8	Shevgaon ...	Shevgaon ...	Do. ...	25					156 4 3
9	Nagar Farm	Nagar ...	Do. ...	6	232 3 0				141 15 0
10	Pimpalgaon Pissa.	Shrigonda ...	Do. ...	13	406 1 4				175 2 0
11	Karjat ...	Karjat ...	Do. ...	4	139 3 0	1,708 13 0	1,994 5 9	1,532 2 2	19 5 0
12	Sangamner ...	Sangamner ...	Do. ...	4	155 4 0				15 6 0
13	Nasik ...	Nasik ...	Nasik ...	10	552 12 0				141 4 0
14	Deola ...	Kalvan ...	Do. ...	12	280 4 10				168 18 0
15	Sindkheda ...	W. Khandesh ...	W. Khandesh ...	8	304 3 0				22 13 0
16	Shirpur ...	Shirpur ...	Do. ...	9	357 15 6				8 4 0
17	Dhulia Farm	Dhulia ...	Do. ...	6	225 0 0				4 0 0
18	Nandurbar ...	Nandurbar ...	Do. ...	3	124 3 0				5 7 0
19	Ner ...	Dhulia ...	Do. ...	5	181 0 0				11 0 0
20	Chalisgaon ...	Chalisgaon ...	E. Khandesh ...	8	324 0 0				45 8 0
21	Amalner ...	Amalner ...	Do. ...	8	321 0 0				15 0 0
22	Jalgaon Farm	Jalgaon ...	Do. ...	4	349 3 0				25 3 8
<i>Canal Division.</i>									
23	Kopergaon Farm.	Kopergaon ...	Godavari Canal	8	.....				160 11 0
24	Kopergaon ...	Do. ...	Do. ...	5	.....				98 3 6
25	Koihar ...	Pravara Canal.	Pravara Canal.	3	.....				17 1 0
26	Pohagaon ...	Godavari Canal.	Godavari Canal.	5	.....				6 12 0
27	Manjur ...	Do. ...	Do. ...	10	4,967 5 2	1,233 3 0	2,303 7 9	641 8 0	128 3 6
28	Ashwi ...	Pravara Canal.	Pravara Canal.	1	.....				0 3 0
29	Ozar ...	Kadwa Canal.	Kadwa Canal.	4	.....				30 8 0
30	Brahmangaon.	Gurna Canal ...	Gurna Canal ...	6	.....				161 15 6
31	Baramati ...	Bhimthadi ...	Nira Canal ...	4	.....				42 14 6
Grand Total ...					12,107 15 9	2,942 0 0	4,297 13 8	2,173 10 2	2,173 10 2

It may be noted that three of the thirty-one depots are managed for the department by private gentlemen without any remuneration, four are managed by private gentlemen who are given 10 per cent of the hire earned in the depots as honorarium, three are managed for the department by the Agricultural Associations through their *kamgars* and remaining twenty-one are managed through departmental agencies as *kamgars* or farm Superintendents. I am much obliged to the gentlemen and Agricultural Associations who managed our depots without remuneration as also to those who managed depots on small honorarium. As usual Messrs. Farate of Mandavgaon, Shivram Patil of Peit and Mr. Machale of Pandeshwar, (an old student of Loni school) in addition to the honorary depot work gave us excellent help in other branches of district work as well.

(2) Registered seed growers' plots.—Like the Agricultural depots, these plots in addition to the production of pure N. R. seed, serve the purpose of introducing improved methods of Agriculture and progressive ideas and most of them serve as model demonstration plots. There are 29 registered plots in the Central Division and they supplied in the year under report (a bad year no doubt) about 59,149 lbs. of N. R. seed keeping part of the seed produced for their general area.

(3) *Demonstration plots.*—With a view to demonstrate the value of our findings on the experimental stations, whenever necessary with due modifications, and to introduce such findings in the districts demonstration plots are organized.

The important demonstration being the introduction of improved system of growing sugarcane, namely planting cane sets, 4' to 5' apart and giving concentrated manures in three doses, the total quantity of Nitrogen in concentrated manures not exceeding 150 lbs. per acre. On Kadwa and Girna Canals as also on Bandharas in Nasik and Khandesh Districts attempts were made to introduce concentrated manures as it is not still common there to use cake, fish or ammonium sulphate. As a result of these demonstrations, concentrated manures are becoming popular in a few new centres such as Brahmangaon on Girna and Niphad and Ozar on Kadwa Canals.

(4) *Distribution of seeds, manures, and implements.*—In the year under report (when war was raging) large quantities of manures were distributed with a view to increase the food supply as will be seen from the statement below. Also large quantities of seeds had to be supplied as due to famine seed was scarce. As regards implements large number of chaff-cutters were distributed in order to economise fodder. The statements do not include the business conducted by Co-operative Societies and farms managed by the Professor of Agriculture in this Division.

Distribution of seeds.

Tracts.	Seeds.	1916-17.	1917-18.	1918-19.
		Lbs.	Lbs.	Lbs.
Division Proper	Cotton seeds	184,088	129,610	101,079
	Fodder seeds ... ..	.....	.....	64,858
	Other seeds	29,576	35,868	47,743
Canal charge	Fodder seeds ... ..	.....	.....	9,680
	Other seeds	3,647	4,776	1,985
Agricultural stations in Deputy Director's charge.	Seeds ... ..	.....	.....	19,101
	Total ... ..	.....	.....	233,446

This shows that 101,079 lbs. of cotton seed, 68,538 lbs. of fodder seeds and 68,829 lbs. of other seeds were distributed during the year under report.

Distribution of concentrated manures.

Tracts.	1916-17.	1917-18.	1918-19.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Division proper	1,725 13 0	1,130 5 0	4,150 0 0
Canal charge	10,551 0 0	10,371 11 9	12,617 3 8
Agricultural stations in Deputy Director's charge.	.....	.....	169 9 7
Total ... ..	.....	.....	16,936 13 3

Distribution of implements.

	1916-17.	1917-18.	1918-19.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Division proper	10,845 4 3	7,544 0 9	2,326 4 0
Canal charge	1,547 0 0	5,318 7 9	1,317 14 0
Agricultural stations in Deputy Director's charge.	.....	.....	822 12 0
Total ... ..	.....	.....	4,466 14 0

Besides following implements were purchased and lent to the cattle camps and cultivators for preparing prickly pear feed and chaffing kirbi.

Chaff-cutters worth	Rs. a. p.
Blow lamps "	8,590 10 0
Spray pumps "	535 12 6
	160 0 0
Total	9,286 6 6

(5) *Shows and demonstrations*.—Due to famine no shows and demonstrations were held during the year under report.

(6) *Agricultural Associations*.—There are a number of Agricultural Associations in the Division. The following however are doing useful work :—

- (1) Deccan Agricultural Association, Poona.
- (2) Jalgaon Agricultural Association.
- (3) Bhusaval " "
- (4) Jamner " "
- (5) Raver " "
- (6) Dhulia " "
- (7) Shindkheda " "
- (8) Shirpur " "
- (9) Nandurbar " "
- (10) Pachora " "

The Deccan Agricultural Association is conducting a useful monthly magazine, *i.e.*, *Shetki* and *Shetkari*. Jalgaon, Bhusaval, Dhulia, Shirpur, Pachora and Shindkheda Associations have employed their own *kamgars* for Agricultural propaganda and these men are found very useful. Jalgaon, Bhusaval, Raver and Dhulia Associations distributed good deal of seeds and demonstrated the use of ploughs and chaff-cutters. They have got their own seed-growers to grow pure N. R. cotton for their members. Jamner and Shirpur Associations have opened cattle breeding farms and have maintained nice herds. Dhulia Association occasionally issues useful popular leaflets. Shindkheda, Shirpur and Nandurbar Agricultural Associations last year distributed large quantities of fodder seeds. Nandurbar Association alone distributed seeds worth about Rs. 6,000. Shahada and Junnar Agricultural Associations are keen on taking agricultural work seriously. The growth of all of the Associations (except that of the Deccan Association) is only six years old and is due to the help received from the Revenue officers like Messrs. R. S. Hiremath, G. A. Hiremath, Rothfield, Potnis and others, as also from private gentlemen like Messrs. Ransing of Dhulia and Kaji of Jamner. Deccan Agricultural Association owes its initiation and work to the Central authorities at Poona. I however think that it is time now to co-ordinate work of these associations if possible through the Central Agricultural Association at Poona.

(III) FAMINE WORK.

The year 1918-19 opened with poor and late monsoon and so kharif crops could not be sown in most parts. Whenever kharif could be sown it was sown in the month of July but with the exception of East Khandesh and scattered fields in other districts protected by irrigation, these crops withered and died for want of sufficient rains. Even the late rains were absent and hence Rabi tracts remained practically fallow including Tapti valley where most of the wheat in the Central Division is usually grown. As a result of the failure of rains water-supply in the wells ran short. The canals also felt the pinch and area under sugarcane crop had to be considerably curtailed. Intelligent cultivators worked their wells as far as possible and pulled on till about November, when they also felt anxiety for food and fodder, especially for the latter.

Food question.—Of all the districts in the Central Division Ahmednagar suffered the most. The Agricultural Department, in good seasons, instructs farmers how to grow more food and fodder. Immediate relief of bringing food from outside remains with other departments; and Agricultural Department during the famine has only to supplement such and other efforts. In the Central Division we distributed concentrated manures to increase the supply of food. A large quantity of cake was distributed mostly on the canals for applying to wheat and jowari crops. This manure responded well.

To save seed of such of the important crops as would have disappeared and also to help the cultivator in getting good seed of important staples (Kharif and Rabi) large quantities of seeds were purchased. The work is still being continued for Rabi season and so exact quantities cannot be given at this stage.

Fodder question.—Due to the scarcity of rain last season fodder was scarce throughout the Division, want of fodder being felt as early as September 1918 and the situation became more serious in subsequent months, especially from March to July 1919. In the plains of Khandesh fair amount of kadbi and wheat straw and in the hilly parts of the districts straw and forest grass was available. In the Mawal tracts of Poona and Nasik and in the Dangs of Ahmednagar fair amount of straw and forest grass was available for local needs. Cattle from the plains however went there in herds. At this time there was scarcity of drinking water and supply of water was not adequate for the incoming rush of cattle and as a result large numbers of cattle going to the forests died either in the forests or on their way back.

In the plains want of fodder was very keenly felt and if it had not been for the Government stores of grass probably 75 per cent. of the cattle from the plains would

have been disappeared. But due to the distribution of Government grass supplemented by Government and private efforts by way of bringing fodder from outside, raising green fodder locally and making use of prickly pear and forest leaves fairly large percentage of cattle was saved. The work of the Relief Committees, in Bombay, Ahmednagar, Nasik, Poona and other large and small Committees all over the Division, was found useful. The Panjarpoles in the Division saved no small number. Yet from a census taken under the orders of the Collector of West Khandesh it has come out that the number of cattle was decreased by 40 per cent. in West Khandesh. In Ahmednagar District and in the Eastern talukas of Poona this decrease must be much higher.

Our efforts to meet the situation can be divided into the following :—

- (1) To bring the help and facilities offered by the Revenue Department to the notice of the cultivators.
- (2) To help and advise the local prickly pear depots in their management.
- (3) To run departmental prickly pear depots.
- (4) To run some pumping plants departmentally and advise others to whom engineering section of the Agricultural Department had lent pumping plants.
- (5) To increase fodder supply by distributing fodder seeds.
- (6) To supply them with quick acting manures to increase the food and fodder supply.
- (7) Economising existing stock of fodder by the use of chaff-cutters, etc.

(1) and (2) Myself, the Divisional officers and the Agricultural overseers were moving in the District asking the cultivators to raise fodder, making use of the existing wells. We tried to meet their difficulties when they were in need of fodder seeds and recommended them to the Revenue authorities when they wanted Tagai for repairing wells which were out of use. While on tour prickly pear depots opened by the Revenue officers, local bodies, panjarpoles, private individuals and by Agricultural Department, were visited to supervise and standardise the preparation of prickly pear feed and feeding and such work was found very necessary and useful, improper preparation and injudicious feeding of this feed being harmful. In the early part such tours were found more useful in bringing the help and facilities offered by Government through the Revenue officers such as giving Government grass at cheap rates and Tagai for seeds, manures and repair of wells, etc., to the notice of peasants residing far away from taluka head-quarters and in fact, I think, it is better to depute a fieldman from the Agricultural Department or a karkun from the Revenue Department out in each taluka, as soon as famine is declared, to acquaint people with the ways of relief offered to them.

(3) There were several dozens of prickly pear depots in each of the five districts opened by the Revenue officers and local bodies. We supplied as far as possible, trained men, chaff-cutters and forges to these depots. With our limited staff we could take management of only few depots in our hands. The Inspector of Agriculture on Famine Duty, Nasik, was one of the two principal managers of the Nasik depot. The Agricultural Overseer, Dhulia, paid special attention to the Arvi depot opened and carefully organised by Mr. MacMillan, the Collector of West Khandesh. In Ahmednagar District we gave a graduate to manage Belapur depot and skilled *mukadams* to the depots started in Shevgaon, Newasa, Ahmednagar, Shrigonda and Parner Talukas and Indapur and Khed Talukas of Poona District. In Poona District we managed two depots (one at Peit and one at Chakan) departmentally and the places being within approachable distances from my head-quarters I kept watch on them. At Peit and Chakan depots no cattle were taken, as in other camps. These two depots prepared prickly pear feed and sold to the cultivators, who freely purchased it at 5 annas per 100 lbs. (the cost of bringing prickly pear, burning, chaffing, etc. came to 5 annas per 100 lbs. as an average of several thousand lbs. sold). Later on, however, we reduced the price for the benefit of cultivators. Moreover we got Rs. 500 for Peit and Rs. 350 for Chakan depots from Bombay Presidency Famine Relief Committee and Poona District Famine Relief Committee respectively for cotton seed to be mixed with prickly pear. Peit depot worked for 103 days and sold 136,060 lbs. and Chakan depot worked for 54 days and sold 95,397 lbs. of prickly pear. In order to know the opinions of the people about such depots and to impress on them the lessons of famine, meetings were called at Peit and Chakan where people seemed to be very much pleased with the work of the depots. Though such depots, of necessity, must be limited in number yet I think for Famine Relief Committees this type is most suited. These are directly useful and have teaching value as for want of whole-time workers and trained hands Relief Committees find difficult to successfully manage cattle camps and it will be better if such Committees simply provide funds for prickly pear depots to the Agricultural Department and keep in touch with the work.

(4) *Pumping plants and fodder growing.*—The Director of Agriculture, in order to encourage pumping plants and fodder growing, gave a number of pumping plants on loan to private cultivators asking the Agricultural Engineer and the Deputy Directors to give these and other installations every help. The following shows the number of

plants in the Central Division which received help from the Department. The Agricultural Engineer's staff looked after the machinery while the Deputy Director and his staff supplied seeds, manures, often implements and gave advice in cropping.

No.	Name of Plant.	Break horse pump.	Area grown.	Crops.	Remarks.
<i>Poona District.</i>					
1	Shiroli	10	21	Maize and Potatoes ...	Plant belonging to a private man.
2	Nandgaon	37	410	Rabi crops and maize ...	Demonstration plant installed by the Department.
3	Vadgaon	4	13	Jowar and Maize ...	Department plant lent.
4	Poona	7	14	Do. ...	Do.
5	Chinchwad	10	17	Do. ...	Do.
6	Manjari	10	30	Maize ...	Department plant worked by the Professor of Agriculture.
7	Patas	10	10	Jowar and Maize ...	Department plant lent.
8	Bibyachi Wadi	7	2½	Maize ...	Do.
<i>Nasik District.</i>					
9	Gondegaon	15½	70	Jowar ...	Department plant worked departmentally.
10	Malegaon	7	12	Jowar and Lucerne ...	Department plant lent.
<i>Ahmednagar District.</i>					
11	Bhambora	60	30	Jowar and Maize ...	Department plant worked by the Union Agency.

The plants were found useful to the cultivators and were responsible for saving number of cattle besides producing food crops in addition.

The plant at Gondegaon on the Godavari was worked departmentally, Agricultural Engineer's staff being responsible for the field work. Mr. Bhagwat was in charge of Agricultural work of the plant. Fodder was grown on cultivators' land by themselves on condition that the Agricultural Department was to supply water (free of charge) and bear the expenses of water channels and half the cost of seeds and manure. The owners of the land were to perform all the field operations and give the Department half the produce. About 70 acres were sown with Khondi, Sundhia and Maize. The crop was top-dressed with oil-cake and ammonium sulphate. On the bases of the several tests, the outturn of green fodder from these 70 acres was estimated to be about 300 tons. In the beginning when the demand was keen fodder from each acre was sold at Rs. 188. At this rate Departmental share would have fetched about Rs. 6,000 at a cost of Rs. 1,475 plus irrigation charges. Conditions, however, changed on account of early rains when plenty of grass was available and as a consequence prices of fodder fell, the total sale of the Departmental share amounting to Rs. 960 only. The fodder, however, was of immense use in the neighbourhood and people have well understood the value of such plants.

(5) and (6) With a view to further increase the fodder-supply Hundi, Khondi, Kalbondi, Sundia and Maize seeds, as detailed under seed distribution, were distributed to the extent of 68,538 lbs. As a further help concentrated manures such as ammonium sulphate and oil-cakes worth Rs. 16,936-13-3 were distributed to stimulate the growth of fodder crops. Of the seeds distributed a large quantity was brought from outside the Division. The operations of the Department moreover held prices in check and helped cultivators directly as well as indirectly.

With a view to help the cultivators further, Tagai was obtained from Government and in a number of cases seed was supplied at 25 per cent. reduced rates. The amount of concession for hot weather and Kharif seeds amounting to Rs. 2,074-3-7 being kindly met by the Bombay Presidency Famine Relief Committee at my request. The work is not stopped here and I have arranged to purchase Rabi seeds worth Rs. 16,000 for the Central Division and I expect to receive Rs. 3,000 from the Honourable Mr. Purshottamdas, the Secretary of the Bombay Presidency Famine Relief Committee.

(7) All the chaff-cutters in my possession including the power chaff-cutters at Jalgaon and Dhulia were used for chaffing kirbi for the farmers at nominal rates. Besides 66 Rotary and 3 hand chaff-cutters worth Rs. 8,590-10-0 were purchased and the use of these given to the prickly pear depots and cattle camps free of charge. Chaff-cutters save fully ¼ to ½ of the kirbi and hence the use of these chaff-cutters was fully appreciated by the people.

(IV) MISCELLANEOUS WORK IN CONNECTION WITH THE FAMINE.

(1) *Capturing wild cattle in Chandhora Forest (near Nandgaon, District Nasik).*

In some of the forests in Central Division domesticated cattle, left loose by their owners in previous famines as also cattle absconded from villages herds have bred and

multiplied and their progeny is turned wild. They migrate from place to place in the neighbouring forests and are a source of trouble to crops. The trouble was felt in previous years, but it became more serious in the year under report when these cattle could not get anything to eat in the forests. The Agricultural Department, in the Central Provinces which had previous experience in this work, was requested to send a couple of experienced hands. The Department, however, could not spare any such hands and we had to take up the work ourselves. The campaign was delayed on this account. The campaign was planned on the lines adopted by the Agricultural Department in Central Provinces and Khedas as described by them were built. A non-graduate fieldman Mr. More was placed in immediate charge of the operations under the guidance of Mr. Athalye. I was present to help the party when operations were opened on the 27th May 1919. On this day 3 animals were caught. The operations were continued for 25 days during which time 3 bulls, 2 bull calves and 14 cows and heiferds were caught. Three of these died of accident while capturing, as they would not stand capturing. Many would not eat or drink anything and as a consequence 9 of the cattle starved themselves to death. The 7 survivors were sold to a cultivator for Rs. 119.

The Khedas have not been dismantled and if animals are seen next season in Chandhora Forest we will resume the work.

(2) Destruction of wild pigs.

Wild pigs have been a constant trouble in many parts of the Central Division and complaints have been received from West and East Khandesh and Poona Districts. The question of dealing with the pigs, living in some kind of forests and visiting grain, groundnut and root crops at night, is more difficult. In the case of sugarcane on the Nira Canal and also on the parts of Mula Mutha Canal to the east of Poona where pigs generally live in the sugarcane fields the matter is not so difficult.

Before undertaking the present campaign and while in charge of the Manjri farm as acting Professor of Agriculture I had attempted to tackle the question on a small scale (1) by improving the fencing, (2) lying in wait at night in the crop with guns, as also (3) hunting the pigs out of sugarcane fields with the help of Gosavis and their dogs and shooting the beasts when they come out. The first is costly and difficult and not suited with the present system of farming. The second can only be followed by the owners of the farm as it is very slow. The third is quite successful and one which can be pursued by organised parties and this was followed in the present campaign.

The campaign was planned in consultation with and help of the Chief of Phaltan and Rajasahab of Malegaon. Mr. S. B. Jadhav, Agricultural Overseer, Nira Canals, was placed in charge of the operations. The party under him consisted of about 20 beaters and 12 dogs. Of the beaters 3 or 4 men were given guns. Of the number of dogs 4 or 5 small ones were intended only to trace the pigs in the field while big dogs kept outside chased and killed young pigs (hunted out by the beaters) and such of the large ones as were wounded by the gunners.

The campaign opened its operations on the 23rd March. By the end of June 134 animals were killed at a cost of Rs. 809-5-0, i.e., about Rs. 6 per head of pig. Of the 134 pigs, 62 were shot by guns and 72 killed by dogs. During this period 286 animals were seen, out of which 134 could be bagged. I joined the party four times and was responsible for a number of pigs each time.

To my mind the work is very useful as each pig is considered to eat canes and grain worth Rs. 100 a year, the loss by way of destruction and spoiling being probably much more. At a meeting held to sound the opinion of the irrigators everyone seemed anxious to have some permanent organization to deal with the question of pigs and they were ready to offer any help.

As a result of the large number of kills and beating and chasing the tract near Barameti is at present practically free from the serious trouble of pigs. It has been reported that the survivors have left the tract and gone beyond Nira. The animals are likely to return again and we may have to plan some permanent organization to deal with the pig question in the sugarcane tract at any rate.

(V) REMARKS.

The whole staff in the Division, where there has always been more work due to the early organization and development of district work in several directions, had to put in strenuous work during the year under report especially due to the famine work such as the distribution of seeds, manures, implements; management and supervision of cattle camps, prickly pear depots and pumping plants; production of fodder and campaigns like killing pigs and capturing wild cattle, etc. Mr. Athalye was in charge of famine work in Nasik and Khandesh Districts. He is a pushing officer and he discharged his duties ably. Mr. Jadhav was in charge of the Kopergaon Sugarcane Plot and subsequently was in the district helping in the famine duties on Godavari and Nira Canals. His work both at the Farm and in the District was splendid. His keen sense of duty was especially noticeable while he was in charge of the pig-killing campaign.

Poona, 23rd September 1919.

P. C. PATIL,
Deputy Director of Agriculture, C. D., Poona.

APPENDIX E.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE,
SOUTHERN DIVISION, DHARWAR, DURING THE YEAR 1918-19.

STAFF.

In the absence of Mr. (now Lieut.) T. Gilbert, on war service still, Rao Sahab M. L. Kulkarni remained as Deputy Director of Agriculture throughout the whole year. He now completes three years' acting service in the vacancy caused by war. During the year under report the newly sanctioned post of the District Agricultural Overseer for Sholapur was filled up by Mr. C. R. Gokhale, a graduate of the Poona Agricultural College. His services were transferred to this Department from the Archaeological Survey Office, Poona, in Government Order No. 4699, dated 6th May 1919, Revenue Department. A non-graduate fieldman, Mr. B. S. Inamdar, working on the Gokak Farm, unfortunately died during the year, of influenza. Mr. Inamdar was one of the most brilliant men in the non-graduate staff of the Department. His place is now filled up by Mr. N. M. Handigol, who was a second clerk on the Dharwar Farm.

For the sake of convenience, the cotton work was separated from the general district work in the Division under the Inspector of Agriculture, and the charge of this work is given to Mr. V. R. Dharwarkar, who has been working in the district cotton work for some years past, and has thus acquired a good deal of practical knowledge in dealing with the cotton question, both with the cultivators and the cotton trade. The services of both Messrs. Dharwarkar and H. B. Kulkarni were lent for three months to the Co-operative Cotton Sale Societies at Dharwar, Hubli, Gadag and Bagalkot.

Mr. L. N. Deshpande, clerk-fieldman in the office of the Inspector of Agriculture, was appointed as District Agricultural Overseer for Dharwar District. But owing to his ill-health in the district he preferred to revert to his original post. This vacancy and the vacancy of the second clerk on the Dharwar Farm are yet to be filled up.

During the year under report, Mr. Swadi, Superintendent of the Gokak Canal Farm at Arbhavi, was on privilege leave for one month and Mr. I. S. Kulkarni, graduate fieldman on the same farm, acted for him.

Mr. Itigi, Overseer, Gadag Farm, having been transferred to the Cotton Branch on the Dharwar Farm, Mr. G. R. Deshpande, a graduate, was appointed in his place on that farm. The designation of Overseer, in charge of the office of the Gadag Farm, was changed into Superintendent, as the farm is now growing into importance and the work done there is as valuable as on other Government farms.

GENERAL.

The general line of work undertaken by the Department on Government farms and in cultivators' fields, *viz.*, land development, improvement of crops in quality and quantity, introduction of suitable machinery and implements, diffusion of agricultural knowledge through leaflets, bulletins, monthly vernacular agricultural magazines, agricultural education in vernacular agricultural schools and demonstrations of successful methods at different places, was pushed forward during the year as vigorously as could be done, notwithstanding the adverse circumstances owing to war, famine and influenza.

A good deal of the time of the district staff was engaged in the famine work undertaken by the Department, *viz.*, collection and distribution of varieties of grain and fodder seeds, in raising fodder crops and in demonstrating the use of prickly pear as cattle food under different methods. The use of hand implements, in places where bullock power was found insufficient, for sowing and interculturing, was also done, especially in the Belgaum and Satara Districts, with the result that some of the cultivators have taken to the latter operation, by human power in place of bullocks.

IMPLEMENTS.

The steady progress in the introduction of improved agricultural implements in this Division, of the previous 5 years, suddenly fell down during the current year owing to the extraordinary high prices for the same on account of war which can be seen from the following statement:—

Serial No.	Year.					Gross value of implements sold.
						Rs.
1.	1913-14	...	...	...	...	4,000
2.	1914-15	...	...	...	...	6,000
3.	1915-16	...	...	...	...	26,000
4.	1916-17	...	...	...	...	38,000
5.	1917-18	...	...	...	...	52,000
6.	1918-19	...	...	...	...	17,500

The details of implements sold by the different implement depôts under the control of the Department are given below :—

Serial No.	Name of depôt.	Value. Rs.
1.	Dharwar Farm	4,080
2.	Gadag Farm	1,911
3.	Devi-hosur School Farm	906
4.	Gokak Farm	2,499
5.	Chikodi Agricultural Association	700
6.	Belgaum Association	3,084
7.	Athani Association	1,000
8.	Bijapur Association	2,718
9.	Sholapur Implement Depôt	470
10.	Islampur Implement Depôt	160
Total ...		17,539

The experimental line of work, of hiring out to cultivators improved agricultural implements, such as ploughs, sugarcane mills and other apparatus, wheat-threshers, groundnut shellers, etc., undertaken by the Department as a demonstration for business purpose, either by individual private people or by Associations, Societies or other bodies, is becoming more and more popular. A number of new co-operative implement societies are being started in this Division, which, it is understood, are doing well. The District Agricultural Associations which have undertaken this work find it now as one of the important items of their work, as it has become a source of income to the Associations.

The following statement gives the details of implements hired by different institutions and the amount of hire realised till 31st March 1919 :—

Serial No.	Name of farm.	Details of articles hired.	Value of articles.	Amount of hire realised.	Cost of repair.	Per cent. of recovery on capital.	Value.
			Rs. a. p.	Rs. a. p.	Rs. a. p.		Rs. a. p.
1	Gokak Farm	3 ploughs with chain	196 7 2	98 8 0	45 8 0	50	185 0 0
2	Gadag Farm	9 ploughs, 1 wheat-thresher, iron chain 235 feet.	475 8 0	150 11 0	...	31.89	448 1 0
3	Devi-hosur	7 ploughs—Gallows, C.T.T., B.T.T., Sabul, 1 Planet Junior Hoe, 1 iron scraper.	353 11 6	99 0 0	9 14 0	27	343 0 0
4	Divisional Superintendent of Agriculture, Sholapur.	5 C.T.T., 4 Gallows, 5 Arlington, 7 Kirloskars, 1 D.T.T.	970 15 0	194 11 0	11 3 0	20	910 0 0
5	Dharwar District Agricultural Association.	25 C.T.T., 1 Gallows, 1 B.T.T., 1 Kirloskar, 1 wheat-thresher.	1,000 0 0	391 5 3	.....	29	905 0 0
6	Athani District Agricultural Association.	17 ploughs	.....	351 8 0	.....	...	Value not given.
7	Bijapur District Agricultural Association.	4 do.	.....	62 7 0	.....	.....	Do.
8	Chikodi Prince Victor Fund.	4 do.	.....	23 5 0	.....	.....	Do.

Experience shows that the success of hiring out improved implements depends upon the immediate repairs to such implements when they are returned by the cultivators after use, and the proper care with which these implements are stored when not in use. It seems, therefore necessary, that institutions keeping implements for hire should have a small workshop of their own, where petty repairs should be done to the implements hired in the busy season, and also undertake to do local agricultural implements of improved patterns in the slack season. If any institutions undertake to start workshops, the Agricultural Department would be glad to supply model local agricultural implements for multiplying the same in the districts through their workshops.

SHOWS AND DEMONSTRATIONS.

The usual demonstrations of useful agricultural implements such as different ploughs, sugarcane mills and other gul-making apparatus were only 14 this year as against 33 of last year. This was partly due to the failure of crops owing to famine, and partly to the staff being engaged in other urgent famine work, *viz.*, demonstrations of preparing prickly pear as cattle fodder and in raising fodder crops under irrigation. The former was demonstrated at 31 villages in the Bijapur and five places in each of the Dharwar and Belgaum Districts. Recently a new devise to remove the thorns by an iron thorn-picker, costing about six annas, has been devised for the use of individual cultivator, having only two or three cattle. The use of this thorn-picker was demonstrated along with the

established methods of burning the thorns by blow-lamps or by country bellows. The hand thorn-picker seems to become popular, as one man or woman is able to prepare about 70 to 75 lbs. of feed in a day of eight hours. The feed when prepared by the picker is absolutely free from thorns.

Two ploughing competitions were held, one in the Dharwar and another in Bijapur District. The total number of competitors in the two competitions was 40, out of which 12 received prizes worth in all Rs. 138. Part of this money was given by the Department and part by local contributions and by co-operative societies. The competition in the Bijapur District was held at Bagalkot at the time of the District Co-operative Conference held there.

The demonstration of water-lifts held by the Agricultural Engineer at the College Farm was attended by 29 cultivators from Sholapur District and 45 from Satara District.

Demonstration of good crops with artificial manures.—A maize crop at Arjunsonda in the Sholapur District was manured with artificial manures. The crop was exceedingly good. It was thought advisable to bring the crop to the notice of the surrounding cultivators. A demonstration was therefore arranged. Professor Knight from the Agricultural College visited the place to see the crop.

The following mixture of manures was given to the crops:—

Name of manure.	Quantity.
Farm yard manure	15 cart-loads per acre.
Superphosphate	100 lbs. per acre.
Sulphate of potash	50 lbs. per acre.
Ammonium sulphate	50 lbs. per acre.

Ridges were made 2½ feet wide, and the seed was dibbled in the middle of the ridges at 12 inches apart in the row. When the plants attained a height of 3 feet, they were earthed up as was done to sugarcane crop. The crop was planted on 3rd June and harvested on the 5th of September. The plants grew 10 feet high. The yield of grain per acre was 4,032 lbs. The yield of a fairly good crop of maize with ordinary farm yard manure in the district is about 2,500 lbs.

An experiment to demonstrate the use of oil-cake to irrigated paddy crop was undertaken at Mugatkhan-Hubli in the Belgaum District. Groundnut cake was given as top-dressing in the beginning of October and the following are the results of yield, etc. :—

Manure given.	Quantity per acre.	Cost of manure per acre.	Yield per acre.		Value of produce per acre.
			Grain.	Straw.	
		Rs. a. p.	Lbs.	Lbs.	Rs.
Sheep-folding +	Cost Rs. 9	9 0 0	2,700	1,200	250
Farm yard manure +	5 cart-loads	5 0 0	.....	.....	.....
Groundnut cake	280 lbs.	10 8 0	.....	.....	.....
		24 8 0			
Sheep-folding +	Cost Rs. 9	9 0 0	1,980	1,000	185
Farm yard manure	5 cart-loads	5 0 0	.....	.....	.....
		14 0 0			

The high value of produce per acre is due to the high rate for food-stuffs during the year. However the difference in the yield of grain per acre in the two plots shows that top-dressing of some quick acting manures to paddy crop is profitable.

The new method of planting sugarcane in the row system has been introduced in 20 villages in the Sholapur District, 3 in Satara, 2 in Bijapur and 6 in the Belgaum District. The method is becoming popular, as it requires less water and it is hoped that it will soon be taken up by all the sugarcane cultivators especially in the well-irrigated tracts.

The details of copper sulphate packets distributed in this Division are shown in the following statement:—

Serial No.	Name of District.	Number of packets.
1.	Dharwar	4,047
2.	Belgaum	1,085
3.	Bijapur	516
4.	Sholapur	41
5.	Satara	554

6,243

There was very little scope for extending this work during the year owing to unfavourable season all over the Division. As stated in the last year's report, it is extremely difficult for the limited staff of the Department to distribute large number of copper sulphate packets in a short period of sowing jowar all over the places. Thus I have suggested last year that this simple work should be undertaken by different bodies, viz., Municipalities, Taluka and District Local Boards, Circle Inspectors, stamp-vendors, village officers and Co-operative Credit and Agricultural Societies. I urge this suggestion once more as it is one of the important simple improvements to be introduced in all parts. Its introduction to the full extent is remaining behind, simply for want of proper organisation.

Fruit Trees.—Owing to unfavourable season, the progress made under this head was not much during the year, though a few plants of different varieties of fruits were obtained and distributed.

Distribution of seeds and manure.—As stated in the last year's report, the work of distribution of ordinary seeds is handed over to the Co-operative Seed and Sale Societies. Accordingly these Societies are distributing very large quantities of seeds, especially of different varieties of cotton, viz., Kumpta, Dharwar-American and Cambodia. The distribution of seeds of selected varieties of cottons as usual and of food-stuffs owing to famine this year only, was undertaken by the Department. The following statement gives the details of the seeds distributed:—

Serial No.	Description of the seed.	Quantity distributed in lbs.	Remarks.
1	Kumpta Selected (Dharwar No. 1)	4,200	Grown on Dharwar Farm.
2	Do. do.	15,550	Seed obtained from seed-growers.
3	Kumpta Cross	1,000	Grown on Dharwar Farm.
4	Upland type of D. A. cotton	1,200	Grown on Gadag Farm.
5	Cambodia	1,200	Do.
6	N. B. cotton	12,875	Obtained from Khandesh.

The details of seeds collected and distributed of food-stuffs in the Division as a special measure against famine are given below:—

Serial No.	Name of seed.	District where distributed.					Total.
		Dharwar.	Belgaum.	Bijapur.	Satara.	Sholapur.	
1	Paddy	217,000	30,000	.....	.....	.....	247,000
2	Kharif Jowar	37,700	9,800	.....	8,300	.....	55,800
3	Rabi Jowar	11,000	.....	.....	.....	.....	11,000
4	Wheat	.....	.....	86,471	.....	.....	86,471
5	Groundnut	.....	.....	.....	15,884	1,920	17,804
6	Tur	.....	.....	.....	6,252	5,887	12,139
7	Castor seed	2,991	5,748	6,249	.....	4,847	19,830
8	Black Kulkhi (Dolichos biflorus).	.....	.....	.....	3,348	.....	3,348

The demand for artificial manures (*ammonium sulphate*) was less during the year under report, owing to the failure of sugarcane crop on account of insufficiency of water in canals, tanks and wells. However owing to the absolute certainty of good crops of sugarcane with a top-dressing of ammonium sulphate, the demand came in from several quarters in small quantities. Similarly the use of different oil-cakes both for sugarcane and other cereals was taken up by cultivators, as advised by the district staff. Arrangements were made to supply these manures at cost price. The following are the details of manures supplied:—

Serial No.	Name of manure.	Quantity in lbs.	Remarks.
1	Ammonium sulphate	17,920	Sholapur District.
	Do.	8,960	Satara District.
	Do.	9,000	Belgaum District.
2	Different oil-cakes for sugarcane	150,000	Sholapur District.
	Do. do.	57,241	Belgaum District.
3	Different oil-cakes for cereal crops as advised by the Department.	81,600	Sholapur District.
	Do. do.	10,860	Belgaum District.

The successful demonstrations of ammonium sulphate on sugarcane and oil-cakes on other crops at different places have been appreciated by cultivators, specially of Satara District, with a result that manure supply societies have been formed at the following places:—

- (1) Peth, (2) Yellur, (3) Koregaon, (4) Retrabudruk, (5) Retra, (6) Devarashta, (7) Supane.

There is now scope for similar societies in the irrigated tracts of all districts especially where sugarcane is grown on large scale.

CROPS.

Cotton.—Owing to uncertain rains in the beginning of the monsoon the area under Broach cotton is not increasing, as was first expected. The staple of Cambodia cotton though the crop gives very high yield, in certain villages in the Gadag and the Ron Talukas of Dharwar District, is deteriorating in strength. Thus after careful consideration it is decided to extend the selected types in the local Kumpta and Dharwar-American cottons only. These are designated as Kumpta Selected (Dharwar No. 1) and Upland type of Dharwar-American cotton (Gadag No. 1). A definite policy of work regarding the extension of these types throughout the Division was laid out at a meeting held at Dharwar in consultation with the Director of Agriculture, Dr. Mann, and the subordinate staff on the farm and in the districts, who are concerned with the cotton work. The policy was strictly followed during the year and the kapas produced from different types of cottons in registered seed-growers' fields was sold by auctions through sale societies at Hubli and Gadag, and pure seeds as far as available from such kapas, were bought back by the Agricultural Department for further distribution on larger areas in suitable localities.

According to the original policy laid down, the work of buying back the seed and distribution of the same was to be done by the Co-operative Societies. But after further consideration, in accordance with the recommendations made by the Cotton Committee in their report, the question was again discussed at a meeting recently held of the Director of Agriculture and the members of the Agricultural staff in the Southern Division, with the Registrar of the Co-operative Societies and his staff, and the Honorary Secretary of Hubli Cotton Sale Society, and certain modifications were made in the original policy of district cotton work. The final policy as recently settled is as below:—

- (1) The cotton supervisor to produce every year newly selected cotton seed. This is essential as good cotton seed rapidly deteriorates through cross-fertilization.
- (2) To multiply the farm cotton seed on the farms of the Agricultural Department until there is seed enough for about 600 acres.
- (3) To multiply such cotton seed further, on the lands of the cultivators, who will become our registered seed-growers, until seed for 5,000 acres is obtained, the actual selling of the kapas produced, being organised in connection with auction sales of the Co-operative Cotton Sale Societies.
- (4) To distribute this seed, in consultation with the Co-operative Department, and undertake to rogue the fields in which it is grown—the sale of the kapas produced being done by the Co-operative Cotton Sale Societies in their auction sales.
- (5) To classify the kapas received at such auction sales in the case of Cambodia and Broach cottons and in the case of other cottons if necessity arises.

Thus the district cotton work has now been put on systematic basis and it is hoped that the joint work of the Agricultural and the Co-operative Departments, on these lines, will solve the question of improving the local cottons to some extent at least.

In all the auction sales held by the Cotton Sale Society at Hubli, Kumpta selected kapas (Dharwar No. 1) has realised from Rs. 25 to Rs. 35 more per Naga which is the produce of four acres. Messrs. Tata & Sons have again valued this year Dharwar No. 1 (Kumpta selected cotton) at Rs. 20 more per khandy of 78½ lbs. Thus there is no question regarding the superiority of the quality of Dharwar No. 1 over the ordinary local Kumpta cotton.

On the Dharwar Farm the Selected Kumpta (Dharwar No. 1) has invariably yielded about 50 lbs. more than ordinary Kumpta under similar conditions. Experiments to test the yield in different localities on large scale under different conditions of rain and soil are undertaken by the district staff in the Dharwar, Belgaum and Bijapur Districts. When conclusive results will be obtained from these experiments the variety will be distributed on wholesale scale throughout the Kumpta tract.

The growing habit of Dharwar No. 1 (Kumpta selected type) seems to favour a more compact stand in the field. To test this view, the Cotton Supervisor laid out

certain experiments on the Dharwar Farm and the following statement gives the result of the experiments during the year:—

Serial number.	Plots.	Area.	Name of cotton.	Spacing.	Number of plants per acre.		Yield of kapas per acre.	Remarks.
					Theoretical.	Actual.		
		A. g.			Lbs.	Lbs.	Lbs.	
1	108-1/8	0 5	Dharwar No. 1 ...	24" x 12"	21,780	18,096	612	
2	108-1/8	0 5	Do. ...	24" x 9"	29,040	24,892	692	
8	108-1/8	0 5	Do. ...	24" x 6"	48,560	37,344	592	
4	108-1/8	0 5	Do. ...	18" x 12"	29,040	25,072	644	
5	108-1/8	0 5	Do. ...	18" x 9"	38,720	34,072	696	
6	108-1/8	0 5	Do. ...	18" x 6"	58,080	51,456	656	

18" between the rows has given better results than 24". Of the three distances between the plants, 9" has done well in both the cases. Taking the average number of plants to be about 30,000, the yield of kapas about 700 lbs. per acre, and the number of bolls to be 10 in a tola of kapas, the yields given in the two cases work out at about 9 bolls per plant in the selected Kumpta (Dharwar No. 1). The experiment will however be continued to confirm the result.

The result as obtained on the Gokak Canal Farm at Arbhavi on the experiments of top-dressing of chilly crop with safflower cake are given below, as these results are very encouraging to advise the chilly cultivators in other parts of the Division to follow the practice:—

Serial number.	Area in gunthas.	Previous crop.	Details of manure given.	Cost of manure per acre.	Yield of dry chilly per acre.	Remarks.
1	10	Sugarcane ...	10 cart-loads F. Y. M. + 400 lbs. of safflower cake.	Rs. 28	Lbs. 2,819	
2	10	Do. ...	10 cart-loads F. Y. M. alone	15	2,500	

Sugarcane.—Owing to the unfavourable season the sugarcane crop in the district was on the whole very poor. In some cases unripe canes were fed to cattle as fodder. In others, where the canes were allowed to ripen, the crop was spoiled for want of sufficient moisture. Gul from such crop was very inferior in quality. On the Gokak Farm, however, the crop was good owing to the fairly sufficient supply of water in the canal till harvest time and the proper timely cultivation operations.

The experiments of planting sugarcane sets under single eye-bud and two eyes up are in progress on larger scale both at Arbhavi and at Dharwar.

MAGAZINE.

It is gratifying to note that the publication of the Kanarese Agricultural Magazine which has been entrusted to a Committee of the graduate staff on the Dharwar Farm has been most satisfactorily conducted throughout the year. The co-operative section, which was being hitherto included in the magazine, has been discontinued as the Central Co-operative Institute is now publishing separate magazines of its own, in different languages. The number of subscribers for the magazine is the same as in the last year.

VERNACULAR AGRICULTURAL SCHOOL AT DEVI-HOSUR.

This school, which is in existence since five years, has now been well established. Applications for admission are rapidly increasing. More attention is paid to admit only suitable boys. There were 36 boys in the beginning of the first term. Five of them left the school before the end of the term, owing to unavoidable home difficulties. One was sent back, being found unfit for the school. Thus there remained 30 boys for the annual examination of whom 13 were in the first and 17 in the second year.

Arranged according to districts, they stand as shown below:—

Serial number.	Name of district.	1st year.	2nd year.	Total.
1	Dharwar ...	9	11	20
2	Belgaum ...	2	3	5
3	Bijapur ...	2	2	4
4	Karwar ...	.....	1	1
	Total ...	13	17	30

When arranged according to caste, they stand as under:—

Caste.				1st year.	2nd year.	Total.	Remarks.
Brahmin	...	...	...	5	.....	5	
Langayet	...	...	...	6	9	15	
Baddy	...	...	...	2	6	8	
Shetti	...	...	...	.....	1	1	
Maratha	...	...	...	.....	1	1	
Total ...				18	17	80	

Of the 17 boys in the 2nd year, 16 passed, of whom 8 with credit, securing 60 per cent. marks.

The *curriculum* remains practically the same. More attention is however paid to practical field work of the boys. The senior students spend 4 hours on the farm while the junior students spend 2 hours daily. During leisure time, the students are engaged in doing work in connection with some minor industries, such as, rope-making, Gudar (carpet) weaving, preparing petty agricultural tools and implements, etc. (iron and wood).

An oil-engine with a power chaff-cutter, grinding mill and a rice-huller is recently fitted. Thus the school is now fully equipped to give thorough practical training to students in all branches of agriculture, and minor industries connected therewith.

Rao Saheb Shetti has shown his usual interest and sympathy towards the school throughout the year.

Acknowledgements are due to all the contributors to the school.

TEGUR FARM.

Though the season was bad during the year, and the pinch of the scarcity of fodder was very severe throughout the country the farm supply of fodder for the large number of cattle at the farm, was sufficient for the whole year. This is due to the foresight in storing sufficient supply in good years, against famine time or other emergency.

Experience shows that cattle do not keep, in good condition on grass fodder alone during the hot months of April and May. Attempts are therefore made to grow some of the varieties of fodder jowars, amongst which, Nilva, Wagar and Local Fulgar, seem to thrive well. A small area was grown with Kulthi for which the land is admirably suitable.

Ensileage.—The growth of grass being poor in the month of September, owing to insufficiency of rain, the standing crop of Wagar variety of jowar, was cut and put into the silo pit. Ensileage from this stuff was found to be good and the cattle relished it very much. There was not much wastage along the sides of the pit, as they are pakka built, with cement plaster.

Construction of a new Dutch Barn.—The steam plough, that was working at Ranebennur having been, removed from Dharwar District, the iron shed intended to keep the plough in the rainy season became available for this farm. It was removed to the farm and put up there during the year. The cost of erecting was Rs. 346-10-0. The shed is big enough to hold stock of fodder, sufficient for at least two years for the farm cattle.

The following statement shows the details of cattle on the farm on 31st March 1919.

Serial Number.	Kind of cattle.	On hand on 1st April 1918.	Purchased in 1918-19.	Born in 1918-19.	Transferred from bull or cow calves.	Total of columns 4 to 6.	Total of columns 4 to 7.	Deaths in 1918-19.	Sold in 1918-19.	Transferred to other farm or otherwise disposed.	Total of columns 8 to 11.	Total disposed.	Balance on hand on 31st March 1919.	Remarks.
1	Bull	1	...	...	...	1	1	...	...	.....	...	...	1	
2	Bullocks	2	...	...	...	2	2	...	...	.....	...	...	2	
3	Cows	87	2 stray.	...	1	88	40	...	2	.....	90	2	88	
4	Bull calves	20	...	14	...	34	34	4	2	2 Gokak farm	32	2	26	
5	Cow calves	19	...	17	...	36	36	1	...	1 to cow	35	2	34	
Total ...		79	2	31	1	84	118	5	4	3	122	12	101	

AGRICULTURAL ASSOCIATIONS.

Owing to war and famine conditions, during the year the progress of work of these associations was much hindered. However their work in the way of selling and hiring ploughs and distribution of good seeds was satisfactory. The Prince Albert Victor Fund Committee at Chikodi is doing useful work in the taluka, especially in introducing improved method of gul-making and in introducing the row system of sugarcane planting. The Dharwar Association has collected sufficient funds to have its own building. Since Mr. Savanur joined the Association as Joint Secretary, the Belgaum Association has become very active. Among the small Taluka Associations, Athani is the foremost. The Sholapur District Agricultural Association organised during the year, a District Agricultural Conference which was presided over by the Honourable Divan Bahadur Godbole. About 400 cultivators from the District and all the local officers attended the Conference. A number of subjects directly or indirectly connected with the improvement of Agriculture, were discussed at the Conference. A demonstration of improved implements was arranged by the Department at the time of the Conference. The Bijapur Association maintains a small demonstration farm with a trained field-man.

Among the several honorary workers in the Agricultural Associations, in this Division the following gentlemen are taking great interest in their work, and their names deserve special mention in this report, *viz.*—(1) S. V. Desai, Vice-President, Dharwar District Agricultural Association, (2) Mr. G. B. Savanur, Secretary, Belgaum Agricultural Association, (3) Mr. S. S. Mangasuli, Secretary, Athani Association, (4) Rao Saheb P. G. Halkatti and (5) Dr. Ranade, Joint Honorary Secretaries, Bijapur Association, (6) Rao Saheb, V. B. Kulkarni, Secretary, Prince Albert Victor Fund Committee, Chikodi, (7) Mr. G. N. Kakade, Secretary, Sholapur Association.

PUBLICATIONS OF BULLETINS AND LEAFLETS.

The following bulletins and leaflets were published during the year :—

1. Plantain stalks as fodder for cattle in famine years, by Rao Saheb M. L. Kulkarni, Acting Deputy Director of Agriculture, S. D.
2. Cultivation of Cambodia cotton as Mungari (Kharif crop) in the light red lands of the S. M. Country by Mr. V. R. Dharwarkar, District Cotton Overseer.
3. Classification and description of the jowar varieties of the Bombay Karnatik, by Mr. G. L. Kottur, Cotton Supervisor, S. D.

Besides the above myself and Mr. Swadi wrote two papers for the Science Congress which are published in the Agricultural Journal of India.

FAMINE WORK.

As already stated most of the time of the District staff was engaged in collection and distribution of varieties of seeds, demonstration of preparing feed for cattle from prickly pear and in raising fodder crops. A special report about Retra Fodder Scheme has been submitted to the Director of Agriculture. A short account of the same is however given here for information of the readers. The total area grown with varieties of fodder crops on cultivators' lands, was 100 acres. The following were the conditions made with the cultivators in securing their lands temporarily for growing fodder :—

- (1) Water to be given free of charge to cultivators for any fodder crops raised by them under the supervision of the Agricultural Department.
- (2) The main water channels to be constructed and its repairs maintained at the expense of the Department.
- (3) The Agricultural Department to secure and supply seeds to cultivators at cost price.
- (4) Cultivators to make their own distributory channels in the fields, sow the crops, irrigate the same and do all other necessary operations required for the proper growing of the crop until it was ready for use.
- (5) The condition regarding the produce, was, that it was to be divided half and half between the Agricultural Department and the owners of the different fields.

The Agricultural Engineer undertook to instal an engine and a pump, and I undertook to make main water channels, induce the cultivators to grow fodder, settle the terms with them, procure seeds and make all other arrangements for the success of the scheme. Accordingly a 20 B. H. P. steam engine and a suitable pump was soon installed by the Agricultural Engineer on the Krishna Left Bank at Retra in the end of February. The crop was ready for sale from the end of May. The total quantity of green fodder produced was 8,00,000 lbs. The following are the details of receipts and expenditure of the scheme. The statement does not include the items of expenditure incurred by the Agricultural Engineer in raising the water.

APPENDIX F.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE,
KONKAN, DURING THE YEAR 1918-19.

During the year 1918-19, there was no change in the general policy of the ordinary work of the Konkan Agricultural Division which has had it developed and developing under three main heads:—

- I. Experimental and research work including investigating into new possibilities;
- II. Extension work or popularization and Introduction of improvements into the practice of agriculturists;
- III. Agricultural education.

In addition to these ordinary functions of the Agricultural Department, it was called upon during the year under report to take its share of tackling with Famine Relief Measures within the scope of the Agricultural Department.

Conditions Influencing the Agriculture of the year.

2. *Rainfall and Season.*—The character of the rainfall which in the largest measure determines the agricultural prosperity or otherwise of a tract like Konkan entirely dependent on the nature's gift, was during the year under report, the most abnormal one a like of which, it is asserted by the oldest men, was not experienced in Konkan during the last forty years. The total fall during the season in most places varied from 40 to 60 per cent of the average, or even more or less in places, and was very badly distributed, more and more decreases being experienced from south to north; the result of this was, that excepting in a few localities which were under the command of some source of water-supply, about 20 per cent of the rice crop remained untransplanted and the outturn of the crop that was planted varied from nil to fifty per cent of the normal. All other *kharif* and *rabi* crops and the sources of water-supply and consequently the irrigated crops had also to suffer their share similarly. The growth of the grass on the whole was not much affected especially in the north Konkan, but owing to a great reduction in the yield of rice straw and great temptations of high prices for selling away of grass, which in ordinary times would have been used for the local cattle, the agricultural livestock did not receive their usual quota of fodder and were consequently in a comparative low condition. Thus the year turned out to be one of great scarcity though not of an acute famine.

3. *Influenza Epidemic.*—The Influenza epidemic which came and spread like wild fire in every nook and corner of the country just at the harvesting time of rice, brought about a further distress by a large loss of life and by a weakening of vitality of a still larger number of survivors preventing timely reaping of whatever crops were to be had.

4. The following comparative figures of the average outturns per acre of the principal crops calculated from the whole area under cultivation on the three farms representing three different conditions for the last two years as well as for the year when the average was the highest in the history of the three farms will give a clearer idea of the effect of the season under report.

Farm and Crops.	Average outturn per acre.			
	1918-19.	1917-18.	The best year for the crop in the history of the farm.	
			Year.	Outturn.
	Lbs.	Lbs.		Lbs.
<i>Abbag Farm.</i> (Kojaba District.)				
Rice	1,434 (was supplied with the water from a stream.)	2,060	1912-18	2,719
Nagli	515	689	1914-15	1,354
<i>Ratnagiri Farm.</i> (Ratnagiri District.)				
Rice, upland	490	1,716	1915-16	2,082
Rice, lowland	1,923 (favourably situated.)	969	1915-16	2,360
<i>Kumta Farm.</i> (Kanara District.)				
Rice, upland	310	990	1917-18	990
Rice, lowland	1,420	1,270 (The crop was taken without any manure for standardizing the plots.)	1918-19	1,420

EXPERIMENTAL WORK.

5. The experimental work was continued to be carried mainly at the experimental farms of which, including the Kumta farm in the Kanara District which commenced during the year under report for the first time, its programme of experimental work, there have been now three, *viz.*, Alibag representing north Konkan, and Ratnagiri and Kumta representing the agricultural conditions of their respective districts. The experimental work in rice carried so long has led us to a stage at which in order to make further progress it has been found necessary to carry on deep scientific researches into the factors which relate the rice plant to its several aspects of environment and cultivation; for this purpose a rice research station has been started since this year. Some simple tests were also carried out or results of the experimental work at the agricultural stations verified on cultivators' fields under the immediate direction and supervision of the district staff.

The most salient features of the results are summarized below item by item.

Rice.

6. Owing to the peculiar climatic conditions of the Konkan, rice has necessarily been the principal crop of the low-lying areas and occupies, on an average, 68 per cent of the total cultivated area. It is legitimate therefore that improvement of the rice crop should occupy a main and prominent position in the programme of the experimental work of the three farms. The work during the year was mostly a continuation on the lines adopted in the previous years, the work of the Kumta Farm which began its experimental work for the first time having fallen into nearly analogous lines modified in details to correspond to the Kanara conditions.

I.—Raising of Seedlings.

7. *Manuring*.—It has been conclusively proved in the past that direct manures such as oil-cake, fish manure and ammonium sulphate can equally or more efficiently take the place of *rab*, for seed-bed manuring where a deficiency of the latter is felt. As regards the new line of tackling the insufficiency of *rab*, by supplementing *rabbed* seed-beds with smaller doses of direct manures, referred to in the last year's report, the results of experiments both at the Alibag and Ratnagiri Farms indicate that rice seed-beds burnt with as much quantity of *rab* as is available at present are benefited by an addition of some quickly available concentrate such as fish manure or ammonium sulphate supplying 1 lb. of nitrogen per guntha, and this above dose of a direct manure can even make up for one-third or half the deficiency of *rab* materials as used at present.

In Kanara the practice of *rabbing* the seed-bed is not known, farm yard manure being employed for the purpose. The Kumta Farm experiments show that fish manure or ammonium sulphate supplying $2\frac{1}{2}$ nitrogen per guntha produces as compared with the farm yard manure plot, fifty per cent more weight of seedlings which is capable of transplanting a correspondingly increased area, without any decrease in the outturn of the final crop.

II.—Field Manuring of Rice.

8. With a view to investigate into the possibilities of increasing the outturn of rice by applying manures in the fields, the use of green matter in the form of green manure crops or green leaves of suitable trees or shrubs, and bulky, concentrated and indirect manures are under trial.

9. *Green manuring*.—The year's work generally confirms the results of the previous years that—

(1) the increase in the yield due to the addition of green matter in the form of green crops of *san* (*crotolaria juncea*) and *dhaincha* (*sesbania aculeata*) cannot go beyond 10 per cent on the Alibag Farm representing the trap soils of North Konkan even after an accumulated effect for six years; the comparatively poorer soils of the Ratnagiri Farm representing the lateritic rice tract respond much better to this form of fertilizing the crop with however a peculiarly interesting limitation that it is only the smaller crops not exceeding 3,000 to 4,000 lbs. of green matter per acre that show such beneficial effects, the heavier crops invariably resulting into a reduction in the outturn of grain. Just why this is so would form a theme for future investigation.

(2) The nature of the rainfall accompanied by the peculiar conditions of rice fields and the short period available between the commencement of the monsoon and the time of transplanting offers little scope for the successful growth and obtaining of an appreciable quantity of green matter from the above crops sown on rain water. A few localities particularly in the south Konkan possess some facilities of a source of water-supply or water retentive fields with the help of which good yields from these crops can be obtained as has been successfully done on the Alibag Farm under the former and on the Ratnagiri Farm under both the conditions. But in view of the observation about the deleterious effect of the addition of large quantities recorded at the end of (1) above, before recommending this for adoption, it must be ascertained whether application of a small portion out of the large coarse crops obtained in the above manner can be as efficacious as smaller and tender crops wholly ploughed *in-situ*.

(3) On the other hand, the second method, namely, of using some kind of easily decayable green stuff of trees and wild shrubs such as *karanja* (*Pongamia glabra*) on the Alibag Farm and *rui* (*Calotropis gigantea*) on the Ratnagiri Farm have continued to be remarkably profitable, the former being responsible for an average increase of 25 per cent. and the latter of 40 per cent resulting into a net profit of Rs. 12 and 23 respectively during the year under report. The former plant is probably of a better economic value for its nuts which yield oil and a residual cake, which would be impaired by stripping the plant of its leaves; but it is not so with the second plant *rui* which can grow abundantly even on very poor grades of soil, is not put to any other economic use, nor is eaten by cattle and when cut does not die but continues to give fresh shoots. There is a very great scope for establishing plantations of these *rui* on the vast *varkas* (hill) areas of Konkan where they can be easily propagated by cuttings.

(4) Combining green matter in the form mentioned under (3) above with phosphoric acid in the form of bone-meal which was tried on the Alibag and Kumta Farms, has not as in the last year shown any advantage over and above the sum total of the individual effects tested separately.

10. *Bulky manures*.—The trial of several manures such as rice hulls, and night soil in bulk on both farms, Alibag and Ratnagiri and *mowra* refuse on the Alibag Farm and cattle-folding and urine earth on the Ratnagiri Farm has been already discontinued as conclusively proved profitable wherever they can be made available. On the Alibag Farm the residual effect of *mowra* refuse even after three years after its discontinuance has been more marked than after two years amounting to 50 per cent. increase over the no manure plot, that of rice-hulls amounts to 14 per cent and the effect of a heavy dose of night soil has altogether vanished after four years at Alibag but is noticeable on the Ratnagiri Farm to the extent of 23 per cent in the second year of its application. Annual application of a small dose of night soil supplying 20 lbs. nitrogen per acre on the Ratnagiri Farm, and poudrette on the Alibag Farm have given substantial increases of 23 per cent and 35 per cent respectively, while the adverse effect of poudrette at Ratnagiri is unaccountable. On the Kumta Farm during the first year dry leaves from the forests have proved superior to the green leaves.

11. *Concentrated manures*.—The experiment with oil-cakes (*karanja* at Alibag, *undi* and groundnut at Ratnagiri), fish manure, ammonium sulphate, bone-meal and superphosphate was concluded last year with an unmistakable and substantial advantage and a more or less profit in favour of these in the manuring of rice, the increases being more marked on poorer laterite soils than the richer trap soils represented by the Alibag Farm. Some of the most striking observations about the residual effects of these manures during the year under report are: (1) the very great residual advantage of bone-meal which amounts to over 50 per cent at Alibag and 70 per cent at Ratnagiri and (2) absence of any residual effect of fish manure even in the first year after its discontinuance.

All the above manures have also been included in the programme of experiments of the Kumta Farm, amongst which even in the first year bone-meal and fish manure have stood out so prominently yielding an increase of over 100 per cent over the local manure plot, that there is no doubt left as to their at once being accepted as one of the surest means of increasing the outturn of rice in Kanara at a great profit. *Undi*-cake comes next though far below the above. Unlike the Alibag and Ratnagiri Farms, ammonium sulphate and nitrate of soda do not show any benefit and it seems therefore that organic forms of nitrogen and phosphoric acid are the ruling ingredients of the Kanara soils for the rice crop.

Rock phosphate, which was highly talked of as a rice fertilizer in the last Board of Agriculture meeting held in Poona, was tried for the first time on all the three farms, but nowhere it has shown any marked advantage, either alone, or when combined with green matter.

12. *Indirect manures*.—The year's results generally confirm those of the previous years that salt is not of much use on the low-lying rice fields; lime on the laterite soils of Ratnagiri which are devoid of this ingredient, has shown up even in the third year after its last application an effect equivalent to over 20 per cent increase in yield while on the trap soils of Alibag which contain sufficient lime, its use has already been discontinued as actually having a depressing effect.

III.—Cultural.

13. The beneficial effect of ploughing with the Meston plough which inverts the soil, noticed last year, is confirmed this year also though not to the same extent.

14. As regards the number of seedlings to be transplanted in a bunch, the year's results on all the three farms lend unmistakable support to drawing the final conclusion that four strong seedlings in a bunch yield more than a larger number adopted by cultivators.

15. Transplanting, sowing of sprouted seed (*Rahu*) in a puddle and sowing of dry seed either broadcast or in drills have been under comparison. On the Ratnagiri Farm transplanting on the uplands which are usually sown with *Rahu*, has contrary to

the earlier results been found more advantageous by 50 per cent as was also the case last year. Sowing of dry seed in drills under the same conditions is no good, which result is in corroboration of the last year's one. On the Kumta Farm which is a transplanting tract broad-casting of dry seed which is the common practice in the Karwar and Ankola Talukas of the Kanara District, has surpassed transplanting or *Rahu* systems by over fifty per cent.

16. On the Ratnagiri Farm, a drilled crop of rice sown in advance of the monsoon (locally called *Shel*) on natural moisture in the low-lying fields which retain enough moisture even in the month of May, was compared with a transplanted crop from seedlings obtained by sowing the seed in the seed-beds by the commencement of the monsoon. The drilled *Shel* crop yielded nearly cent per cent more than the transplanted crop having altogether escaped the attack of the rice stem-borer, at the time of emergence of which the crop is probably rendered unattractive to it.

IV.—Improvement by Seed Selection.

17. Mass selection of large earheads having well filled and plump grains had been conclusively proved to be superior by about 13 per cent in the Alibag Farm experiments. The results of similar experiments which have been undertaken on the Ratnagiri and Kumta Farms since the year under report, point to the same conclusion.

V.—Varieties.

18. This year's work in this possible line of obtaining increased yields from rice has not led any further than the conclusion arrived at by the past results that no exotic variety has yet been found which can surpass the locally established varieties.

Researches into Rice Cultivation.

19. As said elsewhere above, the work in the improvement of rice done so far has now reached a stage, at which in order to make substantial progress hereafter, a systematic and intensively scientific study into the various factors contributing towards the maximum producing capacity of the rice plant are found necessary. For this purpose Mr. K. V. Joshi, one of the most capable Graduate Assistants of the Konkan Division, who has had a long firsthand experience of rice cultivation as the Superintendent of the Alibag Farm and has shown an aptitude for carrying on such work, has been exclusively set on these researches since the year under report. For the first year he carried his observations on the Alibag Farm, but in order to give him an easy access to the facilities of a library, laboratories and scientific advice of the Central Research Institute at Poona a separate Rice Research Station has been established at Karjat in the Kolaba District.

20. A study of the detailed life history of rice from the sowing of the seed to the stage of reaping has been taken up and very interesting and important observations have been made about its root system, its relation to transplanting, depth of transplanting of seedlings, effect of cutting of roots, strength and vigour of seedlings, plant food requirements of rice, and the adjustment of spacing according to the quantity of manures.

Rabi Cropping of the moisture-retentive Rice Fields.

21. *New Crops.*—As was noted in the last year's report, on the moisture-retentive rice fields on the Ratnagiri Farm, groundnut again was very promising as a more remunerative *Rabi* crop and that it could even stand the rather over-saturated condition of the fields. Sweet-potatoes and chillies also seemed to grow well but indicated that the laterite soils are too poor to produce remunerative yields without manuring. *Shalu* (*Rabi Jowar*) has by the year's results been conclusively proved to be a profitable asset in the cropping of lands classed as *rabi* in the North Konkan, the average outturn per acre being 400 lbs. of grain worth Rs. 15 and over 2,000 lbs. of *Kadbi* worth Rs. 15 at normal rates.

Irrigation Farming.

22. In the direction of increasing the yield of either the existing crops or the newly introduced ones of onion, chillies and sweet-potatoes, the year's work points to the following results.

23. *Sugarcane.*—On all the three farms representing different conditions of the Konkan out of the several varieties tried, Striped Mauritius has stood distinctly marked out for its earliness with no sacrifice in yield of *gul*. Red Sports and Manjav which have had during this year an opportunity of a fair normal trial appear to vie with the above. *Pundhia* grows well but is late in ripening and extremely liable to red-rot.

In Ratnagiri and Kanara there is no practice of using concentrated manures for sugarcane. The experiments on Ratnagiri and Kumta Farms have conclusively shown that a top dressing with oil-cake, fish or ammonium sulphate at the rate of 75 lbs. of nitrogen results into a substantial net profit, on the Ratnagiri Farm a combination of *Undi* cake and ammonium sulphate having proved to be the best during the last four or five years' trials.

24. *Chillies*.—On the poor laterite soils of Ratnagiri, last year's observation that a large dose of fish manure, *viz.*, 1,680 lbs. per acre leaves a substantial profit after paying its own way as compared to 1,120 lbs. per acre as used by the people, is confirmed.

25. *Onions*.—On the Alibag Farm, nitrate of soda at the rate of 2 cwts. per acre has again maintained its high profitable record, which is equal to a net profit of Rs. 50 per acre calculated at the normal price as compared to 15 cartloads of pourette supplemented by 800 lbs. of fish manure; supplementing nitrate of soda with 2 cwts. sulphate of potash has, as in the last year, been responsible for a further increase of 9 per cent which leaves a net profit of Rs. 30 per acre due to this artificial alone. These are most striking and definite results and will be brought to the notice of the onion growers.

26. *Sweet-potatoes*.—For this crop again, a complete manure consisting of 20 cartloads of farm yard manure, 170 lbs. of nitrate of soda, 150 lbs. of sulphate of potash and 112 lbs. of superphosphate on the Alibag Farm has corroborated the last year's increase of over 90 per cent. as compared with 1,280 lbs. of fish manure. On the Ratnagiri Farm the crop of sweet-potato yielded substantial profits both in the *Kharif* and *Rabi* seasons, in the former case entirely as a rain fed crop.

Varkas Land Cultivation.

27. *Terracing and Levelling*.—More and more silt is being accumulated in the embanked terraces which are becoming more and more level; and the advantage of this system in retaining and building up the fertility of the land has also begun to be visible as could be seen from the substantial increases in the outturns of crops obtained in plots which have been terraced now for six years, as compared to those in the unterraced plots.

28. *Improvement in the existing crops*.—Green manuring of *nagli* with *san* to be grown in the period intervening between the setting in of the monsoon and transplanting, has most consistently with the previous years been responsible for a substantial increase. The results which have thus been very conclusive and need no further verification, are ripe for being brought to the notice of the agriculturists.

29. *Introduction of more remunerative new crops*.—Rain fed *Kharif* crops of sweet-potatoes and chillies which have proved very remunerative in the past two years failed under the droughty conditions of the year under report. Jowar and hill paddy however did well even in a year of a very abnormal season. The year's work in this line has afforded another very remunerative crop, *viz.*, *Bhendi* (*hibiscus esculentes*) which gave a yield worth Rs. 100 at a cost of Rs. 50 per acre. Tur (*cajanus indicus*) has also taken its place in the list of more remunerative crops.

Improvement of Fodder Supply.

30. *Cultivated Fodder Crops*.—Lucerne under irrigation on the Ratnagiri Farm gave a yield of 20,950 lbs. of green fodder in four cuttings during the fair season; a dressing of superphosphate increased the yield by 13 per cent. The beneficial effects of lime noticed last year were not to be seen this year. It must, however, be told here that lucerne cannot stand the over-saturated conditions of rice fields during the rainy season and the crop has unlike in other places of less rainfall, to be freshly sown every year at the beginning of each fair season. Berseem gave, as in the previous year, only two cuttings with a yield of 10,540 lbs. This result, which is in confirmation of those in the past, leads to a conclusion that there is not much prospect for this cultivated fodder crop in the Konkan.

31. *Ensilage of green grass in Kacha pits* was continued both on the Alibag and Ratnagiri Farms. The proportion of silage made to that of the original green stuff put in was 56 per cent. on the Ratnagiri Farm out of which only 5 per cent. on the edges was spoiled and unfit for feeding.

32. *Supply of green fodder for a dairy farm in Konkan*.—In order to get data and experience about this under the Ratnagiri conditions, a subsidy with a scheme was given to Mr. S. N. Joshi of Ratnagiri who is running a dairy with ten animals. The land utilized was intermediate between upland and lowland rice; fair yields of maize were obtained at all the seasons of the year, the largest being had on a burnt field; *jowar* as a *kharif* fodder crop also gave good yield. *Dhaincha* also yielded heavily and was relished by the buffaloes without any harmful effect. Lucerne showed every sign of success, but was badly neglected by Mr. Joshi. Had it not been for the very indifferent management on the part of Mr. Joshi even better results would have been got. It must, however, be remembered that the past season was considerably less wet and so favourable to the above crops.

Improvement of Water Supply.

33. The water-supply in wells in the lateritic formation of the Ratnagiri District is scanty being diffuse, though it can be tapped almost at any place. This porous lateritic formation overlies an impervious rock like trap, quartzite, granite, etc. With a view to ascertain the possibility of tapping from this impervious zone larger accumulated currents under pressure capable of rising up more or less, five bores were taken with the

Musto's Patent rock-boring machine on the Ratnagiri Farm. One of these was taken from the surface and the other four in the existing wells the bottoms of which are 20 feet deep. In all the bores trap rock was struck at about 50 feet below the ground level, at which a fairly strong current under pressure was tapped, capable of rising to a height of 32 feet or to within 18 feet from the ground level. The bores were carried to a depth of 62 feet, below which the machine could not make a progress of more than six inches by eight hours' work—rather a strange and interesting phenomenon, an explanation for which is yet to be found. It is estimated that the water-supply in the wells which averaged about 600 gallons per hour has been more than doubled.

One bore was also taken to a depth of 100 feet from the surface on a hillock at the Varkas sub-station at Bandhan 10 miles from Alibag, district Kolaba. The formation was trap all throughout; fair supply of water has been tapped at a depth of 70 feet which has been capable of rising to a height of 20 feet or 50 feet below ground land; the capacity of the current has not yet been gauged as there is no pump yet fixed on it.

On the other hand, a bore which has been carried to a depth of over 200 feet also through laterite at Honawar, district Kanara, has not yet tapped any water, the impervious stratum struck being granite.

Improvement of Cattle.

34. The precarious condition of agricultural cattle in the Konkan and the causes which are at the root of the same were summarized in detail and the remedies to improve the situation were outlined in the last year's report.

35. *Use of milch animals for work.*—The pair of she-buffalo to be used for work as well as for milch, under experiment on the Ratnagiri Farm, was continued to be worked; both of them were in calf, one of which has aborted.

36. *Improving the milk breed.*—The three breeding buffalo bulls of the renowned dairy breed—*Surti*—at the three farms are being taken advantage of by the neighbouring she-buffalo keepers.

Entomological Work.

37. The Entomological Assistant for Konkan was for nine months out of the year away from his regular entomological work. For four months he was on deputation to Pusa for training including a study tour through Bengal and Central Provinces on his return, about three weeks were spent in attending the All India Entomological Conference at Pusa and for four months he was called upon to assist at the famine work. During only three months he had thus at his disposal for regular entomological work he continued his studies of rice and mango pests.

Rice Pests.

38. The predisposing causes for the advent of the borers were studied. One important observation made by him which can be taken advantage of in controlling the borers of rice was that the caterpillars at the time of harvest removed to the first node and not into the stubble below; this shows the possibility of the removal of good many hibernating caterpillars if the crop is cut closer to the ground, *i. e.* below the first node; this will be verified next year. Amongst other observations on rice stem-borers that he made, those that are of some popular interest are—

(1) Manured plots are more susceptible to borer attacks.

(2) While at Alibag both chilo and schinobius borers are to be seen, Ratnagiri has mostly the latter only, which difference Mr. Deshpande ascribes to the presence of a thick stemmed grass *coix lachryma Jobi* at Alibag.

The other pests he noticed on rice were rice stem fly and flea beetles on the seedlings of summer rice.

Mango Pests.

39. Rearing of mango hopper was completed; the life history from an egg to an adult took 15 days.

Spraying against the mango hopper was experimented with. Crude oil Emulsion as was then available in the market was found to be decidedly inferior to fish oil Rosin soap; one per cent solution of either was found to be ineffective. Two per cent solution of fish oil soap, though found to be more effective, cannot yet be said to be the optimum strength. A Barrel Sprayer mounted on wheels was used but it was found that it is impossible to carry it up the rough slopes of Ratnagiri hills which are used for the mango plantations.

Other Pests.

40. *Stem-borer on Nagli (Elysiene coracana).*—*Nagli* crop which has been so long considered to be immune to the borer was observed to have been severely attacked by the *chilo simplex* borer in the Ratnagiri District, the damage amounting to about 20 per cent.

Some Special Problems under Investigation.

41. *Manat land Improvement.*—The nature and extent of the problem of *Manat* Land Improvement has been described in the Annual Report of the Department of Agriculture of the Bombay Presidency for the year 1917-18 on page 65 of Appendix F.

In the direction of improving these sticky plastic soils by changing their texture by the addition of coarse materials, organic or inorganic, such as green manures, dry leaves, rice hulls, murum and brick pieces, the last material seems to be more effective than any others.

The testing of the several crops to the *Manat* conditions as they exist has however led to more tangible results of immediate practical application than attempts at improving their texture, in that *shahu jowar* has again proved to be by far the most suitable and profitable of the *rabi* crops, affording a valuable grain and fodder crop that has never been known to grow in Konkan. Sugarcane has been found to thrive well under *manat* conditions wherever irrigation can be provided. Even in the *kharif* season, in which all attempts to grow any crop on the flat field had not been successful, high and broad ridges with brick pieces as an aerating material incorporated into them have been found, during the year, to offer some hopes for growing some crops; out of the several tried, groundnut, *bhendi*, *ambadi*, *tur*, *chavali*, cotton and *jowar* have been the most promising.

42. *Manufacture of gul from palms.*—Mr. Sorabji B. Patel of Tadgaon, petta Umbergaon, district Thana, and one more farmer at Maroli within two miles from the first place continued to manufacture *gul* from wild date palms very successfully by methods evolved in the Departmental experiments. Owing to the droughty nature of the year, the outturn of juice and *gul* averaged at 16 gallons and 20 lbs. respectively per tree. Owing to high prices that ruled for all *gul*, some profits could be made with hired labour. But with the return of the normal prices this can only be suitable as a cottage industry subsidiary to farming.

The results of the experiments have been worked up in detail in form of a bulletin.

43. *Gul from Coconut palm.*—In Kanara nine tappers obtained the tax-free license for *gul* manufacture. In all 123 trees were tapped. One tapper can manage from 10 to 15 trees. The average output of juice and *gul* per tree as taken from 38 trees comes to 47 gallons and 91 lbs. respectively the *gul* fetching a price of Rs. 5-12-0 per tree.

44. *Band disease of betel-nuts.*—Experimental work in diagnosing the cause of the disease which was taken in hand at Kelshi, taluka Dapoli, district Ratnagiri, has been continued, the year's work indicating that it is the lack of drainage and aeration that is probably at the root.

45. *Utilization of tidal saline creek water for crop production.*—A study and analysis of the conditions of the existing practices in Konkan was done by me with the assistance of the Graduate members of the Konkan staff; the results were presented in a paper read before the last session of the Indian Science Congress.

46. *Other personal investigations by the several members of the staff.*—Other members of the staff, in addition to their usual work, took up certain problems for investigation as their own personal work: they are as follows:—

Subject.	Name of the investigator.
1 Determination of the best stage of seedlings for transplanting and whether by any cultural means the lodging of a manuring-crop can be prevented.	Mr. V. L. Bhosekar, B.Ag., Superintendent, Ratnagiri Farm.
2 Eradication of weeds on <i>Varkas</i> lands	„ K. B. Gujar, B.Ag., Graduate Assistant, Alibag Farm.
3 Investigations into the possibilities of growing <i>san</i> crop for fibre in Konkan without <i>rabbing</i> .	Do. do.
4 Designing of an oven-drier for drying plantains, betelnuts, cardamoms, etc.	„ M. R. Gokarn, B.Ag., Agricultural Overseer, Kanara.
5 Designing of an implement for puddling rice fields more economically.	Do. do.

EXTENSION WORK.

47. This consists in introducing improvements into the actual practices of agriculturists and giving such advice and help as will make the agricultural industry in general more profitable. This work has to be principally done by the itinerant district staff called Agricultural Overseers. Owing to the non-availability of new Graduates, Thana District had no overseer during the year and considerable time of the Overseers of other districts was utilized for famine work either in or outside of Konkan Division. The progress made in this direction has therefore necessarily been short of normal years. The Agricultural Stations also serve as standing demonstration centres and as centres for distributing improved seeds, manures and implements.

Popularization and Introduction of Agricultural Improvements.

48. The improvements conclusively proved by experimentation which form the basis of the propaganda work have been given in some detail in the last year's report (*vide* page 65 of the Appendix F. of the Department of Agriculture of the Bombay Presidency). The items in which noticeable progress has been effected are mentioned below.

Rice.

49. *Manuring of rice.*—Such of the manures as have been proved useful either for seed-beds or for fields were demonstrated on cultivators' fields in the Ratnagiri and Kolaba Districts. In most places results more or less similar to those on the farm were obtained.

Sugarcane.

50. *Introduction of more profitable varieties.*—Twenty centres were made in the Kanara District for distribution of Red Mauritius variety of cane in place of the local *Daskabbu* in all 50 new cultivators were induced to take up this variety in addition to those who might have obtained of themselves from their neighbours, from earlier introductions; 7,550 sets of the Striped Mauritius variety were distributed from the Ratnagiri Farm.

51. *Manuring.*—No concentrate is given to the cane crop in Kanara. Knowing that a dressing of a concentrate like fish and ammonium sulphate has been the common practice in the cane tracts in the Deccan and that it has been also found very profitable on the Ratnagiri Farm, four cultivators, two in the above-ghat and two in the below-ghat area of the Kanara District were induced to use the concentrates. The striking advantages of this method of treating their cane has convinced these cultivators and others who saw the crops. As a result of this orders for four tons of fish manure were received and supplied.

52. *Use of improved sugarcane mill, furnace and pans.*—Chatanooga No. 12 Mill, Poona Pans, and furnace were demonstrated at six centres in the Kanara District out of which three were new, and four in the Ratnagiri District all new, at each place the demonstration running over a period of a week or more. Pans were also kept on hire in three centres in the Kanara District, where their use was demonstrated and a demand for them had arisen. In the Kanara District two Chatanooga Mills have been purchased by two cane-growers for their own use and for giving to others on hire.

Onion.

53. In the Kanara District the crop is being steadily extended to newer localities along the coast. During this year 265 lbs. of seed was distributed as against 208 lbs. during last year. In the Ratnagiri District twelve cultivators were persuaded to grow the crop.

The tip wither disease of onions that is appearing for the last two years threatens to interfere with the keeping up and the extension of this newly introduced valuable crop. If the disease continues to be as serious next year also, investigation into the remedial measures will be of the most urgent necessity.

Chillies.

54. Owing to the very high prices of chillies the cultivation of this crop was stimulated to about 200 acres in the Kumta, Honawar and Bhatkal Talukas of the Kanara District. In the Ratnagiri District also, for the same reason the cultivation of this crop increased manyfold even without any efforts on the part of the Agricultural Department.

Improved Implements, Machinery and Appliances.

55. The popularization of the improved appliances for sugarcane crushing and making *gul* has already been referred to above.

56. *Meston Plough* was demonstrated at four places in the Ratnagiri District and ten places in the Kanara District. Nine ploughs were sold in Kanara and four in the Ratnagiri Districts.

57. *Sabul Plough.*—This has a scope for ploughing for sugarcane wherever fairly large fields are to be cultivated. This was demonstrated on the above-ghat area of the Kanara District and at one or two suitable places in the Ratnagiri District.

Popularization of cotton seed cake as cattle food.

58. A beginning in this direction was made three years ago at the Alibag Farm. It did not take long for the people to know the cheapness and milk sustaining and increasing qualities of this cake as compared to the locally available *Niger-seed* cake or

other food stuffs. The information spread and the demand rose so rapidly that it was impossible for the staff of the Alibag Farm to cope with the work. Demands for large quantities began to come in from as distant places as Pen, Khalapur and Karjat Talukas of the Kolaba District. Local merchants have been induced to take up this business. A Co-operative Cattle Feed Society has also come into existence at Alibag.

Its extension further in the southern districts of Ratnagiri and Kanara has been commenced since the year under report by keeping stocks on the Ratnagiri and Kumta Farms. The first consignments of five tons at each place have been sold off in three months and the same advantages as noticed at Alibag are being reported at these localities also.

Exhibitions, Demonstrations, and Shows.

59. Besides the demonstrations which the Agricultural Overseers gave in different items at several places in course of their propoganda work, special demonstrations to parties of cultivators were organised on the farms as follows.

The successful results with *shalu* and other crops on the *mamat* land and the methods adopted for improving these lands at the Alibag Agricultural Station were demonstrated on two occasions, one of which was arranged on the day of a local religious fair and was very largely attended.

The standing crops of sugarcane including the working of improved sugarcane mill, pans and furnace, lucerne, onions, and other *rabi* crops were demonstrated on the Ratnagiri Farm.

Supply of Implements, Manures, Seed and other Articles to Orders.

60. *Seeds*.—Cultivators find much difficulty in getting reliable qualities of vegetable seeds. Keeping a stock of these near at hand on the Ratnagiri Farm during the last year was very much appreciated by the cultivators and was continued during the year under report on the Ratnagiri and Kumta Farms.

The high grade and purity of the selected seeds of even the common crops produced on the farms are now well known to the neighbouring cultivators. Thus there is a keen demand for all the quantity of selected seed of paddy that can be made available on the farms. During the year under report 5,000 lbs. of selected paddy seed was supplied. Besides this, many small orders for the seeds of onion, *kulthi*, *val*, *dhaincha*, *jowar*, castor, groundnut, *san*, tussocks of guinea grass, seeds and seedlings of cashewnut, *kokum*, *undi*, betelnut, and nut-meg were supplied.

61. *Manures*.—The use of some substitute or supplement of *rab* is beginning to be recognised in the neighbourhood of the Alibag Farm and 258 lbs. of ammonium sulphate, about 1,000 lbs. of *Karanj*-cake and 400 lbs. of fish manure were supplied on orders by the Alibag Farm.

62. *Implements*.—Besides those referred to under the head of popularization of improvements, nine Meston Ploughs, one W. K. S. Plough, two iron levellers, one self-sowing plough, and 33 Gujarath weeding sickles were sold from the Alibag Farm depôt.

Publications.

63. A paper embodying the results of "A Study of the utilization of tidal saline creek water for crop production" was read by me before the last Indian Science Congress and has been published in the Special Science Congress number of the Agricultural Journal of India.

64. Two original notes in Marathi one on 'Kadu (bitter) Karandu (Dioscorea bulbifera) as cattle food' and the second on 'Wild plants useful as cattle food' written by Mr. V. S. Dongre, non-graduate fieldman, Alibag Farm and other several adaptations or translations of extracts from already published information were contributed to the 'Konkan Sheti Samachar.'

The Konkan Agricultural Magazine.

65. The monthly magazine in Marathi devoted exclusively to Konkan Agriculture under the name 'Konkan Sheti Samachar' edited by Mr. Y. G. Gurjar of Alibag under the advice of the Konkan Agricultural Department was continued to be published. As an appreciation and encouragement Government have sanctioned subscribing for four hundred copies for the use of Government Officers and for free distribution to deserving cultivators and Co-operative Societies. The magazine is serving a useful purpose in the dissemination of the knowledge of improved methods of agriculture. The total number of subscribers including the copies subscribed by Government on the 30th June 1919 stands at 901. Mr. Gurjar is rendering a valuable public service by means of this magazine.

Agricultural Association.

66. Out of the eleven agricultural associations that are on the list in the Konkan Division, Sirsi (District Kanara) is the only one which has some work to report. It conti-

nued to popularize the improved sugarcane mill, and Poona pans by keeping them on hire which realized Rs. 72-12-0 as against Rs. 52 in the last year. On its demonstration plot Red Mauritius variety of sugarcane has entirely replaced the inferior local variety and from the former of which sets are supplied on a larger scale. Several new varieties of sugarcane and rice which have been renowned as superior in other places are also being tested on the demonstration plot.

AGRICULTURAL EDUCATION.

67. Sardar P. K. Bivalkar having successfully carried out his experiment of a combined Primary and Agricultural School at Veshvi for five years approached Government with a request to take over his school in their charge on the same lines and to start a few more schools of his type for testing the applicability of the principle to the rural primary schools in general. Though the proposal in its entirety was not found feasible to Government they expressed their willingness to take up Sardar Bivalkar's school and work it on the lines of a purely Agricultural Middle School in vernacular on the Loni model. Sardar Bivalkar having consented to this alternative proposal made it over to Government with the land, fencing and buildings worth about Rs. 5,000. The school thus came in the charge of the Agricultural Department from December 1918 with ten boys who were in standard V of the former combined school, the curriculum of which standard was not dissimilar to that of the first year's class in the Loni model. The school has been named "The Lord Willingdon Agricultural School".

Thus at the end of the year under report there have been two vernacular agricultural middle schools in Konkan, the first being at Jambul, taluka Kalyan, district Thana, and the second Lord Willingdon Agricultural School at Veshvi near Alibag, district Kolaba.

There has been no change made in the standard of admission, in respect of age or educational qualifications, which remain at 14 and 18 years of age and passing the vernacular fourth standard, as a minimum.

The total number of boys in the two schools at the end of the last school year was as follows:—

	1st year.	2nd year.	Total.	Remarks.
Jambul School	18	9	27	In all 28 applications fulfilling the prescribed conditions were received for the 1st year's class and all were admitted. Only 25 actually joined. But out of 26, including one failed student of the past year, one died, seven left owing to domestic difficulties or constant susceptibility to malaria. Out of the 12 that were promoted to the 2nd year one died and 2 were dismissed for misconduct.
Lord Willingdon Agricultural School.	11	This being the first year of the Agricultural School there was only one class.	11	

These were derived from the following districts:—

	Thana.	Bombay.	Kolaba.	Ratnagiri.	Outside Konkan.	Total.
Jambul	20	1	5	1	1	27
Alibag	...	1	6	3	1	11

Arranged according to caste they stand as follows:—

	Jambul.	Alibag.
Marathas	9	5
Brahmins	8	6
Goud Saraswats	6	...
Panch Kalshis	2	...
Kshatriya	1	...
Agris	1	...
Total	27	11

The number of candidates for admission to the first year commencing from 1st June 1919 was 12 at each of the two schools, whereas there is accommodation for 20. The reason for this is probably that the schools and the arrangements are not yet sufficiently known.

The curriculum remained the same as in the past year; poultry keeping has been newly introduced at Jambul while it already forms part of the teaching at the Alibag one from the beginning. A *varkas* piece of Government land measuring 21 acres contiguous to the school farm at Jambul has been transferred to the Agricultural Department for

instructions in *varkas* land cultivation. The Agricultural Engineer not being able to fit up the pumping plant on the river side at Jambul, some practice in irrigation farming was given on an area commanded by the well having some water supply, belonging to Mr. Pisal; who kindly placed it at the disposal of the school.

For the Alibag school, about four acres in conjunction with the Alibag farm area, have been leased for the school farm. The Alibag Agricultural Station including its *varkas* and *manat* sub-stations fulfills the requirements of additional area for demonstration purposes.

When the boys join in the agricultural schools in the first year, for the first few months they find it somewhat difficult to follow the instructions which require the application of their reasoning power rather than that of mere remembering of certain facts by rote to which they seem to have been accustomed in their past training; they however very soon begin to understand the new instruction and take to practical work with readiness and zeal.

The boys were examined at the end of the year with the following results:—

At Jambul, out of the nine students of the second or final year of the school course, eight were declared to have passed in all the subjects and were granted certificates; and out of 18 in the first year 15 passed in all the subjects, and were promoted to the second year.

At Alibag there was only one class; out of the eleven 6 passed in all subjects and the remaining 5 failed only in one minor subject; all were therefore promoted to the second year. The boys were found to be rather weak in arithmetic and not up to the mark in the handling of implements.

68. *Cost of the education.*—The total expenditure at the two schools classified under the several important sub-heads was as follows:—

	Jambul School.	Alibag School newly equipped with current expenditure for four months.
<i>Recurring—</i>		
Teaching establishment (including the mechanic) ...	2,527	225
Stationery and materials for teaching in the workshop and tour of students ...	150	29
Boarding charges (including medical attendance) ...	3,768	618
Office expenses ...	138	30
School farm ...	1,701	189
<i>Non-recurring—</i>		
Purchase of teaching apparatus and equipment ...	509	352
Purchase of dead-stock (including school furniture, boarding utensils, farm implements and workshop equipment) ...	1,099	1,782
Purchase of live-stock ...	506	364
Temporary structures ...	358	268
Permanent improvements on the farm such as drainage and levelling, construction of well, etc ...	272	518 (well)
Total ...	11,028	4,225

Excepting Rs. 260 received at Jambul from private donations, all the expenditure was met from public funds.

69. *Future needs.*—Many of the parents and guardians of the boys and visitors are not impressed sufficiently by the Jambul School as they do not see anything of profitable garden crops or fruit trees. In order to make the school attractive and teach to the boys the profitable systems of irrigation farming and some knowledge of machinery the projected pumping plant on the river side is most urgently required.

WAR WORKS.

70. *Increase of food production.*—Owing to the threatening situation of a shortage of food crops on account of war, the War Purposes Board urged for all possible efforts for increasing the production of food crops. For this purpose the formation of District and Taluka Committees was recommended and the agricultural officers were asked to advise these committees.

Out of the four Konkan districts, most substantial results were achieved in the below-ghat talukas of the Kanara district where a large area was brought under cultivation of pulse crops in the *rabi* season, the chief cause of success being the liberal concessions granted by the Collector of the district by way of removing several restrictions in getting fencing and manure materials from the Government forests.

The efforts to extend the cultivation of *shalu jowar*, gram and wheat in the North Konkan failed owing to want of moisture in the fields in the *rabi* season due to the abnormal deficient rainfall.

71. *Extension of castor cultivation.*—Owing to the large demands of castor oil for lubricating aeroplanes and the prospects of realizing good prices for the same, extension of castor seed cultivation was urged. In Konkan especially in the North Konkan there was every possibility for growing large areas of castor seed crop in the *rabi* season in the moisture holding rice fields and so 16,725 lbs. of castor seed was made available for distribution at one-fourth of the cost price. The droughty season, however, proved disastrous by drying off all the moisture from the fields and almost all the seed remained either undisposed or in some places crops that were sown did not mature.

72. *Census of the stock of food crops.*—The Farm Superintendents and the Agricultural Overseers were kept at the disposal of the Collectors for a week for checking the stock-taking of food crops by the village Revenue Officers.

FAMINE WORK.

73. In the Konkan districts though the rainfall was so abnormally deficient for the rice crops it was sufficient for the growth of usual grass especially in the North Konkan; and though the reduction in the outturn of rice straw together with the large export of grass out of Konkan, must have affected the fodder supply adversely to some extent, the situation was not so bad as to necessitate any special relief measures for saving cattle.

74. *Provision to meet shortage of certain seeds.*—The condition of rice crop in some localities and that of salt rice and the *val* crop in the North Konkan generally was so precarious that it was feared that the worst localities would have to go without a crop in the following season for want of seed. A rough and rapid survey of the requirements was therefore made, and arrangements made to make available Rs. 10,000 worth of *val* seed, Rs. 2,000 worth of salt rice, Rs. 2,000 worth of early varieties of rice. The Union Agency of Bombay undertook the collection of *val* seed without charging anything for their services for which the thanks of the Department are due to them.

In addition to this, the members of the Konkan Agricultural Division purchased seeds of the early varieties of rice for the Collector of Thana, Rs. 6,832 worth of rice seed for the Collector of Poona, Rs. 3,000 worth of *nagli* seed for the Collector of Ratnagiri, and assisted the Assistant Director of Agriculture of the Portuguese Government at Goa in purchasing rice seed for distribution in their territory.

75. *Relief measures in Konkan for famine-stricken districts outside Konkan.*—The main line within the scope of the Agricultural Department was affording relief to cattle by making more fodder available. There were two possible directions in which this can be done—

(i) By spotting out suitable places where cattle from famine-stricken parts could be imported and maintained on the grass lands having some surplus to spare. A survey for such localities was made and some able to maintain about fifteen thousand cattle were to be found either on Government lands or on the grazing areas belonging to private owners who were willing to take outside cattle on condition of retaining half the number of the survivals. In fact herds of cattle from the adjoining Deccan districts had already descended down in a few localities. But by the time the idea was struck and a survey made, it was found that many cattle in the famine-stricken districts had already died and those most valuable that were kept alive at any cost had sufficient sources of fodder to pull them through. It was also learnt from the records that about ten thousand cattle from Gujarat were brought for being similarly boarded in the Vada taluka of the Thana district in the famine of 1896, but it has been recorded that the changed climate and the coarse grass were not agreeable to them and that most of them died.

(ii) By growing of fodder crops for export to the Bombay City and other places. There was an ample scope for this on the Patal Ganga River in the Khalapur Petta of the Kolaba district, which carries a sure and plentiful supply of water from the Tata Hydro-Electric Works; but as the local cultivators who are mostly tenants were not in need of any fodder for themselves and are too ignorant to appreciate the prospects of making good profits by an enterprise of growing fodder crops for sale to distant places, nor could the land-lords be persuaded to undertake this enterprise, the source could not be utilized.

The idea of growing the fodder crops and establishing cattle camps as a departmental concern was not found possible. Two land-lords, one along the bank of the Ulhas river at Badalapur and the other near Umbergaon having a well, were prepared to grow about 25 acres each of fodder, provided they were supplied with oil engine and pumps; even these schemes had also to be abandoned as there were no engines available.

The services of Mr. V. R. Subnis, Agricultural Overseer, Ratnagiri, were kept at the disposal of the Central Division for famine work from middle of March 1919 to middle of June 1919.

ADMINISTRATIVE.

76. *Personnel.*—The charge of the division was held by the undersigned throughout the year with the exception of one month, 22nd December 1918 to 23rd January 1919, when he was on privilege leave, and during which period Mr. K. V. Joshi acted for him.

Mr. K. V. Joshi, being set on Rice Research Work, Mr. G. B. Pandit, Agricultural Overseer, Thana, was brought to the Alibag Farm as Superintendent. About four months' time of Messrs. Joshi, Purandhare, Agricultural Overseer, Kolaba, and Deshpande, Entomological Assistant, was required for famine relief measures in Konkan and the services of Mr. Subnis, Agricultural Overseer, Ratnagiri, were loaned to the Central Division for the same purpose. Mr. V. S. Habbu, Superintendent, Kumta Farm, had to be absent on privilege leave for two months owing to illness and Mr. Gokarn, Agricultural Overseer, Kanara, acted for him. The normal activities of the Department were thus much dislocated.

The Annual Divisional Conference of the Graduate staff of the Konkan Division was held in March 1919 at the Jambul Agricultural School and was as usual very successful and useful.

All the staff with solitary exceptions have continued to put in an unswerving, hard and sincere work, to the best of their respective abilities. The aptitude which Mr. K. B. Gujar has shown in his investigation work deserves a special mention.

V. G. GOKHALE,

Deputy Director of Agriculture, Konkan Division.

APPENDIX G.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE
IN SIND FOR THE YEAR 1918-19.*Organization.*

1. The department of Agriculture in Sind is at present represented by one Deputy Director of Agriculture, one Divisional Superintendent with a staff of the following assistants.

Graduates.			Non-Graduates.		
No.	Grade.	Scale of salary.	No.	Grade.	Scale of salary.
9	IV	75-5-100	2	1st	50-2-60
3	IV	60, on confirmation 75-5-100	2	2nd	35-2-45
			9	3rd	20-2-30
			1	Special	75-5-100

Out of nine graduates in the IV grade two died during the year under report and of the three graduates on probation one was transferred to the Revenue Department and one post was vacant.

The number of farms worked were as noted in the margin. To these a new wheat farm at Jacobabad in Upper Sind Frontier District referred to in the concluding portion of para. 12 of last year's report has been added. Operations on this farm have been started from June of this year. The land has been acquired from the Forest Department free of charge except for Rs. 2,000 which have been paid for the timber growing on the land. The budget grant of the farm for the current year is as noted in the margin. About 10 acres have already been sown with fodder and about 25 to 30 acres will be put under Bosi wheat in the ensuing Rabi.

The plans and estimates for the farm buildings and for an Inspection Bungalow are being prepared by the Executive Engineer, Begari Canals. The estimated cost of all the buildings is Rs. 46,100 but the allotment for the current year being only Rs. 20,000. Only a few very necessary buildings will be constructed this year and the rest when the remaining funds become available.

In addition to these farms there were four sub-stations which are referred to in para. 59 below. A fifth sub-station dealing with paddy and berseem cultivation has been opened during the current year at Kamber in Larkana District. This sub-station is financed by the Larkana Farm and is directly managed by the Superintendent of that farm. The points to be demonstrated here are:—

(i) The economy of seed which has been worked out to nearly $\frac{1}{4}$ th of what the cultivators usually use (*vide* Sind leaflet No. 18 of 1918).

(ii) The adoption of 3 to 4 rice seedlings to a hole instead of the local method of bunch transplanting which contains between 15 to 25 seedlings.

(iii) Berseem will be grown as "Dubari" irrigated crop after paddy.

The Agricultural school at Mirpurkhas continued to be run on the same lines as mentioned in the last year's report. The number of students in the beginning of the year was eight but at the end this fell to five who all passed in the final Examination.

The Budget of the Department in Sind for the current year stands at Rs. 1,16,365-2-7 as follows:—

	Rs.	a.	p.
Salaries of Officers and staff	15,838	7	11
Contingencies	1,00,524	10	8

Season.

2. The conspicuous feature of the season exercising harmful as well as beneficial effects on the agriculture of the Province of Sind were as under:—

I.—Harmful effects.

(a) *The extremely poor Inundation.*—This was perhaps the worst on record. During the whole of the inundation season, the river rose to flow level on four occasions only but the rise each time was of such a short duration and the falls so abrupt that very little advantage of the flow water could be taken. The inundation was further shorter than usual and this resulted in lesser area being flooded for bosi wheat than usual.

The cold weather supply was much below normal, necessitating the longer closure of some of the distributaries of the perennial Jamrao Canal in order to allow full supply in others and thus the usual weekly rotations of water merged into 3 or 4 weeks of closure followed by a week or even less of flow. The irrigated wheats were accordingly adversely affected for want of adequate waterings.

(b) *Absence of Rains.*—With the exception of a few cents of rain which fell at an unopportune time there was practically no rain during the year. Perhaps in no year was this absence of rain so severely felt as in the season under review. The small amount of rain which Sind receives in a normal year and which apart from exercising an invigorating effect upon the cultivated crops, produces in abundance natural grasses, and herbage on waste and fallow lands. The rains having thus failed in a bad inundation year, there was no growth of natural grass and consequently the plough and milch cattle suffered terribly from starvation and over 50 per cent died.

(c) *Influenza.*—This disease broke out in an epidemic form and carried off a large proportion of rural as well as urban population. Those who escaped death were so weakened as to be unfit for hard manual work for some months. The epidemic raged severely at a time when kharif crops were ready for harvest and Rabi crops had to be sown. The result was that both the operations could not be attended to in time and much of the kharif grain crop was therefore damaged by birds and stray cattle and considerably less area was put under wheat and other cold weather crops.

(d) *Khas disease in Jowar.*—This was most in evidence in Nawabshah District but also prevailed to a limited extent in Upper Sind. The symptoms of the disease were that there was no grain formation and the earheads were practically empty. Remissions granted by Government on this account amounted to Rs. 1,11,624-11-0. It is under consideration to study the disease in the current year with a view to find out a practical remedy.

The *Cumulative Effects* of the above conditions were that food grains began to sell at famine rates and fodder became scarce.

The agricultural labour was both scarce and plentiful. Scarce at the time when Influenza epidemic was raging and plentiful at the new year time and after. The cultivators took to working as labourers to a greater extent because of the failure of crops. The labour though plentiful was very dear, the average daily wages of a man being between annas 12 to 14.

II.—Beneficial effects.

The good effects of the season were that cotton inspite of the deficiency of water and other abnormal conditions yielded heavily. Yields obtained have not been known in the memory of the present generation. Wheats were wonderfully free from disease and yielded about the average. The success of these crops is attributed to the prevalence of favourable winds throughout the season. The prices of seed cotton ruled unprecedentedly high, the highest being Rs. 26 per Bengal maund. Wheat and Bajri also sold at a high rate, viz. Rs. 9 to 10 a maund and a bundle of jowari or bajri kadbi weighing about 12 lbs. fetched as much as one rupee.

Temperature.—The 40 days of scorching winds were relatively mild and there was no frost worth the name in the cold weather.

American Cotton.

3. The varieties of American cotton grown on the Mirpurkhas farm and the seed farm were—

- | | |
|-----------------|-----------------|
| (1) Old Triumph | (3) New Triumph |
| (2) Punjab F-4 | (4) Cambodia |

Of these, Old Triumph and F-4 were the two principal varieties grown on a fairly large scale on the seed farm for comparative tests. Old Triumph means the crop raised from seed imported in 1913. This cotton occupied 11 plots measuring 16 acres and 5 gunthas on the Seed Farm. F-4 referred to in para. 5 of last year's report was grown on 7 plots measuring 8 acres and 8 gunthas. The highest yield obtained from F-4 was 1,663 lbs. per acre against 1,507 lbs. of Old Triumph. The average outturns and ginning percentages were as noted below:—

Name of cotton.	Average outturn per acre in lbs.	Ginning percentage.
Old Triumph	947	32.8
F-4	1,321	32.7

The results though not strictly comparable owing to variation in soil and difference in the treatment of plot Nos. 1 and 2 of series 12 which were sown with F-4 cotton and which were treated with the canal silt at the rate of about 1,000 maunds per acre, but they are fairly indicative of the relative yielding capacities of each cotton. The earliest plot of Triumph was sown on 23rd March. The remaining plots were sown about three weeks earlier than F-4, the whole of which was sown in the first week of May.

In the case of Triumph 6 plots out of 11 required more or less resowing on small kalar patches which was done from 3 to 4 weeks after the first sowing. In F-4 no gap filling was necessary as the land was fairly sweet.

4. As regards the general appearance of the crop of Old Triumph, there was no noticeable change in the size of the bolls as was observed last year. In this connection it will be interesting to know if the reduction in the size of bolls has affected the yielding capacity. The following are the figures of average out-turns of the past three years:—

Year.		Area.		Average yield per acre in pounds.
1916-17	...	A.	g.	641
Do.	...	75	0	286½
1917-18	...	2	0	163
1918-19	...	16	0	947

These figures do not point to any falling off in the yield and the lower outturns in the 2nd year (1917-18) seem to be due to climatic conditions being unfavourable to the cultivation of this cotton.

5. Owing to favourable season none of the American cottons developed red leaf blight but in a year favourable to this disease like the one of 1917-18, F-4 showed remarkable resistance to red leaf blight to which Triumph fell an easy prey.

During the current year (1919-20) 52,105 lbs. of F-4 cotton seed have been given out for sowing to cultivators on the Jamrao Canal and in North Sind.

6. Regarding New Triumph 100 lbs. of seed were imported last year for sowing in comparison with Old Triumph which showed several small-sized bolls not characteristic of the variety when it was first imported. Unfortunately the seed was not pure as it contained three distinct kinds, viz., black naked seed, seed with white fuzz and seed with green fuzz. A small quantity of each of these was separated and sown. The results showed that black naked seed has low ginning per cent., viz., 31.4, while seed with green fuzz gave a ginning percentage of 36.8. Thus black naked seed proved undesirable and has been eliminated. It may be pointed out that plants grown from the black naked seeds produced both black and fuzzy seeds while those raised from fuzzy seeds produced mostly their own kind. Hence we have selected several single plants which produced only fuzzy seed with complete exclusion of black fuzzless seed. The behaviour of these in current season would determine whether we have hit upon any pure strains as regards the fuzzy character of the seed. This will provide material for future pedigree strains.

7. Two plots measuring an acre each sown on the Mirpurkhas Farm with the new seed (mixture) have given yields of 969 lbs. and 1,154 lbs. respectively. Similarly, yields of 979 and 694 lbs per acre have been obtained from each of the two plots sown on the Seed Farm. The ginning per cent. of this cotton has worked out to be 32.4.

8. - An acre and half sown with Cambodia cotton in March in comparison with F-4 and Triumph on the Seed Farm gave a yield of 601 lbs. per acre as against an average yield of 947 of Old Triumph and 1,321 of Punjab F-4. The growth was very bushy and robust but it being a late ripening variety fruited and yielded later than other American cottons. The pickings continued up to February which would not have been possible if there had been the usual frosts in December and January. The ginning percentage of this cotton was 31.9.

9. 33 bales of American cottons were sold to Messrs. E. D. Sassoon and Company, Bombay, through Messrs. Duncan Stratton and their valuation is as under:—

No. of bales.	Kind of cotton.	Rate per candy of 784 lbs.
13	Old Triumph	Rs. 525
3	New "	535½
1	Mixed new Triumph and Cambodia	535½
1	Cambodia	525
8	F-4	577½
7	Old Triumph	525

It will be seen that F-4 has fetched the highest price which is rather surprising.

10. The results of the comparative experiments between the three deshi cottons, *viz.*, N. R., Bhitshah and Bani on the

Plot.	Yield per acre in lbs.		
	Bhitshah.	N. R.	Bani.
B-2	648	555	275
B-3	1,310	1,969	371
B-4	830	972	447

Mirpurkhas Farm were as noted in the margin. These were sown in the first week of June in 3 equal strips in which each plot was divided. The seed in each case was drilled, other treatment being the same. Bani cotton was raised from the seed received from the Empress Mills, Nagpur. The seed

was unfortunately not pure but the results indicate that Bani gave lowest yields owing to its being a late variety and therefore not suitable for this country. With regard to N. R. and Bhitshah the latter has given the best yield which is contrary to the last year's experience when N. R. did better than Bhitshah. Perhaps further trials will clear the point. In this connection it may be pointed out that plot B-4 while superior to B-2 is inferior to B-3.

On the Khathar demonstration plot, Bhitshah yielded at the rate of 830 lbs. per acre as against 741 lbs. of N. R. on the seed farm results obtained with N. R. and Bhitshah are uncomparable owing to kalar patches which were visible in certain plots.

Selection.

11. Work with the isolation of superior strains from Deshi or Bhitshah cotton has sufficiently progressed to enable comparative tests of the four principal types found in it being made on a field scale in 1919-20 occupying about 30 acres. Last year each type was sown on $\frac{1}{4}$ acre scale and it was found that white flowered narrow-lobed type gave the highest outturn (1,592 lbs. per acre) while white flowered broad-lobed gave the highest ginning percentage, *viz.*, 45.

Wheat.

12. On the Seed Farm, Mirpurkhas, an area of 45 acres 31 gunthas was grown under wheat as under:—

Pusa 12	...	...	...	A. g.
Punjab 11	...	...	...	14—36
				30—35

The average yield of Pusa 12 per acre came to 965 lbs and that of Punjab 11 to 863 lbs. The results are rather uncomparable as the area under Punjab 11 contained large pieces of kalar, hence germination was patchy. The crop received only one watering but the kalar plots needed one more which could not be given owing to scarcity of water.

13. The results of comparative tests on the Mirpurkhas Farm with Pusa 12 and Thori wheats were vitiated by the deficiency of water.

14. On the Sukkur Farm $\frac{1}{4}$ of an acre under Pusa 12 with one irrigation yielded at the rate of 1,620 lbs. per acre. The crop by its large earheads and luxuriant growth attracted considerable attention. The land received repeated ploughings in hot weather and a fine seed bed was formed.

15. On the Larkana Farm Pusa 12 sown in comparison with local Thori gave the following results:—

Plot.	Yield per acre in lbs.		Remarks.
	Thori.	Pusa 12.	
A 1	901	1,172	Irrigated.
A 2	1,496	1,380	Irrigated but much bird attack.
A 3	840	1,024	Irrigated.
G 4	390	388	Bosi.
G 5	707	588	Do.
G 6	776	488	Do.

From the results cited above it will be seen that Pusa 12 did not yield as much under Bosi conditions as it did under irrigation. It was observed that Pusa 12 grew with greater vigour after each watering and threw out new shoots. This is in contradiction to what has been achieved in the Frontier District, *vide* para. 16 below. A probable explanation of this appears to be that the farm plots on which this was grown contained traces of kalar to which unirrigated local Thori stood better than Pusa 12.

16. An interesting result was obtained on the Shikarpur demonstration plot where Pusa 12 and Punjab 11 grown in comparison with each other yielded per acre as shown in the margin. Pusa 12 received four waterings and Punjab 11 only three. The land assigned to the latter was comparatively poor.

The fact that Punjab 11 has inspite of the poorer soil and one less watering has yielded better could only be explained by what was observed on the Larkana Farm that Pusa 12 responded to irrigation so readily as to put on considerable vegetative growth each time that it was watered. This tendency appears in the opinion of the undersigned to be responsible for the lower yield of Pusa 12 in grain. These results however require confirmation by further trials.

17. During the year under report 480 maunds of Pusa 12 and 1,563 maunds of Punjab 11 were distributed. Unfortunately Influenza broke out soon after and therefore much of the seed remained unsown. On 'kutchra' lands at Sekhat near Hyderabad Pusa 12 sown side by side with local wheat showed that the former ripened 3-4 weeks earlier than other wheats and the growth was conspicuous by redness of earheads but fell a prey to bird and pig attack to a greater degree. In spite of this, one plot yielded at the rate of 17 maunds 13 seers and another yielded 16 maunds per acre.

18. On the Jamrao canal yields up to 1,600 lbs. per acre have been obtained under district conditions but the tenting bill has been so heavy as to counterbalance the extra profit in higher yield and superior quality. The Jamrao zamindars however persist in growing Pusa 12 and with development in area the bird attack may become divided and thus partially remove a cause which stands as a barrier in the popularization of this wheat.

19. In Upper Sind Pusa 12 is fast gaining in popularity. Here Pusa 12 grown as bosi side by side with local Thori and Punjab 11 has given an average yield of 14 maunds 29½ seers per acre as against 13 maunds 8½ seers of Punjab 11 and 14 maunds 19 seers of local Thori. This shows that outturn of Pusa is only slightly better than that of local but apart from being superior in grain the former had the advantage of ripening full 3 weeks earlier than either the local Thori or the Punjab 11—a quality much valued by cultivators.

None of the growers of Pusa 12 have parted with the seed but all have stored it for next year's sowing on a much larger scale.

20. Punjab 11 wheat has also a good future before it, as being an awned variety it is less exposed to attacks from birds. It is hardly enough to thrive on a poor soil provided 3 to 4 waterings could be given to standing crop.

21. Work with the isolation of different types found mixed in the local wheats of Sind started two years ago is continued. Several earheads of each of the types were sown singly in lines, most of them were true to type as regards morphological character and very few showed splitting. Plants having weak growth were rejected and the rest gathered for future trial.

Berseem.

22. The crop continued to be grown on a large scale on several of the farms noted in the margin. On the Jamrao there was much deficiency of water during the cold weather, consequently berseem crop on either of the seed farm or the Mirpurkhas Farm did not come to much and was mostly utilized for farm cattle. On the Sukkur Farm where irrigation is secured by pumping direct from the River Indus, the results have been excellent, the average yield

Date of cutting.	Weight of each cutting in Mds.		Value in Rs.		
	Mds.	s.	Rs.	s.	p.
5th December 1918 ...	111	0	111	0	0
1st January 1919 ...	115	0	115	0	0
28rd January 1919 ...	199	30	199	12	0
6th March 1919 ...	205	0	205	0	0
11th April 1919 ...	266	5	266	2	0
25th May 1919 ...	86	20	86	8	0
	Total ...		988	6	0

being 43,000 lbs. of green fodder per acre. One of the best plots D2 gave the results noted in the margin. The area of the plot is one acre. Berseem was sown on 20th September 1918. It gave six cuttings. The total cost of production was Rs. 145-14-2 of which Rs. 105-11-0 were spent on pumping water from the river. In connection with berseem it has been possible to work out the following points on the Sukkur Farm:—

(a) Berseem sown in September gives averagely 6 cuttings, that sown in October 5, that in November 4 and that sown in December only 3 cuttings. This points to the advantage of sowing berseem in September. Though September sowing is the best in yield, the October sowing has been found to be safer so far as germination is concerned as September is hotter than October, berseem being a cold weather crop.

(b) Sown by the 15th September first cutting of berseem is ready by 1st November.

(c) The right stage for cutting is also an important factor in berseem cultivation. It should be cut neither too early nor too late. Otherwise the yield is affected.

(d) It is also observed that it does not pay to keep berseem in May as owing to hot blowing winds its growth is retarded and the stem gets hardened and therefore not so much relished by cattle.

23. On the Larkana Farm berseem was sown for the second time on an area of 15 acres in the year under report. Owing to drying up of the Ghar Canal the crop did not receive any irrigation after February. In spite of this it kept on growing and gave from 1 to 2 cuttings between February and May as under:—

1st cutting averaged about 6,000 lbs. per acre.

2nd cutting „ „ 3,200 lbs. „

Before February the crop yielded on an average 15,654 lbs. per acre. Thus it gave 1 cutting before February and 2 cuttings after the crop ceased receiving any irrigation. These results show that Larkana lands are wonderfully retentive of moisture.

Another point noticeable was that berseem following paddy grew very slowly for the first three months from sowing. The reason of this appears to be that the water table being nearly risen to within 6' of the surface by rice cultivation, berseem crop suffered from water-logging conditions.

Berseem kept for seed could not be watered after February and at the harvest, which was full 100 days after the last watering, it yielded seed at the rate of 5 maunds per acre.

24. In para. 19 of last year's report some observations were made on the good yield of berseem on the Larkana Farm and one of the reasons assigned for this yield was that the crop had attained a great height measuring as much as 6 feet. During the year under report the average height was 2 feet due to deficiency of water yet the seed produced was as noted in the margin. This indicates that the length of the plant has little

D-2	...	...	320 lbs.	connection with the high seed yield. It seems probable that
D-3	...	...	450 "	the removal of lesser quantity of green berseem, <i>viz.</i> , one cutting only resulted in the greater production of seed but this
D-4	...	...	190 "	point requires confirmation. Natural richness of the land is

also another factor for the high seed yield but the Farm Superintendent thinks that the land assigned to berseem seed was inferior to that of the last year. Flies and bees were in considerable evidence on berseem flowers.

25. On the Landhi Farm where land is coarse sand it was noticed that the usual method of sowing berseem broadcast in standing water did not give satisfactory germination, because before the seed had a chance to strike root, the water drained down away owing to pervious nature of the soil. Hence it has been found necessary to sow the seed on dry land and cover it with a light harrow such as a babul branch and to water immediately afterwards.

26. Owing to poor inundation and absence of rain there was a great scarcity of fodder, consequently there was more demand for seed than could be met with. Transport difficulties prevented the importation of new seed. Hence only about 3,000 lbs. stored by the Department were distributed in small lots and was well made use of by the cultivators.

Sugarcane.

27. Comparative tests were made on the Sukkur Farm with striped Mauritius, Lahori and Java. The first occupied 20 gunthas, the second 15 gunthas and the third 5 gunthas. The canes were sown after the Poona method alternately in parallel rows. 100 carts of farm yard manure were applied to the plot before ploughing. Striped Mauritius and Java 33 grew splendidly but Lahori was very poor in growth. 15 gunthas of Mauritius fetched Rs. 100 while 10 gunthas of Lahori realized only Rs. 20.

Striped Mauritius and Java 33 being hard canes are not popular for chewing purposes, though for gul-making purposes they appear to be excellent. It is rather interesting to note that this year these canes were purchased more for chaffing and feeding to cattle than for chewing. The one great trouble about striped Mauritius is that being a very heavy and tall grower it lodges very easily.

One acre realized Rs. 205-4-5 including Rs. 17-12-0 for onions which had been put in $\frac{1}{4}$ an acre with the cane. During the year striped Mauritius and Java 33 were practically free from stem borer while Lahori was badly attacked. In point of yield and quality the canes from stalks (roots) were equal to those from the tops. As to the borer attack both were equally affected. But this requires confirmation by further trials.

28. On the Landhi Farm plot C 5 measuring one acre sown in March with striped Mauritius was badly attacked by borer and hence it is proposed to alter the date of sowing to see if the borer attack could be avoided. Khadya variety was also grown as ratoon crop on an area of 5 gunthas. It seems to have got acclimatized as it was free from disease or damage from sea breeze. This was disposed off at Karachi for chewing purposes and fetched somewhat lower price per unit weight than the local cane, which is thicker and more juicy although much less vigorous in growth and tillering capacity.

The yield of a plot of 5 gunthas was a under:—

				Rs. a. p.
175 bundles of canes (16) each	...	...	84	15 6
5,000 sets kept for sowing	...	...	15	0 0
			<hr/>	
Total	...	...	99	15 6

Rice.

29. Rice is cultivated on the Larkana and Sukkur Farms. At Larkana owing to failure of inundation much of the experimental work was vitiated and nothing important could be gathered beyond the following two points:—

(a) Local method of transplanting closely with heavy seed rate as compared with the farm practice of transplanting about 6" apart with a few seedlings to a hole gave the following results:—

Plot No.	Area.	Method of sowing.	Outturn per acre.	
			Grain.	Straw.
A-5	A. g. 0 20	Local bunch method of close trans-plantation.	960	1,560
A-5	0 20	Farm practice of few seedlings and wider transplantation.	1,212	1,560

The amount of seed required by local practice is 8 toyas per jireb. ($\frac{1}{2}$ acre) and by the farm practice 3 toyas.

(b) As a rule cultivators do not plough their lands in the cold weather but simply puddle them at the time of transplantation. It has been proved that preparatory ploughing does immense good and saves time at the transplanting season. The following table will verify the point in question:—

Plot.	Area.	Puddled in 1917-18.		Cold weather ploughing 1918-19.		Remarks.
		Grain.	Straw.	Grain.	Straw.	
A-3	1 0	1,027	1,680	3,600	4,980	*This was transplanted under feet of cattle to check moss growth.
A-4	1 0	1,140	2,000	3,152	4,860	
B-3	1 0	742	600	2,824	3,720	
B-4	1 0	460	490	* 1,120	2,240	

Experiments to find out suitable Rab substitute have been undertaken since last two years but the results could only be given after these are concluded.

30. On the Sukkur Farm about 11 acres were put under Rice Sathri variety irrigated by means of pump. Experiments on the reduction of seed rate were continued during the year and the following results will show that a smaller seed rate gave better outturn.

Plot.	Seed rate in lbs.	Yield per acre in lbs.	Remarks.
A-5	40	1,320	} Both plots were uniform.
A-6	12	1,520	

Fruit.

31. The fruit trees continued receiving the same treatment and attention. The heavy pruning practiced in case of certain fruit trees elsewhere proved to be harmful in Mirpurkhas where high temperature and rigorous winds are destructive to fruit when exposed by the renewal of extra branches and foliage. Grape, peach and orange trees fruited heavily and found ready market. Orange fruit was sold on contract for Rs. 800. Owing to Influenza epidemic the demand for sour lemons was so great that the contractor sold off all the fruit in a raw state at a good price by the beginning of January which otherwise used to last till first week of April.

32. Country mango trees were badly attacked by 'Mahlo' disease. Bombay grafted mangoes were quite free from the disease and yielded well. An experiment with spraying against 'mahlo' hopper was started on the farm just before the flowering period of the mango trees and continued up to the end of February 1919. It was noticed that Fish Oil Rosin Soap was the best insecticide to use for the spray and that its strength should be 1 lb. in 10 gallons of water. It was further observed that trees planted at longer distances from each other showed lesser attack of the disease than those planted thickly. How far spraying is effective in checking the disease requires to be proved by further tests though the year's results are very encouraging.

33. The grape vines again did remarkably well, the fruit has acquired much reputation in the country, and is in such a demand that during the year under report its price was increased from eight annas to one rupee a seer and still it was all readily sold. The crop realized Rs. 504-9-2 as against Rs. 326-10-0 last year.

The peach crop was also excellent and fetched Rs. 255-0-6.

34. The principal sales of fruit stock at Mirpurkhas were as noted below:—

Lemon seedlings	...	...	...	407
Orange grafts	...	...	...	374
Mangoes grafted	...	...	...	348
Grape plants	...	...	...	180
Peach and apple seedlings	...	...	...	178

35. *New Orchard.*—The plants are now well established and thriving excellently. Plums though flowered profusely bore no fruit at all and hence they were cut. Their places will be filled by new varieties of oranges which have been ordered out from different parts of India. Grapes here also fruited during the current year and so have some of the oranges and pears. The quality of their fruit will be tested when ripe.

36. Different varieties of grape vines ordered out from Saharanpur contained a lot of mixture hence they have been planted in two rows with the object of—

- (1) separating different varieties,
- (2) seeing which variety fruits heavily,
- (3) and testing as to which variety has the best fruit.

37. The Talli (*Dal bergia Sissoo*) planted along the western side of the New Orchard to serve the purpose of wind brake and hedge has now grown up well and is found very useful in sheltering the fruit trees against hot and sultry winds.

38. In addition to the above fruit culture, English and country vegetables were grown in the garden area both at Mirpurkhas and Landhi Farms. The sale-proceeds at Mirpurkhas amounted to Rs. 256-6-8 and seed worth Rs. 128-8-0 was produced. On the Landhi Farm vegetables realized Rs. 463-3-9.

39. Arrangements are in progress to extend fruit work both on the Mirpurkhas and Landhi Farms. Several varieties of lemons, limes and citrus are being collected on the Mirpurkhas Farm to find out the best stock on which to bud oranges. Several varieties of oranges and pomeloes are also being imported for trial.

On the Landhi Farm different kinds of plantains, cocoanuts and papayas (*c. dicumana*) are being imported with a view to making selection of the best varieties suitable under Landhi conditions.

Rotations.

40. The work started at Landhi with cotton and sugarcane as rotation crops with potatoes which get diseased owing to continuous cropping was continued during the year under report. Sindh cotton yielded 640 lbs. per acre in 8 pickings as against 564 lbs. in last year. Cambodia did not do well owing to its being a late ripening variety and yielded only 280 lbs. per acre. The land is yet too light for cotton but with the folding of goats and sheep already started on a small scale and with green manuring it will soon be in a condition for cotton culture. Work on sugarcane is in progress (*vide* para. 27 above) and a larger area has been put under it during the current year.

Irrigation.

41. The results obtained during the previous year in connection with the reduced number of waterings given to the standing crop on land which received a thorough tillage during the period June to October and given a double irrigation at the time of sowing have been confirmed by this year's work. There were about 46 acres sown on the seed farm under wheat and given only one watering after sowing to the standing crop gave an average outturn of 900 lbs. per acre. The outturn is not so high as that obtained in the previous year but is very satisfactory in view of the plots contained large patches of kalar on which there was no germination.

On the Jamrao Canal the number of waterings ordinarily given to cotton crop is ten to twelve. This has been reduced on the Mirpurkhas Farm with the usual tillage and by sowing the cotton in drill and making intercultivation after every irrigation. Number of waterings given to drilled cotton sown in B-2 to 4 and their outturns were as follows:—

Plot.	No. of waterings.	Outturn per acre in lbs.	Remarks.
B-2	4	503	Kalar.
B-3	5	961	
B-4	3	773	

Average of the above 3 plots = 746 lbs.

This experiment was not especially designed for irrigational investigations but was undertaken side by side with varietal tests. The results however indicate the scope in the reduction of total number of waterings in cotton if the land is given good preparatory tillage, seed sown in lines and crop intercultivated after each watering.

Cultural Operations.

42. Operations in connection with cultural experiments were continued on the same lines as reported in paragraph 29 of last year's report. The obstacle in the way of getting good seed bed prepared for using Gujarat cotton drill has been overcome by the introduction, after repeated trials, of a tube attached behind a local plough by which seed is dropped in furrows made by the plough. The distance between the rows is secured by the use of a yoke which should be 4 feet long between the centres of the bullocks neck for lines two feet apart. For this method of drilling an elaborate preparatory tillage is not necessary. A couple of ploughings with the Egyptian plough followed by samaring has been found to answer the purpose of a good seed bed quite well. This is remarkable in a country where scarcity of labour is a limiting factor in the way of introduction of any elaborate cultural operations requiring excessive amount of labour.

43. Drilling gives satisfactory results on free working soils. On stiff soils the germination is generally patchy owing to the reason that such lands are generally cloddy after ploughing and the seed dropping below clods, does not come out.

44. With regard to the preparation of land for bajri described in paragraph 30 of last year's report the results obtained during the year confirm the views expressed therein, but these methods are not likely to be taken up in the district where it is rather difficult to get good preparatory tillage especially for bajri. Besides the disc harrow is costly and therefore beyond the means of an average zemindar. It has however been possible to get bajri drilled in the district by the same means as those adopted in cotton namely a tube attached behind a plough and this has a much scope for further extension.

45. Further trials with intercultivating operations of crops sown in lines showed that a country or an Egyptian plough is the best implement for interculture but it is important to see that the operations are done at the proper stage when the land is neither too dry nor too wet.

46. On the Landhi Farm Planet Junior Hand Hoe has given a great satisfaction and is likely to find favour with the cultivators. This success is due to the fact that the soil is sandy and hence it works freely which would not be the case on stiff soils found in alluvial tracts of Sind.

47. Further observations in connection with the proper date of sowing wheat as remarked in paragraph 33 of last year's report go in favour of November sowing. The October sowings are seldom free from "Mothe" and ground insects. In this connection Mr. Howard to whom affected plants of wheat sown in October on the Larkana Farm were submitted wrote as under:—

"The trouble is not in my opinion a disease but a consequence of sowing wheat in too warm a seed bed".

Reclamation work.

48. Work conducted on the Larkana Farm in connection with the reclamation of land on the dry area which had developed kalar to much extent showed that there was an all round increase in outturn of rice. In 1917-18 plots Nos. C-2 to C-6 and D-2 to D-7 gave the following outturns:—

Plot No.	Area.	Variety.	Method of transplanting.	Yield per acre			
				1917-18.		1918-19.	
				Grain.	Str.	Grain.	Str.
C-2	1 4	K—Paddy ...	Bunch of seedling ...	760	720	1,650	1,472
				...	1,120	green.	...
3	1 0	R—Berseem G. fodder ...	Broadcasted ...	...	22,444	...	19,640
			
4	1 0	K—Paddy ...	Bunch of seedling ...	883	720	1,792	1,590
			
5	1 0	R—Berseem ...	Broadcasted ...	...	31,825	...	23,650
			
6	1 0	K—Paddy ...	Bunch seedling ...	998	960	1,854	1,740
				...	20,976	...	11,100
6	1 0	R—Berseem ...	Broadcasted ...	964	760	1,598	1,710
				...	20,408	...	29,530
6	1 0	K—Paddy ...	Bunch seedling ...	692	520	1,751	1,410
				...	14,809	...	23,460

Plot No.	Area.	Variety.	Method of transplanting.	Yield per acre.			
				1917-18.		1918-19.	
				Grain.	Str.	Grain.	Str.
D-2	A. g. 0 25	K—Torh paddy	Bunch seedling	801	384	960	432
					896	green.	...
	0 25	R—Berseam	Broadcasted	...	27,780	...	7,370
3	1 0	K—Torh	Bunch seedling	733	880	1,387	1,230
	1 0	R—Berseam	Broadcasted	...	27,159	...	16,814
4	1 0	K—Torh	Bunch seedling	1,352	1,640	1,513	1,860
	1 0	R—Berseam	Broadcasted	...	25,244	...	17,490
5	1 0	K—Torh	Bunch seedling	1,594	1,760	1,930	1,500
	1 0	R—Berseam	Broadcasted	...	25,248	...	7,200
6	1 0	K—Torh	Bunch seedling	1,520	1,400	1,840	2,130
	1 0	R—Berseam	Broadcasted	...	18,706	...	13,250
7	0 20	K—Torh	Bunch seedling	728	720	1,764	1,690
	0 20	R—Berseam	Broadcasted	...	7,840	...	4,650

K=Kharif

R=Rabi.

It will appear from the above table how quickly has the improvement taken place by only one year's treatment as to give yields almost equal to that of a sweet land.

In addition to the results mentioned above the following more points in connection with the reclamation work have been noticed.

(1) that very bad salt plots required to be kept submerged under water at least a fortnight before transplanting otherwise the young seedlings either did not thrive well or died eventually.

(2) that till the time the young seedlings establish themselves and put on green appearance every portion of the kalar land should be well covered with water but at the same time care should be taken not to submerge the young seedlings.

(3) that certain kalar patches inspite of the above treatment continued to be bare of vegetation. Trial pits dug in such patches showed that they overlaid a very hard clay subsoil of considerable depth and consequently defective in drainage. Thus such lands with the above method of reclamation would require more time than otherwise to be sweetened.

(4) It was further noticed that the proportion of grain to straw goes on decreasing to a certain limit as the land is getting freed from kalar.

49. Plot No. E-7 sown in 1917-18 on the above farm with paddy gave very thin growth and outturn was poor. This was ascribed to too much salt in the plot. In the year under review the plot was again sown and although it required resowing three times the plants established themselves eventually and gave an outturn of about 900 lbs. This is remarkable as the analysis of a sample of standing water in the plot disclosed such a high proportion of salts as below:—

Total salts containing.	Parts per 100,000 parts.
Calcium sulphate	63.68
„ carbonate	5.17
Magnesium sulphate	43.56
Sodium sulphate	38.34
„ chloride	742.50

District work.

50. The principal items of programme for the year under report were:—

I. Drilling cotton in lines.

II. Seed distribution.

III. Popularization and distribution of superior implements.

IV. Popularization of crops in tracts where they are not ordinarily grown.

51. Drilling cotton. The object of this has been fully explained in the last year's

report under the heading of district work. The results of the year under report may be summed up as follows:—

23. drilling demonstrations were given in the marginally noted villages and each demonstration extended over an area of 1 to 2 acres. The land was given two ploughings followed by a samar and seed sown by a tube attached to the local plough. The distance between the lines being regulated by the width of the yoke described in paragraph 42 above. In all the villages except where the land had some kalar and in deh 72 where the crop was damaged by a breach in the neighbouring karia the operations were successful. Two hoeings were given to the plots with the plough. In the broadcasted crop in a normal year 2 hand weedings costing from Rs. 3 to Rs. 5 each per acre become necessary. But in the rains when the growth of weeds is stronger and greater not only is the cost doubled but the labour becomes scarce owing to the depletion of Marwaris who from the greater bulk of the labouring class and who leave Sind for Marwar at the very sign of rain in the latter place. The cultivators were accordingly greatly impressed with the economy in weeding by means of plough run between the lines.

Number of Demonstrations.	Village.	Taluka.	District.
1	Deh 52	Mirpurkhas	Thar & Parkar.
7	Deh 72	"	"
4	" 128	"	"
4	" 128	"	"
8	Underolal	"	Hyderabad.
1	Ghanghuro	"	"
1	Gundar	Hyderabad	"
1	Ganji	Nawabshah	Nawabshah.
1	Rupabad	"	"

As a result of these demonstrations a well-known pleader of Hyderabad wrote in the following terms to the District Agricultural Overseer.

"I cultivated cotton in my garden under the guidance of Government Agricultural Department. I adopted the drilling method of sowing cotton and I had about one acre of land under cultivation by that method. It yielded about 25 maunds of Sindhi cotton and I would advise every one to adopt that method".

Another zemindar on the Jamrao canal in Mirpurkhas taluka has sown nearly 1/3rd of his total cotton crop by the drill system and is enthusiastic enough to entirely abandon broadcasting in favour of drilling in future years.

In the neighbourhood of the Jamesabad sub-station cotton and bajri fields could be seen sown with drill and these are increasing year by year.

All these indicate the growing popularity of the system introduced by the department and with further demonstrations it is hoped that the sowing of crops, particularly cotton by drill will extend fast.

53. *Distribution of cotton seed.*—During the year under report the following seeds were distributed for sowing

Kind of cotton.	Quantity distributed.
N. R. ... ..	... 3,526 lbs.
Bhitshah ... ..	... 36,880 "
Triumph ... ..	... 5,500 "

There was very large demand for N. R. seed but it being not possible to get any supply from Khandesh owing to failure of cotton crop there, only such quantity as was available on the Government farms, was given out.

54. Our selection work in isolating desirable superior strains in the neglectum types has advanced sufficiently far to enable us to give out next season a large quantity of seed for district sowings. For this purpose the Bomby cotton syndicate's ginning factory at Mirpurkhas will be very useful in ginning and storing the seed without any danger of pure strains being mixed.

55. *Distribution of wheat seed.*—In addition to the distribution of 1,623 Bengal maunds of Punjab 11 and 480 maunds of Pusa 12 wheats mentioned in paragraph 17 above, 2,670 maunds 21 seers of wheat were ordered from Karachi at the request of the Collector of Thar and Parkar for distribution among zemindars at cost price. The seed arrived late and therefore only one fourth of it was purchased by zemindars for seed, the remaining was disposed of to grain merchants at slightly over the cost price. The transaction ended in a profit of Rs. 2,066-1-10 to Government.

As mentioned elsewhere all the seed of Punjab 11 and Pusa 12 wheats purchased by zemindars for sowing was not sown owing to Influenza epidemic and deficiency of water, hence only 190 maunds of good seed of Pusa 12 could be purchased for the current year's distribution from among the zemindars who were under agreement of giving the department the option of repurchasing the seed. Others had either the mixed seed or the grain was very shrivelled owing to deficiency of water.

56. *Distribution of Implements.*—Demand for the Egyptian ploughs especially on the Jamrao continues to be very great. At Mirpurkhas these ploughs are made by local carpenters and are sold in hundreds annually. The price of this plough has risen to Rs. 9. The iron ploughs are also in demand but as the prices have risen much they are not in immediate demand. Among the implements distributed by the department during the season there were 18 Egyptian ploughs 4 Monsoon ploughs 3 (three) coulters Gujarat wheat drills and 4 hand archimedian screws.

57. *Popularization of crops where not ordinarily grown.*—Efforts to popularize cotton cultivation in Upper Sind were continued. An area of 2 acres was put under Bhitshah cotton at Khandakote. The seed was drilled in July but owing to unprecedented scarcity of irrigation water the crop did poorly, yielding at the rate of 3 Bengal maunds per acre. The produce has been hand ginned by the cultivators and the seed stored for the current year's sowing. Similarly an area of about 8 acres sown near Shikarpur with Triumph cotton though suffered from drought gave an average outturn of about 3 maunds per acre. 30 acres sown with Bhitshah cotton in March 18 on previous year's moisture by a well-known Upper Sind zemindar and irrigated in the inundation season yielded at the rate of 6 maunds and 27 seers an acre. During the current year about 20 acres have been sown by one Haji Mahomed Umar in Jacobabad and Shikarpur talukas with Punjab F—4 cotton. The crop is reported to be doing well.

58. *Shows and Demonstration.*—During the year under report there were 3 shows as noted in the margin.

Mirpurkhas, Nawabshah, and Larkana. The Mirpurkhas agricultural show was combined with cattle and pony show. The latter being in charge of the Civil Veterinary Department. The total amount given in prizes was Rs. 550; of this Rs. 300 were contributed by the Agricultural Department.

Nawabshah show was purely an Agricultural show and was held on 23rd January 1919, Rs. 400 were given in prizes. English vegetables grown by the boys of the Agricultural School Mirpurkhas and exhibited in the show were the object of great admiration.

Larkana show was as usual combined with cattle and mule show. The working of the implements was shown on the Larkana Farm and not at the seat of the show. The visitors liked the implements and the crops specially berseem. The total amount given in prizes was Rs. 465.

All the above shows were held on the same lines as those followed in the previous year.

In addition to these there were 6 organized demonstrations given at Mirpurkhas experimental farm, Mirpurkhas Seed Farm, Sukkur Farm, Larkana Farm, at Ghotki in Sukkur district and at Gundar in Hyderabad district which all were a great success. The points demonstrated were—

- (1) the cultivation of berseem as an excellent fodder crop in cold weather especially in a year like the one under review when scarcity of fodder was almost unprecedented;
- (2) Pusa 12 wheat as the best among local wheats both in points of yield and quality and also an early ripener;
- (3) the value of sowing cottons in lines;
- (4) the value of superior implements such as iron ploughs;
- (5) and the hand archimedian screws for lifting water from short lifts.

Sub-Stations.

59. The sub-stations worked during the year were as noted in the margin. All except Khathar were run on Hari system. Owing to very poor inundation kharif crops at Shikarpur and Nawabshah sub-station did not do well. But at Khathar it was possible to overcome the water difficulty by lifting water direct from the Phuleli—a perennial canal. An outturn of 834 lbs. per acre of Bhitshah cotton was obtained as against 741 lbs. of N. R. Similarly a plot of local jowar yielded at the rate of 1,210 lbs. per acre of grain. Berseem sown on one acre 12 gunthas came up luxuriantly and produced good impression on the minds of the neighbouring cultivators. Green fodder worth Rs. 57-2-0 was sold locally and the rest fed to sub-station cattle. On the Jamesabad plot owing to deficiency of water and owing to patches of Kalar in the plots sown with cotton the outturns were rather poor. Punjab F—4 yielded 686 lbs. per acre as against 473 of N. R., 386 of Triumph and 365 of Bhitshah. The results are however uncomparable as the plot assigned to F—4 cotton was free from kalar whereas Bhitshah and Triumph plots had kalar patches which gave no germination.

Shikarpur, Nawabshah, Khathar, and Jamesabad.

Pusa 12 wheat sown in comparison with local Sharbati wheat and Punjab 11 on the same sub-station gave the following results :—

Variety.	Area sown.	Yield per acre in	Remarks.
Pusa 12	A. g. 2 0	Lbs. 610	The plots contained Kalar.
Punjab 11	1 0	1,180	
Sharbati local	1 0	1,040	

The results are obviously uncomparable owing to the plots under Pusa 12 being Kalar.

On the Shikarpur demonstration plot results obtained with Pusa 12 and Punjab 11 showed that Punjab 11 yielded about 18 maunds as against 15 maunds and 19 seers of Pusa 12. This has been discussed in paragraph 16 above.

Work in connection with the war.

60. In July 1918 there was a large demand for plough bullocks and implements for Mesopotamia and the Agricultural Department in Sind was called upon to arrange to supply 4,000 ploughs and yokes and an equal number of plough bullocks. Enquiries showed that the sources from which bullocks could be purchased easily and in large numbers were the Desert in Jodhapur territory beyond Khokhrapar station, 'Kachho' in Larkana district (valley of Khirthar range) and on the borders of Jessulmer near Ghotki (Sukkur District). A limited number of bullocks were also reported to be available in Karachi district and in Lar in Hyderabad district but no purchases were made in Karachi district as in the experience of the Department the bullocks of that tract are not good plough cattle. The first purchases were therefore made from Lar and from the south of the Jamrao at an average cost of Rs. 46 a bullock. 55 bullocks were purchased from the south of the Jamrao and 50 from Lar. The remaining bullocks, viz., 560 were purchased in person by the Deputy Director of Agriculture from Khokhrapar at an average cost of Rs. 38 a bullock. All purchases were made in consultation with the Veterinary Assistant of the beat who was present to examine the animals at each centre where the bullocks were collected for selection. The total number of bullocks purchased was 665. All these bullocks were railed to Karachi and handed over to the Superintendent, Military Dairy, for transshipment to Basra. Out of the 665 bullocks one broke his leg and was condemned and one was stolen. The remaining 663 were shipped in good condition. Ropes, nose strings and buckets required for the above bullocks were also arranged for and supplied by this Department.

Arrangements were also made to raise some fodder for these bullocks and for this purpose an area of about 25 acres was taken on lease near the Government Farm at Landhi on Rs. 150 plus the assessment of the land. The bullocks however were only for a few days on the Landhi Farm and therefore the remaining fodder was either sold or fed to farm cattle.

Subsequent orders received were to purchase only 600 ploughs and yokes of the Egyptian type and 665 bullocks. As the ploughs were required at once, orders were given to three contractors, one at Mirpurkhas and two at Hyderabad. The ploughs were examined and passed by Mr. Main before despatch to the Embarkation Officer, Karachi, for shipment to Basra.

The total amount spent on ploughs and bullocks came to Rs. 38,610-7-5.

All the members of the Department worked overtime to cope with this heavy work in addition to their ordinary duties.

Live Stock.

61. Operations in connection with Live stock consist in—

- (a) breeding of famous Karachi cows at Mirpurkhas Experimental Farm with a view to create interest which supply of pure milk in towns necessitates ;
- (b) dairy farming on a commercial basis at Sukkur Farm consistent with post-barrage conditions, when rice or cotton berseem rotation would provide an ample supply of excellent fodder ;
- (c) breeding a herd of Konkreji cattle at Government Seed Farm with a view to producing good plough bullocks of which there is in this Province deficiency both in number and quality ;
- (d) raising of goats and sheep at Landhi with the special object of improving farm land with their droppings ;
- (e) Maintenance of poultry at experimental farms to serve as an object lesson to the prospective poultry farmers in Sind.

With the exception of (b) and (c) the work on the remaining objects has been in progress for some years past.

The Karachi herd on the Mirpurkhas Farm at present consists of 26 cows and calves. Efforts directed in the past towards hand feeding the calves had to be given up during the year under report because not only did the young stock lose condition but the cows refused to give milk easily, with the consequence that their yields diminished daily. Cow number 16 Bhally of the Willingdon Cattle Farm promises to be a good cow. She has given at her first calving 2,246½ lbs. from two teats, the remaining two teats being sucked by her calf during the lactation period, *i. e.*, from 19th August 1918 to 30th May 1919. Maximum monthly yield of 500 lbs. was obtained in case of cow No. 3 Karachi.

With regard to (b) a dairy herd at Sukkur which consists of 15 she buffaloes and one he buffalo was imported from the Punjab at an average cost of Rs. 142 per head. The chief point in the economy of feeding is to exclude concentrates as far as possible and it has been found that with ample supply of green nutritious fodder like berseem very little concentrates are necessary. The value of fodder fed per head per annum works out to Rs. 112 and concentrates to nearly Rs. 43 while value of average dairy produce (excluding the value of manure produced) is about Rs. 348 (2,789 lbs. milk at ten rupees per maund of 80 lbs.) showing thereby a net average profit of Rs. 193 per head per annum.

There is a good demand for pure milk at Sukkur hence no ghee is made.

After several trials conducted on the rearing of the calves by hand feeding the following feeding table has been resorted to:—

I.—From birth to 3 weeks	6 lbs. whole milk.				
II.—From 4 to 5 weeks	<table border="0"> <tr> <td>1 lb. whole milk.</td> </tr> <tr> <td>5 lbs. separated milk.</td> </tr> <tr> <td>1 oz. linseed oil.</td> </tr> <tr> <td>1 lb. crushed peas.</td> </tr> </table>	1 lb. whole milk.	5 lbs. separated milk.	1 oz. linseed oil.	1 lb. crushed peas.
1 lb. whole milk.							
5 lbs. separated milk.							
1 oz. linseed oil.							
1 lb. crushed peas.							
III.—From 6 to 16 weeks	<table border="0"> <tr> <td>2 lbs. separated milk.</td> </tr> <tr> <td>1 lb. linseed oil.</td> </tr> <tr> <td>1 lb. crushed peas.</td> </tr> </table>	2 lbs. separated milk.	1 lb. linseed oil.	1 lb. crushed peas.	
2 lbs. separated milk.							
1 lb. linseed oil.							
1 lb. crushed peas.							
IV.—From 17 to 32 weeks	1 lb. crushed peas.				

Milk to be given three times a day at blood temperature.

Arrangements are being made to convert all the animal droppings in the cattle byre into liquid manure by a connection from the pump and drain it off direct to the field by washing it into the irrigation channel.

Education.

62. In 1918 the sixth session of the Agricultural School, Mirpurkhas, closed. There were nine boys out of which one was sent to Lyallpur Agricultural College to take a two year course in Agriculture. The remaining eight sat at the annual examination. One boy failed and the rest satisfied the examiners and secured the school certificates.

Out of the seven successful boys only three have taken to agriculture, the rest have either entered service or taken to trade. One is reported dead.

The seventh or the current session opened in September 1918 and the attendance went up to eight boys but gradually four boys left one after the other chiefly for want of interest in agriculture and aversion to manual work, a certain amount of which each boy is expected to do as a daily routine. Thus there were only four boys for the whole session with an addition of a domiciled Maratha boy who joined a few months before the close of the session. At the annual examination just over, all the five passed successfully.

The boys as usual were taken on tour to see representative agricultural tracts of Sind.

Among the crops grown by the students there were several English and country vegetables and cottons. The sale proceeds of vegetables, etc., amounted to Rs. 454-11-6. The vegetables were exhibited at the Agricultural Show, Mirpurkhas, in January 1919 and carried a prize of Rs. 15.

His Excellency the Governor of Bombay on his visit to the Mirpurkhas Farm in February 1919 inspected the cultivation of the boys and was much pleased with what he saw.

The training was on the same lines as was reported in the last year's report but a proposal is before Government to overhaul the present system by opening a Middle School on a large scale at Hyderabad where Agriculture will be taught side by side with English up to standard four.

The cost of the school under all heads amounted to Rs. 3,307-2-2 against Rs. 2,757-5-5 of last year.

Issue of Leaflets and Bulletins.

63. During the year under report following publications were issued by the Department:—

- Leaflet No. 15 on the Economy of irrigation,
- 16 on conservation and utilization of cattle manure;
- 17 Fodder shortage,
- 18 Economy of Rice seed.

Bulletin No. 88 First report on Fruit Culture round about Tharushah in Nawabshah District.

In addition to these a contribution was made by Mr. Main in the Agricultural Journal of India on "Irrigation in Sind" and an article on Indigo cultivation written by Mr. Balooch, D. A. Overseer, Nawabshah District, was sent for publication in the Poona College Magazine. Also a note on "Burry Goats in Sind" written by Mr. Jaffarali was published in the College Magazine.

General.

64. During the course of the sitting of the Cotton Committee at Karachi a recommendation to start pumping stations to solve post-barrage agricultural problems was made and proposals in this connection have since been submitted to Government.

Owing to the unusual scarcity of fodder in the past year proposals have lately been invited for a fodder farm in Sind. The site for both the above farms along with a suitable site for a large Middle Agricultural School have been selected and Government sanction is being awaited.

GUL MAHOMED,

Acting Deputy Director of Agriculture, Sind.

APPENDIX H.

WORK DONE UNDER THE PROFESSOR OF AGRICULTURE,
DURING THE YEAR 1918-1919.

The farms under the Professor of Agriculture are almost exclusively used in the practical teaching of the various courses. Only at Mánjri sugarcane station is definite experimental work carried on.

However, a few observations on the other work may be of public interest.

The rainfall being only 14.63" for the whole year, nearly 5" of which came before June 1st and was largely dissipated by the burning sun, before the monsoon really broke, hence the rain crops were not a great success.

American jowars.

Four varieties of jowar received through the Agricultural Department of Washington were tried on areas of one-fourth acre each and they give promise of being of use, under certain conditions in some parts of the Presidency. These originally came from the East and were collected and tested by the Plant Industry Bureau of Washington. They have a shorter season of growth than the Indian varieties, hence they should do well where the rainfall is scanty. The outturn of fodder from these is very much less than from the local varieties but its quality is satisfactory. These jowars would be competitors of bajri rather than of local jowars. The quality of these jowars was tested by giving some to our farm servants, who approved of it. They apparently are poorer in gluten than ordinary jowars. I give below the outturn:—

			Yield per acre in lbs.	
			Grain.	Fodder.
Frettaria	...	...	1,672	5,708
Black hulled-Kaoling	...	...	1,040	4,284
Black hulled-Kaffir	...	...	2,144	4,368
Standard Milo	...	...	1,408	3,916

Cotton.

The various types of neglectum cottons that we have been cultivating, were sown after thoroughly soaking the soil with irrigation water to secure germination, but with no further irrigations.

The outturns appear below:—

		Libs. of seed-cotton per acre.
White flowered narrow lobed (N. Roseum)	...	796
White flowered broad lobed (N. R. Cutchica)	...	688
Yellow flowered broad lobed (N. V. Malvensis)	...	476
Yellow flowered narrow lobed (N. Vera)	...	316

Herbaceum cottons completely failed in the year under report.

Garden crops.

The irrigated crops were also less vigorous in growth than normal, due to the extra amount of sunlight and heat.

I give below the outturn, cost of cultivation and value of some of the garden crops.

All figures are per acre.

Crop.	Area.	Outturn.		Cost of cultivation.	Value of outturn.	Profit or loss.
		Principle.	Secondary.			
	A. g.	Libs.	Libs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Turmeric mixture No. 1	0 20	.....	...	529 4 4	577 9 0	48 4 8
Turmeric	...	6,348	...			
Yam	...	1,700	...			
Gowar	...	1,404	801			
Bhandi	...	320	...			
Turmeric Mixture No. 2	0 80	.....	...	400 8 8	287 14 8	112 10 0
Turmeric	...	4,524	...			
Maize	...	2,776	4,880			

Crop.	Area.	Outturn.		Cost of cultivation.	Value of outturn.	Profit or loss.
		Principal.	Secondary.			
	A. g.	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Suran	0 10	21,296	...	552 4 8	1,010 7 0	458 2 4
Big Dharwar chillies	0 10	3,258	800	149 1 8	205 10 0	56 8 4
Chillies (local)	0 30	469 green. 144 dry.	...	133 11 5	140 10 8	6 15 3
French beans	0 20	3,494	800	181 5 8	306 2 8	124 13 0
Tomatoes	0 20	10,064	...	149 15 10	315 8 0	165 8 2
Brinjals mixture and Methi... ..	0 10	2,600 7,476	...	180 11 6	286 14 8	106 9 2

Rabi area was restricted and in February the whole area was devoted to grow in maize for maintenance of famine cattle.

Sugarcane.

The semi-permanent manurial series of experiments have been continued.

In the bulky manure tests the economy of growing in the preceding year a crop of san for green manuring rather than a money crop like groundnut has again been demonstrated. The net income for the two years gave about Rs. 90 more under this method than under the local one of taking a money crop.

A new experiment to work out the minimum amount of organic matter to be added to soils of the tract in order to maintain them in the optimum physical condition for production, when irrigation water is given in a rational manner, was newly started. The results of the year show that even when so small a quantity as 5,000 lbs. of dry matter per acre, which is equal to ten cart-loads of farmyard manure, is supplied to keep up the structure, the soil was suitable for obtaining maximum production. The local practice of applying 30 cart-loads or even twice that amount of this sort of manure, is made necessary if the soil is to continue productive when it is flooded with water. Of course sufficient nitrogen must be supplied but farmyard manure is a very expensive form of this element since it becomes available very slowly.

The trials of phosphoric acid and potash manures have been continued and although the results show some increase in yield from these manures, their use cannot yet be recommended from an economic standpoint.

The experiment to find out the comparative value of the different sources of nitrogen was continued. The cakes have on the whole done better than what they did last year as compared with ammonium sulphate but the abnormality of the season makes it necessary to continue this work further before anything conclusive can be said.

The new manurial work of the year was an attempt to still further reduce the application of nitrogen. For a long time a total of 350 lbs. of nitrogen per acre was taken as a standard, including that in the bulky manure; this was little more than half of the quantity that was being applied by the cultivators when sugarcane studies were begun by the Department in 1895. Later on, this was changed to 150 lbs. of nitrogen in the top-dressing and the bulky manure was looked upon only as a soil corrective as it was found that such a material as trash which was very poor in nitrogen content, when supplemented by a top-dressing containing the above quantity of nitrogen, yielded as good crops as the richer bulky applications like farmyard manure.

We are now depending entirely upon san for our soil improvement. It is difficult to estimate how much nitrogen this actually adds to the soil. Taking 150 lbs. of nitrogen per acre in the top-dressing as the standard, we have compared this with 125 lbs. nitrogen and 100 lbs. nitrogen only plus whatever is found in the san; this has resulted in no apparent reduction of the yields obtained. If we can grow cane with no other application than one containing 100 lbs. of nitrogen, we shall have reduced the cost of growing on this head by Rs. 35 or thereabouts. Even further reduction will doubtless be possible. Of course any such saving depends upon a proper system of application of water.

The new method of planting cane has now been fully developed in detail and demonstrated since 1914. Measurements of water used by this system compared with the old

Poona system, when both were irrigated as carefully as possible, were made by using the Cippoletti Weir and the immense saving of water effected by the new method proved. Both the areas gave good crops of cane. The statement below will show clearly the advantages of the new method in this respect. The water utilized in the Java method as introduced by Mr. Keatinge was also measured and is included in the statement, but the very light rain supply vitiated the advantages of this system as a water saving agent.

System of planting.	Outturn in cane per acre.	Total number of irrigations.	Cubic feet per acre.	Acre inches.	Time required for irrigation per acre.
	Lbs.				Total number of working hours.
Poona Local	80,768	39	525,035	89.54	277
New Method	92,620	39	241,477.6	66.62	253
Java System	53,903	28	102,295	28.20	205

Other experimental work with cane consisted in determining the effect upon the yield of removing tillers, further trial at reducing the seed rate, trying to grow the green manure crop while the cane is growing instead of during a previous fallow, and variety work.

The early varieties of cane, namely, Manjav, Striped Mauritius and Red Sports were compared with Pundia on $\frac{1}{4}$ th acre plots; the results were in favour of these under the peculiar conditions of the season under report and they were ready for crushing in December. About ten of the exotics have now reached a field trial scale and but for the famine their results would have been available next year.

The classification of Bombay canes is still going on.

Dairy.

Owing to changes in personnel of the staff at the dairy and also to pressure of teaching and famine work, very little experimental work was possible. In fact little can be done, till the buildings and equipment that have been asked for are available. The year's crop of young stock have grown well and we have 23 cow-heifers and 21 buffalo-heifers. The yields of the year have been fully average in spite of the abnormality of the season.

For three months one-half of the coarse fodder given to the entire herd was prickly-pear. No ill-effects whatever were observed and no dropping of the milk yield. The Gañeshkhind farm and dairy were managed by the staff of the Agricultural College Dairy upto November.

Famine work.

When it became evident that there would be a serious shortage of fodder, I resolved to put all the area possible, to growing maize under irrigation. But I found that the Irrigation Department was unable to supply me with water for more than 57 acres. I then requested them to allow me to spread this water over 115 acres to which they agreed. A grant for manure, seed, etc., was obtained from the Government. After manuring the land the maize was planted in furrows at $3\frac{1}{2}$ feet to 5 feet apart and irrigated by the new slow current method practised with sugarcane at Mánjri. After the second application of water a period of 27 days was allowed between subsequent waterings. Just before the last watering a second crop of maize was dibbled between the rows.

Two crops were taken on this area and outturn of from 8,000 to 10,000 lbs. of dry fodder obtained.

The system thus worked very satisfactorily. The total water given did not exceed 30 acre inches for the two crops and in some cases only 20 acre inches were given.

Another activity of the branch was the saving of cattle by the utilization of prickly-pear. 1,046 bullocks were purchased when in a starving condition and restored to health and condition until the rains more than 80 per cent. of their food was prickly-pear, the rest consisted of one pound of cotton seed per animal and 4 lbs. of dry fodder.

The animals when put in condition were sold on Tagai advance to the cultivators of Sirur Taluka. A separate report will deal with the details of the work. Much help was given to the District Officers by supplying burning apparatus used in the preparation of prickly-pear, and in keeping the same in repair; and a continuous training school, for operators, who were to prepare prickly-pear, was carried on for three months.

I must not close this note without a reference to the willingness and enthusiasm which my staff displayed in carrying out this extra work which they did without any pay or relief from their own duties.

J. B. KNIGHT,
Professor of Agriculture.

APPENDIX I.

REPORT OF THE AGRICULTURAL CHEMIST FOR THE YEAR 1918-1919.

During the year under report Dr. Harold H. Mann held charge of the Office and Laboratory of the Agricultural Chemist to the Government of Bombay from the beginning of the year to the 20th of September and again from the 11th of November to the 31st of May. Mr. V. A. Tamhane was in acting charge from 20th September to 11th November and myself from the 1st of June onwards.

2. The routine work of the laboratory was as usual and the number of samples received during the year under report is given in the following table in which are also included for comparison the numbers of samples of the previous two years:—

1916-17	...	...	...	1,613
1917-18	...	...	...	1,278
1918-19	...	...	...	1,162

There is a small apparent drop in the samples received. But this is only apparent because in the previous year a large number (148) of sewage effluent samples were sent to this laboratory as the question of the use of ordinary town sewage effluent in sugar-cane growing was under investigation by the Professor of Agriculture while none of these samples was received during the year of the report.

3. The character of the analyses done is shown in the following list for the year under report, and compared with a similar list for the previous year:—

Nature of samples.	Number.	
	1917-18.	1918-19.
Soils	295	610
Manures	152	218
Feeding stuffs	94	91
Waters	334	102
Sewage effluents	148	Nil
Gul and Sugar	22	6
Oil-seeds and Oils	53	11
Dairy products	66	16
Fruits	6	15
Miscellaneous	108	93
Total	1,278	1,162

4. It was always maintained—and rightly maintained—by Dr. Mann that the real test of the success of the laboratory in filling a public need is best shown by the use made of it by the public, both by actual cultivators and by those responsible for industries directly dependent on agriculture. The number of samples received for analyses from the public as distinguished from those from the Government farms and departments continues large and was as follows during the year under report, compared with that for the previous year:—

Nature of samples.	Number.	
	1917-18.	1918-19.
Soils	65	61
Manures	69	166
Feeding stuffs	51	35
Waters	94	26
Gul and Sugar	4	Nil
Oil-seeds and Oils	37	11
Fruits	Nil	3
Dairy products	13	5
Miscellaneous	87	86
Total	424	393

5. Samples received from the public compare with those received from the Government farms and departments as follows:—

Nature of samples.	Number.	
	Government.	Public.
Soils	549	61
Manures	52	166
Feeding stuffs	56	35
Waters	76	26
Gul and Sugar	6	Nil
Oil-seeds and Oils	Nil	11
Dairy products	11	5
Fruits	12	3
Miscellaneous	7	86
Total	769	393

6. The nature of the routine work done was nearly of the same character as in previous years. The general demand is for examination of and opinion upon the suitability of land for special purposes and causes for the deterioration of land; value of waters, especially when newly brought into use for irrigation purposes; suitability of particular manures and other problems in connection with cultivation. Examination of feeding stuffs, oils, oil-seeds and other similar matters is also included in the usual work of the laboratory.

7. There is little to report as new in connection with soils. A few samples of Manvat soils were sent from Konkán for examination. Both the chemical and mechanical analyses of these samples were done. These soils are very sticky, difficult to be drained, and crack very badly in the fair season. They occupy several acres of land in the Konkán and are all useless for crops. A detailed study of this is necessary, and it is hoped that the laboratory will soon be in a position to take up this work.

8. No new materials for use as manures were put on the market during the year of this report, probably on account of the war. A sample of Indian Phosphatic nodules was received the examination of which showed that it was an excellent material as mineral phosphate. The laboratory was consulted by a Thymol factory as to whether the water that remains with the spent seed in the still after distillation and which is at present simply thrown away as waste, could be used for any purpose. This water contains a large amount of acidity and tannin. If Thymol factories have any fields near by and if the water is treated with enough lime to neutralise the acidity and precipitate tannin and then allowed to settle, the water could be used with irrigation water and run on to the land as manure.

9. On account of the severe famine there was a great scarcity of fodder and therefore several materials were sent for being examined for their suitability as cattle food. Plantain stems both fresh and dried were examined. In places where plantains are grown in regular plantations the stems at present are merely thrown away but these could very well be utilised for feeding cattle along with the usual fodders. A beginning should always be made with very small quantities which could then be increased as cattle got accustomed to the stuff.

Plants growing in lakes such as the Bid Rhizomes (*Scirpus grossus* var *Kysoor*) and Poyana (Egyptian Lotus) were sent from Ahmedabad to determine their feeding value. This year in some places roots of Kunda (*Ischaemum pilosum*) and Hariali (*Cynodon dactylon*) were fed to the cattle and as these are not usually fed they were also sent for being examined. These and many other interesting materials formed a prominent feature of the food stuffs sent to the laboratory. Their analyses show that these materials are all useful as famine fodders if these could be obtained in sufficient quantities.

10. D. T. Chadwick, Esquire, Indian Trade Commissioner, London, wrote to the Agricultural Adviser to the Government of India to send him the analysis of eggs from different provinces and a few fresh eggs. The Agricultural Adviser requested Dr. Mann to take this in hand for the Bombay Presidency and accordingly a few analyses of eggs and samples of fresh eggs were sent to the Indian Trade Commissioner, London.

11. Some enquiries were received with regard to the methods of extracting starch especially from maize and potatoes. The process for the manufacture of starch is elaborate but a satisfactory quality of starch is not likely to be obtained without an elaborate process. The produce to be an economic success must be prepared on a fairly large scale. Some samples of rice starch were received for examination. They were of a good quality, white in colour and free from impurities.

12. A sample of Chocolate, manufactured in India, was sent for examination and suggestion to prevent the loss caused by attacks of weevils, &c. The sample was in every way satisfactory, suitable as article of food and free from the usual adulterants. If the tablets of chocolate are packed in oil paper and not kept exposed to air there is little chance of their being spoiled.

13. Mr. T. S. Swadi, Superintendent of the Government Farm at Gokák, came across certain cases of Gul which suggested to him that the keeping qualities of Gul did not wholly depend on the method of boiling and preparing Gul but in many cases perhaps they were due to the presence of certain salts in the soils or irrigation waters. In order to ascertain the truth he sent various samples of soils, irrigation waters and Gul prepared from the sugarcane grown on those soils and irrigated with those waters, for analyses. From the figures of analyses it seems that the salts in solution in the irrigation waters may affect the keeping qualities of Gul. Mr. Swadi has published a separate paper on this subject.

14. From the point of view of the investigation work the year has been a rather unfruitful one, largely owing to the fact of the staff being dispersed. The problems which form the principal research work of the laboratory are probably the same as previously, with one or two deductions and additions.

15. The study of certain problems in the spice gardens of Kánara is being continued. The chief question here, as described last year, is that of the deterioration of the cardamom plants in gardens which have been previously under cardamom cultivation, the great complaint of the growers being that they are no longer able to propagaté the

cardamom plants from the rhizomes as used to be done. The data collected during the year seems to indicate that the partial sterilisation of the soil by heat allows cardamom plants to be produced from the rhizomes as healthy as those grown from seed or grown in virgin soil. It is hoped that within the next two years the whole question will be cleared up.

16. The study of the chemistry and physiology of betel-vine leaves is being continued, the actual work being chiefly in the hands of Mr. V. G. Patwardhan. The present work consists chiefly in an attempt to determine how far the quantity and composition of the essential oil, on which the quality of the leaves chiefly depends can be modified by the action of manures.

17. The preparation of Jaggery from the date palm in Western India was studied and investigated in conjunction with Mr. V. G. Gokhale, Deputy Director of Agriculture, Konkan. Mr. Gokhale is now writing up the report on the subject.

18. The rotting of stored potatoes at high temperature. Dr. Mann is conducting a special research work in this connection as the matter has become of great importance in the potato districts of the Deccan and he is now subjecting the rotting of these potatoes to a chemical investigation. The chemical changes accompanying it are being worked out and the influence of moisture and aeration on the process are being determined.

19. Mr. V. A. Tamhane of the Agricultural Chemist's staff has been deputed for six months during the year to Sind to examine the probable effect of the proposed Sukkur Barrage Scheme on the development of salt land in Sind. He has completed his enquiries and his report will soon be ready.

20. The usual staff of the laboratory consists of the following :—

Senior Laboratory Assistant Mr. V. A. Tamhane M. Sc., L. Ag.

First Junior Laboratory Assistant Mr. D. M. Ranade, B. Ag., B. Sc.

Second Junior Laboratory Assistant Mr. V. G. Patwardhan, B. Ag., B. Sc.

Graduate Fieldman Mr. V. J. Atgur, B. Ag.

Non-Graduate Fieldman Mr. S. R. Deshmukh.

Mr. V. A. Tamhane was on deputation as a Special Agricultural Chemist for the Sind Barrage Project from 22nd November 1918 to 21st May 1919. Mr. D. M. Ranade who was acting as Senior Laboratory Assistant in Mr. Tamhane's absence was sent out to work on the water-finder work from December 1918 to the end of May 1919. Mr. V. G. Patwardhan was transferred to the College in August 1918 as Lecturer in Chemistry and subsequently as Assistant Professor of Chemistry. Mr. V. J. Atgur was on privilege leave for two months from April 22nd to June 22nd 1919 and Mr. S. R. Deshmukh went out as Assistant to Mr. Tamhane on the Sind Barrage Project. Mr. V. N. Gokhale, B. Ag., was taken up in February 1919 to act in one of the vacancies and Mr. Narayan Kadam worked in place of Mr. Deshmukh as a Non-graduate Fieldman. It is highly creditable to the whole staff of the laboratory to have carried on the usual work under a great strain of so many changes and transfers.

D. L. SAHASRABUDDHE,
Ag. Agricultural Chemist to the Government.
of Bombay.

APPENDIX J.

WORK DONE UNDER THE ECONOMIC BOTANIST FOR THE YEAR 1918-1919.

Staff.

I held charge of the office of the Economic Botanist throughout the year with the exception of the 10 days between 6th and 15th January 1919, during which time Dr. Burns had reverted to civil duties from the Indian Army Reserve of Officers before proceeding on six months leave. Mr. G. S. Kulkarni has acted for me as Assistant Professor of Mycology and his post of Assistant Mycologist has remained vacant since the transfer of Mr. P. G. Dani to the post in Ganeshkhind Botanical Garden vacated by the resignation of Mr. Kokatnur on 10th October 1918. Mr. G. B. Patwardhan was on privilege leave combined with sick leave from 20th March to 3rd April and 21st April to 7th September 1918, and Mr. H. P. Paranjpye acted as Assistant Professor of Botany in Mr. Patwardhan's place during the first college term.

Of the clerical staff, Mr. G. B. Patwardhan, clerk at the Ganeshkhind Botanical Garden left in December 1918 to join the office of the Assistant Registrar, Co-operative Credit Societies, Poona, on a higher pay. His place was taken by Mr. G. N. Shirgurkar from the office of the Sugarcane Expert, Kopergaon. Mr. Gokhale, Head clerk to the Economic Botanist, was on privilege leave combined with sick leave from 5th March to 6th July 1919. Mr. G. K. Bendre, 2nd clerk in the Economic Botanist's office proceeded on privilege leave combined with sick leave on 10th August 1918 and having failed to return on the proper date was dismissed from the service under the Director of Agriculture's orders. Much difficulty has been experienced in filling up this vacancy on the scale of pay sanctioned (20—2—30), the temporary men engaged from time to time not being found suitable or, if suitable not finding the prospects attractive enough to keep them. This fact and the frequent illness of the existing staff resulted in much inconvenience to the office work.

The post of a non-graduate Laboratory assistant for Mycology which was proposed in October 1917 was not actually sanctioned by Government till March 1919 and Mr. B. R. Tonapay has been appointed to it.

Education.

The usual training in Botany and Horticulture was given to students of the College of Agriculture. Two students for the final examination had selected Advanced Botany for their special subject. These were taken on a special Horticultural and Botanical tour to Gujarat and the S. M. Country, which was very successful. One of the two students for the M.Sc. Degree referred to in the last year's report as having failed to take the supplementary oral and written examination last year, obtained the degree this year.

The Arboricultural course for the Public Works Department subordinates was held in abeyance as a sufficiently large number of them could not be spared this year for this training from their other duties.

Seven students attended the one year's Horticultural course at the Ganeshkhind Botanical Garden including two paid "Malis" under training. The accommodation at the quarters for these pupils continued to be the limiting factor to the admission of pupils to this course as the proposed extension of the quarters alluded to in the last year's report has not yet taken place.

It must be mentioned that the teaching work of the Economic Botanist and his staff has increased enormously during the last ten years and the increase is particularly marked since the adoption of the revised curriculum two years ago. The work was heavier than ever during the year under report because the very large sizes of the classes and the insufficiency of microscopes rendered it necessary to divide the classes into two, and in the case of the first year's class into four batches for purposes of practical work. The need for increased staff and better equipment to deal with the increased work has been represented and it is hoped the pressure will be relieved before long. A proposal to acquire a part of the Mody Bagh estate adjoining the college for the purposes of a garden for teaching Botany and Horticulture was made and approved by Government and the garden when ready will be a great convenience. At present the students have to go to the Ganeshkhind Botanical Garden about 4 miles away from the College.

Research Work.

Mango.—Study of botanical and cultural characteristics of different varieties has been continued. Study of propagation methods has added another conclusion to that recorded in the last year's report. It can now be asserted from experience obtained at the Ganeshkhind Gardens that "layering" as a method of propagation cannot be recommended because of (1) low percentage of success, (2) slow formation of roots, and (3) slow growth and fruiting. Attempts were made to obtain a hybrid between the variety China and the Aphonse, but were not successful and will have to be repeated.

Of two 25-year-old trees in Ganeshkhind Botanical Garden one was crown-grafted and the other was top-grafted during this year and the progress of these will be watched to obtain an idea of the relative merits of the two operations.

The top-worked mango trees mentioned in last year's report are progressing satisfactorily.

A bad attack of Jassids soon after flowering of the mango this season completely ruined the crop.

Citrus.—Compilation of the information on matters connected with citrus cultivation has been carried on. Comparative study of methods of propagation has been instituted with the object of determining the best method for the nurseryman. Hybridisation has also been attempted, with no success so far.

Guavas.—Observations on varieties have been continued; the Sind-Hyderabad variety continues to be regarded as the best and is fast becoming popular among the public. The attempt to obtain seedlessness in the guava by continued vegetative propagation has been abandoned, as unpromising in results. The plants trained on wires have made good progress and have yielded fruit which was decidedly larger in size and numbers than that of the ordinary plants. Plants on wires also require less space, but it still remains to be seen if this system of training can be recommended as a practical one for large growers.

Comparison of pruned and unpruned guava plants has shown that pruning improves the vigour of plants and increases the size and number of fruits and a few experiments are undertaken and others contemplated, on cultivators' fields if possible, to determine if pruning cannot replace the local method of bending down branches of the guava periodically. Pruning for shape has given results slightly in favour of the "standard" shape as against the "Bushy". Guava plants planted in pits blasted out of trap rock in 1915 have not borne well and this points to the unsuitability of a shallow soil above hard trap rock for a guava plantation.

Papaya.—Hybrids from crosses made in September 1917 between plants bearing different types of flowers received considerable check in their growth from the extremely dry season and have not borne flowers so far; the distribution of six in these will be observed next year. Papaya plants propagated from cuttings last year are bearing well.

Fig.—Observations on the Punjab and other foreign varieties have been continued. Pruning was seen to be effective in inducing early bearing, but there is reason to fear that the weather conditions prevailing in January and February lead to the dropping down of young fruit in large numbers and might possibly act as the limiting factor to the practical utility of the pruning.

Spraying with Bordeaux mixture was not effective in checking the rust (*Uredo Fici*) on fig.

Grapes.—A number of foreign varieties—French and American and some from Karachi and Aurangabad—have become established and out of these "Campbell's Early" and "Barry" have even fruited. These will be propagated and cultivated in separate plots for comparison as soon as possible. Comparative trials of the efficacy against powdery mildew of Bordeaux mixture, Ammoniacal solution of copper carbonate and Potassium sulphide again showed that Bordeaux mixture was the most effective of the three. The plot treated with Bordeaux mixture remained entirely mildew-free. An attack of Anthracnose in July and August 1918 was successfully checked by promptly removing the parts affected and by washing the vines after the October pruning with iron sulphate dissolved in sulphuric acid (1 part commercial sulphuric acid, 8 parts iron sulphate and 20 parts water).

Propagation by grafting has been started with several varieties for study as to effect on yield and time of bearing.

Attempts at hybridisation were made in December 1918 between the varieties of Neelum, Black Prince and Bhokri (Neelum being used as the female parent) with a view to obtain a mildew-resistant type that would yield well. Several fruits set but the seeds except one failed to germinate.

The outturn statistics of different systems of grape training have shown results in favour of the Umbrella and Kniffin systems, the highest yield of a single plant of Bhokri variety under each system being 66 lbs. 11 ozs. and 47 lbs. 3 ozs. respectively. The highest yield of Bhokri on the single stake system was 28 lbs.

Banana.—Work on this crop has continued but has had to be carried on under somewhat difficult conditions—frequent changes of hands, want of sufficient space for the variety trials, and irrigation difficulties. It has been decided, however, to put the information obtained together for publication. The Banana sun-drying experiments were continued, and although the produce was found to keep well for over twelve months, the obtaining of an agreeable colour to the finished product which will not blacken with time is still a practical difficulty. Enquiries made of the various Deputy Directors of Agriculture in the Presidency further elicited the information that there is not at present

much scope for Banana drying as industry by itself. The experience obtained will be put together in the form of a leaflet shortly.

Pomegranates.—The plantation of local varieties started in 1912 in limy soil is thriving well but suffered owing to the dry season and attack of "sursa" (*Virachola isocrateo*). The Kabuli grafts are dying out one after another and have proved quite unsuitable in this tract.

Fodder Plants.—The trials with wild fodder grasses were continued, the object being to find out suitable mixtures which would replace the inferior and coarse grasses naturally found on waste lands and convert them into good fodder yielding areas.

Rice.—Of the selected varieties mentioned in last year's report as being tried on large scale at Alibag, the varieties that came out best are:—

Variety.	Original locality.		Time for maturing.	Yield per acre.	
				Clean paddy.	Straw.
			Days.	Lbs.	Lbs.
Kuli Sal (fine, scented)	Kalyan ... ..	...	145—155	1,780	2,220
Parwal (fine, unscented)	Chiplun ... ..	...	125—135	2,589	3,269
Dangi (Coarse, unscented)	Pardi ... ..	...	145—155	2,292	3,236

These varieties and others (which probably had not a good chance owing to the unfavourable season last year) have been handed over for further trials to the Alibag farm.

Mycology.—The experiment of feeding rabbits on *Cerebella* bodies developed in association with *Sphacelia* disease of jowar was repeated and no derangement resulted as a consequence. This and the negative results obtained with the chemical tests for "ergotin" in these bodies, as also the study of pure cultures from *Cerebella* spores, leave no doubt that they are not genetically connected with *Sphacelia* and that they are not to be regarded as harmful to cattle.

The study of "Green smut" on rice has had to be held in abeyance.

The study of storage rots of potatoes has been continued, the establishment of the Potato Works and Storage rooms by the Union Agency on the premises of the Agricultural College having afforded opportunities for studying the conditions of storage on a large scale. The suspected causal fungi of the "Dry rot" and "Black Rot" have been isolated and inoculations with pure cultures of them have produced the respective rots. The "Black Rot" has been found to be different to the "Black heart" described in American literature. The latter is a purely heat effect, while the former is associated with *Rhizoctonia solani* "Black heart" begins at the centre while "Black Rot" begins at the surface of the tuber. Temperature seems to be the controlling factor in the ravages of the "Black Rot" fungus, temperatures above 30°C favouring it and those below 30°C preventing it almost entirely. The experience at the Potato Works of the Union Agency where efforts were made to keep down the temperature in the storage house agrees with this conclusion. The obscure "Tamera" disease of Potato crop in Poona district was studied and evidence was obtained which makes it probable, if not certain, that the disease is due to a mite. Experiments are being planned to deal with this mite with lime sulphur washing and dusting with sulphur this season. The occurrence of *Scelerospora Maydis* on Maize (Cory's Early sweet American variety) grown from imported seed for the purposes of the practical plant-breeding class suggests seed infection in the case of this parasite and deserves to be recorded.

Study of the smuts on jowar (*Andropogon sorghum*) and Nachni (*Eleusine coracana*) has been continued. Preliminary experiments with spraying against the powdery mildew on Jiru (*Cuminum cuminum*) indicated the possibility of checking this disease by spraying the crop, when a month and a half old, with normal Bordeaux mixture.

Observations have been made on various diseases of crops not mentioned in the above list as opportunity occurred.

Miscellaneous Experiments.

Trials with different methods of preparing nursery stock are being carried out in order to determine the cheapest and best methods to recommend to the trade, mango and citrus being the chief plants experimented with. Top-grafting seedlings of guava and mango on larger trees has been done with a view to minimise space and to hasten flowering in the variety trials in connection with these crops. Propagation of *Anona cherimolia* and the better varieties of guava and papaya has been carried on for distribution among the public.

Advisory and Demonstration work.

A large number of enquiries on Botanical, Horticultural and Mycological matters have been dealt with as usual. The Economic Botanist and his staff have been freely consulted by the public and the need for increase of staff to deal with the increased number of enquiries and to investigate the new problems that are placed before us by the

public has been keenly felt. There is great demand for technical advice on the cultivation of fruit crops among the public and the ordinary organisation of District Agricultural Overseers is not found adequate to cope with it. An extension of the horticultural staff for work in the districts seems to be very desirable for this reason.

The campaign against "Koleroga" and "Gal" (*Phytophthora omnivora* var. *Areca* Coleman) was carried on as in previous years in the North Kanara and Ratnagiri Districts. Demonstration of treatment against grape vine mildew was carried on on cultivators' gardens at Pimpalgaon and Ujjain in Ahmednagar District with very great success.

Assistance with sprayers and spraying material and trained malis to do spraying and pruning was given to several grape vine growers, amongst whom there is a great demand for such service and for which they are willing to pay. But our staff being limited we can only serve a few.

It may be mentioned that as a direct result of the spraying campaign against the grape vine mildew, the area under grape vine cultivation in Nasik taluka has been extended by over 25 per cent. Records kept for several gardens further show that the yield per acre has increased from 300 lbs. to 5,000 lbs. in many gardens.

Indeed it may be said in general that the horticultural and mycological work carried on by the Botanical Section has created a demand for more advisory, teaching and investigational work in problems connected with fruit cultivation and plant diseases than the present organisation of the section enables it to undertake.

War and Famine Work.

The Economic Botanist supplied Rs. 7,279 worth of seed to the military this year and was frequently consulted by them on technical matters connected with fruit and vegetable culture. Mr. H. P. Paranjpye assisted with the grain census at Baramati in November 1918 and Mr. R. K. Bhide devoted some time to the study of drought resistant plants of the Deccan which were likely to be useful for fodder.

Miscellaneous.

I served in July 1918 on the Committee appointed to draw up a syllabus for Nature Study in Schools at the special request of the Director of Public Instruction. Messrs. G. B. Patwardhan, G. S. Kulkarni and myself represented the Bombay Department at the second Mycologists' Conference held at Pusa in February 1919. Among the resolutions passed at this Conference the following one concerns the Bombay Department of Agriculture:—"That in view of the work already done with the present limited staff and equipment and in view of the number of important diseases of crops awaiting investigation in Bombay, this conference recommends the early expansion of the Mycological Section of the Bombay Department of Agriculture into a mycological department with adequate staff and equipment."

Mr. S. H. Prayag submitted during this year a thesis embodying the results of his many years' study of the mango crop for the M.Ag. degree of the Bombay University which was approved.

Mr. P. G. Dani passed the Intermediate examination for the degree of B.Sc.

Conclusion.

In conclusion it is pleasant to record my appreciation of the willing work and hearty co-operation of the teaching and research staff which helped me to carry on the duties of my office under many difficulties due to financial stress, scarcity of labour, failure of rains and insufficiency of staff.

Publications.

By S. L. Ajrekar, B.A.—

On the Identity of *Blastospora Bulteri* Syd., in the Bombay Natural Society's Journal, Vol. XXVI, No. 2, May 1919.

By G. B. Patwardhan, B.Sc., F.R.H.S.—

(1) Note on fruits for Jam making, in the Poona Agricultural College Magazine of October.

(2) Penetration of Scion by Stock in the Journal of Heredity of April 1918.

(3) Leaflet on cultivation of Cape-gooseberry; in English, its translation into Kanarese and Marathi. Published as Departmental Leaflets.

(4) Pruning of Grapes in India; in the Poona Agricultural College Magazine of January 1919.

(5) A Creeping mango; in the Poona Agricultural College Magazine, Vol. X, October 1918.

(6) Another new fruit recommended for introduction in Bombay Presidency—Anona Cherimola; in Poona Agricultural College Magazine, October 1918.

(7) Maruti Phal; in Shetki and Shetkari Magazine for November 1918.

By H. P. Paranjpye, B.A.—

(1) Ambariayanchi Jopasana or Care of Mango plantations; published in the Shetki and Shetkari Magazine of August and September 1918.

(2) Kagadi Limbuchi Lagwad or Lemon cultivation; published in the Shetki and Shetkari of September 1918 and also in the Konkany Shetki Samachar in January 1919 number.

(3) Khaznantil Kanhi Zhadinchi Charya sarkhya Upyog or Use of some tidal plants for fodder; published in the Shetki and Shetkari for January 1919 and also in the Konkany Samachar for March 1919.

(4) Kalami Boranchi Lagwad or Cultivation of Bor Tree; published in the Shetki and Shetkari in April and also in the Konkany Shetki Samachar for February 1919.

(5) A curious case of the juxta-position of two trees; published in the Agricultural College Magazine for March 1919.

(6) Treatment of wounds and cavities in old Mango trees; published as a departmental leaflet both in English and Marathi.

By Mr. R. K. Bhide—

“Probable material for the study of the Experimental Evolution of *Oryza Sativa* var. plena, L'rain”—Paper read before the Indian Science Congress, 1919 and published in the Agricultural Journal of India, Special Indian Science Congress, November 1919.

By Mr. G. S. Kulkarni, L.Ag.—

Leaflet on “Ring Disease of Potato” in English, Marathi and Kanarese.

S. L. AJREKAR,

31st July 1919.

Acting Economic Botanist to Government, Bombay.

APPENDIX K.

REPORT OF THE PLANT-BREEDING EXPERT FOR THE YEAR 1918-1919.

Staff.

I held charge of the office throughout the year. I had to work all through by myself as I failed to get an assistant, worth retaining, to serve on the sanctioned scale of pay. I would, however, like to record here the good work done by the clerk and the two fieldmen placed under me.

Plan of work.

2. This is a newly created office and it is natural that it takes some time before the work settles down after a particular plan. I was very anxious to continue the policy explained in my last report of locating my plots in the tract which it was intended to benefit by the work turned out on them. I had started work last year at Jambul and Alibag on rice and at Nasik on wheat. The continued absence of a suitable assistant for one thing made it impossible to persist any further in this policy. I have, therefore, transferred my wheats from Nasik to Poona which is my head quarters and which is also the centre of agricultural activities in the Presidency. I have also merged the two rice stations of Jambul and Alibag into one at Karjat. This is reached from Poona much more quickly and easily than either Jambul or Alibag.

Progress of work.

3. Rice was sown, as stated in my last report, at Jambul and Alibag in June 1918. For want of funds, due to the war, I could not have a free hand in choosing the sites for my plots. The monsoon proved a poor one and artificial irrigation was not available. A number of plots, as a consequence, dried up without yielding any seed. I have again collected this year and sown some five hundred fresh samples of seed coming chiefly from the districts of Thana and Kolaba. Of my last year's crop, I have selected and sown separately as single-plant-cultures the seeds of about a thousand heads. The close inspection which I made of my crop for effecting this selection, revealed to me the extraordinary richness in strains of our leading varieties such as the Kolamba, Bhadas, Patni, and Garvel. The single heads were sown in rabbed fields in beds 2' by 2', isolated on all the sides by gutters 6" wide. The seedlings were transplanted, when a month old, in long single rows with 6" between two plants and 12" between two rows. In some of the seed-beds one could see uniform seedlings throughout a bed, while in others a more or less pronounced ring of stronger seedlings could be observed. It may be that the capacity to withstand crowding together is a hereditary character. I may also note here that a good many of the cultures were found splitting for various characters. This fact of splitting makes it necessary to handle very large numbers, as I have been doing, if the goal of obtaining better strains in a fixed state is to be reached within a reasonable time. It is proposed to put together the results that may be obtained up to December 1919 in the form of a paper to be read before the next meeting of the Indian Science Congress.

4. The plots of *nagli* (*Eleusine coracana*) which I had last year at Bandhan near Alibag dried up for want of water and the same have not been renewed this year for want of staff.

5. As regards the plots of wheat at Nasik, they commanded well irrigation and consequently they did not suffer from drought. I was obliged to irrigate the dry wheats since the monsoon failed to supply the requisite moisture. Single plants have been selected as in the case of rice for starting their separate cultures next cold weather in Poona.

H. M. CHIBRER,
Plant-Breeding Expert.

APPENDIX L.

ANNUAL REPORT OF THE AGRICULTURAL ENGINEER FOR THE YEAR
ENDING THE 30TH JUNE 1919.

INTRODUCTORY.

The past year has been a particularly strenuous one for this Department owing to famine and the call for 200 sets of pumping machinery and other agricultural implements for Mesopotamia. The work of finding, purchasing, repairing, testing and packing this plant was largely borne by Mr. W. M. Schutte, the Agricultural Engineer, who was appointed Deputy Controller of Agricultural Machinery, Mesopotamia in addition to his other duties. This, and the additional strain of having to provide and set up pumps in famine areas under most difficult circumstances, are the contributing causes of a break down in health which compelled Mr. Schutte to go to England at the end of April on six months' leave to recuperate. Since that time the Department has been under my charge as Acting Agricultural Engineer. I fear, therefore, that this report which should be of unusual interest, will merely be a bald recital of facts as they are placed before me by the staff.

MECHANICAL CULTIVATION.

After considerable deliberation the Munitions Board decided to purchase one of the Steam Ploughing Sets for Mesopotamia, and this was despatched with a full complement of tackle and accessories. The remaining Steam Plough Set in Gujrath was held up pending the decision of the Munitions Board, and when it was decided that it was not required for Mesopotamia there was no demand in Gujrath owing to the famine.

Finally at the request of the Collector of Ahmednagar it was removed to Rahuri for the purpose of ploughing up large tracts by shallow ploughing which could not be undertaken owing to the heavy mortality among the plough oxen.

Unfortunately it was late in the season before its arrival and the demand for shallow ploughing at Rs. 6-0-0 per acre was exceedingly disappointing, only 112 acres being broken up.

The cultivators were quite unwilling to pay Rs. 6 per acre for this work and wanted deep ploughing carried out for the same price.

The tackle has since been brought to the Poona workshops for a complete overhaul in order to be ready for the next season.

No balance sheet is submitted as the work accomplished is insignificant.

Motor tractors for working agricultural implements have been largely developed during the war and this Department is experimenting with a Moghul tractor and plough purchased from Captain Crawford of Sirur. It is also hoped to secure a Fordson tractor for ploughing and drilling shortly, and in addition, investigations are being carried out in England with the idea of sending out two different motor tractors which appear to be suited for Indian conditions so that they can be tested by the Department.

The Moghul tractor and plough have ploughed some 60 acres at Bhamhora with fairly satisfactory results but accurate figures of cost are not yet available.

It must be remembered that these tractors are worked by rather delicate high speed oil-engines and have only recently come into extensive use in Europe. They certainly require a well-paid and skilful man to work and look after them, and it is open to doubt if they will long survive in the conditions prevailing in India. However, exhaustive tests will be carried out with at least four different types, and it is anticipated that some useful information will be obtained.

BORING.

656 enquiries for boring were received during the year. The demands were as follows:—

Northern Division	...	...	...	...	315
Central	..	...	...	...	226
Southern	..	...	...	...	97
Sind	...	...	...	...	3
Outside Presidency	...	...	...	...	15
					656

239 bores were made, and of these 158 were successful. 37 are still under progress, 24 were unsuccessful and 20 were abandoned incomplete at the owners' request.

All the machines at the disposal of the Department were working owing to the Famine, and in Gujrath 134 bores were made with 85.58 per cent of successes. The lower percentage is due to the sinking of the normal water level owing to drought and the unwillingness of owners to pay for deeper borings.

Thana again accounts for 89.0 per cent of successful bores and in the Konkan most promising results are obtained.

Shallow bores in Maharashtra and the Karnatic usually produce only small supplies sufficient for domestic purposes.

Work in Sind had to be shut down owing to the necessity of concentrating in famine areas. A statement is attached showing the results and cost of boring in different tracts.

The increasing interest which is now being taken in shallow boring has led to a more extensive use of the Musto hand machine by District Local Boards, and in this connection facilities are given by the Department to train men. Unfortunately a hand machine which cost Rs. 750 before the war, now costs Rs. 2,950 and the price of a similar machine fitted with an oil-engine to drive it amounts to Rs. 6,000.

The employment of oil-engine driven machines is becoming more and more necessary in view of the difficulty experienced in gathering together the eleven coolies required to work the hand-machine, the work being hard and not very popular.

POWER PUMPING.

Owing to the drought which caused famine in many districts every effort was made to get pumping sets working in localities where sufficient water was available in close proximity to suitable land for irrigation.

17 pumps and engines were collected at Government expense together with pipes, fittings and accessories and these were installed and set to work in less than six months' time. These pumps, together with six other which had been fixed previously were all worked and supplied with stores by the Department. In this way some 2,000 acres of fodder crops were irrigated.

In addition, five pumping sets belonging to cultivators were put in order and worked under the supervision of the Department in order to minimise the risk of a breakdown.

There is little doubt that the benefits to be derived from irrigation by pumping are becoming well known throughout the Presidency and 120 inquiries were attended to during the year.

WORKSHOPS, ETC.

A very large amount of repair work was carried out in the Workshops owing to famine work and the preparation of machinery for Mesopotamia.

Additional accommodation is badly required for the stores, plants and blacksmiths shops which are now accommodated in temporary shanties and often suffer from leaky roofs during the monsoon.

Practically all the available engines and pumps from the experimental well were taken down and used for famine work, and for this reason also, the Oil Engine Class did not meet for 9 months. Ten boys, however, were trained as oil engine drivers and one in working boring machines. The experimental well will be re-equipped as far as possible, and the regular Oil Engine Class commences on July 1st 1919.

MISCELLANEOUS.

The usual work in connection with cane-crushers, shredding and baling machinery, inspection of plant and sites has been carried out during the year.

The engines fitted to two departmental crushers used for demonstration purposes were employed for pumping water to grow fodder crops. Six enquiries for power crushers were received.

Prices of machinery and pipes are still very high and are likely to remain so, but a better side to the situation is the fact that machinery is coming into the country again and it is once more possible to purchase pumps and engines.

GENERAL.

This is the third time during the last seven years that I have acted as Agricultural Engineer. The first occasion was in 1912 before Mr. Schutte came out to India. At that time the Department was starting. There was no workshop, no steam ploughs, few borings were carried out and the number of pumping installations and inquiries was small.

I have watched the Department grow under Mr. Schutte's guidance and for the third time I am again in charge. The above report and those preceding give some idea of the scope of the work of the Department, but it is doubtful if it is properly realized what an enormous amount of detailed work is now carried on continuously by Mr. Schutte, his Assistant Mr. Paranjape and his Boring Overseer, Mr. Chitale. I have pointed out more than once, both to the Director of Agriculture and to Mr. Schutte, the necessity of obtaining additional assistance in this Department so that more supervision can be given and still more work be undertaken.

This department has an enormous field before it and I cannot help feeling that instead of one Mr. Schutte there should be three or four.

Sind, on account of its distance is sadly neglected in this respect and there appears to be ample scope for a trained Agricultural Engineer who would have his head-quarters there.

The amount of routine office work and accounts is a serious handicap to a single Agricultural Engineer who has to spend so much of his time in the Districts, often in the most remote places. There appears to be ample work for a responsible officer who would remain at Poona head-quarters and attend to all these clerical duties. He would also be able to supervise the workshop and experimental work, the teaching of drivers and boring men, all of which require a guiding and driving force constantly near at hand.

Now that the war is over I hope that steps can be taken to strengthen the staff under Mr. Schutte so that he may have a little time to think out his many problems and a responsible officer to carry on the work during his absence.

It is a great drawback to a progressive department to lose its head, and this is emphasised when a substitute can only be found who is unfamiliar with the details of the work and able to devote only a small part of his time to Agricultural Engineering every day.

G. H. THEISELTON-DYER,
Acting Agricultural Engineer, B. P. Poona.

STATEMENT OF ANNUAL REPORT FOR THE YEAR 1918-1919.

Serial Number.	Name of well owner.	Taluka.	Village.	Diameter of bore.	Depth of boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of bore hole.	Cost per foot.	Result and Remarks
				Inches.	Ft. in.			Rs. s. p.	Rs. s. p.	Rs. s. p.	Rs. s. p.	
GUJARAT.												
<i>Katra District.</i>												
1	Mr. Girdhardas Mangaldas.	Nadiad	Nadiad	3	74 0	500	2,500	221 0 10	70 0 0	291 0 10	3 14 11	Successful.
2	Bangibhai Nathabhai	Do.	Uttavanda	3	58 0	1,500	5,500	179 8 11	35 0 0	214 8 11	3 13 4	Do.
3	Narharbhai Nathabhai and Rangibhai, N.	Do.	Do.	3	59 0	1,000	3,000	269 10 2	50 0 0	319 10 2	5 13 9	Do.
4	Mathoorbhai Naranbhai.	Borsad	Golei	2½	95 0	2,000	6,000	233 1 4	47 4 0	285 5 4	3 0 1	Do.
5	Kalia Dabya	Mehmadabad	Aklaoha	2½	108 0	...	...	.....	.....	.....	...	Failure.
6	Jivabhai Motibhai	Anand	Bhalaj	3½	49 0	1,000	4,000	173 5 2	39 8 0	211 13 2	4 5 2	Successful.
7	Lalloobhai Nathabhai	Nadiad	Uttarsanda	3	33 0	1,000	4,000	254 4 7	100 0 0	354 4 7	4 4 3	Do.
8	Mathoorbhai Naranbhai.	Borsad	Golei	2½	53 0	6,000	12,000	143 1 4	3 0 0	145 1 4	2 11 10	Do.
9	Baha Dafa	Mehmadabad	Binchol	2½	154 0	250	1,500	145 2 2	32 5 0	177 7 2	3 4 7	Do.
10	Naranbhai Vallabbhai.	Borsad	Ras	2½	70 0	4,000	10,000	207 0 7	29 13 0	236 13 7	3 6 2	Do.
11	Nathumia Tijumia	Anand	Bhalaj	2½	70 6	250	1,250	233 12 6	96 8 0	336 4 6	4 12 1	Do.
12	Koya Dabya	Mehmadabad	Aklaoha	2½	24 0	...	...	.....	.....	.....	...	Failure.
13	Experimental	Nadiad	Nadiad	3	205 0	...	500	449 8 0	220 13 6	670 5 6	3 4 4	Successful.
14	Mangalbhai Veribhai	Mehmadabad	Aklaoha	2½	73 0	...	...	.....	.....	.....	...	Incomplete.
15	Ramchandra Mayashanker.	Do.	Woodpura	2½	103 0	2,000	3,500	251 11 11	112 8 0	364 3 11	3 9 3	Successful.
16	Chaturbhai Haribhai	Nadiad	Arera	2½	52 0	...	...	.....	.....	.....	...	Failure.
17	Kalidas Mulibhai	Borsad	Ras	2½	106 0	2,000	5,000	262 9 4	37 4 0	300 5 4	3 3 11	Successful.
18	Motibhai Punjabhai	Mehmadabad	Binchhod	2½	146 0	...	...	.....	.....	.....	...	Failure.
19	Kalidas Mulibhai and Babar Versibhai.	Borsad	Ras	2½	101 0	1,000	2,000	233 13 10	68 0 0	345 13 10	3 7 3	Successful.
20	Malek Batu Gaba	Anand	Bhedaj	2½	95 0	500	3,500	322 4 1	256 8 0	585 12 1	6 2 8	Do.
21	Bhikhabhai Becharbhai.	Mehmadabad	Aklaoha	2½	34 0	500	1,000	217 15 3	100 0 0	317 15 3	2 12 6	Do.
22	Motiram Jamanadas	Borsad	Ras	2½	53 0	500	3,500	140 12 8	39 12 0	180 9 8	3 7 6	Do.
23	Indian Dairy Supply Co.	Nadiad	Nadiad	4	223 0	NH	2,000	716 8 5	122 7 6	978 15 11	4 3 3	Do.
24	Purshotum Hathibhai	Borsad	Ras	2½	98 0	2,000	7,000	255 8 7	30 15 0	336 2 6	3 6 11	Do.
25	Bhulebhai Jethabhai	Mehmadabad	Sankhaj	2½	41 0	1,000	2,000	106 4 4	36 0 0	142 4 4	3 7 6	Do.
26	Chunnilal Ganpalla	Nadiad	Mahudha	2½	93 0	...	...	.....	.....	.....	...	Failure.
27	Mansukhlal Chunilal	Anand	Bhalaj	3½	64 0	1,000	4,000	212 4 11	72 9 0	284 13 11	4 7 3	Successful.
28	Purshotum Sivabhai	Borsad	Ras	2½	112 0	...	...	.....	.....	.....	...	Failure.
29	Bhulebhai Jethabhai	Mehmadabad	Sankhaj	2½	17 0	2,000	3,000	47 11 1	3 0 0	55 11 1	4 3 5	Successful.
30	Harjibhai Narsibhai	Do.	Do.	2½	66 6	...	...	.....	.....	.....	...	Failure.
31	Jinsbhai Motibhai	Anand	Bhalaj	2½	42 0	1,000	6,000	156 14 8	48 15 0	205 13 8	4 14 5	Successful.
32	Somabhai Kishorbhai	Nadiad	Uttarsanda	2½	102 0	...	...	.....	.....	.....	...	Failure.
33	Pagi Bhana Rajji	Mehmadabad	Binchhol	2½	38 0	250	6,250	100 0 10	30 0 0	130 0 10	3 6 9	Successful.
34	Kashibhai Bhojabhai	Anand	Bhalaj	3½	76 0	1,000	5,000	274 9 3	162 12 6	417 5 9	5 12 1	Do.
35	Shamsidas Mulibhai	Nadiad	Mahudha	2½	34 0	750	1,750	225 4 0	120 0 0	243 4 0	4 1 4	Do.
36	Dahyabhai Haribhai	Borsad	Dehvan	2½	53 0	500	3,500	135 0 1	18 14 0	153 14 1	2 14 5	Do.
37	Maganlal Mansukhlal	Mehmadabad	Sankhaj	2½	34 0	1,000	5,000	223 12 8	90 0 0	312 12 8	3 8 8	Do.
38	Malek Bapu Jaba	Do.	Keshra	2½	72 0	1,000	3,000	150 1 4	46 4 0	196 4 4	2 11 7	Do.
39	Bhalil Becher	Matar	Traj	2½	109 0	1,000	2,000	227 9 2	129 4 0	356 13 2	3 4 4	Do.
40	Pagi Bhalba Jiva	Borsad	Bamanwa	2½	33 0	...	...	.....	.....	.....	...	Failure.
41	Pagi Mathoor Kabhai	Nadiad	Laloon	3	17 0	1,000	5,000	63 8 3	11 4 0	74 12 3	4 5 9	Successful.
42	Lalloobhai Mithabhai	Do.	Uttarsanda	3	97 0	1,500	7,500	250 10 9	135 0 0	415 10 9	4 4 7	Do.
43	Vaghjibhai Shankarbhai.	Do.	Do.	3	90 0	500	4,500	246 7 2	80 0 0	326 7 2	3 9 7	Do.
44	Ghavanbhai Ichhabhai	Anand	Ajupura	2½	60 0	250	3,250	149 8 0	25 0 0	174 8 0	2 14 0	Do.
45	Pagi Bavaji Nathoo	Borsad	Bamanwa	2½	70 0	1,500	3,500	167 4 8	9 10 0	176 14 8	2 8 5	Do.
46	Chhotalal Kapurchand	Matar	Sandhana	3½	140 0	2,000	5,000	437 10 6	109 0 0	576 10 6	4 1 11	Do.
47	Lalloobhai Bapuji	Anand	Bhalaj	3	22 0	1,000	2,000	244 12 10	173 14 0	418 10 10	5 1 8	Do.
48	Motibhai Ranchhod	Do.	Ajupura	2½	53 0	500	1,500	134 8 1	25 0 0	159 8 1	3 0 1	Do.
49	Amin Hatu	Mehmadabad	Keshra	2½	64 0	2,000	7,000	154 5 2	40 0 0	204 4 2	3 3 1	Do.
50	Purshotam Dhaneshwar	Borsad	Bamanwa	2½	122 0	1,000	2,000	243 9 2	75 0 6	318 10 8	2 9 9	Do.
51	Narayanbhai Lalloobhai.	Nadiad	Mahudha	2½	34 0	2,000	3,000	34 12 0	50 0 0	124 12 0	3 15 4	Do.

Serial Number.	Name of well owner.	Taluka.	Village.	Diameter of bore.	Depth of boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of bore hole.	Cost per foot.	Result and Remarks.
				Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
	Kaira District—contd.											
53	Lalloobhai Bhaktibhai	Nadiad	Uttarsanda	3	76 0	...	...	.....	.....	.....	...	Failure.
53	Harjibhai Narajibhai	Mehmadabad	Sankhaj	2½	24 0	500	2,500	69 1 0	9 4 0	78 5 0	3 4 2	Successful.
54	Nanabbhai Dalabbhai	Anand	Ajupura	2½	88 0	500	4,500	175 14 0	39 0 0	214 14 0	2 7 1	Do.
55	Someshwar Muljibhai	Mehmadabad	Sankhaj	2½	90 0	2,000	5,000	185 1 0	75 0 0	260 1 0	2 14 8	Do.
56	Malek Jamed Abdool	Do.	Keshra	2½	36 0	250	2,250	67 4 0	50 0 0	117 4 0	3 4 1	Do.
57	Franjivan Haribhai	Nadiad	Uttarsanda	3	123 6	...	...	.....	.....	.....	...	Failure.
58	Shivabhai Dalabbhai	Anand	Ajupura	2½	80 0	1,000	7,000	161 10 9	34 8 0	195 2 9	2 7 3	Successful.
59	Lalloobhai Bhaktibhai	Nadiad	Uttarsanda	3	90 0	3,000	3,000	254 10 0	75 0 0	329 10 0	3 11 0	Do.
60	Nagindas Nathji	Do.	Padorsar	2½	111 0	...	...	.....	.....	.....	...	Failure.
61	Haribhai Manorbhai	Borsad	Bamanwa	2½	98 0	500	4,500	73 14 8	10 8 0	84 6 8	3 0 3	Successful.
62	Motibhai Bavaji	Do.	Bhetosi	2½	103 0	4,000	6,000	230 4 2	213 8 0	443 12 2	4 4 10	Do.
63	Adu Vaghe	Mehmadabad	Sankhaj	2½	70 0	1,000	2,000	142 14 11	38 0 0	178 14 11	2 8 11	Do.
64	Motibhai Jijibhai	Matar	Traj	2½	110 6	1,000	3,000	212 5 5	125 0 0	337 5 5	4 12 6	Do.
65	Aju Nabhu	Mehmadabad	Ginger	2½	55 0	...	...	.....	.....	.....	...	Failure.
66	Mohanlal S. Dalal	Nadiad	Nadiad	3½	70 0	3,000	7,000	214 1 6	85 0 0	299 1 6	4 4 4	Successful.
67	Talsibhai Jibhai	Mehmadabad	Keshra	2½	52 0	1,000	2,000	106 11 7	85 0 0	142 11 7	2 11 11	Do.
68	Hirabbhai Manorbhai	Borsad	Bamanwa	2½	35 0	...	...	.....	.....	.....	...	Failure.
69	Somabbhai Dhoribhai	Anand	Ajupura	3	48 0	1,000	7,000	135 3 1	8 0 0	143 3 1	2 15 9	Successful.
70	Veribhai V. Engineer	Nadiad	Narsanda	3½	62 0	...	...	.....	.....	.....	...	Incomplete.
71	Shah Bakar Virchand	Mehmadabad	Aklacha	2½	93 0	...	...	.....	.....	.....	...	Failure.
72	Bhulabhai Jethabhai	Do.	Sankhaj	2½	16 0	...	...	.....	.....	.....	...	Do. †
73	Desai Herilal Chunilal	Nadiad	Mahudha	2½	172 5	...	...	.....	.....	.....	...	Do.
74	Dhira Khonda (Netha)	Borsad	Kathana	2½	42 0	1,000	2,000	103 8 7	46 1 0	149 9 7	3 9 0	Successful.
75	Chunilal Ranchood	Anand	Bhalaj	3½	54 0	2,000	5,000	188 2 11	73 11 6	266 14 5	4 18 3	Do.
76	Desaibhai Dalabbhai	Do.	Ajupura	3	74 0	1,000	2,000	214 15 2	120 10 0	335 9 2	4 8 7	Do.
77	Bhulabhai Jethabhai	Mehmadabad	Sankhaa	2½	28 0	1,000	3,000	60 14 6	10 0 0	70 14 6	2 8 6	Do.
78	Tranads Shivaram Gir-dhar.	Do.	Malataj	2½	19 0	...	...	.....	.....	.....	...	Failure.
79	Motibhai Lalloobhai	Anand	Khambholaj.	2½	40 0	...	...	.....	.....	.....	...	Do.
80	Dhulabhai Jamanadas	Nadiad	Piplote	3	75 0	...	...	.....	.....	.....	...	On hand.
81	Chotalal Dwardkadas	Mehmadabad	Woodpura	2½	60 0	250	4,250	133 4 10	75 0 0	208 4 10	3 7 6	Successful.
82	Gokalbhai Jivabhai Patel.	Matar	Khandhli	2½	135 0	2,000	2,500	250 3 5	218 3 9	478 7 2	3 8 8	Do.
83	Desaibhai Nagarbhai	Nadiad	Akhdol	3	35 0	1,000	5,000	104 14 11	60 0 0	164 14 11	4 6 10	Do.
84	Chatoorbhai Lalloobhai	Mehmadabad	Aklacha	2½	74 0	500	2,500	155 14 11	80 0 0	235 14 11	3 3 0	Do.
85	Tranads Shivaram Gir-dhar.	Do.	Malataj	2½	20 0	...	...	.....	.....	.....	...	Failure.
86	Mahadeoram Nathuram.	Borsad	Kathana	2½	117 0	1,000	5,000	226 0 9	47 2 0	273 2 9	2 5 4	Successful.
87	Maganlal Kahandas	Mehmadabad	Malataj	2½	115 0	...	...	.....	.....	.....	...	Failure.
88	Desaibhai Wagesbhai	Nadiad	Akhdol	3	35 0	5,000	6,000	103 1 0	40 0 0	143 1 0	4 1 4	Successful.
89	Ahmed Hussein Miya-sahib.	Borsad	Gogan	3½	114 0	4,000	10,000	346 13 8	135 4 0	482 1 8	4 3 8	Do.
90	Narattam Bajibhai	Anand	Ajupura	3	49 0	225	1,725	144 18 8	40 0 0	184 18 8	3 12 4	Do.
91	Mandil Virajlal	Nadiad	Narsanda	3	110 0	1,000	2,000	211 13 5	175 0 0	386 13 5	4 6 10	Do.
92	Samatsing Bhupatsing	Borsad	Kothal	2½	47 0	1,500	4,500	96 4 11	12 1 1	108 5 11	2 4 1	Do.
93	Chotalal Dwardkadas and Motibhai Kashibhai.	Mehmadabad	Samadra	2½	91 6	1,000	3,000	197 11 7	150 0 0	347 11 7	3 12 10	Do.
94	Ashabbhai Bhupatsing	Borsad	Amfad	2½	34 0	1,000	4,000	78 15 11	20 1 0	99 0 11	2 14 7	Do.
95	Pagi Soma Galam	Mehmadabad	Sankhaj	2½	88 0	500	4,500	183 12 1	75 0 0	257 12 1	2 14 10	Do.
96	Dhulabhai Vallabh	Do.	Sunj	2½	25 0	...	...	.....	.....	.....	...	Failure.
97	Ashabbhai Bhupatsing	Borsad	Amfad	2½	103 0	4,000	10,000	216 1 1	70 9 0	286 6 1	2 10 5	Successful.
98	Shankarbhai Punjabhai	Nadiad	Nadiad	3½	32 0	3,000	7,000	112 15 3	30 0 0	142 15 3	4 7 2	Do.
99	Lalloobhai Bhaktibhai	Do.	Uttarsanda	...	125 0	...	...	.....	.....	.....	...	On hand.
100	Shamaibhai Shambhu-das.	Anand	Khambholaj.	2½	60 0	1,000	2,000	125 0 9	45 8 0	170 8 9	2 7 5	Successful.
101	Shamaibhai Lalloobhai	Mehmadabad	Aklacha	...	55 0	...	...	.....	.....	.....	...	On hand.
102	Bhallal Sakhdas	Borsad	Ras	3	109 6	1,000	5,000	306 14 10	71 15 0	378 13 10	3 7 4	Successful.
103	Desai Varajlal Herilal	Do.	Khadana	3½	104 0	4,000	3,000	212 4 0	158 14 0	370 2 0	4 8 7	Do.
104	Mangal Laxmidas	Anand	Khambholaj.	2½	62 0	...	...	.....	.....	.....	...	On hand.
105	Valand Mangal Gir-dhar.	Do.	Samarkha	3	52 0	2,000	7,000	162 12 0	25 0 0	177 12 0	3 6 8	Successful.
106	Chagandas Jethidas	Mehmadabad	Vasna-Marji.	...	85 0	On hand.

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				Inches.	Ft. in.			Rs. s. p.	Rs. s. p.	Rs. s. p.	Rs. s. p.	
<i>Katra District—contd.</i>												
107	Himabhai Mithabhai ...	Nadiad ...	Piplaj ...	3½	60 0	1,500	3,500	188 15 8	73 0 0	260 15 8	4 5 7	Successful.
108	Vohra Adam Abhram ...	Anand ...	Samarkha ...	3	70 0	...	...	.....	.....	.....	...	Failure.
109	Alladin Sher Khan Pathan.	Borsad ...	Pondoli ...	3½	107 0	..	...	.....	.....	.....	...	On hand.
110	Motibhai Dalabhai ...	Nadiad ...	Vadthal ...	3½	62 0	...	...	.....	.....	.....	...	Do.
111	Babarabhai Haribhai ...	Borsad ...	Ashi ...	3	36 0	6,000	9,000	111 2 6	16 5 0	127 7 6	3 4 3	Successful.
112	Do.	Do.	Do.	3	20 0	...	...	.....	.....	.....	...	On hand.
113	Dadabhai Pursotam ...	Nadiad ...	Nadiad ...	3	106 0	500	1,000	386 14 8	160 0 0	486 14 8	4 11 0	Successful.
<i>Breach District.</i>												
114	Dinshaw Pirojshaw Patel.	Ankleshwar...	Survadi ...	4	205 0	...	...	.....	.....	.....	...	On hand.
<i>Ahmedabad District.</i>												
115	Taluka Local Board, Dholka.	Dholka ...	Kharati ...	3	108 0	250	4,250	258 15 4	258 15 0	512 14 4	4 11 11	Successful.
116	Do.	Do.	Bhumli ...	3	48 0	NH	1,000	155 0 0	137 10 0	292 10 0	6 1 6	Do.
117	Shah Maneklal and Mamlal Ranchoddas.	Daskroi ...	Manipur ...	3½	102 0	...	...	.....	.....	.....	...	On hand.
118	Kalidas Lalbhai Gontipur.	Ahmedabad ...	Do.	3½	88 0	...	...	.....	.....	.....	...	Do.
119	Taluka Local Board ...	Dholka ...	Transad ...	3	48 0	...	...	.....	.....	.....	...	Do.
120	Do.	Do.	Ambhati ...	3	37 3	250	1,250	106 5 5	67 14 0	174 3 5	4 10 10	Successful.
121	Do.	Do.	Rampur ...	3	24 0	...	...	.....	.....	.....	...	On hand.
122	Sarangpur Cotton Manufacturing Co.	Ahmedabad ...	Raipur ...	3½	205 0	...	...	.....	.....	.....	...	Failure.
<i>Panch Mahals District.</i>												
123	Chunilal Mansukhlal ...	Godhra ...	Godhra ...	3	4 6	...	...	.....	.....	.....	...	Failure.
124	Do.	Do.	Do.	3	10 4	...	...	.....	.....	.....	...	Do.
125	Amthabhai Bhaiji ...	Do.	Shimpuri ...	3	50 0	...	...	.....	.....	.....	...	On hand.
<i>Mahi Kantha Agency.</i>												
126	Rewandas Prandas ...	Sadra ...	Dabhoda ...	3	50 0	...	...	.....	.....	.....	...	Failure.
127	Do.	Do.	Do.	3	56 0	1,000	4,000	180 10 0	38 12 0	219 6 0	3 14 8	Successful.
128	Patel Shunil Motidas ...	Do.	Do.	3½	97 0	500	1,500	330 6 6	93 0 0	423 6 6	4 5 10	Do.
129	Gopalidas Jugaldas ...	Do.	Do.	3½	62 0	500	1,500	181 3 1	28 8 0	209 11 1	4 0 6	Do.
130	Thakore Surabhai Gandaji.	Do.	Vadodara ...	3	50 0	500	3,500	154 3 0	40 7 0	194 10 0	3 14 3	Do.
131	Lalloobhai Bhulabhai ...	Do.	Do.	3	62 0	500	3,500	197 6 3	75 0 0	272 6 3	4 6 3	Do.
132	Vagheh Gulabji Nathuji.	Do.	Pethapur ...	3	55 0	...	...	.....	.....	.....	...	Failure.
133	Do.	Do.	Do.	3	92 0	...	...	.....	.....	.....	...	Do.
134	Hoshanji Barjorji ...	Do.	Dabhoda ...	3	70 0	1,000	4,000	74 10 6	212 1 1	286 11 7	4 1 6	Successful.
<i>Thana District.</i>												
135	Mr. Morubhau Marathe.	Umbergaon...	Bardi ...	3	50 0	...	...	.....	.....	.....	...	Abandoned at the request of well owner.
136	.. V. L. Bhaye	Thana ...	Sarsola ...	3	63 0	...	...	.....	.....	.....	...	Do.
137	.. G. S. Dandekar	Mahim ...	Wakora ...	3	30 0	...	...	.....	.....	.....	...	Do.
138	.. G. V. Ganu	Umbergaon...	Sanjan ...	3	68 0	200	1,200	36 6 0	50 0 0	86 6 0	1 4 4	Successful.
139	.. Morubhau Marathe.	Do.	Bardi ...	3	75 0	500	5,500	42 10 6	32 0 0	73 10 6	0 15 6	Do.
140	Parsi Girl School	Sasti ...	Bandra ...	3	18 0	...	...	.....	.....	.....	...	Failure.
141	Ardesar Dorabji	Umbergaon...	Sanjan ...	3	54 0	500	1,000	15 9 4	40 8 0	56 1 5	1 0 7	Successful.
142	Parsi Girl School	Sasti ...	Bandra ...	3	21 0	...	...	.....	.....	.....	...	Failure.
143	Mr. Kaldate	Do.	Ithan ...	3	16 0	1,000	2,000	5 7 0	35 0 0	40 7 0	2 8 5	Successful.
144	.. Maganlal Karsandas.	Umbergaon ...	Ghantal pada	3	99 0	NH	800	25 5 1	60 8 0	85 3 1	0 11 10	Do.
145	.. K. K. Dandekar	Mahim ...	Palghar ...	6	77 0	NH	4,000	348 10 2	21 5 10	370 0 0	4 12 11	Do.
146	.. G. S. Dandekar	Do.	Wakora ...	3½	67 0	NH	1,500	32 13 6	106 0 0	138 13 6	2 1 2	Do.
147	Government Bore	Thana ...	Sarsola ...	3	51 0	NH	240	74 4 2	34 3 7	108 7 9	2 2 0	Do.
148	Mr. G. V. Joshi	Umbergaon...	Sanjan ...	3	24 0	...	...	.....	.....	.....	...	Abandoned at the request of well owner.
149	.. K. K. Dandekar	Mahim ...	Palghar ...	6	30 0	...	...	.....	.....	.....	...	Mishap of tool.
150	.. V. K. Sanjanwala	Dahanu ...	Umbergaon...	3½	22 0	500	1,500	26 4 0	12 14 8	39 2 3	1 12 7	Successful.
151	.. K. K. Dandekar	Mahim ...	Palghar ...	6	30 0	...	...	.....	.....	.....	...	Failure.
152	.. P. P. Mahatre	Sasti ...	Goregaon ...	3	22 0	...	...	.....	.....	.....	...	Mishap of tool.
153	.. M. N. Indulkar	Umbergaon...	Wase ...	3½	64 0	NH	800	26 13 7	45 0 0	71 13 7	1 12 7	Successful.
154	.. Kawasji Palamji	Dahanu ...	Gholwad ...	3½	33 0	1,000	5,000	18 5 2	25 0 0	43 5 2	1 5 0	Do.
155	.. Ardesar Irani	Do.	Do.	3½	22 0	100	1,000	7 15 0	15 0 0	22 15 0	1 0 7	Do.

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				Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
<i>Thana District—contd.</i>												
156	Mr. Gopala Nanu Patil...	Dahanu	Bordi	3½	45 0	NH	1,500	19 3 6	15 0 0	34 3 6	0 12 9	Successful.
157	" Kawaji Palamji ...	Do.	Gholwad	5½	15 0	...	...	.....	.....	.....	...	Failure Salt water.
158	" Makund Anant Save.	Do.	Bordi	3½	18 0	300	1,500	23 10 8	25 0 0	48 10 8	2 11 4	Successful.
159	" Manikji Sorabji ...	Do.	Do.	3½	38 0	500	2,000	14 1 0	12 0 0	26 1 0	0 11 0	Do.
160	Do.	Do.	Do.	3½	17 0	NH	500	30 5 6	15 13 6	45 8 0	2 11 6	Do.
161	" K. K. Dandekar ...	Mahim	Palghar	6	87 0	100	3,500	422 4 6	72 11 6	506 0 0	5 12 6	Do.
162	" Manikji Sorabji ...	Dahanu	Bordi	3½	19 0	500	700	10 11 6	15 6 0	25 1 6	2 6 0	Do.
163	" Haji Mahamed ...	Thana	Nerul	3	42 0	...	...	.....	.....	.....	...	Failure.
164	" P. P. Mahatre ...	Sasti	Goregaon	3	145 0	NH	800	31 14 6	122 0 0	143 14 6	0 15 11	Successful.
165	" A. B. Waiwalkar ...	Mahim	Palghar	3	51 0	200	600	14 0 6	35 6 9	49 11 9	0 15 7	Do.
166	" Gopaldas Bhagewandas.	Dahanu	Zai	3½	66 0	200	1,000	9 10 0	13 6 9	22 9 0	0 6 7	Do.
167	" Ratna Dhedka ...	Do.	Do.	3	28 0	500	1,500	19 7 8	11 4 0	30 11 8	1 1 7	Do.
168	" Ganeshmal Banichand Marwadi.	Do.	Bordi	3	57 0	200	800	66 13 10	30 6 0	97 3 10	1 11 2	Do.
169	" Sakharam Patil ...	Mahim	Nandora	3½	33 0	6,000	9,000	28 15 2	9 13 0	38 12 9	1 2 10	Do.
170	" Ambalal Mawaji ...	Umbergaon	Deheri	3½	45 0	500	1,000	16 6 6	25 0 0	41 6 6	0 14 9	Do.
171	" Narayan K. Patil ...	Mahim	Palghar	3	97 0	200	500	20 4 9	20 3 0	40 12 9	1 8 2	Do.
172	" K. K. Dandekar ...	Do.	Do.	6	50 0	1,000	3,000	125 2 0	44 14 0	170 0 0	3 6 5	Do.
173	" T. G. Kelkar ...	Dahanu	Malyan	3½	31 0	NH	5,000	13 14 0	28 14 0	42 12 0	1 6 0	Do.
174	" Ambalal Mawaji ...	Umbergaon	Deheri	3½	55 0	200	1,500	25 14 0	21 4 0	47 2 0	0 13 4	Do.
175	" Arjuna Raut ...	Dahanu	Bordi	3	11 0	300	1,000	12 5 3	10 4 0	22 9 3	2 0 10	Do.
176	" G. G. Dandekar ...	Mahim	Palghar	6	65 0	500	3,000	125 15 0	27 1 0	153 0 0	2 7 6	Do.
177	" P. P. Mahatre ...	Sasti	Goregaon	3	20 0	NH	500	15 2 0	8 0 0	23 2 0	1 2 6	Do.
178	" Narayan L. Raut ...	Dahanu	Bordi	3	80 0	300	1,000	24 9 9	50 0 0	74 9 9	0 14 11	Do.
179	" Hirasing Dhansing ...	Mahim	Palghar	3	49 0	NH	900	15 7 4	20 0 0	35 7 4	0 11 11	Do.
180	" K. M. Irani ...	Dahanu	Malyan	3½	51 0	500	5,000	34 0 6	33 0 0	67 0 6	1 5 0	Do.
181	" Mangla Bushah ...	Mahim	Palghar	3	28 0	300	2,000	16 11 3	12 8 0	29 3 3	1 0 8	Do.
182	Agricultural School	Kalyan	Jambul	3	60 0	NH	700	37 2 0	30 0 0	117 2 0	1 15 3	Do.
183	Mr. Vamanrao Pimpulkar.	Dahanu	Umbergaon	3½	50 0	500	3,000	21 11 0	33 12 0	55 7 0	0 14 10	Do.
184	" Vithal G. Patil ...	Do.	Bordi	3	29 0	500	2,100	14 8 2	15 0 0	29 8 2	1 0 4	Do.
185	" Laxuman B. Raut ...	Do.	Do.	3	40 0	400	1,500	18 7 8	18 8 0	36 15 8	0 14 10	Do.
186	" Barve, S. S. ...	Do.	Wangaon	3	20 0	...	...	.....	.....	.....	...	On hand.
187	" Appaji Ganesh Dandekar.	Mahim	Palghar	3	28 0	NH	1,200	19 6 0	15 0 0	34 6 0	1 3 3	Successful.
188	" V. V. Dandekar, Pleader.	Do.	Do.	6	68 0	NH	3,000	85 6 0	20 10 0	106 0 0	1 8 11	Do.
189	" Laxuman B. Raut ...	Dahanu	Bordi	3	22 0	500	2,000	24 14 0	12 0 0	36 14 0	1 5 2	Do.
190	" E. G. Dandekar ...	Mahim	Palghar	3	10 0	...	...	.....	.....	.....	...	On hand.
191	" K. M. Irani ...	Dahanu	Malyan	3½	22 0	1,000	5,000	11 8 0	8 0 0	19 8 0	0 14 2	Successful.
192	" Framji Rustumji ...	Umbergaon	Nargol	3½	34 0	...	...	.....	.....	.....	...	On hand.
193	" Dorabji Sorabji ...	Dahanu	Wangaon	3	3 0	...	...	.....	.....	.....	...	Do.
194	" K. M. Karandikar ...	Do.	Malyan	3½	57 0	NH	1,000	14 15 0	30 0 0	44 15 0	0 12 8	Successful.
195	Do.	Do.	Do.	3½	25 0	1,000	2,000	2 5 6	9 0 0	11 5 6	0 7 6	Do.
196	Dr. Massania	Do.	Gholwad	3½	2 0	...	...	.....	.....	.....	...	On hand.
<i>Kolaba District.</i>												
197	Government Agricultural Farm.	Alibag	Bandhan	3	50 0	...	...	.....	.....	.....	...	Incomplete.
198	Do.	Do.	Do.	3	100 0	NH	1,000	26 12 0	99 1 0	125 13 0	1 4 2	Successful.
199	Mr. G. M. Kamat	Do.	Do.	3	28 0	NH	600	11 0 0	67 4 0	78 14 0	2 13 1	Do.
200	Do.	Do.	Do.	3	20 0	NH	700	13 0 0	50 4 0	67 4 0	2 3 0	Do.
201	Do.	Do.	Do.	3	25 0	NH	500	18 4 6	68 3 0	86 12 6	3 7 6	Do.
202	Government Agricultural Farm.	Do.	Do.	3	30 0	...	...	.....	.....	.....	...	Incomplete.
203	Mr. Hormasji Manekji ...	Do.	Uran	3	50 0	NH	4,500	15 1 0	40 0 0	55 1 0	1 7 1	Successful.
204	" Amin Bhaiji ...	Do.	Jaskar	4	215 0	...	...	.....	.....	.....	...	Incomplete.
205	" B. M. Tilak ...	Karjat	Wawashi	3	46 0	...	...	.....	.....	.....	...	On hand.
206	" Ramchandra Balabhai	Alibag	Uran	3	50 0	...	...	.....	.....	.....	...	Do.
<i>Nasik District.</i>												
207	Mr. Murlidhar Nathushet.	Yeola	Kolamgaon	3	80 0	Mishap of tool.

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				Inches.	Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
<i>Surat District—concl'd.</i>												
208	Mr. Potidar	Balsar	Pimpalgabban	3	85 0	Abandoned at the request of well owner.
209	„ K. K. Desai, Pleader.	Do.	Balsar	3	85 0	...	...	.....	.....	.....	...	On hand.
210	„ Fakirbhai Ismailji	Do.	Bagdawadi	3	77 0	...	...	.....	.....	.....	...	Do.
<i>Ahmednagar District.</i>												
211	„ Ishwara Hanamanta Thanka.	Jamner	Limgaon ghana.	3	24 0	Nil	500	19 6 5	28 9 7	48 0 0	2 0-0	Successful.
<i>Dharwar District.</i>												
212	Taluka Local Board	Ranebennur	Byadgi	3	25 0	...	...	.....	.....	.....	...	On hand.
213	Mr. N. R. Nadgir, Pleader.	Havery	Havery	3	88 0	Nil	250	120 9 4	99 5 0	219 9 4	2 7 11	Successful.
214	„ G. S. Muktali	Do.	Do.	3	76 0	Nil	250	140 12 8	63 0 0	203 12 8	2 2 2	Do.
215	Do.	Do.	Do.	3	68 0	Nil	275	17 7 4	60 11 0	78 2 4	0 14 3	Do.
216	Mr. S. G. Mahajani, Merchant.	Do.	Do.	3	60 0	Nil	250	10 6 0	51 0 0	61 6 0	1 0-4	Do.
217	„ V. G. Kelkar, Pleader.	Do.	Do.	3	55 0	Nil	250	16 10 0	79 8 0	96 2 0	1 2 4	Do.
218	„ B. Y. Kulkarni	Do.	Hosur	3	8 3	...	...	.....	.....	.....	...	Abandoned at the request of well owner.
219	Do.	Do.	Do.	3	7 0	...	...	.....	.....	.....	...	Do.
220	Navalgand Municipality.	Navalgand	Navalgand	3	5 0	...	...	.....	.....	.....	...	On hand.
<i>Bijapur District.</i>												
221	Campaign work	Bagalkot	Tulsigiri	3	135 6	Nil	300	136 12 0	659 2 0	795 14 0	5 14 0	Successful.
222	Divan Bahadursha Press.	Do.	Bagalkot	3	141 0	Nil	750	29 12 6	107 4 0	137 0 6	0 9 8	Do.
223	Do.	Do.	Do.	3	101 0	750	1,500	27 7 2	100 4 0	127 11 2	0 10 9	Do.
224	Taluka Local Board	Do.	Tulsigiri	3	...	...	...	.....	.....	.....	...	On hand.
225	Sanitary Committee	Havery	Karagi	3	177 0	Nil	240	35 0 6	142 8 0	177 8 6	1 8 6	Successful.
<i>Belgaum District.</i>												
226	Campaign Work	Gokak	Laxmeshwar.	4	117 0	...	...	.....	.....	.....	...	On hand.
227	Do.	Do.	Udgatti	4	101 0	Nil	250	40 0 0	205 7 0	245 7 0	2 8 5	Successful.
<i>Ratnagiri District.</i>												
228	Farm Superintendent	Ratnagiri	Shirgaon	3	62 7	Nil	240	80 11 5	95 0 0	175 11 5	2 12 1	Do.
229	Do.	Do.	Do.	3	50 6	1,500	2,500	20 9 6	40 0 0	60 9 6	1 3 5	Do.
230	Do.	Do.	Do.	3	59 9	2,500	3,500	35 7 9	115 0 0	150 7 9	2 8 2	Do.
231	Do.	Do.	Do.	3	42 0	1,500	2,500	12 1 8	65 0 0	67 1 8	1 9 7	Do.
232	Do.	Do.	Do.	3	42 0	2,500	3,500	5 2 4	20 0 0	25 2 4	0 9 6	Do.
233	Do.	Do.	Do.	3	43 0	Nil	240	6 2 2	25 0 0	31 2 2	0 11 6	Do.
<i>North Kanara.</i>												
234	Rao sahib B. M. Basrur.	Honavar	Honavar	3	202 0	...	...	.....	.....	.....	...	Failure.
235	Do.	Do.	Do.	3	92 0	...	...	.....	.....	.....	...	On hand.
<i>Sholapur District.</i>												
236	Mr. S. S. Kulkarni	Barsi	Yadshi	3	50 0	...	...	.....	.....	.....	...	Failure.
<i>Poona District.</i>												
237	Mr. Anaji Dhondo Patil	Junnar	Junnar	4	45 0	...	...	.....	.....	.....	...	On hand.
<i>Sindh District.</i>												
238	Mauripur Salt work	Karachi	Mauripur	4	93 0	Mishap of tool.
239	Do.	Do.	Do.	4	202 0	Unsuccessful Salt water.

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STATEMENT SHOWING PARTICULARS OF EACH DIVISION IN THE WHOLE
OF THE BOMBAY PRESIDENCY.

No.	Item.	Northern Division.	Central Division.	Southern Division.	Sindh.	Total.
1	Bores made	134	78	25	2	239
2	Successful bores	89	53	16	Nil	158
3	Failures	15	6	2	1	24
4	Incomplete including on hand	16	15	5	1	37
5	Abandoned at well owner's request, mishap of tools or owing to salt water.	14	4	2	Nil	20
6	Total depth bored	9,830' 6"	3,529'	2,226' 7"	294'	15,880' 1"
7	Total cost of successful bores only. (Rupees.)	24,442 2 9	8,909 10 7	2,662 11 9	Nil	31,014 9 1
8	Percentage of success	85.58	89	80	Nil	
9	Average number of working days for each bore.	18	7	15	Nil	
10	Number of accidents took place in the year.	10	15	2	1	28
11	Number of accidents removed	9	11	2	Nil	22
12	Average. Number of feet bored by each machine in 8 months.	446' 9"	352'	316'	Nil	

Note—Northern Division—Includes Ahmedabad, Kaira, Panch Mahals and Broach Districts.

Central Division—Includes Surat, Kanara, Kolaba, Nasik, Ahmednagar, Poona and East and West Khandesh.

Southern Division—Includes Satara, Sholapur, Bijapur, Dharwar, Belgaum, Ratnagiri and North Kanara.

Sindh—Includes all the Districts in Sindh.

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