

Bombay Province

Agriculture Dept.

Annual Report

1940/41

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ANNUAL REPORT OF THE DEPARTMENT OF
AGRICULTURE, BOMBAY PROVINCE
1940-41.

CHAPTER I.

FEATURES OF THE YEAR.

CLIMATE AND RAINFALL.

(1) *The Agricultural Year, 1940-41.*—The agricultural season of 1940-41 may, in general, be considered to have been satisfactory over the greater part of the Province. Judged by the crop acreage and total output of the principal crops, it was better than the preceding year. The monsoon generally proved fairly adequate throughout the greater part of the Province and the distribution of rainfall was also satisfactory on the whole. Accordingly, the total area under cultivation extended beyond the average acreage of the past decennium and, as a result of suitable rainfall and favourable weather-conditions, was associated with a gratifying increase in the total crop yields. The only exceptions were to be found in the northern areas of Gujarat and the south-eastern tracts of the Province where the rainfall, in addition to being inadequate, was irregular and unevenly distributed. Especially in the south-eastern tracts, the effect of this uncertain condition of rainfall was aggravated by other adverse factors, such as, unseasonal late showers accompanied by hail-storms, prevalence of easterly dry winds, incidence of insect pests and plant diseases, etc., and proved detrimental to the satisfactory growth of crops. Such climatic conditions had the effect of reducing considerably the anticipated favourable crop returns in these areas.

A special and unfortunate feature of the year was the occurrence, during October, of a severe cyclone accompanied by heavy rain which caused considerable damage to crops and orchards along the coastal tract of the North Konkan and the South Surat district. At the same time, in the West Khandesh areas, cotton and *rabi* seedlings and, in parts of the Belgaum district, sugarcane, were severely affected by heavy showers and stormy winds. These cyclonic weather conditions hindered the normal progress of field operations in the areas affected. The cyclone was the severest known during the last four or five decades and caused considerable loss of human life and serious and widespread damage to crops and fruit gardens.

(2) *Crop Statistics—Areas.*—Taking all crops together, the total area sown in the Province, during the year under report, showed a slight increase as compared with the similar area in the preceding decennium. The area under rice advanced by 5·9 per cent. over the area of last year but decreased by 0·9 per cent. below the average of the preceding ten years. The wheat area was some 3·9 per cent. and 2·3 per cent. more than the previous year's acreage and the decennial average, respectively. The acreage sown with *jowar* remained almost steady being only 1·4 per cent. and 2 per cent. above the figure of the preceding year and the average of last ten years, respectively. The area under *bajri* showed a reduction of 4 per cent. below the acreage of the preceding year but there was an increase of about 10 per cent. when compared with the decennial average.

The area under groundnut increased by 4·2 per cent. and 42·8 per cent. respectively, over the last year's acreage and the average acreage of the past decennium and reached its maximum figure of 1,579,823 acres. The cotton acreage was 4·4 per cent. and 0·3 per cent. above the area sown during last season and the average of the preceding ten years, respectively. The sugarcane area which has increased considerably during the preceding year, recorded a further increase during the year under report. The total area under this crop was, 1,16,836 acres against 1,00,090 acres in the preceding year or 16·7 per cent. and 62·2 per cent., respectively, above the previous year's acreage and the average of the past decennium. The table below gives the actual acreage in the Province under the more important crops in the year under report, i.e., 1940-41, the preceding year 1939-40 and the average acreage of the decennium 1929-30 to 1938-39 :—

No.	Name of the crop.	Acreage in the Bombay Province.		
		1940-41.	1939-40.	Average of decennium 1929-30 to 1938-39.
		Acres.	Acres.	Acres.
	<i>Cereals</i>			
1	Rice	1,969,891	1,860,474	1,986,651
2	Wheat	1,751,733	1,686,055	1,712,449
3	Jowari	8,155,422	8,041,627	7,992,453
4	Bajri	4,086,925	4,258,227	3,716,805

No.	Name of the crop.	Acreage in the Bombay Province.		
		1940-41.	1939-40.	Average of decennium 1929-30 to 1938-39.
		Acres.	Acres.	Acres.
	<i>Fibres.</i>			
5	Cotton	3,884,652	3,721,799	3,872,955
	<i>Pulses.</i>			
6	Gram	584,874	517,242	661,852
7	Tur	412,958	408,946	398,407
	<i>Oilseeds.</i>			
8	Groundnut	1,579,823	1,515,893	1,106,107
9	Sesamum	161,943	158,253	183,501
10	Linseed	111,956	123,235	125,770
11	Castorseed	41,313	40,526	55,600
	<i>Miscellaneous.</i>			
12	Sugarcane	116,836	100,090	72,041
13'	Tobacco	173,935	183,285	153,087

(3) *Crop statistics—Production.*—In view of the seasonal conditions reported upon above, the increase in the crop acreages was associated with a corresponding increase in the total output of principal crops, thus reflecting the favourable character of the season in the Province. The yield of rice advanced by as much as 20·1 per cent. over the yield of the previous year but went down by 6·3 per cent. below the decennial average. The total estimated outturn of wheat was more by 2·9 per cent. and 3·8 per cent., respectively, than that of the previous year and of the average of the preceding decennium. The corresponding figures of increase in the case of *bajri* were 9·4 per cent. and 10·6 per cent., respectively. The yield of *jowar* was 13·6 per cent. above that of the last year but 8·1 per cent. below the decennial average.

The outturn of groundnut worked out to 20 per cent. and 34·5 per cent., respectively, above last year's figure and the figure of the decennial average. The yield of the cotton crop also was more by 14·9 per cent. and 11 per cent., respectively,

when compared with the yield in the previous year and the average yield of past ten years.

The production of *gul* during the year under report indicated an increase over that of the preceding year and also over the decennial average, respectively, by 18·8 per cent. and 61·3 per cent. as a result of the increase in the acreage under sugarcane.

The table below gives the yields of the more important crops in the Province in the year under report, i.e., 1940-41, the preceding year 1939-40 and the average yield of the decennium 1929-30 to 1938-39 :—

No.	Name of the crop.	Production of crops in the Bombay Province.		
		1940-41.	1939-40.	Average of decennium 1929-30 to 1938-39.
	<i>Cereals.</i>	Tons.	Tons.	Tons.
1	Rice	802,295	668,011	856,516.
2	Wheat	319,491	310,628	307,823
3	Jowari	1,416,840	1,246,769	1,542,022
4	Bajri	522,385	477,620	472,488.
	<i>Fibres.</i>	Bales.	Bales.	Bales.
		(400 lbs.)	(400 lbs.)	(400 lbs.)
5	Cotton	780,496	679,305	703,031
	<i>Pulses.</i>	Tons.	Tons.	Tons.
6	Gram	95,819	77,667	105,040
7	Tur	104,347	99,185	104,580.
	<i>Oilseeds.</i>			
8	Groundnut	659,946	549,827	490,653
9	Sesamum	19,892	14,622	21,174
10	Linseed	11,421	12,316	12,613
11	Castorseed	5,472	4,355	7,356
	<i>Miscellaneous.</i>			
12	Sugarcane (<i>gul</i>)	301,990	254,272	187,169
13	Tobacco	37,216	36,032	33,572

Taking the Province as a whole, there was an appreciable increase in the food crops produced during the year under report as compared with the previous year. As a result, there was a general sufficiency of food and fodder over the greater part of the Province.

(4) *Crop prices.*—The most outstanding feature of the year was the prevalence of considerable fluctuations in the prices of the agricultural produce principally on account of transport difficulties, loss and diminution of overseas markets resulting from the War and speculative activities. Owing to the uncertain international conditions resulting from the continuance of the war, the incidence of price variations on different commodities was uneven. The prices of *jowar* and *bajri* ruled somewhat cheaper but those of rice rose abnormally due mainly to the shortage of Burma rice imports in the market. The price of wheat likewise had an upward tendency but the extended cultivation of groundnut and the transport difficulties for its export were reflected in the reduction of price of the commodity and its bye-products. The actual fluctuations in prices of different agricultural produce between the period of July 1940 to June 1941 at the most important places in the Province are detailed below.

The price of rice at Thana rose from Rs. 5-5-1 per maund in July 1940 to Rs. 5-8-5 per maund in October 1940 and remained steady till March 1941 when there was a spectacular rise to Rs. 6-10-11 per maund and in April 1941 to Rs. 6-14-4 per maund. The price of this commodity reached its highest peak in June 1941 when it ruled at Rs. 7-4-1 per maund. The wheat price at Ahmedabad was at Rs. 4-9-2 per maund in July 1940 but fell to Rs. 4-7-1 per maund during the next two months. Thereafter it rose steadily from Rs. 4-8-1 per maund in October 1940 to Rs. 4-13-7 in January 1941 and with minor variations in the intervening period assumed a sharp upward trend in April 1941 when it reached Rs. 5-2-7 per maund. Subsequently, the price fell steadily and stood at Rs. 4-12-5 per maund in June 1941. The rate of *jowar* at Sholapur showed a decline with some slight intermediate variations during the season. In July 1940, the rate stood at Rs. 2-9-0 per maund and gradually fell to Rs. 2-6-5 per maund in October 1940. It rose to Rs. 2-8-8 per maund in December 1940 but again decreased to Rs. 2-1-11 per maund in March 1941. In June 1941, the price of the commodity stood at Rs. 2-3-11 per maund. Likewise the price of *bajri* at Nasik showed

a persistent decline from Rs. 4-1-11 per maund in July 1940 to Rs. 3-14-11 per maund in August 1940 and to Rs. 3-9-8 in October 1940. It remained steady at that level till February 1941 when it suffered a further set-back and declined to Rs. 3-5-3 per maund and stood at Rs. 3-5-11 per maund in June 1941. The groundnut price at Karad ruled at Rs. 3-4-0 per maund in July 1940 and stood at the same level till February 1941 when it dropped to Rs. 2-12-2 per maund. It rose temporarily to Rs. 2-13-3 per maund in March 1941 but again declined and continued to rule about Rs. 2-11-9 per maund from April 1941 onwards.

The price of Broach cotton ruling in Bombay indicated a distinct upward trend and there was a sharp rise in the rate during the year under report. The price stood at Rs. 178 per *khandi* (784 lbs.) in August 1940 and rose to Rs. 183 in September 1940. It was quoted at Rs. 206 per *khandi* in February 1941. The sharp upward trend continued and the price reached Rs. 282 per *khandi* in May 1941. The quotation, however, declined in June 1941 and was ruling at Rs. 256 per *khandi* in July 1941.

The year under report was marked by a phenomenal fall in the price of *gul*. The price continued more or less steady till December 1940 but from January 1941 onwards exhibited a sharp decline and reached very low levels in April 1941. At Poona, the average harvest price of *gul* declined from Rs. 4-11-0 per maund in 1940 to Rs. 3-5-0 per maund, i.e., a drop of as much as 29 per cent. below the price of the previous year. The reduction in the price may be attributed to the very large increase in the acreage of sugarcane and in the output of *gul* in India as a whole in 1940-41.

(5) During the year under report, no important new legislative measures connected with agriculture were enacted in the Bombay Province. An additional protected area, known as Mahi-Sabarmati Zone, was notified by the Provincial Government under the Cotton Transport Act, 1923. Government also amended the Bombay Cotton Ginning and Pressing Factories Rules, 1925, by the addition of a provision whereby managers of Ginning Factories are required to submit to the prescribed authorities a monthly return under sub-section (1) of section 5 of the Bombay Cotton Ginning and Pressing Factories Act, 1925, in which the amount of cotton ginned each month is to be given in *bojas* and lbs.

CHAPTER II.

AGRICULTURAL RESEARCH.

(6) *Introduction.*—Considerable progress can be recorded during the year under report in many of the important scientific research activities which are being carried out by the staff of the Agricultural Department in the Province. This progress is not only confined to existing schemes of experimentation on crop and live-stock improvement, and other scientific research work in progress, but is indicated by the numerous developments of new research schemes designed to remove the difficulties and add to the profits of the cultivators. As reported in last year's Report, such research work is now being reviewed periodically by departmental committees of expert officers presided over by the Director of Agriculture. This system has proved of the very greatest assistance in the guidance of research workers in different parts of the Province and, more particularly, in securing effective co-ordination between scientific research work on the same and allied subjects. These departmental committees deal with (a) insect pests and plant diseases, (b) fodder and livestock, (c) fruit and vegetables, (d) plant breeding and (e) land development and agronomy and, in all, 18 meetings were held during the year under report. No meeting of the Provincial Board of Agricultural Research was held during the year but several research schemes were circulated to the members for opinion.

(7) In this Chapter of the Annual Report, a very brief review of the main results of the scientific research work conducted by the staff of the Agricultural Department is given. More detailed accounts of this work will be found in the Appendices to the Report. As in previous years, scientific research work in the Province was considerably assisted by generous grants made by the Imperial Council of Agricultural Research, the Indian Central Cotton Committee and the Trustees of the Sir Sassoon David Trust Fund, Bombay, which bodies are always ready to assist in the promotion of agricultural research through the medium of approved schemes. Reference to the schemes financed wholly or partly by such bodies is made whenever such schemes are reported upon in the Report. The first Section of this Chapter deals with major fundamental research, connected mainly with soil and irrigation problems and centred

at the Sugarcane Research Station, Bombay-Deccan, Padegaon, and at the Dry Farming Research Station, Sholapur and Bijapur. Other sections deal briefly with the improvement of crops in all its aspects, livestock research work, horticultural research, investigations into the prevention and control of insect pests and plant diseases and miscellaneous research work, including agricultural engineering, etc. A brief account is given of new research schemes sanctioned by contributing bodies during the year, in some of which work has already been commenced.

SECTION A.

SOIL AND IRRIGATION RESEARCH.

A. *The Bombay-Deccan Sugarcane Research Scheme, Padegaon.*

(8) This scheme, which is financed jointly by the Provincial Government and the Imperial Council of Agricultural Research, has been extended for a further period of two years from June 1940. The year under report is the first year of this extension. The object of the scheme is to secure higher and more economical yields of sugarcane under canal irrigation in the Bombay-Deccan and scientific research work is being carried on in three main directions, viz., soil management, sugarcane physiology and improved cultural methods, including trial of new cane varieties. In the Soil Physics Section, progress has been made in the studies on soil genetics, soil fertility and alkali soils. Completion of the soil type identification on the Godavari Left Bank Canal has revealed the common occurrence of a new soil type termed "J". Studies on the association of soil types in the farm area have shown that the soil types F, A, B and "degraded" B are closely inter-related genetically. A critical examination of the yield data under continuous cane; and under cane in rotation at the farm, indicates a lower response of certain soil types, e.g., "F" type, to rotation and manuring when compared with other soil types, e.g., "B" type. No appreciable deterioration in soil condition was found after one cane cropping with heavy doses of manure and water. Lysimeter studies with cane showed an increase of desirable exchangeable bases in all soil types excepting "F". As a result of surveys of alkali soils on the Nira and Pravara Canals, it is now possible to ascribe specific conditions of soil formation resulting in different soil types. Tests with reclaimed soils showed the higher availability of nutrient materials in fully reclaimed soils when compared with partially reclaimed or unreclaimed soils.

The work of the Crop Physiology Section includes investigation of such problems as the varying climatic and environmental conditions on the development of different cane varieties in the field and on the water and manurial requirements of cane. While climatic factors, during the year under report, were favourable from the standpoint of growth, they proved adverse during the maturity stage and, as a result, the sucrose content was low. Pot culture studies have shown the value

of rain water to be three times that of irrigational water during the growth period of the crop. It has been further found that the presence of soil moisture above 40 per cent. is not conducive to good growth. Continuation of studies on the water requirements of cane has confirmed the close relationship between water and manure applications during the second year of experimentation. Three new systems of irrigational technique, devised with the object of effecting economy in irrigational water, have completed their second year under trial and one of them is showing good promise. Biochemical research into mineral nutrition of the cane crop indicates the greater influence of potash over phosphate on increasing cane tonnages and also, to a certain extent, on improving sucrose content. Application of all nitrogenous top dressings in the form of sulphate of ammonia alone, leads to less availability of phosphate and also reduces the p^H of the soil. Studies in minor elements are in progress with different cane varieties and on differing soil types. Such minor problems as the utilisation of trash for manuring, variation in seed rate and modifications in the practice of "earthing up" have also received attention.

In the Agricultural Management Section, field experiments on varied irrigation and manurial techniques for cane growing have completed the second year of trial. The relative importance of compost, cake and inorganic manures as sources of N. P. K. in cane cultivation, the optimum proportions of applications of these three types of manures and their relation to total irrigation and distribution of irrigation applications are under investigation. Among the nitrogenous top-dressings, progressively higher yields of cane were secured with increasing quantities up to 375 lbs. N per acre but, from the standpoint of sugar formation, quantities above 300 lbs. N are not found economical. Varietal trials of sugarcane, which were continued as usual during the year, confirmed previous results on the promising behaviour of Co. 428 and Co. 443 which were found to be next best to Co. 419. These varieties have been given out for trials with two of the sugar factories in order to secure data regarding their mill tests. Trials on the periodical planting of some promising varieties, which have completed a three years' cycle, have shown the July planting to be significantly better than October planting which, in turn, is superior to January planting. Among other varieties, Cos. 408, 413 and 419 proved superior to Cos. 360 and 409. In *chopan* soil, Cos. 426 and 443 are found to be next best to Co. 419.

The scheme for the regional survey of borer pests of sugarcane was continued in accordance with the all-India programme of investigation. Top shoot borers (*Scirpophaga monostigma* and *Scirpophaga nivella*), not found previously in the Bombay-Deccan, were observed on Co. 419 and POJ 2878 in certain areas on the Nira Canals. These insects appear to be increasing in numbers and may develop into a major pest in the Deccan cane tracts. Three new schemes were started during the year under report. The first of these schemes is financed by the Imperial Council of Agricultural Research and is designed to study the water requirement of crops other than sugarcane. Twelve such crops were under investigation during the year and the results showed that an increased number of waterings above those normally given have been beneficial in the case of fodder crops as also onion, wheat and gram. The other two schemes, viz., (1) the genetic soil survey scheme and (2) the establishment of five cane research sub-stations in different areas and on different soil types in the Deccan Canal tract, are financed by the Government of India from the Sugar Excise Fund. This latter scheme is meant to test the improved cane varieties and the applicability of improved methods of irrigation and manuring, evolved at the main Sugarcane Research Scheme, Padegaon, on other soil types. In the genetic soil survey scheme, attempts are being made to simplify methods of soil survey in large scale soil survey and soil classification work and this work is being worked out on two factory estates. The current year's work has indicated reasonable possibilities of simplifying soil survey and classification work both in the direction of minimising the number of soil samples and of reducing the determinations of soil constants.

B. *The Bombay Dry Farming Research Scheme, Sholapur and Bijapur.*

(9) The year under report was the eighth year of the sanctioned period of the scheme for scientific research into the problems of crop production in scarcity or famine areas of the Bombay-Deccan. This scheme is financed jointly by the Imperial Council of Agricultural Research and the Provincial Government. The agricultural season at Sholapur proved to be exceptionally favourable for *rabi* crops but only fair for *kharif* crops. The total annual rainfall amounted to 27.35 inches, which is nearly normal for Sholapur. At Bijapur, the season was the worst in the history of the Research Station. The total rainfall amounted to only 13.16 inches, which was 57 per cent. of the average normal precipitation.

Periodic soil-moisture determinations at Sholapur showed that the adoption of the "Bombay Dry Farming Method" resulted in the conservation of more moisture in the soil than the "Cultivators' Method" during the *rabi* season. At Bijapur, soil moisture was found to be inadequate in deep black and medium black soils under both methods of cultivation. However, in an area of deep black soil, which was kept fallow in the previous season, there was just sufficient moisture to support a good crop of *rabi* jowar in spite of the extremely low rainfall of the season. The loss of rain-water by run-off at Sholapur varied from 4.5" to 7.8" under different plot treatments. The loss by underground drainage determined at 5.4" from a cropped lysimeter and 14.5" from an uncropped lysimeter at Sholapur. The loss of silt by erosion at Sholapur varied from 3.4 tons to 27.7 tons per acre under different plot treatments. At Bijapur, there was practically no loss of rain-water either by run-off or underground drainage. The water requirement of *rabi* jowar was determined on three different types of soil, two from Bijapur and one from Sholapur. Jowar plants grown in the deep black soil of Bijapur showed a higher water requirement than when grown in the limy soil of Bijapur or in the medium deep soil of Sholapur. The addition of farm-yard manure to the two Bijapur soils lowered the water-requirement of the jowar crop. Properly vernalised seeds of jowar showed no appreciable earliness in maturity when grown at Sholapur on randomised and replicated experimental plots.

At Sholapur, the "Bombay Dry Farming Method", when tried on a field consisting of deep and medium deep soils, gave 498 lbs. of jowar grain and 889 lbs. of straw per acre as compared to the "Cultivators' Method" which yielded 200 lbs. of grain and 393 lbs. of straw per acre. At Bijapur, the "Bombay Dry Farming Method" when tested on a field scale gave 189 lbs. of jowar grain and 402 lbs. of straw per acre. The "Cultivators' Method", under similar conditions, yielded only 102 lbs. of grain and 255 lbs. of straw per acre. The most outstanding result of the year at Bijapur, was the jowar crop obtained from a plot fallowed in the previous year. An acre of land consisting of deep black soil was kept as a clean fallow during the season of 1939-40, and was sown with *rabi* jowar in 1940-41. The yield from this plot was 667 lbs. of jowar grain and 869 lbs. of straw, indicating that the practice of fallowing is an insurance against famine or partial crop failure in a succeeding year of exceptionally low rainfall.

SECTION B.

THE IMPROVEMENT OF CROPS.

A. COTTON.

(10) *Gujarat*.—The work of cotton crop improvement in Gujarat is centred at Government Research Stations at Surat, Broach and Viramgam and is directed towards the production of better strains of cotton, which will yield more monetary returns per acre to the cotton-growers in the important cotton-growing tracts of Gujarat. This important research work is mainly designed towards the evolution of cotton varieties with increased outturns, higher ginning percentage, better quality staple, i.e., superior spinning performance and increased resistance to plant diseases and insect pests than the local varieties. The research activities are supplemented at all the above-mentioned centres by organised schemes for the multiplication and extension of the seed of the improved varieties in the districts.

(11) At Surat, research work with the main object of producing an improved cotton variety which will possess the highly valued fibre qualities of the existing improved type 1027 A.L.F. and which, at the same time, will excel that improved variety in yield and ginning percentage, was continued. This is a most pressing problem as a variety named 1A. Long Boll has, for many years past, been a serious competitor of 1027 A.L.F. on account of its high ginning percentage although it is definitely inferior in lint quality. One improved strain known as Seg. 8-1 (which is somewhat less silky than 1027 A.L.F.) represents the nearest approach to the desired improvement and is now being tested on cultivators' fields in comparison with 1027 A.L.F. In the coming season, it will also be grown on a fairly large area in the district in order to obtain sufficient quantities of lint for mill tests and thus to obtain further information about its quality from the trade point of view. One special merit of this improved strain is that it is highly resistant to wilt disease whereas both 1027 A.L.F. and 1A. Long Boll are highly susceptible. Further scientific work, both by selection and hybridization, is being carried on with a view to evolve types possessing the best possible combination of economic characters required for the tract. Work on breeding wilt-resistant types of cotton is also in progress at Shera near Ankleshwar.

(12) The Broach Cotton Breeding Scheme, which is financed by the Indian Central Cotton Committee, is now in its ninth

season. The main object of this research work is to evolve a highly wilt resistant (free from mortality and partial wilt), high ginning (40%), high spinning (above 30's) and better yielding type of cotton to replace the inferior quality (spinning only 15's), wilt susceptible but high ginning (40%) Broach local cotton—commercially known as Kanvi—now being cultivated over eight lakhs of acres in the Nerbudda-Mahi Zone of the Broach tract. Several segregates with the combination of ginning 40 to 43 per cent., spinning 34 to 39's and high resistance to wilt, from straight and back crosses between the highly wilt resistant, high spinning (40's) but low ginning (33 per cent.) strain B.D. 8 and some high ginning types lacking in resistance to wilt and high spinning qualities, were isolated in 1936-37, certain of these segregates have been under continuous replication trials on the farm since 1937-38. During the year under review, seven segregates, viz., 76-1, 76-12, 1-2, 1-6, 5-18, 7-29 and 3-1, along with checks Broach Local and B.D. 8, were under trial on the farm; while segregates 76-1, 1-2 and 1-6, along with the two checks, were tried for the first time at four representative centres (three in black and one in *gorat* soils) of the Broach and Panch Mahals district. This year, local out-yielded all the segregates and B.D. 8 both at the farm and the district trials. The season, however, was highly abnormal and the yields were much below normal. Heavy rains accompanied by wind storms in the third week of October and untimely showers in November caused widespread lodging of plants and shedding of flower buds. The yield results of this season, therefore, cannot be considered as indicative of the intrinsic yielding capacity of the segregates, for the occurrence of such an abnormal weather, particularly in the flowering period, is rare in the Broach and Panch Mahals district. Comparative spinning tests of the segregates 1-2, 1-6, B.D. 8 and Broach Local were also carried out and segregates 1-2, 1-6 and B.D. 8 were found much superior to Broach Local in spinning performance under mill conditions. The average farm results of the past four seasons show that segregates 76-1, 1-2, 1-6 and 5-18 are most promising though they do not show any significant difference with the local in respect of yield of seed-cotton per acre. The trials will be continued.

(13) At Viramgam, scientific botanical improvement is being carried on with the financial assistance of the Indian Central Cotton Committee under the Wagad Cotton Breeding Research Scheme. The object of this work is to improve upon the existing Dholleras Wagad cotton with regard to (a) yield and quality and (b) earliness in maturity, so as to minimise risk

of loss from frost damage and to enable the replacement of the early local Mathio cotton with Wagad types. The season was a very dry one and botanical selection among local Wagad varieties and the crosses under study was continued under un-irrigated conditions. The results under such conditions were disappointing. S. 89, which was found promising under irrigation last year, gave this year a significantly lower yield with a spinning value of only 12's against 10's and 11's of local and of Wagad 8, respectively. However, S. 305 gave 14's even under dry conditions. It is proposed to try these promising selections in the high rainfall tract of Dholka where they will have a better chance to develop their inherent characters. The establishment of a small sub-station at Dholka for such work is essential to further progress in the Dholka tract. As a result of replicated progeny row tests, it has been ascertained that certain selections and segregates from crosses are still capable of further improvement in ginning percentage. Some of the selections from Kutch, etc., were placed under replicated progeny row tests for further critical selection. Crosses with Persian and Russian cottons were carried a stage further during the year under report.

(14) *Khandesh*.—The Khandesh Cotton Breeding Research Scheme has now completed the fourth year of its five year extension period. The object of this work is to improve upon the existing Jarila Cotton with regard to (1) ginning percentage, (2) yield, and (3) high wilt resistance. Work in the direction of further selection in "Dokras" cotton has given 18 cultures, of which four are showing marked superiority over Jarila in ginning percentage and are equal to it in respect of yield and staple quality. Their wilt resistance yet remains to be tested. The composite cross [(Jarila \times N.R. 5) \times New Million Dollar] F2 has given segregates with 4 to 8 per cent. higher ginning values than Jarila and with high wilt resistance. The study of the cross (Jarila \times N.R. 5) now in F3 and that of Jarila \times New Million Dollar, back-crossed to Jarila and now in the F1 generation, is being continued. The study of these crosses is being carried on in collaboration with the Plant Pathologist to Government.

(15) *Southern Division*.—Scientific work towards the improvement in the Kumpta and Dharwar-American cotton crops is carried on at the Government Cotton Breeding Station, Dharwar. The object of the work is to isolate superior types of cotton to replace Jayawant and Gadag No. 1 in the Bombay-Karnatak and to yield higher profits to the cotton-growers of

this tract. During the year under report, trials of the promising segregates, viz., New Jayawant and Early Jayawant, were continued ; they gave increased outturns of 5 per cent. over Jayawant. A new and highly wilt resistant strain, viz., K.F.T. 12-2-5, was also added in these trials and promises well. Fresh hybridization work was carried out among selected material and promising cultures combining high yield, high ginning percentage, good staple and wilt resistance have been isolated. These cultures will be tested further in the next season. In addition, back crosses were carried out among existing hybrid strains in order to endeavour to accentuate desirable economic characters in later progenies. The study of wilt resistance in the cottons of the Southern Division was continued both in the glass-house and in wilt-infected plots at the Dharwar Station. With regard to American cottons, the segregates 4-4-1-1-3 and 9-7-4-6-5 were put under trial both at Dharwar and at Gadag and further work in this direction is being continued. At Gadag, the last named segregate gave 10·9 per cent. higher yield than Gadag No. 1. A scheme for the establishment of a breeding sub-station at Gadag for work on American cottons was prepared and submitted to the Indian Central Cotton Committee as it has been found that climatic and environmental conditions at Dharwar are unsuitable for the growth of American cotton varieties.

(16) *Miscellaneous.*—Work on the evolution of 100 per cent. wilt-resistant strains of cotton is being carried out under the Cotton Wilt Breeding Scheme at Poona. The Plant Pathologist to Government has succeeded in isolating homozygous wilt-resistant types in B.D. 8 and the Broach back-cross. Fundamental research work on the mole of inheritance of resistance to wilt in *Gossypium herbaceum* and *G. arboreum* var. *neglectum* has also been done.

(17) Research work, under the scheme for Inter-specific Hybridization in Cotton at Surat, financed by grants from the funds of the Indian Central Cotton Committee, aims at exploring the possibilities of combining the superior quality of American cottons with the hardiness, adaptability and disease resistance of Asiatic cottons. It is difficult to cross these two groups of cotton and, previously, the rare hybrids, if obtained, were generally self-sterile. However, fertility has been induced by back-crossing to American parents and selections are being made from the succeeding generations of the back-crosses. It has also been possible to induce fertility by treating

the sterile hybrids with the alkaloid, colchicine. A variety of combinations have been created and efforts are directed towards synthesizing new forms from species crosses.

(18) Various experiments on improved methods of cotton cultivation and agronomy were carried out at all Government Farms and Research Stations in the cotton-growing tracts. The items included in such work were, in general, decided at local conferences of cotton research workers and, in all cases, the experimental work was devised with particular consideration to the main problems of the local cotton-growers. The results of such experiments are given in detail in the Appendices to this Report submitted by the territorial Deputy Directors of Agriculture.

B. RICE.

(19) In all the main rice-growing tracts of the Province, scientific work on the improvement of the local rice crops is being conducted at Rice Breeding Stations. The main Stations are situated at Karjat, for the rices of the Kolaba and Thana districts, at Mugad for the rice crops of the Southern Maratha Country and at the Government Farms, Kumpta and Ratnagiri, for the rices of the Konkan coastal areas. A Rice Research Station for Gujarat is required in order to complete the necessary facilities for scientific work on this important food crop in all divisions of the Province. The main object of rice improvement work is the evolution of high yielding strains suitable for local conditions in order to increase as far as possible the production of rice in the Province so as to reduce the need for large imports of this commodity which are at present required to meet the demands of internal consumption.

(20) *Karjat*.—Selection work in Zinya, Kolamba, Bhadas, Kada, Jirbuti, Mahadi, etc., was continued. The three best selections from Bhadas have now reached the district trial stage which will be undertaken from next year. Two new synthetic mid-late strains from a cross of Zinya and Kolamba have now been isolated and found to give consistently better yields than K-540. They are better also in quality than K-540. District trials of one of them will be commenced next season. A consistently higher yielding strain from the Sutarsal variety of Gujarat has been evolved and will be tested in the district next year. Repeated selections from coarser varieties of Thana, such as, Kada and Jirbuti, have not shown much promise, hence hybridization of these varieties has been undertaken. Selections from a number of coarse varieties from Kolaba have been made. Agronomic experiments were continued and it was found that 12 and 16 seedlings per bunch gave significantly higher yields than other numbers. This is

contrary to results of the previous year when no difference in any of the treatments was found.

Vadgaon.—The sub-station under Karjat commenced working from this season and its main work is to improve scented varieties. Selections from scented varieties obtained at Karjat were transferred for further comparisons here. A large number of plants from Ambemohor and Chimansal were grown during the season and selections for further study have been made. This being the first year of the station, damage from crabs was very serious.

(21) *Mugad.*—On the basis of the last five years' results, only the three most promising Dodagya selections, viz., 5-1-1, 6-2-2 and 6-2-3, were again tested in replicated field experiments against the local Dodagya variety of paddy at the Mugad Rice Breeding Station in the Dharwar district. Strains Nos. 6-2-2 and 6-2-3 were tried against local Dodagya, for the first time, in cultivators' fields in three typical "Mallad" villages. Both on the Mugad Farm and in the district, strain No. 6-2-2 has given the best yields. The strain 6-2-2 will now be tested against local Dodagya rices in twenty-five villages of the "Mallad" tract. Six new selections from Dodagya were tested for yield on a field scale for the first time and strains Nos. 89-7 and 97-1 gave better yields than strain 6-2-2. Two late selections from Antersal were tried against A. 200 for yield and non-chaff-formation. A. 176 is distinctly non-chaffy but shows no superiority in yield. The trial will be repeated. The best of the early, mid-late, late and very late selections from local fine rices were brought under replicated field trials for the first time. Certain of these selections hold out a good promise for the future. All these selections will be continued for similar work next season. Hybridization work was confined to crosses designed to evolve early, mid-late and late rice varieties with desirable economic characters and a purple colour of stem and leaf, so as to facilitate the roguing out wild rices from the rice fields to combine high yield with scent and to evolve better quality, drought-resistant types suited to high lands and scanty rain-fall conditions. The work of evolving suitable varieties with purple leaf and stem is in the preliminary stage. Out of four crosses made with the object of combining scent and yield with fineness, which were grown in F₂ during the year under report, Luchai × P.R. 90 and T. 24 × P.R. 90 show good promise and will be grown in the F₃ generation next season.

(22) *Kumpta and Ratnagiri.*—At the Government Farm, Kumpta, numerous selections among the local varieties of rice in the Ankola-Karwar tract were studied and the most promising retained for further investigation. Yield trials of improved

strains of Upghat White Halga and Muginbeldu rices were carried out and hybridization work was done with the object of combining the high yielding character of Mugad strains with the best strains of improved Kumpta Farm rices. At Ratnagiri, village trials of improved Varangal and Waksal strains were continued in the second year, and, having proved again superior to the local varieties in outturn, they will be released for general distribution next season after three years' trials have been completed.

C. WHEAT.

(23) Further progress was made in the improvement of dry wheats at the Cereal Breeding Station, Niphad, which is the only place in the Province where genetic improvement of this important cereal is being done. Trials on the Farm and in the district confirmed the superiority of Niphad-81 (formerly B.G. 8-1) over the local variety and the synthetic strain, Bansipalli-808. A very high quality strain, Baxi-31, for dry conditions, has been evolved. This strain has out-yielded Bansipalli-808, but yields somewhat lower than Niphad-81. Its grain, however, is as lustrous as the famous Parner-Baxi. An exceptionally large grained wheat from a Polish-Bansipalli cross is under trial. A large amount of varied material will be subjected to stem rust next season to evolve resistant varieties. It is gratifying to note that a strain, Niphad-4, *better than Pusa-4*, has been evolved. This strain is not only higher yielding but has the added advantage of awnedness and non-shedding habit of grain. District trials of this wheat will be commenced from next year. It should be noted here, *en-passant*, that large quantities of Pusa wheats are imported every year in Bombay because no irrigated improved wheat has been locally evolved. An improved local variety will curtail importation of such costly seed. Irrigated wheat is grown all over the Province and expansion of work on such wheats is very urgently needed. This work will be undertaken when further facilities at the Cereal Breeding Station are provided for work on irrigated wheats.

(24) Work under the Scheme for testing rust reactions of wheat varieties could not be undertaken during the year as the officer appointed by Government was not able to take up his duties. The construction of the glasshouses at Mahableshwar and Poona has been completed and arrangements for the supply of water to the Mahableshwar Centre have also been made. Work will commence next *rabi* season.

D. OTHER CEREALS.

(25) Genetic improvement of *bajri* was continued at the Cereal Breeding Station, Niphad. It has been definitely proved that crops from hybrid seed produce more yields than inbreds. Mass-selected material appears very promising. The work at the Station has reached a stage when a sub-station for testing strains under other environmental conditions in the main *bajri* growing tract at Akola is desirable.

At Nadiad, selection work among the local *bajri* varieties has given results of economic importance. Certain sub-selections from the original selection 207 have given up to 29 per cent. statistically significant higher yields of grain and more straw than the local variety with two irrigations necessitated by shortage of rainfall. In the tract, this selection is now appreciated as yielding decidedly higher than the local and for its earlier maturing character.

Schemes for the seed multiplication and distribution of the improved variety B 207 are now being organised throughout the neighbouring tract.

At Viramgam, in spite of the abnormally dry season, *jowar* breeding work was carried a stage further. The early selection 10-2 gave the highest grain yield, but the late types practically failed to set seeds. As this selection is the earliest to ripen and has superior fodder, it is being tried in the district in comparison with an early local variety, viz., Utavali. This selection, if successful, should give greater profits per acre to the growers. Further fresh selections were done during the year.

E. TOBACCO.

(26) The main centres for scientific work on the improvement of the tobacco crop in the Province are at Nadiad, for the tobacco crops of Gujarat and at Nipani, for the improvement of the tobacco varieties grown over a considerable area in the Southern Maratha Country. The main lines of work consist of the evolution of high-yielding and superior quality strains from local varieties, the devising of improved methods of tillage, manuring and rotational cropping to effect improvement in yield and quality of the crop, seed multiplication of superior types and scientific work on the introduction, cultivation and curing of cigarette tobacco varieties.

(27). *Nadiad*.—The improved Keliu selections, Nos. 49 and 24, when compared with local under replicated trials, gave a

statistically significant result of 8 per cent. higher yield in favour of Keliu No. 49. Under dry conditions in the district, to which it is suited, this selection has been yielding 12-15 per cent. higher than the local variety. It has a comparatively longer leaf, better "spangle" development and stronger smoking quality than the local and, for these reasons, it is much appreciated by the public. Selection in the Saijpuria variety, has resulted in some cultures that promise higher yield than the local material. The results previously recorded with regard to cigarette tobacco varieties were confirmed for the third year but cigarette tobacco production on the farm is not proving successful on account of the accumulation of sodium salts in the soil resulting from the excessive use of well water for irrigation on account of the deficiency of rainfall in the past few years. This water contains an excessive percentage of such injurious alkaline salts. Experimental work on the control of "damping off" of seedlings in tobacco seed beds was continued and the results obtained will be confirmed in following years. Schemes for seed multiplication and distribution of the improved selection K. 49 are being organised in the tract for which this improved type has been found suitable.

(28) *Nipani*.—The ten selections from Surti, Baglani and Bhopli varieties, which were reported upon last year, were studied during the year under report for their purity and botanical characters. Two of these No. 3 and No. 12 were tried in yield tests along with the local but were not found to be significantly superior. Six are retained for further study and purification. The thirty-seven fresh selections made from various samples of the local crops grown on the Station, as reported last year, were studied during the year under report for their purity and botanical characters. Of these eighteen have been retained for further study. Fifteen individual plant selections from cultivators' fields were similarly studied and eight retained for further study. The Surti variety is the most important variety of the tract and further selection work will be concentrated on this variety. No work could be done on cigarette tobacco as the curing barn has not yet been constructed. It is expected that a new site for tobacco research work in this tract will be acquired at Soundalagi during 1941-42 when a barn will be constructed and work on cigarette tobacco carried out intensively. Three cigarette tobacco varieties Bonanza, Gold Dollar and Harrison Special, however, were studied for their general performance under Nipani conditions.

F. OTHER CROPS.

(29) *Linseed*.—During the third year of the extension period of the Linseed Breeding Scheme, financed by the Sir Sassoon David Trust Fund, replicated yield trials of the best 18 selections made in 1937-38 were again repeated. The results, as in the case of the previous year, were significantly in favour of three selected strains of the Nasik type. The Deccan types maintained their superiority. The Karnatak strains have not shown any significant increase over the local. Further attempts are being made to obtain superior strains from the Karnatak types. Hybridization work has yielded some good selections which combine high yield and high oil percentage. The work of purification of the selected strains is progressing.

(30) *Castor*.—At Nadiad, the improved castor selection, S-20, has been found to be quite pure for all the important economic characters and is maintaining its superiority over the local varieties in yield and oil percentage. This improved selection is now spreading throughout the tract. Further selections are still under study.

(31) *Other Oil Seeds*.—The Oil-seed Breeding Scheme, financed by the Sir Sassoon David Trust Fund, has now completed three years' working. Further work on the selection and purification of promising material in sesamum, niger and safflower was continued. The number of individual plants retained for further studies were 54 in sesamum, 44 in niger and 53 in safflower. Promising strains among these for yield, earliness and high oil percentage will be selected for purification. Under the Crop Botanist to Government, scientific work towards the genetic improvement of *til* and safflower was continued at Niphad. From both these crops, two outstanding strains, which have consistently given better yields than local varieties, are now ready for district trials which will be commenced from next season.

(32) *Gram*.—District trials of Niphad-816 were continued during the season and this improved strain has proved eminently suitable for Nasik district. Further trials in this tract will be continued. The strain is likely to be suitable for the Ahmednagar and Poona districts also. Selection in Khandesh gram is being done and Selection N-816 has bigger and more attractive colour of grain than the local varieties.

(33) *Tur*.—Improvement in this important pulse crop is also being done at the Cereal Breeding Station, Niphad, under

the Crop Botanist to Government. A high yielding strain, T-84, has now reached a stage when district trials are necessary. It is being multiplied for this purpose.

(34) *Potatoes*.—*Varietal trials of Indian potatoes*.—Owing to the complete cessation of supplies of seed potatoes from Italy, eight varieties of Indian-grown potatoes were tested for their suitability for general cultivation in the potato-growing tracts of the Poona district. Trials were laid out on the randomised block design at three different centres of potato cultivation. The *Numbri* and *Sitbo* varieties of potatoes (both "Up-to-date" varieties) were the most successful both from the point of view of yield and of suitability of type, e.g., shape, size, etc. These varieties have excellent flavour on cooking, but they do not possess the same firmness after cooking as is shown by the Italian potatoes. The *Numbri* variety is largely grown in the Simla hills and *Sitbo* in Shan States in Burma.

(35) *Sugarcane*.—The main scientific work on sugarcane in the Province is carried out at Padegaon under the Sugarcane Research Scheme, Bombay-Deccan. At this centre, botanical work on the cane crop is not done but new varieties of improved cane, obtained from other parts of India, notably, Coimbatore, are rigidly tested to ascertain their respective suitability for different types of cane cultivation, e.g., plant, adsali and ratoon, under the Deccan conditions. Two varieties—Cos. 428 and 443—which were found to be promising were given out for trials on the estates of two sugar factories in order to secure their mill data. Investigations on the water and manurial requirements of sugarcane, cultural methods and rotational crops are in progress at Padegaon with a view to secure higher and economical yields. During this year, work has been also commenced on five sub-stations established on different soil types in order to test the improved varieties and the applicability of methods of irrigation and manuring evolved at Padegaon to these soil types. The Government Farm, Kopergaon, forms one of these sub-stations and its programme of work has been modified accordingly.

(36) *Groundnut*.—Trials of six groundnut varieties supplied by the Oilseeds Specialist, Coimbatore, were made both at Jalgaon and Kopergaon Farms. These were compared with Spanish Peanut and K. 1, respectively. This is the third year of this experiment. As none of the strains have shown consistent and all round superiority over the local, their trials will now be discontinued. The area under this crop, which had increased considerably in Khandesh, is likely to be

reduced owing to the low price prevailing for groundnut oil and cake. In the Southern Division, varietal trials of different groundnut varieties were continued at the Dharwar Farm and spacing experiments with the Spanish Peanut variety were carried out.

G. GRAZING AND FODDER CROPS.

(37) The large scale experiment on rotational grazing, financed by the Sir Sassoon David Trust Fund, was concluded during the year. A detailed report of the work is being prepared for submission to the Trustees. Work on the acclimatisation of exotic grasses and legumes continues. It is also proposed to make a collection of suitable indigenous legumes for introduction in the grasslands of the Province.

(38) *Provincial and District Fodder and Grazing Committees.* District Fodder and Grazing Committees have now been established in all districts, except Sholapur. The work of the Thana District Fodder and Grazing Committee has been transferred to the District Rural Development Board since the personnel of the two committees were practically the same. Many of the District Committees have met and considered questions dealing with fodder and grazing problems in their respective districts and, in some districts, schemes for fodder and grazing land improvement have been framed. There has been no meeting of the Provincial Fodder and Grazing Committee since June 1940.

SECTION C.

LIVESTOCK RESEARCH WORK.

(39) *Cattle.*—Scientific research work on the improvement of the cattle breeds of the Province is carried out by the Livestock Expert to Government at Government Cattle Breeding Farms at (1) Bankapur and (2) Tagur both in the Dharwar district. The Northcote Cattle Breeding Farm, Chharodi, Gujarat, where work on the Kankrej breed of cattle has been in progress since the year 1917, was handed over to the Institute of Agriculture, Animal Husbandry and Dairying, Anand, Gujarat, from 1st April 1940.

At the Bankapur Cattle Breeding Farm, Dharwar district, the herd of Amrit Mahal cattle maintained there have now reached a high standard with regard to early maturity, regularity and calving and types adherence as the result of the breeding policy followed in the past. During the year under

report, Government have sanctioned the reorganisation of this farm and its utilisation for the establishment of a nucleus centre for breeding herds of pure Amrit Mahal and Gir cattle, not exceeding 60 animals of each breed. Arrangements for obtaining foundation stock of Gir cattle from the Bombay Gowrakshak Mandali are in progress since no Gir cattle can be procured from Kathiawar, the home of the breed.

The foundation stocks of the Dangi and the Nimari breeds for the Tegur Cattle Breeding Farm in the Dharwar district were purchased during the year. The main object of the scientific work at this Farm is the production of suitable dual purpose cattle, particularly for the Konkan division.

Work on the scientific improvement of the valuable Gir breed of dairy cattle was continued by the authorities of the Bombay Gowrakshak Mandali in cooperation with the Livestock Expert to Government. Similar work is being done with the same breed at the Nathu Lalji Charity Trust Fund Gowshala, Mulund, which obtained valuable awards for their Gir cattle at the 4th All-India Cattle Show, Delhi. The Livestock Expert to Government is also associated with the work done by the Taluka Development Associations of Jalgaon and Jamner in the East Khandesh district at their cattle farms at Pimple and Gangapuri, respectively, where scientific breeding of the Nimar breed of cattle is being undertaken.

(40) *Sheep—Sheep Breeding Research Scheme, Bombay—Deccan, Bhamburda, Poona.*—This is a ten-year scheme financed partly by the Imperial Council of Agricultural Research and partly by the Provincial Government and aims at the improvement of the Deccani breed of sheep (1) by selection and (2) by crossing with the Merino breed of sheep from South Africa. The year under report, which was the 4th year of the scheme, showed considerable progress towards these objects. Much advance was made in the analytical study of individual fleeces and on the grading of the flock based upon the outcome of such study. Upon the result of such work, future breeding policy will be based. A larger field for selection was found necessary and proposals for increasing the experimental flocks have been approved by the Imperial Council of Agricultural Research.

The work of crossing the Deccani and Merino breeds was continued and a very considerable improvement in quality and quantity of wool is evident in the early crosses. A small Wool Analysis Laboratory, which was urgently required for the purpose of the scheme, was established during the year in

the office of the Livestock Expert. Further problems investigated dealt with the best time of lambing, prevention and control of diseases and pests of sheep, shearing and grazing technique. Most important and economically valuable results have been obtained from preliminary work on wool utilisation with the object of enabling local shepherds to obtain higher prices through the grading and selection of wool, spinning and dyeing. A small machine for carding Deccani 'A' type wool was designed during the year.

(41) *Poultry—Bombay Poultry Research Scheme, Kirkee.*—This is a five-year scheme started in 1936 and is carried out at the Government Poultry Research Station, Kirkee, Poona, and at sub-stations at Vadala in the Ahmednagar district and at Ankleshwar in the Broach and Panch Mahals district. The scheme is due to terminate on the 30th September 1941. Proposals for the extension of the scheme at the Government Poultry Research Station, Kirkee, Poona, for a further period of five years have been submitted to the Imperial Council of Agricultural Research for sanction. In the meanwhile, Government have issued orders for the closing of the two sub-stations at Vadala and Ankleshwar. Very useful results in testing the adaptibility and egg-laying capacity of different breeds of poultry, both imported and Indian, and their crosses, were obtained during the year. Additional work included testing the feeding values of different feeds, incubation trials and experiments on designing cheap poultry houses for village use.

The economics of poultry farming is receiving close attention at the Kirkee centre which is also being largely utilised for the training of villagers and students in poultry management. Forty-one students completed the full poultry training course during the year. The work on breeding and rearing of turkeys was successfully continued and has resulted in a heavy demand for eggs and birds.

Auxiliary Government Poultry Farms, which were established at Dhulia and Dharwar during the last year, carried out similar work to Kirkee.

Fourteen students at Dhulia and six students at Dharwar were trained in practical poultry farming.

(42) *Goats.*—As numerous enquiries had been received from all parts of the Province regarding the use of goats for milk production, a small experiment with the Kamori breed of goats from Sind was commenced at the Government Central Poultry

Farm, Kirkee, in November 1939. The results of investigations into the milk yielding capacity of the Kamori goats during the last eighteen months indicate that the Kamori breed of goats do not attain the same standard of milk yield in this Province as is claimed for it in Sind. Unfortunately, there were several abortions in the flock which may account for the inferior results. The highest milk yield per day was $7\frac{1}{2}$ lbs. from one doe. Two home-bred kids have just come into milk and their milking capacity will be watched. The scheme for goat breeding for the Province, which was submitted to the Imperial Council of Agricultural Research in 1934, has been received for revision during the year.

(43) *Bees*.—The Bee-Keeping Scheme at the Ganeshkhind Gardens, Poona, was closed down during the year under report mainly on account of the unsuitability of Poona as a centre for scientific work on Apiculture and for the organization of bee-keeping as a subsidiary industry among agriculturists. A revised scheme which will be situated in the forest tracts of the Kanara district and which is designed to stimulate the development of the industry on a co-operative basis and to afford facilities for training to forest villagers has been approved by Government and will be shortly commenced in co-operation with the Karnatak Branch of the All-India Village Industries Association.

SECTION D.

MISCELLANEOUS RESEARCH WORK.

(1) *Horticultural Research*.

(44) *Cold Storage Research Scheme, Ganeshkhind*.—The year under report was the seventh year of the Cold Storage Research Scheme for scientific investigations in connection with the cold storage of Indian fruits and vegetables. This scheme is financed by the Imperial Council of Agricultural Research and has been extended up to 31st March 1942.

The principal item of research work during the year under report relates to the gas storage investigations on Alphonso mango and Nagpur orange (*Santra*). The effect of three concentrations of carbon dioxide, 5, 10 and 15 per cent. at the two temperatures of 45° F and 52° F, was studied. The results were not satisfactory as considerable loss due to fungal growth was observed under the high humidity conditions in the gas tight containers. An experiment has now been arranged under

somewhat drier conditions and the gas storage trials will be repeated at the above two temperatures under 5 and 15 per cent. concentrations of carbon dioxide.

(45) *Government Fruit Experiment Station, Ganeshkhind.*—Manurial trials on banana were finally concluded and it was found that a manurial application consisting of 80 lbs. farm-yard manure, 10 lbs. castor cake and 2 lbs. sulphate of potash, on the basis of 0·8 lb. nitrogen per tree, gives 30 per cent. more yield over the control, i.e., 80 lbs. farm-yard manure only. Further investigations with a view to fix the optimum application based on 0·4 lb. nitrogen per tree is now being undertaken. Manurial investigations relating to *mosambi*, grape and mango were continued. Irrigation experiments in connection with *mosambi* and grape vine cultivation have also been concluded. The “furrow” method of irrigation consumes 29 per cent. more water and gives only 5 per cent. increased yield as compared with the “square basin” method of irrigation in *mosambi* cultivation. In the case of grape vine orchards, the “furrow” system consumes 31 per cent. more water and gives 16 per cent. more yield than the “ring” method of irrigation. Work relating to the improvement of guava by selection was concluded. Strain Lucknow 49 is decidedly superior to all the local strains. Its cultivation on a field scale is already being undertaken to test its commercial value. As regards pomegranate selections, arrangement is being made for field trials with promising varieties. G. B. No. 1 is the best of all selections in regard to the quality of seed and colour of pulp. Work relating to vegetable crop improvement is now being undertaken by the Professor of Agriculture. Improved chillie and brinjal strains, however, are being maintained with a view to provide pure seeds for trial and extension in the districts. A “basic” nursery of fruit tree plants of known origin is being established at the Ganeshkhind Fruit Experiment Station, Kirkee. Fruit survey work in the Province is also being carried out. The total receipts from the Ganeshkhind Fruit Experiment Station, Kirkee, amounted to Rs. 13,849-5-2 as against a cultivation cost of Rs. 12,325. At the Modibag Gardens, College of Agriculture, Poona, the total receipts amounted to Rs. 4,005 as against a contingent expenditure of Rs. 4,340.

(2) *Research Work in Agricultural Engineering.*

(46) In co-operation with the Livestock Expert to Government, the Agricultural Engineer to Government undertook

the design and manufacture of an experimental plant for the artificial drying of grass. This work has been undertaken to meet the requirements of a scheme for research work into artificial grass drying, which has been sanctioned by the Imperial Council of Agricultural Research. Preliminary trials with the experimental plant have been carried out and a large unit is now under construction for further experimental work, particularly in connection with the economics of the process and the technique required to obtain a final product of dried grass with as low a moisture content as possible. Due to the rise in the price of materials it is only possible to operate this scheme at one centre, viz., Poona, instead of at Poona and Kandivlee as originally contemplated.

(47) Under the Agricultural Engineer to Government, research work on the improvement of existing agricultural implements, and on the devising of new agricultural implements for specific farm operations, was continued. The improved wheat drill was again tried at the Jalgaon Farm to compare its effect on yield with that of the local one and it was found that the improved drill gave 7.5 per cent. higher yield. Similar tests will be carried out for a year or two more, in order to determine whether these results are consistent. A clamping arrangement has been introduced in the winnowing fan so that its position on the supporting post can be altered as required. The soil scooper was modified to suit the peculiar soil conditions at Bijapur and it has now been reported that it works satisfactorily. The ground-nut digger and the milk can insertions have been further modified and are still under study. A pair of hubs of cart wheels was fixed with ball bearings at the Workshop and the remainder of the wheels were built around them. These wheels have been given to the Agricultural College Farm for trial and it is reported that they are giving satisfactory work.

(3) *Research Work in Crop Protection.*

(48) *Against plant diseases.*—The Plant Pathologist to Government continued many items of scientific research work designed towards evolving efficient and economic methods for the prevention and control of plant diseases on a wide range of cultivated crops of the Province. Full details of such work can be found in the Annual Report of that officer (Appendix F) so only brief notes on the progress made in the major items of work are given below:—

(1) *Fusarium wilt in sann hemp.*—In order to prevent cross-pollination with susceptible varieties of sann hemp, the

wilt-immune strain D-IX was grown in the wire cage for the purpose of producing nucleus seed by the agency of pollination by *Aphis* and *Megachile* bees. About 40,000 lbs. of seed of the wilt-immune strain multiplied at Dharwar was handed over to the Rural Development Department for growing in the Deccan Canal areas.

(2) *Wilt in Lathyrus sativus*.—Self-bred progenies of 39 plants including four Indore varieties and one local selection, which, with the exception of one Indore variety, were free from wilt when grown in the infected plot in 1939-40 season, were tested in pot culture during the year. Two cultures, viz., Indore T-2-1 and Indore T-3-8, were completely free from wilt, whilst progenies of a number of plants in other cultures also did not suffer any mortality. Further work has shown that the causative fungus is a new variety of *Fusarium orthoceras*.

(3) *Koleroga of areca-nut*.—Observations made during the year under report have shown that the tops of some areca-nut palms sometimes develop lesions on their outer surface as a result of infection by *Phytophthora arecae*, which often does not penetrate deep into the cone. These lesions, which are later found on the sheaths of young leaves, increase in extent and coalesce into larger spots at the approach of the rainy season. The diseased areas thus formed on the leaf-sheaths support an active growth of the fungus. Infection then spreads to the nuts. The fall of diseased nuts early in the monsoon is a feature that characterises arecanut trees harbouring latent infection. Such trees constitute a potent source of primary infection, and continue to grow for several years without showing any ill effects. However, when infection of the top becomes deep-seated, the growing-point is attacked and killed by the fungus. In further tests made during the year, the fungus failed to infect sandal. Heterothallic strains of the fungus, which were so far considered to be isolated in different areas, have now been found to exist together in a valley of arecanut gardens; but oospore formation has not yet been found in such valleys. Spraying trials to test the relative efficiency of different adhesives in spraying mixtures were continued.

(4) *Soft rot of ginger*.—In Gujarat, cultivation of ginger is usually on the flat and this method of growing ginger favours the development of soft rot. The comparative effects of growing ginger in flat beds, as compared to the broad ridge method of cultivation, in the control of soft rot

was tested in experiments laid out at Bassein and at Kachholi in South Gujarat. Effective control of soft rot was obtained by growing ginger on broad ridges.

(5) *Cotton Wilt Breeding Schemes*.—Under the Cotton Breeding Schemes, Gujarat and Khandesh, the Plant Pathologist to Government has succeeded in isolating homozygous wilt-resistant strains in B. D. 8 and the Broach back-cross. There appears to be a good prospect of producing a 100 per cent. wilt-resistant strain of Seg. 8-1 for the Surat area. Fundamental research work on the genetics of wilt resistance has shown that resistance to wilt in *Gossypium herbaceum* is due to a single genetic difference, whilst crosses of *G. arboreum* var. *neglectum* indicate that this character involves three complementary factors.

(6) “*Damping off*” in tobacco seed-beds.—The use of different fungicides for disinfection of soil in tobacco seed-beds as a measure of control against “damping off”, was further investigated. The “lay-out” of the experiment was a Latin square of seven replications of seven treatments of fungicides Perenox, Mycol, Bordeaux mixture, and the control. Unfortunately, the incidence of “damping off” in the treated and control plots was low. Results of the treatments were therefore inconclusive.

(7) *Miscellaneous*.—Further work was carried out on numerous other plant diseases including Panama disease of bananas, rust on chrysanthemum, black spot of mango, twig blight and fruit rot of mango and others. The results are very promising.

(8) *Plant Virus Disease Research Scheme*.—A detailed study of the insect vector in relation to vein-mosaic virus of bhendi has been carried out. The efficiency of the white-fly, *Bemisia gossypiperda*, as a vector seems to increase if it is made to fast after feeding on a source of infection. The white-fly can secure the virus in a much shorter time if made to fast immediately before being fed upon a diseased plant. The virus undergoes an incubation of 7 hours in the white-fly. Many new viruses have been discovered. Interesting results of chemical analyses of healthy and diseased *bhendi* plants have been obtained. The total carbohydrate content of diseased leaves is less than that of healthy leaves. On the other hand, the carbohydrate content of diseased fruits is higher than that of healthy fruits. There is an increase in the fat content of diseased plants. Proportions of protein and nitrogen fractions in diseased plants are not different

from those in healthy plants. The relationship of the mineral nutrition of the *bhendi* plant to its susceptibility to the virus attack was further investigated.

(9) *Striga*.—The selection of *Striga*-resistant *jowars* under the Scheme for research into the attack of *Striga* on *jowar*, sanctioned by the Imperial Council of Agricultural Research, was carried a stage further. During the year under report, test for resistance under controlled conditions of temperature and moisture in soil temperature tanks was made. The resistant plants from "Bilichigan" and "Moddinandyal" varieties, which had shown almost 100 per cent. resistance under uncontrolled laboratory condition, when tested under optimum conditions gave only 10 per cent. resistant plants. The progenies of these will be again tested under optimum conditions of attack, as obtaining in the soil temperature tanks, for making further selections.

(10) *Orobanche*.—The work of selection of tobacco strains resistant to *Orobanche* was continued. Ninety-two samples of seeds of cigarette, *beedi* and cheroot tobacco were obtained from different provinces of India and from Burma and Ceylon. Of these, 50 plants, each of six types, were tested and a few resistant plants from only two varieties were obtained. Tests on other varieties will be taken up.

(49) *Against insect pests*.—The main items of entomological research carried out by the Professor of Entomology during the year under report are as noted below :—

(1) *Experimental work on sulphur dusting against mango hoppers*.—This year, *I. clypealis* was the dominating species of hoppers in all the mango growing tracts of the Province including the Gujarat and Bombay Suburban areas. This species, being most susceptible to the action of sulphur, could be easily controlled with three to four dustings only, applied at an interval of 10 days. There was a very bad attack of hoppers and the effect of the treatment, where undertaken, was most marked.

(2) *Fruit flies*.—A record of fruits affected, kept during the year, has shown that 58 per cent. of the guavas and 19 per cent. of the mosambis are affected by fruit flies. Trapping of the flies in Clensel traps is not sufficient to control the damage. Sweetened poison sprays made with sodium fluosilicate and copper carbonate in conjunction with the traps have, however, given promising results. This method will be tried on a large scale in the next guava season.

(3) *Grapevine Beetle*.—The life history and habits of the pest have been completely studied and confirmed. Methods of control based on periods in the life history when control measures can be effectively employed, are being tried. This work is being financed by grants from the Sir Sassoon David Trust Fund.

(4) *Betelvine bug*.—This is another item of research work financed by the Sir Sassoon David Trust Fund. The study of the life history of the pest and trials of control measures on a small scale have been completed. Promising control measures are now being tried on a field scale and the economic aspect of such measures is being investigated.

(5) *Miscellaneous*.—Experimental work on other insect pests, e.g., fig hopper and lang pod borer, is in progress.

(4) *Agricultural Economics and Marketing.*

(50) The results of cost accounting studies and investigations into family budgets in the Charotar tract of Gujarat were further concised and sent for publication to the Indian Economic Journal, Allahabad, and the Journal of the University of Bombay, respectively. An investigation into the supply and demand of milk in Poona City and the utilisation of fodder produced in the neighbourhood of Poona was started and preliminary work with regard to local production and outside supply of milk and fodder was completed.

SECTION E.

FURTHER RESEARCH SCHEMES.

(51) *Imperial Council of Agricultural Research*.—During the year under report, the following new research schemes, or extensions of existing research schemes, were sanctioned by the Imperial Council of Agricultural Research :—

(1) Scheme for the establishment of Wool Analysis Laboratory under the Sheep Breeding Research Scheme.

(2) Scheme for the expansion of scientific work in Sheep Breeding—Establishment of a sub-station under the Sheep Breeding Research Scheme at Javala, taluka Sangola, district Sholapur.

(3) Scheme for research on Cytology of Papaya.

(4) Scheme for writing up of a Monograph on Dry Farming Research Work in India.

(5) Extension of the scheme for the water requirements of crops other than sugarcane.

(6) Model Project Scheme for extension of agricultural improvements in the Surat district.

(7) Scheme for the scientific research work in improvement of pulse crops in the Bombay Province.

(8) Scheme for the improvement of grassland by rotational system of grazing and the ecological study of forest grasses.

(9) Scheme for testing reactions of wheat to black stem rust.

(10) Scheme for experimental work on the mechanical drying of grass.

Schemes Nos. 1 to 6 have been started during the year under report, and Nos. 7 to 10 will be commenced during the next year.

The Goat Breeding Scheme sanctioned by the Imperial Council of Agricultural Research some years ago has now been referred back for modifications and a modified scheme will be prepared during the current year.

The under-noted new schemes, or applications for extensions of current schemes, have been submitted to the Imperial Council of Agricultural Research for consideration during the year under report :—

(1) Scheme for the botanical improvement of rice crop in Gujarat.

(2) Scheme for a model project for the demonstration and improvement of all agricultural improvement in the Dohad and Jhalod talukas of the Broach and Panch Mahals district.

(3) Scheme for scientific research work on rice cultivation on salt lands.

(4) Extension of the Scheme for research work in Poultry Husbandry in Western India, Kirkee Centre.

(5) Extension of the Milk Recording Scheme.

(6) Scheme for Insect Pests of Sugarcane.

(52) *Indian Central Cotton Committee.*—(1) A scheme for the grading and marking of 1027 A.L.F. cotton in the Surat Area for a period of six months was sanctioned during the year under report and work commenced from 17th January 1941.

(2) A scheme for Model Projects for extension of improvements in cultivation of crops in the Surat district for a period of three years was sanctioned during the year under report and work was started from 2nd June 1941.

(53) *Sir Sassoon David Trust Fund*.—(1) A scheme for Botanical research into the selection of *Orobanche*-resistant tobacco for a period of 5 years was sanctioned by the Trustees of the Sir Sassoon David Trust Fund, Bombay, during the year under report.

(2) The present scheme for Betelvine Bug Investigation was extended for two years more, i.e., 1941-42, and 1942-43.

(54) *Sugar Excise Fund*.—During the year under report no new schemes were sanctioned from the Sugar Excise Fund of the Government of India.

CHAPTER III. LIVESTOCK WORK.

(55) *Introduction.*—During the year under report, the work of the Livestock Section of the Agricultural Department continued to grow in extent and importance. This work includes not only scientific research work into problems connected with all aspects of the livestock industry but, what is of even greater importance, the dissemination of the results of successful research among the public and the encouragement and development of animal husbandry in practically every district of the Province. One notable and welcome feature of the expansion of the activities of the livestock section of the Department is the ever closer co-ordination which is being achieved between livestock improvement and the development of better grazing facilities and fodder production. This is largely due to the work of the Provincial and District Fodder and Grazing Committees and augurs well for a rapid advance towards a higher standard of animal husbandry throughout the Province. It is also noteworthy that many District Rural Development Boards are paying particular attention to livestock improvement work and are co-operating fully with the departmental experts in the expansion of this important branch of agriculture. Increased public interest in animal husbandry is confirmed by the great increase in the demand for the advice and assistance of the Livestock Expert to Government and his staff and by the growing spirit of competition and rivalry evinced at numerous cattle shows and rallies held under the direction of the livestock section of the Agricultural Department.

(56) *Premium Bulls.*—During the year under report, 236 additional breeding bulls of different breeds were supplied to selected agents in villages under the "Premium Bull" system. It is most interesting to note that 80 of these bulls were the progeny of Premium bulls previously distributed by the livestock section of the Agricultural Department, thus indicating the value of such work in the progressive improvement of village cattle. 507 "Premium" bulls were situated throughout the Province in July 1941 as compared with 336 in July 1940. In many tracts of the Province, the influence of these selected breeding bulls on the raising of the standard of village cattle is now most noticeable. Under a similar "Premium Cow" scheme, 126 selected breeding cows have also been issued in suitable villages mainly from funds provided by the various District Rural Development Boards.

(57) *His Excellency the Viceroy's Gift Bull Scheme.*—In the Province, the total contributions received towards His Excellency the Viceroy's Gift Bull Scheme now amount to Rs. 89,685, out of which Rs. 60,946 have already been expended in the purchase and maintenance of selected breeding bulls for use in villages. Since the commencement of the Scheme, 322 bulls have been located in villages. Of these, 25 have died and 139 have completed the service period leaving 154 still at stand in different villages. As a result of the centralization of the work of livestock improvement in the districts under the Livestock Expert to Government, a complete review of the present position of the "Gift" bulls was made and proposals submitted to Government for future development.

(58) *Scheme for Buffalo Breeding and Improvement.*—This scheme, which was commenced three years ago, provides for the issue of male buffalo stock from known high milking strains from the Agricultural College Dairy, Poona, to selected buffalo breeders in the Kaira district, Gujarat. The young male stock thus distributed are reared by the agents and utilized for issue as "Premium Bulls" when fit for breeding purposes. 20 Surti buffalo male calves were issued under the scheme this year and there are now 41 buffalo breeding bulls, situated under the "Premium" and "Gift" bull schemes, at work in various villages throughout the Province.

(59) *Application of the Livestock Improvement Act of 1933.*—The Bombay Livestock Improvement Act of 1933, which provides for the compulsory castration of "scrub" male cattle stock in villages on the instance of local bodies, has now been applied to 77 villages in the Province. During the year under report, 7,600 castrations of scrub bulls were done with the help of the Veterinary Assistant Surgeons in villages. The effect of this Act in village cattle improvement has been most marked in the areas where it has been applied and, with the co-operation of the villagers, it has worked very satisfactorily towards raising the standard of village herds of cattle. Eleven more villages have been surveyed during the year with a view to the application of the Act in these centres.

(60) *Co-operation with Gowshalas and Panjarpoles in the improvement of cattle.*—The Livestock Expert to Government, in order to secure the co-operation of Gowshalas and Panjarpoles with Government in livestock improvement work, paid personal visits to the institutions at (1) Barsi, (2) Dhulia, (3) Nandurbar and (4) Sholapur and discussed with their

managing committee members the advantages of such co-operation. For various reasons mainly connected with the administration of the institutes concerned, it has not yet been possible to secure the co-operation of any of these institutes but efforts in this direction will be intensified and extended to other areas.

(61) *Cattle Shows, Rallies and Demonstrations.*—The Province was again well represented at the 4th All-India Cattle Show held at Delhi in February 1941, when 52 typical animals of the main breeds of the Province were exhibited. These exhibits obtained numerous awards and prizes, including the Bharatpur Challenge Cup for the best general utility bull in the Show, which went to the Northcote Cattle Breeding Farm, Chharodi. District cattle shows and rallies continued to form an important part of the departmental propaganda in cattle improvement and, during the year under report, 16 small district shows and 41 cattle rallies were held by the livestock section. The most important of these district shows was held at Chincholi in the Jalgaon taluka of the East Khandesh district on 17th August 1940 when His Excellency the Viceroy was present.

(62) *Advisory and Propaganda work in the districts.*—The centralisation of all district advisory and propaganda work in connection with the livestock improvement under the Livestock Expert to Government has proved to be most effective in the intensification of such work in the districts and in the adoption of co-ordinated measures for livestock improvement throughout the Province as a whole. Progress has been made in framing measures for the improvement of the village butter and ghee industry in Khandesh and the Southern Maratha Country, for the improvement of Konkan cattle by the organisation of the Dangi cattle breeders and in the preparation and initiation of projects for livestock improvement in co-operation with District Rural Development Boards. The Livestock Expert to Government has taken effective steps to acquaint non-official workers as well as district officers with the work of the Department in cattle and livestock improvement by organizing "Farmers' Weeks" at Government Cattle Farms so as to secure their co-operation in the working of livestock improvement and development activities.

(63) *Formation of Milk Recording Societies.*—The work undertaken under this heading aims at commencing a system of village milk recording for certain milch breeds of Indian cattle and is being carried out in co-operation with the Imperial

Council of Agricultural Research. Nine villages in the Sanand taluka of the Ahmedabad district have been taken up for the purpose of the scheme, with the co-operation of Kankrej cattle breeders in that area. The work of milk recording was continued during the year and records of 212 cows were maintained with reference to quantity and quality of milk by fortnightly tests.

The first Progress Report of the Milk Recording Scheme in the Bombay Province was considered at the meeting of the Milk and Milk Products Committee of the Advisory Board, Imperial Council of Agricultural Research, held at New Delhi on 15th November 1940. The Committee expressed the view that the scheme had proved to be of great value in connection with the Provincial Pedigree Registration Scheme already in progress in the same area. A proposal for the extension of the scheme for a further period of two years has been submitted to the Imperial Council of Agricultural Research.

(64) *Definition of breed characteristics.*—On the initiation of the Imperial Council of Agricultural Research, steps have already been taken to lay down systematic definitions of (1) the Kankrej breed of cattle, (2) the Khillar breed of cattle and (3) the Surti breed of buffaloes, during the past three years by Committees of local cattle breeders and other interested parties, both official and non-official, presided over by the Livestock Expert to Government. The reports of these Committees, together with the photos and measurements of typical specimens of the breeds have been forwarded to the Imperial Council of Agricultural Research. The definition of the Kankrej breed of cattle has been embodied in the Miscellaneous Bulletin No. 27 of 1939 of the Imperial Council of Agricultural Research. During the year of report, no other breed of Bombay cattle has been selected for definition of breed characters.

(65) *Poultry improvement in villages.*—During the year, two schemes for the improvement of poultry in villages were continued. The first of these schemes aims at the improvement of village poultry by the distribution of selected cockerels for breeding purposes in selected villages and under the care of approved cultivators. During the year under report, 367 cockerels—214 White Leghorns, 95 Rhode Island Reds, 18 Black Minorcas, 15 White Wyandottes, 15 Australorps, 6 Light Sussex and 4 Chitt-Sussex—were put out in villages for grading up the village fowls. This work has

been found most effective in improving the standard of quality and egg-laying capacity of the graded village hens. Graded pullets, resulting from similar work in the past, have been found to show an increase of 40 per cent. in egg-laying capacity and to produce larger eggs than their dams under village conditions. The full benefit of this scheme, however, cannot be realised until the more systematic marketing of graded eggs produced in villages can be organised on a wider basis and more effective measures taken to control and prevent the great mortality, resulting from poultry diseases, in the districts.

The second scheme aims at encouraging scientific poultry keeping by villagers through the grant of premia to intelligent cultivators for, either the construction of up to date poultry houses, or the purchase of fowls or egg settings of improved breeds. 14 such premia were granted during the year under report. District poultry centres established, mainly under the auspices of District Rural Development Boards, have been started in several districts and are giving useful co-operation and assistance to the Agricultural Department in village poultry improvement.

(66) *Egg Marketing Scheme, Belgaum.*—This scheme, which is financed by grants from the Sir Sassoon David Trust Fund, continued its work for the scientific grading and marketing of eggs in the Belgaum district during the year. 93,588 eggs were dealt with and the bulk were marketed under the "Agmark" grades. This scheme will terminate in October 1941 and proposals have been submitted for its transfer to the Chief Marketing Officer, Bombay.

(67) *Egg Producers Association, Gardi (Satara district).*—This is an unregistered egg producers' association organized by the livestock section in co-operation with the poultry keepers of Gardi village. The Association handled about 2,345 eggs per month and the graded eggs were sold at Poona and Bombay at twelve annas to one rupee per dozen. After deducting all expenses incurred in packing and transporting, the producers received annas eight per dozen as compared with annas four or five which is generally offered at the local market. A Central Egg Sale Co-operative Society, organized in Bombay, would be a great stimulus to the increased formation of egg marketing societies in the district and would enable adequate prices to be obtained for the higher grades of eggs which is an essential prerequisite to the success of producers' societies in the villages.

CHAPTER IV.

AGRICULTURAL SERVICE AND PROPAGANDA.

(68) *Introduction.*—With the deamalgamation of the district staff of the Rural Development and Co-operative Departments, which was put into force by Government during the year under report, the Agricultural Department has been enabled to resume its work in agricultural service and propaganda through the medium of the district staff restored to the control and supervision of the Director of Agriculture. District propaganda work towards all aspects of rural development is now controlled by the Collectors of districts assisted by District Rural Development Boards. The district staff of the Agricultural Department is co-operating fully with Collectors in such work, especially in its agricultural aspects, and, in addition, is supervising and managing the agricultural propaganda and demonstration work conducted through the agency of Taluka Demonstration Centres. "Officials" demonstration days and "Farmers Weeks" were organised at practically all Government Farms and Research Stations in the Province and were, in general, well attended and successful. The special staff, engaged upon major cotton seed multiplication and distribution schemes in Gujarat, Khandesh and the Southern Maratha Country, has also been re-transferred to the Agricultural Department on deamalgamation.

(a) SEED SUPPLY.

(69) The Model Seed Multiplication and Distribution scheme, framed by the Director of Agriculture, was circulated to all District Rural Development Boards and has already been taken up in several districts and with varied crops. This scheme is based upon the full co-operation of the Revenue and Agricultural staff in the districts and provides for the organised multiplication and distribution of improved seed on a taluka basis in districts wherein the District Rural Development Boards agree to adopt the scheme. The production of the nucleus seed of such improved crop varieties will continue, as in the past, to be the special work of the Agricultural Department on Government farms and allied registered seed-growers' lands.

(70) *Cotton—Khandesh.*—12,350 lbs. and 29,665 lbs. of pure Jarila cotton seed from Jalgaon and Bhadgaon Farms, respectively, were supplied to the Cotton Superintendent, Jalgaon. The area organised for multiplication under Departmental control during the year was 26,236 acres under

Stages III, IV and V, and 908,180 lbs. (6,986 bags) seed was stocked for organising an area of 48,860 acres during the season 1941-42, under Stages III, IV and V. A beginning was made in Khandesh to establish on systematic lines an organization for seed supply on a country-wide scale. The seed produced from Stage V was secured and 144 approved agents, consisting of merchants, registered seed growers, co-operative bodies, etc., stocked 2,615,470 lbs. Jarila seed (20,120 bags) sufficient for approximately 140,800 acres. The total area receiving controlled seed during the coming season would thus be 190,000 acres nearly. This is the fourth year of the scheme. With a view to cover eight lakhs of acres in Khandesh by this improved variety, proposals to extend the scheme for a further period of five years, commencing from April 1942, at an estimated cost of Rs. 3,48,068 have been submitted to the Indian Central Cotton Committee.

(71) *Deccan Canals*.—3,500 lbs. of pure Banilla seed was grown on 300 acres in the Baramati tract and 18,600 lbs. seed obtained from this area was distributed to the cultivators in the Deccan Canal tract, sufficient for about 1,000 acres. This is the second year of the five-year extension period granted for the scheme under which this work is being carried out.

(72) *Gujarat*.—In the Northern Division, two Cotton Seed Multiplication and Distribution Schemes—one with 1027 A. L. F. in Surat and the other with B. D. 8 in the Broach area—were working during the year under review. The Department controlled 20,640 acres of pure 1027 A. L. F., and 4.156 acres of pure B. D. 8 cotton for seed multiplication. The total quantities of pure seed stocked in and distributed from various depots were 1,674,755 lbs. 1027 A. L. F. and 169,380 lbs. B. D. 8 cotton. Besides this quantity distributed in the British area, 693,600 lbs. 1027 A. L. F. seed was sent out to Rajpipla State. The total area covered by 1027 A. L. F. cotton during the year in the British area was 1 lakh acres against an equal area during the last year and that covered by B. D. 8 was only 8,978 acres against 30,957 acres during the last year. The fall in the area of B. D. 8 cotton was due to the low premium realised for it during the previous year.

(73) *Southern Maratha Country*.—The revised and extended Scheme for the multiplication and distribution of Jayawant and Gadag No. 1 cotton seed, financed jointly by the Provincial Government and the Indian Central Cotton Committee, was in its fifth year. Work was continued through seven centres, for

Jayawant cotton and two centres, for Gadag No. 1 cotton. Reserved seed-growing areas of 117,582 acres under Jayawant and 30,870 acres under Gadag No. 1 cottons were organised, of which 68,908 acres and 25,184 acres, respectively, were rogued for the production of pedigree seed. The work of multiplication and distribution was carried out at all centres through co-operative organizations and "approved agents" working in co-operation with the special cotton staff under the Cotton Superintendent, Southern Maratha Country. The area covered with the improved varieties of cotton, i.e., Jayawant and Gadag No. 1, during the year under report, were 555,544 and 151,840 acres, respectively, with departmentally controlled seed only. It was estimated that further acreages of 176,000 acres under Jayawant and 30,000 acres under Gadag No. 1 were sown as a result of natural spread. In all, 6,379,025 lbs. of Jayawant seed and 1,600,000 lbs. of Gadag No. 1 seed were stocked for distribution and the total amounts of these improved seeds distributed for sowing were 4,851,330 lbs. Jayawant and 1,514,000 lbs. Gadag No. 1. All the seed stocked would have been distributed but for the prevalence of drought conditions in Athani, Bijapur and Bagalkot centres. 48 auction sales for Jayawant cotton and 20 auction sales for Gadag cotton were organised by the Agricultural Department and, on an average, these sales, which were highly appreciated by the growers, realised a premium of Rs. 10 per *nag* (1,344 lbs.) of *kapas* over the local cotton. 7,408,372 lbs. of Jayawant cotton seed and 1,456,000 lbs. Gadag No. 1 seed have up-to-date been stocked for distribution next sowing season.

(74) *Rice*.—Various improved strains of Kolamba were multiplied at the Rice Breeding Station, Karjat, and 5,705 lbs. of seed was supplied to the Deputy Director of Agriculture, Northern Division, for further multiplication on the lands of the Registered Seed Growers in the Thana and Kolaba districts. Considerable quantities of the seed of improved rice varieties were produced at the rice-breeding stations in the Southern Division, i.e., Mugad, Kumpta and Ratnagiri, and issued for further district trials, multiplication and distribution in the appropriate rice-growing tracts. The total quantity of improved rice varieties seed produced on Government farms was 43,940 lbs. which was distributed to approved seed-growers in the Southern Division.

(75) *Other crops*.—The multiplication and distribution of seed of improved varieties of wheat, viz., Bansipalli 808, Bansi 168, Niphad 81 and other improved types, is based upon the Cereal Breeding Station, Niphad, and, during the year under

report, this work made further progress. In the Northern Division, considerable quantities of seed of improved varieties of *bajri*, wheat, rice and *jowar* were grown on the lands of local seed-growers working in co-operation with the Agricultural Department and distributed in the districts for further multiplication and extension. Similar progress was made in the Southern Division also where rice seed, sugarcane sets, and vegetable seeds were distributed in the districts.

(76) *Taluka Demonstration Centres*.—In all Divisions of the Province, Taluka Demonstration Centres have been established on the holdings of cultivators who have been induced to co-operate with the Agricultural Department in demonstrating the advantages and profits of improved methods of cultivation, better crops, etc., on their own lands and with their own labour. A departmental fieldman is stationed at each centre to guide and assist in the work and to carry out propaganda and extension work in the neighbouring villages. Seeds of improved crops, manures, etc., are supplied free by the Department and a small implement and seed depot is run in conjunction with each Centre. Up-to-date 54 such Taluka Demonstration Centres have been organised in the districts and many more are in course of establishment. Such centres, whereon improved methods of agriculture are introduced and carried out by the cultivator himself, under departmental guidance, are proving potent agencies for the demonstration and extension of better farming in the districts.

(b) CROP PROTECTION.

(77) *Against wild animals*.—The “gun club” movement as a method of control of the damage caused to crops by wild animals, e.g., pig, nilgai, etc., made further progress during the year. In the Kaira district of Gujarat, four more gun clubs were started in the Borsad taluka making a total of ten now at work in the district. These clubs accounted for 1,338 nilgais from December 1940 to April 1941. Similar work was carried out by the three gun clubs in the Kolaba district. In Khandesh, the clubs were mostly confined to the Edlabad Peta and the Jalgaon and Bhusaval talukas, there being six in Edlabad Peta. The total number of animals killed was 1,150, of which 780 were pigs, 170 blue bulls and 200 spotted deer. In addition, the Shikar Officer organised shikar campaigns in villages surrounded by dense forest areas, when 108 animals (78 pigs and 30 blue bulls) were killed. The source of income was the subscription collected from the members at

half an anna per rupee of the land assessment and the amount so collected was Rs. 550. In Satara district, 16 gun clubs were at work and destroyed 89 wild pigs during the year. Similarly, the work of protecting crops from the ravages of wild pigs was continued in the Southern Division. Five more Gun Clubs were newly organised in 1940-41 which make up the total of 29 group gun clubs in an area of 193 villages. In all, 666 wild pigs and 82 deer were destroyed—341 pigs in the Dharwar district, 209 in the Belgaum district, 107 in Kanara and 9 in the Bijapur district. It is estimated that crops on about 100,000 acres were protected as a result of the operation of these gun clubs.

(78) *Against plant diseases and insect pests.*—As in previous years, the Plant Pathologist to Government and the Professor of Entomology dealt with a large number of enquiries from the public on a wide range of subjects relating to plant diseases and insect pests on crops. Special demonstrations on the control of mango hoppers and mildew were carried out in the Karnatak, the Konkan, the Bombay Suburban district, and in South Gujarat. The Plant Pathologist to Government and the Professor of Entomology and their staffs co-operated with the district staff of the Rural Development Department in many areas in demonstrating to cultivators effective and economic measures against plant diseases and insect pests on agricultural and orchard crops.

(79) *Agricultural engineering.*—The Agricultural Engineer to Government dealt with 127 applications, in addition to 57 dealt by the District Staff, from the public for advice and assistance in matters connected with agricultural engineering. Of these enquiries and applications, 39 were for pumping, 30 for boring, 6 for mechanical cultivation, 9 for repairs of plants, 6 for hire of machinery and the rest with miscellaneous subjects. 74 estimates for machinery and works were prepared and supplied. The number of power plants erected was 22 and repairs were carried out to 40. The number of sites surveyed was 42, and 97 plants were inspected by the Agricultural Engineer and the three territorial Mechanical Assistants on his staff. A considerable amount of special and general constructional work was carried out as a result of recent expansion in the research activities of the Agricultural Department. This work included the construction of the glass-houses at Poona, Sirsi and Mahableshwar, the construction of poultry houses and runs at Poona and Dhulia, and construction of various office, school and farm structures at the new Centres, viz., Vadgaon, Manjri, Dhulia and Devihosur. Boring

machines were given on hire to seven individual parties and an amount of Rs. 5,832-12-10 was realised as total hire receipts. 10 pumping plants were hired out and an amount of Rs. 968-15-4 was realised as hire receipts. The proceeds of the sale of the boring machines, spares and tools to the public amounted to Rs. 2,686-9-0. One tractor was also hired out this year and the amount realised as hire receipts was Rs. 1,744.

(80) *Poona Agricultural College.—Services rendered to the public by Heads of Sections.*—The demand for advice and assistance in agricultural problems, which has increased considerably in recent years, was fully met by the Heads of Sections at the Agricultural College whose expert knowledge of different aspects of scientific agriculture is readily available to all sections of the public.

CHAPTER V.

AGRICULTURAL EDUCATION.

(81) *The College of Agriculture, Poona.*—The year under report was the thirty-third year since the establishment of the College of Agriculture at Poona and this institution continues to be the centre of agricultural education and scientific research in agriculture in the Province. The expert staff of the College are fully engaged in both these aspects of work and, in addition, they are being increasingly utilised by the public for advice and assistance in agricultural development and propaganda. The number of students attending the College during the year 1940-41 was 203 in the first term and 210 in the second term. Sixty-eight students appeared for the final year examination for the degree of Bachelor of Science (Agriculture) of which 38 or 55·9 per cent. were successful. Much consideration was given during the year to the intensification of practical instruction in agriculture in the courses at the College which have now been readjusted and the period of two terms extended by six weeks to enable more time to be devoted to practical training on the College Farm. The revised syllabus accepted by the Bombay University came into force during the year under report. Six Postgraduate students were engaged on scientific research work under the College staff during the year under report, viz., three in botany, one in entomology and two in plant pathology. Special courses in Crop Production, Plant Pathology, Dairy, Chemistry and Horticulture were attended by seventeen students. The special Forest Rangers' Course instituted by Government for the training of Forest Rangers in the Province was continued. This course has now been extended for a further period of two years and a second batch of ten students are now under training six of whom are Government nominees, two nominated by Indian States and two private candidates.

A training class in agriculture for junior officers in the Revenue Department was held for twelve days in September, 1940, and was attended by eleven Assistant and Deputy Collectors.

The College activities in connection with the University Training Corps, Students' Co-operative Stores, sports, etc., continued with success during the year under report. The College library was extended and the new system of classification and cataloguing of books continued.

The numerous and varied activities of the expert staff of the Agricultural College connected with scientific research work and in advice and assistance to the public are dealt with in detail in the relevant sections of this Report and in the Appendices.

District Agricultural Schools.

(82) *Dhulia*.—The Marathi Agricultural School at Dhulia has now completed its 17th year. One hundred and seventeen applications for admission were received from the districts of East Khandesh, West Khandesh, and Nasik during the year, and 20 students were admitted on the recommendation of the Local School Committee. The total strength of students under training was 41, twenty in the first year and twenty-one in the second year. The Local Agricultural School Committee collected Rs. 1,800 during the year whereas its expenditure amounted to Rs. 2,141, the excess amount of Rs. 341 being spent from the reserve fund which at the close of the year was Rs. 4,135. The Committee pays a stipend of Rs. 5 per month to each student during the period of training.

Devi-hosur.—The Kannada Agricultural School at Devihosur had another successful year. The total number of students was 28, fifteen in the first year class and thirteen in the second year class. The total number of students who have received training and obtained certificates at this school now amounts to 314 and, in addition, 39 Primary School Teachers have obtained agricultural training at this institution.

(83) *Agricultural Bias Classes*.—These classes are now under the administrative control of the Educational Department but the district officers of the Agricultural Department continue to maintain a close contact with their working and are responsible for the periodic examinations and inspections.

(84) *Special Agricultural Training Classes*.—During the year under report, 60 students attended the Horticultural Training Class at the Ganeshkhind Fruit Experiment Station, Kirkee, for a period of 9½ months. Fifty-one students passed the final test and completed their training satisfactorily. Government have sanctioned proposals to increase the number of scholarships from 23 to 30 and to raise the amount of each scholarship from Rs. 10 to Rs. 15. This action is likely to attract a greater number of *bona fide* cultivators' sons.

Three students, including a member of the Sind Agricultural Department, completed a special course in Fruit Preservation at the College of Agriculture, Poona, over a period of three months.

Sixty-eight students joined the special Poultry Training Classes held at the Government Poultry Farms at (1) Kirkee, (2) Dhulia and (3) Dharwar. Of these, sixty-seven successfully completed the courses and were awarded certificates. In addition, 48 rural assistants from Sabarmati Rural Development Centre were given a course of practical training in poultry husbandry for one week at the Kirkee centre.

Two classes for intensive training in the technique of scientific field bunding, etc., against soil erosion were held at the Agricultural College, Poona, for a period of three months each, from 16th September onwards. In all, forty-seven cultivator students attended and instruction was given by the Professor of Agricultural Engineering, Physics and Mathematics and a special staff. Such a training given to young cultivators is hoped to be useful in the extension of bunding work in the districts from which they come.

Thirty-eight cultivators were trained in field bunding and terracing at a short training class held under the auspices of the Rural Development Board, Nasik. Lectures with practical demonstrations in the field on direct contouring, aligning of bunds and construction of waste-weirs were given to the adult students of the Young Men's Training Camp at Chinchpada organised by the Bhil Uplift Committee, Dhulia. Training in bunding was given for a week to students attending the Secretaries' Training Class for Village Panchayats in Satara district.

Horticultural Classes were held in three villages of Ahmednagar district and they were well attended by the fruit growers of the surrounding villages.

The Agricultural Engineer held an oil engine training class at which 14 students were trained in the upkeep and management of oil engines for agricultural purposes.

(85) *Rural Assistants' Training Centres.*—Official training centres for the instruction of village or rural assistants in practical agriculture, co-operation and village industries have been established at Manjri (Poona district), Dhulia (West Khandesh district) and Devi-hosur (Dharwar district). The assistants, who receive nine months' training at these centres followed by three months' specialized and intensive training at Poona, are destined for appointment as "village assistants," secretaries of village panchayats, etc., to further the work of rural development in the districts. During the year under report, 92 candidates were admitted for training at the three centres mentioned above and instructional courses on definitely practical lines in all aspects of rural development are being carried out.

CHAPTER VI.

ADMINISTRATION AND FINANCE.

(86) *Introduction.*—During the year under report, Government decided upon the deamalgamation of the newly formed Rural Development Department, the formation of which was mentioned in last year's Report. As a result of this action, a considerable proportion of the former district staff of the Agricultural Department, which had been transferred to the Rural Development Department, was restored to the Agricultural Department and placed again under the administrative and technical control of the Director of Agriculture. The remainder of this staff was allotted to the Collectors of districts to work under their direction in furthering and expanding rural development activities. In addition, Government made it clear that the district officers of the Agricultural Department were, in future, to work under the direction of Collectors of districts in propaganda work connected with the agricultural aspects of rural development work, e.g., seed multiplication and distribution schemes, demonstrations and shows, etc., technical advice and assistance in such activities being rendered by the expert officers of the Agricultural Department. As an outcome of this deamalgamation scheme, the control and supervision of organised cotton seed multiplication and distribution schemes and of Taluka Demonstration Centres was again placed in the hands of the Director of Agriculture and his technical staff. The present position, therefore, is that, in each district, the district agricultural staff consists of one District Agricultural Officer and two District Agricultural Assistants with fieldmen in charge of each Taluka Demonstration Centre and separate staff for work on Government Farms and Research Stations and in connection with major cotton seed distribution schemes, most of which are financed in part by grants from the Indian Central Cotton Committee. This district staff is working in the closest co-operation with Collectors, and their special rural development staffs, in rural development activities and, at the same time, is available to assist the technical experts of the Agricultural Department in the extension of scientific research work on cultivators' fields and in other aspects of experimental work outside Government farms and research stations. In this way, the district staff of the Agricultural Department, as of other Departments of Government in the districts, is taking a co-ordinated part in advancing Government's policy of wide-spread rural development which is now

making considerable progress under the general direction of District Rural Development Boards which have been established in all districts of the Province. In addition, Government has sanctioned a new appointment of Deputy Director of Agriculture, Central Division, whose territorial charge coincides with that of the Revenue Commissioner, Central Division, with the exception of Sholapur district which remains under the control of the Deputy Director of Agriculture, Southern Division. There are thus three territorial Deputy Directors' charges, i.e., Northern, Central and Southern in the Province in place of only two as previously. The restoration of a district staff under the control of the Director of Agriculture has also contributed considerably to the progress of scientific research work by providing the necessary liaison between the cultivators and the technical experts engaged on such work at the Agricultural College, Poona, and at Government farms and research stations in the districts. Such scientific research work, as will be seen from the information supplied in this Report and its Appendices, is expanding very rapidly and is being considerably facilitated by the assistance and co-operation of such bodies as the Imperial Council of Agricultural Research, the Indian Central Cotton Committee and the Sir Sassoon David Trust Fund. In connection with animal husbandry, all the work in the Province dealing with livestock improvement has now been concentrated under the Livestock Expert to Government, a step which is already proving to be of much value and importance. The progress of the World War has not yet had any very marked effect on the agricultural economy of the Province although there are indications that a reorientation of agricultural policy will be required in the near future in order to ensure that the cultivators of the Province do not suffer as a result of economic conditions resulting from the War and to provide for post-War reconstruction and development. The increased responsibility and the greatly extended demands which have now to be shouldered by the staff of the Agricultural Department as a result of War conditions and the intensification of agricultural and rural development activities in the districts, are being willingly borne and the welfare of the cultivating classes is the first consideration in all departmental activities. It is gratifying to report that the closest co-operation is now being achieved between the departmental officers and all other agencies, official and non-official, engaged in the great work of rural reconstruction and agricultural development in the Province.

A.—ADMINISTRATION.

(87) *Staff*.—Mr. W. J. Jenkins held charge of the post of the Director of Agriculture throughout the year under report.

The following gazetted officers were re-transferred to the Agricultural Department with effect from 1st January 1941, as a result of the deamalgamation of the Co-operative and Rural Development Department staff :—

- (1) Rao Saheb G. P. Pathak, Cotton Superintendent, Surat.
- (2) Mr. V. C. Pavate, Cotton Superintendent, S. M. C., Dharwar.
- (3) Mr. G. P. Patil, Divisional Superintendent of Agriculture, Deccan Canals, Ahmednagar.
- (4) Mr. P. G. Dani, Assistant Horticulturist to Government, Poona.

The under-noted major staff changes may be noted :—

Dr. B. S. Kadam, Crop Botanist to Government, Bombay, Karjat, who was on leave out of India, resumed duty as Crop Botanist to Government with effect from 30th August 1940.

Rao Saheb S. H. Prayag, Cotton Breeder, S. M. C., Dharwar, was appointed to officiate as Deputy Director of Agriculture, C. D., Poona, in this newly created post in Class I of the Bombay Agricultural Service.

Mr. P. J. Patel was appointed to officiate as Agricultural Engineer to Government, B. P., Poona, vice Rao Bahadur C. G. Paranjpe, proceeded on leave preparatory to retirement.

Mr. P. V. Wagle, Senior Assistant to the Crop Physiologist, Sugarcane Research Scheme, Padegaon, was appointed to officiate as Professor of Entomology, Agricultural College, Poona, vice Dr. V. G. Deshpande on leave on medical certificate.

Dr. R. D. Rege, Crop Physiologist, Sugarcane Research Scheme, Padegaon, was appointed as Principal Agricultural Officer, Sugarcane Research Scheme, Padegaon, in addition to his own duties.

Mr. A. A. Vasavada was appointed as Professor of Agricultural Engineering, Physics and Mathematics, Agricultural College, Poona, vice Professor J. P. Trivedi, deceased.

Mr. M. L. Patel, Cotton Breeder, North Gujarat, Viramgam, was appointed as Cotton Breeder, S. M. C., Dharwar, vice Rao Saheb Prayag.

(88) *Retirement*.—The following officers of the Agricultural Department were permitted to retire from service during the year under report :—

(1) Rao Bahadur C. G. Paranjpe, Agricultural Engineer, entered the Agricultural Department in November 1911, and after serving in non-gazetted appointments till 1925, was appointed Assistant to the Agricultural Engineer in April 1925 and became confirmed as Agricultural Engineer in November 1933. He was one of the most able and popular officers in the Agricultural Department and his enthusiasm and energy contributed largely to the development of the Agricultural Engineering Section and to the extension of the work of that section in the districts. His services were worthily recognised by the award of the title of "Rao Bahadur" in the Honours List of January 1941. He retired from service on 2nd May 1941.

(2) Rao Saheb G. P. Pathak entered the Agricultural Department in 1909 and after serving in various capacities in non-gazetted appointments, was appointed as Cotton Superintendent in July 1936. His work in this post at Surat was most creditable and he established very close relations with the cotton growers and the trade which contributed largely to the departmental efforts to spread improved types of cotton in general cultivation. He retired from service on 15th March 1941.

(3) Mr. T. N. Jhaveri entered the Agricultural Department in March 1907. He served for some time in non-gazetted appointments in the Agricultural Department in Poona District and Gujarat and was later appointed as Assistant Professor of Entomology at the Agricultural College, Poona, in January 1930, which post was later on converted into that of Professor of Entomology, which position he held till the date of his retirement. He retired from service on 30th January 1941.

(89) *Obituary*.—The death of Mr. J. P. Trivedi, who passed away on 2nd May 1941 after a short illness, is recorded with much regret. Mr. Trivedi commenced service in the non-gazetted appointments in the Public Works Department and, by his ability and industry, soon rose to the rank of an Assistant Engineer in that Department. He acted for some

time as Assistant Professor of Agricultural Engineering, Physics and Mathematics at the Agricultural College, Poona, and his services were permanently transferred to the Agricultural Department in 1923. He was a popular figure both in official and non-official circles. He had a high sense of duty and a real and human interest in the welfare of his students. At the time of his death, he had retired from Government service and was engaged in the arduous and important work of organizing and starting the Institute of Agriculture, Animal Husbandry and Dairying, Anand, as Secretary of the Institute.

B.—FINANCE.

DEPARTMENTAL EXPENDITURE AND RECEIPTS.

(90) The expenditure of the Agricultural Department for the year under report was Rs. 9,54,929 as against Rs. 9,81,022 in the previous year. The receipts of the Department amounted to Rs. 2,00,442 as against Rs. 2,28,490 in the preceding year. The decrease in the revenue of the year under report as compared with that of the last year was mainly due to the transfer of the Chharodi Farm to the Anand Institute and the unfavourable agricultural season.

SUBSIDIES AND GRANTS.

(91) The subsidies and grants noted below were placed at the disposal of the Director of Agriculture during the year 1940-41 for approved schemes of agricultural research, multiplication of improved seeds, livestock improvement and similar activities by the—

- (1) Imperial Council of Agricultural Research and Sugar Excise Fund.
- (2) Indian Central Cotton Committee.
- (3) Sir Sassoon David Trust Fund.
- (4) Grants made by the Central Government for schemes for Economic Development and Improvement of Rural Areas.
- (5) Donations to His Excellency the Viceroy's Livestock Improvement Scheme.

(1) (A) Imperial Council of Agricultural Research.

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
1. <i>Sugarcane Research Scheme</i>	74,050	73,662
Total ..	74,050	73,662
<i>Deduct—</i> Government Contribution	—23,573	—23,379
Contribution from the Sugar Excise Fund ..	—13,452	—13,452
Net grant from the Imperial Council of Agricultural Research	37,025	36,831
2. <i>Dry Farming Research Scheme</i>	46,000	45,509
Total ..	46,000	45,509
<i>Deduct—</i> Government Contribution	—16,393	—16,218
Net grant from the Imperial Council of Agricultural Research	29,607	29,291
3. <i>Cold Storage Research Scheme</i>	18,700	16,583
4. <i>Scheme for Investigations into Virus Diseases of Plants.</i>	17,500	14,248
5. <i>Poultry Research Scheme</i>	7,690	6,986
Total ..	7,690	6,986
<i>Deduct—</i> Government Contribution	—600	—26
Net grant from the Imperial Council of Agricultural Research	7,090	6,960
6. <i>Milk Recording Scheme</i>	900	816
Total ..	900	816
<i>Deduct—</i> Government Contribution	—450	—408
Net grant from the Imperial Council of Agricultural Research	450	408

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
7. <i>Sheep Breeding Scheme</i>	7,750	7,718
8. <i>Sugarcane Insect Pests Scheme</i>	5,400	4,868
9. <i>Scheme for Investigations into Striga attacks on Jowar</i> ..	3,900	3,839
Total ..	3,900	3,839
<i>Deduct—Government Contribution</i>	—780	—768
Net grant from the Imperial Council of Agricultural Research	3,120	3,071
10. <i>Scheme for testing the reaction of Wheat to Blackstem Wheat Rust</i>	2,500	150
11. <i>Scheme of Research on the Cytology of Papaya</i> ..	2,240	1,880
12. <i>Scheme for preparation of a Critical Monograph on Dry Farming in India</i>	5,700	2,526
13. <i>Scheme of Sangola Sub-Station for Sheep Breeding Work</i>	7,570	6,274
Total ..	7,570	6,274
<i>Deduct—Government Contribution</i>	—3,785	—3,137
Net grant from the Imperial Council of Agricultural Research	3,785	3,137
14. <i>Scheme for establishment of a Wool Analysis Laboratory at Poona</i>	3,870	2,420
Total ..	3,870	2,420
<i>Deduct—Government Contribution</i>	—3,400	—1,966
Net grant from the Imperial Council of Agricultural Research	470	454
15. <i>Scheme for a model project for demonstration of Agricultural Improvements in Panch Mahals</i> ..	2,800	....
16. <i>Scheme for Training of a Special Tobacco Officer in America</i>	730	727
Total net grant from the Imperial Council of Agricultural Research	1,44,867	1,28,852

(1)-(B) Sugar Excise Fund.

Name of the Scheme.	Grant.	Expenditure.
	Rs.	Rs.
1. Scheme for control of Grass-hopper Pest on Pravara and Godavari Canals	16,400	7,099
2. Scheme for establishment of five Research Sub-Stations for Sugarcane Areas	23,560	19,451
3. Scheme for Genetic Method of Soil Survey in Sugarcane Areas	5,030	4,891
Total net grant from the Sugar Excise Fund ..	44,990	31,441

(2) Indian Central Cotton Committee.

Serial No.	Name of the Scheme.	Grant 1940-41.	Expenditure 1940-41.
		Ra.	Ra.
1	Broach Cotton Breeding Scheme	10,114	9,464
2	Jalgaon Cotton Breeding Scheme	5,759	4,576
3	Surat Cotton Seed Distribution and Extension Scheme.	5,460	3,294
4	Banilla Cotton Seed Distribution Scheme on Deccan Canals	235	188
5	Plant Puller Propaganda Scheme	4,435	2,622
6	Technological Assistant, Surat	4,439	3,513
7	B.D. 8 Cotton Seed Distribution and Extension Scheme, Broach	7,678	6,502
8	Revised Jayawant Cotton Seed Scheme	38,641	37,648
9	Revised Gadag No. I	10,262	9,937
10	Clerks for Bombay Schemes	2,238	2,100
11	Cotton Wilt Breeding Scheme, Poona	8,480	7,564
12	Cotton Wilt Breeding Scheme for Surat Area	2,877	2,397
13	Dholeras Wagad Cotton Improvement Scheme, Viramgam	5,100	4,129
14	Jarila Cotton Seed Scheme, stages I to V	26,225	23,121
15	Inclusion of Northern and Western Cottons in Dry Farming Scheme, Bijapur	2,169	1,095
16	Inter-specific Hybridization in Cottons at Surat	12,037	9,822
17	Control of Selection IA Cotton in Surat	2,424	828
18	Grading and Marking of 1027 A.L.F. in Surat	683	425
19	Schemes for maintenance of Nucleus of Improved varieties of Cotton Seed in Bombay Province	2,300	1,967
	Total	1,51,556	1,30,992

(3) *Sir Sassoon David Trust Fund (1940-41).*

	Rs.
(a) Further grant for the research work on the wilt disease of sann hemp	2,163
(b) Further grant for linseed breeding scheme	1,834
(c) Further grant for egg-marketing scheme in the Belgaum district	360
(d) Further grant-in-aid to the Marathi Agricultural School, Dhulia	500
(e) Scheme for the study of betelvine bug investigation	1,858
(f) Further grant for the oil-seed breeding scheme	1,283
(g) Further grant for the scheme for the study of the rate of availability of phosphates for plants in typical soils of Western India	1,176
(h) Grapevine beetle scheme	1,141
Total ..	10,315

(4) *Village Improvement Schemes.*

(Grants made by the Central Government).

Name of the Scheme.	42—Co-operation.	
	Grant.	Expenditure.
	Rs.	Rs.
(1) Scheme for the Improvement of Poultry in Villages ..	6,600	5,902
Total ..	6,600	5,902

(5) *His Excellency the Viceroy's Livestock Improvement Scheme.*

Division.	Total amount of donations received from the start till 31st March 1941.	Expenditure from start till 31st March 1941.	Balance on 31st March 1941.
	Rs.	Rs.	Rs.
Northern Division	62,745	42,693	20,052
Southern Division	26,353	15,400	10,953
Total	89,098	58,093	31,005

PERSONAL LEDGER ACCOUNT OF THE DIRECTOR OF AGRICULTURE.

(92) The amount at the disposal of this Department during the year under report under the head was Rs. 5,000 for financing certain research activities specified in Government Resolution, Revenue Department, No. 15/33/20026, dated 27th July 1940. The position of the account as at 31st March 1941 was as follows :—

	Rs.
(1) Amount with the Agricultural Officers.	2,188
(2) Balance in the account	2,812
Total	<u>5,000</u>

W. J. JENKINS,
Director of Agriculture,
Bombay Province.

APPENDIX A.

SUMMARY OF WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, SOUTHERN DIVISION, FOR THE YEAR 1940-41.

A. STAFF AND ADMINISTRATION.

Mr. H. G. Baluch continued to hold charge of the Deputy Director of Agriculture, S. D., Dharwar, throughout the year. The Division consisted of nine Districts viz., Poona, Ahmednagar, Sholapur and Satara in Deccan, Belgaum, Bijapur and Dharwar in Karnatak and Ratnagiri and Kanara in Konkan. In the month of May last, a new post of the Deputy Director of Agriculture, Central Division, was created with his Head Quarters at Poona and three Districts, viz. Satara, Poona, and Ahmednagar were given in his charge only very recently.

Due to modifications in the former Scheme of the Rural Development Department, some District Staff of this Department which was transferred to the Rural Development Department in 1939 was retransferred to this Department from 1st January 1941. This staff consisted—the Cotton Superintendent Mr. V. C. Pavate and his Office and District Staff, District. Agricultural Officers, Agricultural Assistants, Taluka Demonstration Field Kamgars, Shikar Staff and Bunding Officers.

Transfers.—The Cotton Breeder—Rao Saheb S. H. Prayag was transferred to Poona as Deputy Director of Agriculture, Central Division, and his post was temporarily held in charge of the Deputy Director of Agriculture and Mr. S. S. Marlihalli has been appointed from 21st May 1941 till permanent hand arrived.

B. SEASON.

(a) *Climate and Rainfall.*—The anti-monsoon showers were fairly substantial in Karnatak, light in South Konkan and very feeble in the Sholapur District.

The regular monsoon commenced during the first week of June in South Konkan, Second week in Karnatak and third week in the Sholapur District. The Malnad and transition tracts received adequate and wide spread rains in June which facilitated the Kharif sowings and the satisfactory germination of the crops. While over a major portion of the eastern dry tract the rainfall was below requirements and the Kharif sowings were confined to favourable areas only. There was plentiful and widespread rainfall in the months of July and August in South Konkan and in the areas adjoining the Western Ghats where Kharif sowings were in full swing and the standing crops progressed satisfactorily. As the August rains were rather heavy in Kanara District the crops in the low lying fields suffered from floods and over saturation. In the eastern parts, on the other hand, the rainfall was inadequate and the Kharif sowings could not be undertaken on an extensive scale. The early sown crops suffered from deficient soil moisture and also from the adverse effects of unfavourable dry winds. The September rains being inadequate

over a large part of the Division could not promote the proper Development of the standing crops. But these rains were fairly good in parts of Sholapur district and could help the sowing of Rabi Jowar in light and medium types of soils only. The rainfall in October was heavy and continuous in South Konkan and delayed the harvesting of early and intermediate varieties of rice which ultimately caused grain shedding to some extent. The harvested crops also could not be gathered in time and thus the quality of both the grain and straw was spoiled. However, elsewhere in the Division, the October showers were most opportune, beneficial to the Standing crops and encouraged Rabi sowing on a large scale. During the months of November and December also there were occasional showers in some parts of Karnatak which benefited the standing crops but came in the way of harvesting of paddy and damaged the crop to a considerable extent. In parts of Sholapur District also these showers proved beneficial to a certain extent. During these months the weather conditions were favourable to the Cotton Crop which thrived well. But from January onwards the weather was quite unfavourable to this crop and the showers in the last week of January and the first week of February induced vegetative growth in the Cotton Crop and damaged the other standing crops like, wheat, tobacco etc. After this the monsoon practically stopped, there being no rains except some light showers in parts of Karnatak during the third week of March and first week of April.

(b) *Condition of Crops.*—In short, during the year under report no crop had ideal weather conditions throughout its life and almost all the crops suffered from inadequacy of soil moisture during one or the other stage of their growing period. The dry spells arrested their proper development.

The season under review was generally free from crop pests and diseases of serious nature except Koleroga on betelnut in Kanara District which appeared in a very serious form. However, in Sholapur District the sugarcane suffered from Stem Borer, Bajri from slight attack of aphid and the Banilla Cotton from wilt. While in Karnatak, the paddy crop was damaged to some extent from the attack of army worm and grass hoppers and Jowar from Grass-hoppers and field rats. The "Rhyzoctonia" and the "Red-Leaf-Blight" disease on cotton, "Tikka" on groundnut, and mosaic on chillies took their tolls also in some parts of Karnatak but their appearance was sporadic.

C. RESEARCH WORK.

I. COTTON—COTTON BREEDER'S SECTION.

(a) KUMPTA COTTON.

Trial of selected strains against local Kumpta.—New—Jayawant, Early-Jayawant, Jayawant and an additional type K.F.T. 12-2-5 were tested with Kumpta local in six random replications. K.F.T. 12-2-5 yielded significantly higher than the others.

2. Selection in the following crosses :—

The crosses 1A-14-3 × 1-0-1 F8 and (Jayawant × N14) × 1A-14-3 F7, were highly susceptible to wilt, hence the best pure cultures viz., 5 from the former and 3 from the latter are only maintained. The selection was continued in the crosses K.F.T. 12-2-5 × New-Jayawant F4 and K.F.T. 12-2-5 × 1A-14-3 F3, for economic characters and wilt resistance. In the latter cross the segregate 3-6 shows combination of wilt resistance and other economic characters. In the cross (New-Jayawant × B.D. 8 B.C. F6-1-6) F1 selection is done for earliness. The cross (K.W.R. × 2519) × Early-Jayawant is rejected.

Back crosses and composite crosses.—In order to evolve types having all the desirable characters, the following crosses are done :—

(K.F.T. 12-2-5 × 1A-14-3) F1 × 1A-14-3.

(New-Jayawant × K.F.T. 12-2-5) F1 × New-Jayawant.

(New-Jayawant × B.D. 8 B.C. 1-6) F1 × K.F.T. 12-2-5.

(Early-Jayawant × B.D. 8 B.C. 1-6) F1 × K.F.T. 12-2-5.

The crossed bolls will be grown for further selection.

Testing wilt-resistance.

(1) *Behaviour in the wilt infected field.*—Eleven promising strains were tried; observations were taken every week, K.F.T. 12-2-5 and K.F.T. 14 were homozygous for wilt resistance, the former had the least infection in the roots.

(2) *Behaviour in the Green-House.*—The field selections of K.F.T. 12-2-5 × 1A-14-3 F2 and the selections from the transplants of the cross K.F.T. 12-2-5 × New-Jayawant F3 were tried. In the former, the segregate 3-6 gave encouraging results; in the latter cross, there was wilt resistance, but had low ginning outturn, thus plants having ginning percentage similar to Jayawant with wilt resistance are selected; selection is continued in both the crosses. The following crosses were tried in pots in F1 :—K.F.T. 12-2-5 × B.D. 8 B.C. F6-1-6, K.F.T. 12-2-5 × New-Jayawant and (K.W.R. × 2519) × Early-Jayawant; The last one completely broke down while the first cross was cent. per cent. resistant.

(b) AMERICAN-COTTONS.

Trial of promising segregates of G1 × CO2.F9.—The segregates 4-4-1-1-3 and 9-7-6-6-6 were tried on Dharwar Farm in a single plot of 12·7 gunthas each; the yield of the latter was 9·8 per cent. more than that of the former; these two segregates with Gadag 1 were also tried in random replications at Gadag. There was no difference in yield; the ginning percentage of lint in Gadag 1, in 9-7-6-6-6 and in 4-4-1-1-3 was 33, 38 and 35 respectively. 9-7-6-6-6 is found capable of further improvement and selection is continued.

Back crossing.—The cross 9-7-6-6-6 × *G. peruvianum* was grown in FI and was back crossed with 9-7-6-6-6. These bolls will be grown next year for further selection.

Interspecific crosses.—The promising selected cultures of 1939-40 from Gadag and 51 from Surat were grown at Gadag; in the majority of cases the germination was bad, they were late, susceptible to leaf blight and had defective boll opening; selection was continued from the best cultures.

Selfed Seed.—The quantity of selfed seed produced was 292 lbs. of Jayawant and 289 lbs. of Gadag 1 for further multiplication.

Spinning tests of 1939-40:—Seven samples of the promising selections were sent to the Matunga Laboratory of *G. herbaceum*, K.F.T.12-2-5 gave 44's while of *G. hirsutum* 9-7-6-6 gave 32's against 29's of Gadag 1.

The scheme for the improvement of Dharwar-American cotton has been sanctioned by the Government and the Indian Central Cotton Committee.

IV. DHARWAR FARM.

(a) *Cotton Varietal trial.*—The cotton strains, Jayawant, New-Jayawant and Early-Jayawant were tried with Local Kumpta in six random replications. They are all found to be similar in yield.

(b) *Manurial trials.*—(i) Last year's experiment of giving F.Y.M. 2½ tons every year to both the rotated crops, viz., Jowar and Cotton, 2½ tons only to Jowar every second year and 2½ tons to only Cotton following bare fallow, were compared with no manure. The results of both cotton and jowar are not significant. The treatment of manuring cotton after bare fallow is dropped, as the cultivators would not forego one jowar crop.

(ii) *San green manuring to both the rotated crops viz., Cotton and Wheat.*—San green manuring, sangreen-manuring in addition to 1,500 lbs. of F.Y.M. and 2½ tons of F.Y.M. alone, were compared with no manure. The results are not significant for both cotton and wheat.

(c) *Cultural trials.*—(i) To ascertain if it would be economical to plough the lands once in three years, once every 2 years or every year or to replace it with only harrowing, were tried in the rotated crops viz., Cotton and Jowar. The results for both were not found to be significant.

(ii) To ascertain the most profitable way to grow wheat, i.e., in Kharif season (a) to have bare fallow (b) to take a crop of *Vigna-Catiang* (Alsandi) and (c) to grow *Phaseolous Trilobus* (Ran Matki), were tried in 5 random replications. The wheat yields are not significant; however the treatment (b) was highly paying. This experiment is dropped.

(iii) The experiment of dibbling cotton 24" × 9" vs. drilling in rows 24" apart was continued in the paired strips. The results are not significant. The experiment is dropped, as dibbling is not practicable owing to short sowing period.

ARBHAVI FARM.

Varietal trial.—G1 × CO-2, 9-7-6-6 and CO 2 were again compared in 7 replications. The results were not significant. On an average of last 4 seasons the yield per acre of 9-7-6-6 was 961·2 lbs. against 964·5 lbs. of CO 2, CO 3 and CO 4 will be tried with CO 2 next year.

District trial of cotton.—Jayawant, New-Jayawant and Early-Jayawant were tried under the Cotton Superintendent on Farmers' fields in 7 centres of Dharwar, Belgaum and Bijapur districts. All the three types were tested in 19 fields; there was negligible difference in yield between the types viz., Jayawant=316 lbs., Early-Jayawant=324 lbs. and New-Jayawant=326 lbs. Early-Jayawant cannot be recommended as it is found to be susceptible to wilt.

The trial of G1 × CO 2 9-7-6-6 with Gadag 1 was taken at Dundur in duplicate plots. Gadag 1 yielded slightly more but the ginning percentage of 9-7-6-6 was distinctly high.

II. PADDY.

I. MUGAD RICE BREEDING STATION.

(a) *Dodagya strains (Old lot).*—This is the sixth year of this trial. The three promising Dodagya strains were tried against local Dodagya variety on the Farm and in cultivators' fields. D. 6-2-2 gave the highest yield in all places. The same trial will be repeated, for one year more, on the Farm. But in the District D. 6-2-2 alone will be compared with local check.

(b) *Dodagya Selection (New lot).*—The freshly isolated six promising strains were tried against D. 6-2-2 for the first time. D. 89-7 and D. 97-1 yielded better than D. 6-2-2. This trial will be repeated next year.

(c) *Yield trial of Fine Rice Selections*—(1) *Early strains.*—Waner 1 and 26-2 were compared with local, early, fine rice variety and M. 161, for the first time. Both the selections were found to be superior to local check, but equal to M. 161 in yield.

(2) *Mid-late strains.*—The three promising Mid-late selections were tried against local check and M. 81. Strains 52-1 and 52-2 showed superiority in yield over local variety but were equal to M. 81.

(3) *Late strains.*—This trial was also conducted for the first time. Five promising selections were compared with local fine rice late variety and M. 141. Strains 44-1 and 47-5 seem to be promising.

(4) *Very late strains.*—Six very late prolific types were put under field trial, for the first time, Indrasal and Local "Sanna-bhatta" being used as checks. Yelikirsal-4 and 11-1 seem to be outstanding.

All these yield trials of fine rice selections will be repeated.

(d) *Antarsal late*.—A. 267 and A. 176 were tried against A. 200. A. 267 is decidedly inferior. The other two strains yield equally well. This trial will be repeated once more.

(e) *Hybridization work*.—This work is confined to (1) crosses made to evolve early, mid-late and late types of intense, purple leaf and stem colour, in combination with other economic characters, to facilitate eradication of "Gonag". (2) Crosses to combine high yield and scent, and (3) crosses made to combine yield, earliness and drought resistance. Work under (1) and (3) is in the preliminary stage. From the second set of crosses P.R. 90 × Luchai and P.R. 90 × T. 24 seem to be promising. P.R. 50 × Luchai and P.R. 50 × A. 200 have been discontinued, as no useful material could be obtained from these crosses.

(2) KUMTA FARM.

(a) EARLINES.

Selections for Ankola-Karwar Zone.—Out of the 511 individuals under study, 162 have been retained for further observation. In addition to these, 1,265 panicles, from the standing crops, in cultivators' fields, have been selected, for single row tests next year.

(b) *Up-ghat White Halga*.—To ascertain the utility of strains 1690 and 1681 in the "drilled tract," these strains were tried under "dibbled" and "transplanted" conditions. When dibbled, strain 1690 gave higher yields of straw and grain. There was no difference in grain-shedding under both these conditions.

(c) *Muginbeldu Strains*.—Out of the seven strains, tested for yield, strains 125 and 159 seem to be very promising. The trial will be repeated.

(d) *Crosses*.—With a view to secure higher yield M. 161 and A. 90 were crossed with Red Halga 244 and Jaddu 1061. This is the F_4 generation of these crosses. Out of the seventeen segregates tested, five look promising. They have been retained for further study.

(3) RATNAGIRI FARM.

The work on Rice is confined to maintenance of purity of the strains, already evolved, and their multiplication.

Village trials.—Late Varangal No. 487 and fine Waksal No. 1 were tested, for yield, in cultivators' fields. Both these strains proved superior to local check. These strains will be released for general distribution from next year.

(4) *Paddy seed multiplication on Mugad, Kumta and Ratnagiri Farms*.

On Mugad, Kumta and Ratnagiri Farms, respectively, 10,043 lbs., 12,240 lbs. and 13,138 lbs. pure pedigree seeds of the improved strains were produced and given for distribution in the districts.

III. SUGARCANE.

(1) ARBHAVI FARM.

(a) *Varietal trial.*—Five of the promising CO varieties were tested, for yield, with J. 213. CO. 419 and CO. 413 seem to be promising. CO. 419 gave the highest yield of gul per acre.

(b) *Better rotting of Sann.*—(Sann-green manure on CO. 419). There are four treatments:—(1) 25 cart-loads of F.Y. Manure, (2) Sann plus 5 cart-loads of F.Y. Manure before sowing, (3) Sann plus 5 cart-loads of F.Y. Manure before burying sann, (4) Sann alone. No difference was seen in yield, due to any of these treatments.

(c) *Top-dressing.*—Nitrogen, at two levels viz. 75 lbs. and 100 lbs. per acre, to be applied as top-dressing to Sugarcane in three doses was compared. This year, there was no difference in gul yields.

(d) *Spacing experiment.*— $3\frac{1}{2}$ feet spacing between rows of sugarcane was compared to 3 feet spacing as check. This year's results were in favour of wider spacing of $3\frac{1}{2}$ feet.

(e) *Rotational series.*—

(a) *Two-year rotation* with an object to improve "Kirl" soils by sann-green manuring was tried. The treatments were (i) Sugarcane after sann, (ii) and Sugarcane after "Maize and Sann" mixture. The results are not conclusive.

(b) *Three-year rotation.*—This experiment has been laid out to ascertain the most economic rotation for CO. 419

First year.—Sugarcane.

Second year.—Sann-green manuring.

Third year.—Sann followed by early maize and cotton and maize mixture.

No inference can be drawn, from the results obtained, until one cycle of rotation is completed.

(2) KUMTA FARM.

(a) *Varietal trials.*—Three promising CO varieties of sugarcane were tried against H.M. 320 as check. CO. 419 tops the list from the point of yield obtained and the quality of its gul.

IV. TOBACCO.

(1) NIPANI FARM.

(a) *Selection in local Tobacco.*—The 10 selections reported last year—8 from Surti, 1 from Baglani and 1 from Bhopli—were studied during the year for their purity and Botanical characters and 6 from Surti are only retained for further study and purification.

The 37 fresh selections made from various samples of the local crops grown on the farm as reported last year were studied for their purity and botanical characters and 18 are only retained for further study.

15 individual plant selections from the cultivators' fields reported last year were studied for purity and Botanical characters and 8 are retained for further study.

(b) *Cigarette Tobacco*.—Three cigarette tobacco varieties Bonanza, Gold Doller and Harrison special were studied for their general performance under Nipani climatic conditions. No flue-curing could be done in absence of curing barn. It is expected that a new site will be acquired at Soundalga during 1941-42 and a barn will be then constructed and the work on cigarette Tobacco will be conducted in detail there.

(c) *Yield Trials*.—Out of the 8 selections from Surti, 2 selections No. 3 and No. 12 were tried for yield test along with local in 9 randomised blocks. They were found to be not significantly superior over the local check.

V. GROUNDNUT.

DHARWAR FARM.

The promising strains, Spanish Peanut 5, Spanish Improved and Pondicherry 8 have been maintained pure and the pure seeds are handed over to the Agricultural Officers for multiplication.

(a) *I. Varietal trial*.—Spanish Peanut 5, Spanish Improved and Valencia were tried in five random replications. Spanish Peanut 5 yielded the highest and Spanish Peanut 5 and Spanish Improved were significantly superior to Valencia.

II. Six Coimbatore strains were compared with Pondicherry in seven replications in a latin square system. A.H. 218, A.H. 113, A.H. 186 and Pondicherry were significantly superior to the rest.

(b) *Spacing*.—In order to decide the best spacing, the experiment to dibble at varying distances was repeated; the distance of 6" × 9" gave the highest yield though the difference is not great as to be reliable. Last year the spacing 6" × 4" was the best.

VI. JOWAR.

(a) DHARWAR FARM.

The improved strains of Chowri, Bilichigan, Ambemohor, Fulgar-White, Fulgar-Yellow and Nandyal are maintained pure by the Cotton Breeder and the selfed seeds of three varieties are multiplied by the Agricultural Officer for distribution.

(b) MOHOL RABI JOWAR.

The Maldandi selection 35-1 gave significantly higher yield than local which was late by 10-12 days—Selection 35-1 is still capable of further improvement.

Dagdi.—N.D. 15 and B.D. 24 were tried in 4 random replications with local. B.D. 24 yielded 5 per cent. more than local which was not significant. The experiment of trying *Dagdi* strains in Nagar and Bijapur districts was vitiated owing to partial or complete failure of Jowar crop.

VII. GRAM.

DHARWAR FARM.

In a highly wilt infected plot, the strain 18-12 was tried along with outside types. 18-12 showed 4.6 per cent. wilt mortality against 5.5 per cent. of Niphad 816. Most of Punjab selections were highly susceptible and late. The fungus was isolated this season and its pathogenicity was tested.

It was tried with local and Burma grams in random replications. 18-12 yielded the highest, though it is not significant over local. On an average of last six years 18-12 gave 666 lbs. *versus* 514 lbs. of local, proving superiority of the selection.

VIII. TUR.

ARBHAVI FARM.

Culture of Tur wilt fungus was supplied by the Cotton Breeder for preparing wilt compost; this compost was applied to the soil and on it the selections were tried, ten selections are retained.

IX. WHEAT.

DHARWAR FARM.

Varietal trial.—Bansi palli 808, I.P. 80-5, 165 and 120 were compared with the local. Local yielded the best this season; while 808 and Local yielded significantly higher than the others, hence they are left out from further trial. For the last eight years 808 is tried with Local. The yield of 808 was higher than the Local in all the seasons except the current one; the difference in yield in favour of 808 was higher in 3 seasons *viz.*, 1933-34, 1935-36 and in 1938-39, thus it can be said to be superior to Local.

X. MAIZE.

ARBHAVI FARM.

The Botanical improvement of the local was continued. The Sahara and Peruvian varieties were also grown side by side, they were found late; these will also be tried next year. Selection in the Local was continued on the basis of high weight of grain per cob.

XI. OTHER EXPERIMENTS.

(a) *Varietal trial of Mug (Phaseolus Mungo) on Dharwar Farm*.—Two China varieties Nos. 1 and 2 were tried each on a guntha plot and replicated six times. The control was local *Mug*. China Nos. 1 and 2 gave significantly higher yield over local.

(b) *Trial of Napier Grass as a dry ratoon crop on Dharwar Farm.*—
 (1) It yielded 15,062 lbs. green grass per acre in five cuttings. This grass was not relished by the Farm cattle.

(2) *On Arbhavi Farm.*—The ratoon crop of Napier grass dry as well as irrigated was tried. The irrigated crop yielded 16,272 lbs. of green fodder per acre in seven cuttings. Dry crop gave 5,312 lbs. of green fodder in six cuttings. In view of discouraging results, the trials will be discontinued.

(3) *On Ratnagiri Farm.*—The Napier grass which survived quite well during the fair season without irrigation, gave in three cuttings 28,500 lbs. of green fodder per acre.

(4) *On Kumta Farm.*—In the year 1939, yield was 5,373 lbs. in two cuttings, in 1940, 12,098 lbs. in three cuttings. This experiment is to be continued further.

(c) *Fruits.*—

(a) *Pine Apple.*

(1) *Kumta Farm.*—I. Fertiliser Experiments (i) F. Y. Manure 7,000 lbs.+Am₂ SO₄ 155 lbs.+K₂ SO₄ 312.5 lbs.+Bone Meal 300 lbs. (ii) Undi cake 1,030 lbs.+F.Y.M. 7,000 lbs.+K₂ SO₄ 312.5+B.M. 250 lbs. (iii) Niciphos 150 lbs.+F.Y.M. 7,000 lbs.+K₂ SO₄ 312.5+AM₂ SO₄ 100 lbs. (iv) F.Y.M. 15,000 lbs. tried in four replications and found that the mixture of F.Y.M. 7,000 lbs.+Undi cake 1,030 lbs.+K₂ SO₄ 312.5 lbs. and Bone Meal 250 lbs. per acre has given 26,200 lbs. of fruits with an increase of 16 per cent. over the check per acre.

II. Cultivation of Kew variety as a dry crop was continued. Two fruits were developed on two plants weighing 1 and 1½ lbs. respectively. This experiment will be continued. No suckers were developed. The fruits developed were less juicy and equal in point of taste and flavour.

(2) *Ratnagiri Farm.*—(i) Spacing Experiments have been undertaken and laid out in 4 replications. The different spacings adopted are 5 × 3 × 2½ feet; 4 × 3 feet; and 3 × 3 feet.

(ii) *Desuckering Experiments* are also in progress to find out if the process of desuckering pine apple plants encourages shooting out of basal suckers in large numbers.

(b) *Cashew Nuts.*—96 plants planted in 1938 and 200 plants in 1939-40 were thriving well. No irrigation was done during summer. Out of 96 plants 5 plants had developed blossoms and 30 nuts were realised. Out of 200 plants 10 plants had developed blossoms but no fruit was developed.

(c) *Ahmedabad Bor.*—There are 12 plants of bor on Kumta Farm. During the year 5 plants had borne blossoms but only two gave fruits.

(d) MISCELLANEOUS ITEMS.

Tapioca on Kumta Farm.—The six varieties obtained from Travancore State were cultivated on 12-guntha plot. Of these Sundry-Vella and Kovilla-Vella varieties were planted on 6 gunthas and the remaining ones together with local red were planted on the remaining area. As stated in the last year's report, Kovilla-Vella and Sundry-Vella varieties showed better growth and the tubers of the same were far superior to those of the other varieties in point of taste and size.

(e) GENERAL WORK ON FRUITS.

(i) *Early and annual bearing of mangoes.*—To find out if mango trees known and proved to be regular early bearers would transmit their quality of earliness in their progeny propagated vegetatively, a dozen grafts were prepared on the well-known early bearing alphonso trees belonging to Kazi Hussein Kazi Alli in the Shirgaon village of the Ratnagiri Taluka.

(ii) *Side grafting of Mangoes.*—The results achieved with regard to the experiments conducted for the last five years on the improvement of the common method of side grafting have fully convinced the public about the usefulness and utility of this method. More than 80 per cent. success is obtained by the improved method.

(iii) *Budding of Mango.*—It has now been definitely proved that Mango budding can be made a practical proposition. Large number of budded mango plants have been prepared on the farm as well as in the District to convince the public.

D. RURAL DEVELOPMENT.

Cotton.—(a) The work under the Extended and Revised seed Multiplication and distribution scheme of Jayawant and Gadag No. 1 cotton seed was continued through the Co-operative Societies and the Agents. All Centres worked well. The rogued Reserved area under Jayawant cotton in 7 centres was 68,908 acres and that under Gadag No. 1 cotton in two centres was 25,184 acres. The crop was rogued under careful supervision of the Cotton Staff. The roguing charges came to 4.02 pies in case of Jayawant and 3.86 pies in case of Gadag No. 1 cotton, per acre. The approved Agencies of the Department continued to do very satisfactory work. The quantity of Jayawant cotton seed stocked was 6,379,025 lbs., and that of Gadag No. 1 was 1,600,900 lbs. The season for cotton was unfavourable and some seed remained unsold. The quantities actually distributed and the area covered were 4,851,330 lbs., 555,544 acres in the case of Jayawant and 1,514,800 lbs., 151,480 acres in the case of Gadag No. 1 cotton, respectively. In addition to this, an area of 170,000 acres in the case of Jayawant and 30,000 acres in the case of Gadag No. 1 cotton was covered by natural spread.

(b) *Grading and Auction sales.*—Grading and Auction sales of Jayawant and Gadag No. 1 cottons were organised in all the centres through the

help of the Approved Agencies. The agencies continued to work hard in pooling together the produce from the cultivators to whom they had supplied seed. They also gave advances to deserving clients on the security of the standing crop and worked in close co-ordination of the cotton staff in making these auction sales of the improved cottons very successful. The total number of docras sold by auction sales and private treaties arranged by the Department was 83,324 in the case of Jayawant and 35,029 in the case of Gadag No. 1 cotton. The extra prices realised in auction sales were about Rs. 15 to 20 per Nag of 1,344 lbs. of seed-cotton on an average. In these auction sales held during the year, about 7,266,832 lbs. of Jayawant and 1,441,000 lbs. of Gadag No. 1 cotton seed have been purchased and stocked by the Agencies, for distribution during the next season.

(c) *Working of the Cotton Transport Act.*—Twenty Cotton Check Stations were opened during the year. The Cotton Superintendent, S. M. C., Dharwar, and the District Agricultural Officers continued to supervise the work of the same. Licenses were issued as usual, from Gadag, Bagalkot and Nargund offices, for importing of good cotton from the bordering villages outside the protected areas. The total quantity thus imported under the cover of licenses was 2,012 docras of seed cotton, 72,952 docras of lint, 6,735 Full Pressed Bales and 360 bags of cotton seed. The Cotton Transport Act continued to work well in the interest of consumers as well as growers of cotton. Illicit import by Rail was totally stopped and that by Road was continued to a certain extent on account of inadequate supervision and of the existence of a few check stations. Appointment of special staff and opening up of some more check stations are again emphasised to work the Act more effectively.

(d) *Working of the Cotton Market Act.*—The Regulated Cotton Markets at Bailhongal and Bijapur continued to work satisfactorily. The Cotton Superintendent, S. M. C., Dharwar, was again elected as the Chairman of the Market Committee, Bailhongal. 80,160 docras of kapas and 1,963 docras of lint were sold in the market yard, Bailhongal. Similarly, 47,371 docras of kapas and 21,499 docras of lint were sold in the market yard, Bijapur. The Market Committee, Bailhongal, received in all Rs. 6,607 as gross income and expended on the whole Rs. 6,545 including the paid-up loan instalment of Rs. 2,787 in connection with purchasing the market land of the Committee. The Cotton Market Committee, Bijapur, had saved a net gain of Rs. 2,993 after spending Rs. 3,560 as running expenses of the Market Committee. Thus, the work of both the Markets in Karnatak is quite satisfactory.

(e) *Ginning and Pressing Factories Act.*—Inspection of Ginning and Pressing Factories, so far as they concern to watering of cotton and admixture of the same was done by the Cotton Staff. Watering of cotton was not found in any factories. Admixture of cotton is difficult to be detected. However the provisions of the Act have been enforced. Necessary awakening is created. But special staff is necessary to do the needful more efficiently.

Crop Protection.—The work of protecting crops from the ravages of wild pigs was continued. Five more Gun Clubs were newly organised in 1940-41 which make up the total of 29 group gun clubs in an area of 193 villages. In all 666 wild pigs and 82 deer were destroyed, 341 pigs in Dharwar District, 209 in Belgaum District, 107 in Kanara and 9 in Bijapur district. It is estimated that crop on about 100,000 acres was thus protected by the operation of these gun clubs in the four districts.

Advisory and Development Work.—The Wilson Anti-Famine Institute under the guidance of the Collector of Bijapur took "Bunding" as one of the scarcity measures in the District. Subsidy ranging from Rs. 2 to Rs. 4, per acre, was given to cultivators who put up bunds according to the plans given by the Bunding and Embankment Officers.

Services to the Public.—Surveying and levelling works were undertaken mainly in Saundatti Taluka of the Belgaum District and Navalgund Taluka of Dharwar District for preparing field embankment plans on an area of 395 acres costing Rs. 5,000 in Saundatti Taluka, while in Navalgund Taluka plans covering an area of 75 acres costing Rs. 1,500 have been undertaken. One Land-Development and Drainage Work in the village of Agragoni in Ankola Taluka of Kanara District was referred to for supplying plans and advice, and this was duly attended to. Plans and estimates for an area of 6,161 acres at an estimated cost of Rs. 96,818 were given. Schemes prepared were 225 for 51 villages, Tagai recommended was Rs. 24,786 for six talukas in Bijapur District.

Taluka Demonstration Centres.—There are seventeen Demonstration Centres working in this Division. 4 in Dharwar, 3 in Belgaum, 3 in Bijapur, 3 in Sholapur, 2 in Kanara and 2 in Ratnagiri Districts. The idea of these Centres was to select a progressive farmer with a fairly decent holding and help him to put in his estate all possible resources for land improvements, better tillage, improved crops, disease control etc. to show him and to the farming public around, the benefits of improved farming.

Bijapur.—There are three T. D. Centres working at Bijadur, Bagewadi, and Bagalkot (Honnakatta), each centre owns two iron ploughs and those at Bagewadi and Bagalkot were much in demand on hire. Good work was done at Bagewadi and Bagalkot T. D. Centres. Dry Farming method was successfully demonstrated on the three T.D. Centres Farms and seed of Joswar M-47-3 (7312 lbs.) was handed to the Rural Development Staff for further multiplication. 45 small demonstrations of standing crops were held on T. D. Centres.

Kanara.—There were two T. D. Centres working, one at Bargi in Kumta Taluka and the other at Kannalli in Siddapur Taluka. All the available seeds of paddy strains and sugarcane sets were stocked and distributed to the neighbouring cultivators for further multiplication. English and American vegetables, onions and pulses were successfully grown on Bargi T.D. Centre. Improvement of poultry by the introduction of

white Leghorn & Rhode Island Red for cross breeding on the country hens was attempted in the area of the Kannali T. D. Centre. But further results from the Cross breeds are awaited.

Ratnagiri.—There were two T. D. Centres one at Deorukh and the other at the Phonda Ghat. Demonstration plots were arranged at these Centres. Four demonstrations were arranged during the period on vegetable crops, sulphur dusting against mango hoppers, etc.

Belgaum.—There were three Taluka Demonstration Centres at Belgaum, Hirekodi in Chikodi Taluka and Bailwad in Bailhongal Taluka.

(a) About 1,500 acres were got ploughed with iron ploughs round about the T. D. Centre. (b) The following quantities of improved seeds have been distributed. Jowar 1094 lbs., groundnut (Spanish Peanut) 640 lbs., wheat No. 808, 7,500 lbs., Gram strain (18-12), 200 lbs., Paddy, 14800 lbs., Nagli 56 lbs., improved sugarcane sets 7 lacks and small quantities of vegetable seeds. (c) Control measures against pests and diseases. (d) Use of stone rollers and improved cane crushers and construction of improved furnaces were also attended to. (e) Reliable grafts and plants were supplied. (f) Shows and Demonstrations of improved implements 15, manure treatments 6, improved crops 15, protection of crops against pests and diseases 12 were arranged.

• *Dharwar*.—There were 4 Taluka Demonstration Centres, one at Navalur in Dharwar Taluka, Second at Harti in Gadag Taluka, Third at Yellapur in Haveri Taluka, fourth at Singapur in Hangal Taluka—

(a) Nearly 500 lbs of concentrated manures like sulphate of Ammonia and Superphosphate were distributed.

(b) Improved implements supplied were 2 Iron Ploughs one dozen plough shares, spare parts of Vatandar plough worth Rs. 30 and one Kirloskar sprayer.

(c) The following quantities of improved seeds of Jowar (varieties) 764 lbs., Groundnut 7000 lbs., Wheat 808, 3,000 lbs., Gram 18-12, 464 lbs., Paddy strains 1000 lbs., improved sugarcane sets 10,000 and improved vegetable seed were distributed.

(d) Control and remedial measures against pests and diseases viz., Jowar smut, murda disease on chillies, grasshoppers on Jowar and field rats were demonstrated. Sulphur dust packets distributed were 3000.

(e) Reliable plants and grafts 630 were supplied.

(f) Shows and Demonstrations—of improved implements 12, standing crops 18, treatments against pests and diseases 36, and of improved method of gul-making 2, were held.

Sholapur.—There were three Taluka Demonstration Centres one at Malshiras, second at Madha and third at Jeur.

(a) Improved methods were adopted in raising better crops.

(b) *Improved types of seeds distributed*.—Banilla Cotton 200 lbs., Jarilla cotton 4210 lbs., Akola Bajri 275 lbs., Groundnut K-1-1275 lbs.,

Groundnut K-3-1550 lbs., Spanish peanut 200 lbs., Jowar 35-1-3002 lbs., Jowar 47-3-448 lbs., Pusa Wheat 165, 50 lbs., and Cane sets of CO. 419, 12,30000, CO. 413,200,000 and P.O.J. 2878., 600,000 were distributed.

(c) 68 mango plants were planted and budding of 80 bor trees was carried out successfully.

(d) Seed drill with 15" distance; 30 drills were made and given out.

(e) 40 demonstrations of different types were held.—(i) Wider sowing (ii) standing crops (iii) sulphur dusting (iv) budding (v) seed grading (vi) better tillage by Sayan harrow (vii) compost making.

Demonstrations for Officials.—Demonstrations on Government Farms (Kumta, Dharwar, Mugad, Ratnagiri & Arbhavi) were held in the months of November, December and January 1940-41.

Farmers' Weeks were arranged on Kumta, Mugad, Dharwar, and Mohol Farms in the months of November, December and January, 1940-41. Number of cultivators varying from 130 to 360 attended with interest and the demonstrations held were of great benefit to them.

Distribution of pure pedigree seeds of improved crops produced on Government Farms.—Definite quantities of seeds were allotted to District Agricultural Officers for village trials and multiplication and to Rural Development Inspectors for further multiplication and distribution according to items of improvements suggested for each district. Rural Development Inspectors of the districts where the Farms are situated are allotted the whole stock of fruit plants available.

A statement showing the distribution of pedigree seed and grafts etc., is appended.

E. AGRICULTURAL EDUCATION.

(i) *Agricultural Schools—Kannad Agricultural School, Devihosur.*—The total number of students during the year under report was 28, there being 15 students in the first year class and 13 in the second year class. Of the 28 students present, 12 were from the Dharwar District, 10 from Bijapur, 4 from Belgaum, and 2 from Kanara Districts. Out of the total strength, 14 belonged to each of the advanced and intermediate class. The total number of students turned out with certificates so far comes to 314 and that of the Primary School Teachers reaches 39. The average per head monthly expenses came to Rs. 7-13-7.

(ii) *Rural Assistants Training Centre.*—Devihosur Centre started work from 1st May 1941. The Ad-hoc Committee, Dharwar, Belgaum, Bijapur and North Kanara Districts had selected 10, 8, 9 and 5 candidates respectively, from their jurisdiction. But, however, only 26 Rural Assistants have joined this Centre. Out of these 7 are from Dharwar, 8 from Belgaum, 7 from Bijapur districts and only 4 from Karwar District.

(iii) The Agricultural School at Rajapur is given all guidance and advisory assistance by the Agricultural Staff.

F. MISCELLANEOUS WORK.

(1) The Deputy Director of Agriculture, Southern Division, is a member of the Fodder and Grazing Committee for the Districts Bijapur, Belgaum, Dharwar and Kanara.

(2) The Deputy Director of Agriculture, Southern Division, has also attended the conference of irrigators and gave suggestions for extension of period of season upto the end of February for rabi crops, proposals for the revision of water rates on the Dharma Canal.

(3) Technical advice were given to the Collector of Dharwar after inspection of waste lands in Ranebennur, Haveri and Gadag Talukas regarding feasibility of lands for cultivation and probable expenses required.

(4) General information regarding tractor ploughing and tagai loans for eradication of hariali in Southern Division was supplied to Government and Tractor Ploughing Companies and a report was made on the previous work together with suggestions and remarks.

(5) His Excellency the Governor of Bombay visited (Hatkhamba) and Kumta Farm during his tour to the coastal districts in the month of May, 1941.

(6) Enquiries as usual were received from the public on various technical questions pertaining to improvements in Agriculture and these were promptly attended to.

Dharwar, 9th September 1941.

(Signed) H. G. BALUCH,
Deputy Director of Agriculture,
Southern Division, Dharwar.

Production and Supply of Pedigree Seeds and Grafts etc.

The following statement shows the production and supply of pedigree seed, grafts etc. from the different Agricultural Farms in the Southern Division during 1940-41 :—

Name of Seed.	Dharwar Farm.		Mugad Farm.		Arbhavi Farm.		Ratnagiri Farm		Mohol Farm.		Kumta Farm.	
	Produce Lbs.	Supply Lbs.	Produce Lbs.	Supply Lbs.	Produce Lbs.	Supply Lbs.	Produce Lbs.	Supply Lbs.	Produce Lbs.	Supply Lbs.	Produce Lbs.	Supply Lbs.
1. Rice .. ..	..	..	18,863	18,863	..	..	13,338	13,138	..	..	11,740	11,740
2. Wheat	12,532	12,532	..	..	..	..	..	..	..	..	..	..
3. Jowar	10,588	10,588	..	..	..	..	..	..	3,050	3,050	..	..
4. Nagli .. ..	..	..	..	..	..	..	650	617	..	..	..	..
5. Gram	3,101	3,101	..	..	..	..	..	..	..	..	..	..
6. Groundnut ..	2,514	2,514	..	..	..	..	..	..	..	..	..	..
7. Sugarcane sets (In Nos.) Canes..	..	..	..	..	30,750	30,750	..	..	..	..	10,000	10,000
8. Cotton	6,162	6,162	..	..	841	841	..	..	..	..	..	..
9. Lemon Seedlings (In Nos.) .. ..	..	..	..	..	2,583	2,583	..	..	..	..	..	..
10. Pomegranate seedlings (In Nos.) ..	..	..	..	..	1,209	1,209	..	..	..	..	..	..
11. Mosambi Grafts (In Nos.) .. ..	..	..	..	..	918	918	..	..	..	..	..	..
12. Guava Seedlings and grafts (In Nos.) .. ..	..	..	..	..	519	105	52	52	..	..	..	..
13. Mango Grafts (In Nos.) .. ..	..	..	..	..	480	480	923	923	..	..	600	600
14. Italian Lemon Grafts (In Nos.) ..	..	..	..	..	304	304	18	18	..	..	..	..
15. Chickoo .. ..	..	..	..	..	..	..	66	66	..	..	..	..
16. Santra grafts (In Nos.) .. ..	..	..	..	..	150	150	..	..	..	..	..	..
17. Pine apple suckers (In Nos.) .. ..	..	..	..	..	..	..	713	713	..	..	8,500	8,500
18. Grape Fruit and Pamparl Grafts (In Nos.) .. ..	..	..	..	..	24	24	..	..	..	..	..	..
19. Grape vine cuttings .. ..	..	..	..	..	24	24	..	..	..	..	..	..
20. Other fruit plants (In Nos.) .. ..	..	..	..	..	..	..	..	..	..	..	700	700
21. Miscellaneous seedlings of Sitaphal, Ramphal, Rayanelli, Papaya and Karbov .. ..	..	..	..	..	54	54	..	..	..	..	..	..

Programme of Work for the year 1941-42.

COTTON BREEDER'S SECTION, DHARWAR FARM.

A. COTTON.

(a) KUMPTA.

1. Trial of selected strains against Kumpta.
2. Selection in the following crosses :—
 - (i) K.F.T. 12-2-5 × 1A-14-3 (D1 × Rosea) F4.
 - (ii) K.F.T. 12-2-5 × New Jayawant F5.
 - (iii) (New Jayawant × B.D.8 B.C.1-6 F6) F2.
3. Selection in the following back crosses :—
 - (i) K.F.T. 12-2-5 × 1A-14-3 B.C.L.
 - (ii) New Jayawant × K.F.T. 12-2-5 B.C.L.
4. Selection in the following composite crosses :—,
 - (i) (New Jayawant × B.D. 8 B.C. 1-6 F6) × K.F.T. 12-2-5.
 - (ii) (Early Jayawant × B.D.8 B.C.1-6 F6) × K.F.T. 12-2-5.
5. Cotton wilt.
 - (i) Behaviour of wilt resistant cotton in the field.
 - (ii) Behaviour of the promising individuals, selected from the transplanted plants of the above crosses and of certain selections made.

(b) AMERICAN COTTONS.

- (i) Trial of the promising segregates 9-7-6-6-6 and 4-4-1-13 against Gadag 1.
- (ii) Trial of interspecific crosses from Surat.
- (iii) Selections in the following back crosses :—
 - (G1 × Co. II) 9-7-6-6- × G. peruvianum) Fl. × 9-7-6-6.

B. GROUNDNUT.

- (i) Maintaining the promising strains pure.

C. JOWAR.

- (i) Maintaining the selected strains pure.

D. GRAM-WILT.

- (i) Testing varieties from different places for wilt resistance in the field.
- (ii) Pot test of strain 18-12 under green house conditions.

E. TUR-WILT.

- (i) Preparing wilt compost for a highly inflected wilt plot both at Arbhavi and Dharwar Farm.

DHARWAR FARM.

The following are the experiments to be conducted during the year 1941-42 :—

- | | |
|------------------------------|------------|
| (1) Cultural Series | .. Jowar. |
| Do. | .. Cotton. |
| (2) F. Y. M. Series | .. Jowar. |
| Do. | .. Cotton. |
| (3) Sann green manure series | .. Cotton. |
| Do. do. | .. Wheat. |

(4) Wheat varieties.

(5) Wheat Spacing Experiment :—12 Inches, 15 inches and 18 inches.

(6) Wheat interculturing vs. Non-interculturing.

(7) Cotton Spacing :—18", 24" and 36" apart (to be drilled).

8. This year the multiplication of selfed seed of Jowar varieties viz. Fulgar White, Fulgar Yellow and Nandyal supplied from the Cotton Breeder, has been undertaken.

9. The multiplication of selfed seed of Jayawant cotton will be continued.

TOBACCO BREEDING STATION, NIPANI.

1. SELECTION BREEDING IN LOCAL TOBACCO.

I. *Selections prepared for study.*—The following selections will be studied during 1941-42 in seed-section as well as in leaf section :—

(i) Selection numbers—1, 3, 12, 16, 20, 24, 27 of 1938-39 origin.

(ii) Selection numbers—41, 42, 49, 50, 51, 52, 56, 57, 60, 61, 62, 79, 83, 84, 85, 89, 74, 75, 92, 65, 66, 67, 68, 73, 90, 91 of 1939-40 origin.

(iii) In addition to these—Local selections No. 1-6 (selected from the local population studied at Nipani during 1940-41 will be studied.

II. *Cigarette Tobacco.*—The following varieties of cigarette tobacco will be studied to see their relative performance etc.: (1) Harrison Special, (2) Bonanza, (3) Gold Dollar, (4) Mammoth Gold, (5) Cash and (6) White Bureley,

PROGRAMME OF WORK FOR 1941-42.

*Arabhavi Farm.*1. *Research work.*A. *Experiments on Sugar-cane—*

- (i) Varietal trials.
- (ii) Two and three year rotation to Sugar-cane.
- (iii) Better rotting of sann.
- (iv) Top-dressing experiments.
- (v) Spacing experiment.
- (vi) Seed multiplication and study of promising cane varieties.

B. *Varietal trial of cotton.*—Strains from cambodia cotton will be compared.

C. *Tur Wilt work.*—Cultures having incidence of wilt below 40 per cent. will be studied.

D. Selection work in maize to be continued.

E. Shara and Peruvian varieties of maize will be tested against some of the Arabhavi Farm maize selections.

F. Service. Nursery to be run as usual.

H. Compost making.

*Mugad Rice Breeding Station.*A. *Rice.*1. *Yield trials of the following:—*

- (i) Dodagya selections (old lot): strain Nos. 5-1-1, 6-2-2 and 6-2-3.
- (ii) Village trials of D.6-2-2 against local Dodagya variety, all over Malkad tract.
- (iii) Dodagya selections (New lot): Strain Nos. D.79-4, D.106-6, D.89-6, D.97-1, D.89-7 and D.137-5 against D.6-2-2.
- (iv) Early fine rice Strains: Waner 1 and 26-2 against M.161 and local check.
- (v) Mid-late Fine Rice strains: 3-3, 52-1 and 52-2 against M.81 and local check.
- (vi) Late fine Rice strains: 27-6, 44-1, 47-3 and 47-5 against local M.141.
- (vii) Very late fine rice strains: 9-1, 11-1, 11-3, 21-1, Sanna bhatta 5 and Yelikirsal 4 against local and Indrasal.
- (viii) Antarsal late: A.267 and A.176 against A.200.

2. *Hybridization work*.—Study of F_2 and F_3 of crosses.
3. The continuance of the seed multiplication work of important varieties and their maintenance in pure form.

Kumta Farm.

A. *Rice*—

- (i) Selection work for the Ankola-Karwar zone will be continued.
- (ii) The most promising Muginbeladu strains will be put under field trial.
- (iii) Botanical work on Chintamani and below ghat "Bile-Halaga" varieties will continue.
- (iv) The five promising cultures from crosses will be grown in F_3 generation.
- (v) Further study of the promising Mysore varieties of paddy.
- (vi) Seed multiplication of the improved strains.

B. *Sugarcane*—

- (i) Varietal trials.

C. *Mango*—

- (i) F. Y. Manure vs. common salt on Alphonso variety.

D. *Pine-apple*—

The same work will be continued.

E. *Introduction of new crops*—

Observations on the crops under study, will be made.

F. *Farm Nursery*.

Ratnagiri Farm.

1. Seed multiplication of improved rice and Nagali strains.
2. Yield trials of Mysore, Madras and Karjat varieties of paddy and Nagali strains against Ratnagiri strains.
3. Village trials.
4. Individual fruit tree records.
5. Early and annual bearing in mango.
6. Spacing and desuckering on pine-apple.
7. Training class in Mango canning and side-grafting.
8. Trial of Sudan and Napier grass.
9. Improvement of Varkas lands.
10. Nursery.

Mohol Farm.

1. Trial of Maldandi Strain No. 35-1 (General) and its sub-cultures *versus* local.
2. Trial of strain No. 35-1 and 47-3 by student's method.
3. Multiplication of pure seed of strain No. 35-1.
4. Trial of Dagadi strains on the Farm and in the Districts.

BUNDING WORK.

The bunding schemes as per details given will be attended to during the year.

SHIKAR SECTION.

1. Intensified work of Gun Clubs in the area of the group of Gun Clubs.
2. General guidance and supervision and inspecting and meeting the requirements of the Gun Club members wherever necessary.
3. Taking up organisation of new Gun Clubs wherever needed.
4. Organisation and guiding the deer campaign work in the affected areas in the Dharwar District.

Programme of work of the District Agricultural Officers and Staff under them in S. D. for the year 1941-42.

1. To take village trials in selected centres of improved or promising crops varieties in the districts.
2. To organise primary stages of seed multiplication Centres for improved farm seeds, suggested for the District.
3. To supervise and guide the working of Taluka Demonstration Centres and to take steps to establish new Taluka Demonstration Centres in each Taluka or Petha. The Field Kamgars in charge of T. D. Centres are to tour 2 days in a week for getting in full contact with cultivators round about.
4. To take the fullest possible use of Taluka Demonstration Centres for demonstration purposes at suitable times throughout the year, within a radius of five miles of such centres.
5. The fullest co-operation and assistance in the working of the "Model Seed Multiplication Scheme" in its later stages, is to be given to Revenue and Rural Development Department Officers.
6. To organise "Official Days" and "Farmers' Weeks" at Taluka Demonstration Centres and at District improved seed trial and multiplication Centres.

7. To suggest suitable Centres and give necessary help for agricultural shows and demonstrations for propaganda purpose to the Revenue and Rural Development Staff.

8. To attend all meetings of Rural Development Activities for discussing the programme of work in the District, and quarterly progress of work done in the district.

9. Inspection of Cotton Check Stations and Taluka Demonstration Centres.

10. To attend public enquiries regarding technical matters like Land Development, Fruit Cultivation, control and remedial measures against plant pests and diseases, etc.

11. To give technical advice on minor irrigation projects, cultivation of Government Waste Lands and working of Better Farming Societies, etc.

12. Other work as per instructions will be attended to.

H. G. BALUCH,

Dharwar, 9th September 1941.

Deputy Director of Agriculture,
Southern Division, Dharwar.

APPENDIX B.

SUMMARY OF WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, NORTHERN DIVISION, FOR THE YEAR 1940-41.

I—STAFF AND ADMINISTRATION.

Rao Bahadur S. S. Salimath held charge of the post of the Deputy Director of Agriculture, Northern Division, throughout the year.

With the de-amalgamation of the Rural Development Department, major part of the District Agricultural work was restored to the Agricultural Department and with it some staff also, on 1st January 1941. This District staff consists of the Cotton Superintendent and his Assistants engaged in special cotton work, one Agricultural Officer and two Assistants for general agricultural work other than Cotton for each District, one Bunding Officer and two Shikar Assistants. Rao Saheb G. P. Pathak went on leave on average pay for 28 days followed by leave on half average pay for 1 month 14 days preparatory to retirement from 3rd January 1941 and Mr. J. G. Naik was appointed as Cotton Superintendent in his place. Recently in May 1941, one additional post of the Deputy Director of Agriculture for the Central Division was created by the Bombay Government and Nasik and Khandesh Districts from the Northern Division along with some other Districts from the Southern Division formed the Central Division with Poona as headquarters. The Northern Division as it now stands comprises all the four Districts of Gujarat, Thana, Kolaba and Bombay Suburban Districts and the Deputy Director of Agriculture is required to attend to both research and propaganda work as he did before the amalgamation of the Agricultural and Co-operative Departments.

II—SEASON.

The agricultural season for 1940-41 opened with bright prospects all over the Northern Division. The rainfall in June was good in all Districts and kharif sowings were done satisfactorily and in time. Rains in July and August were rather scanty in Ahmedabad, fair in Kaira, good in Broach and heavy in Surat, Thana, Kolaba and Bombay Suburban Districts. In September, the rains continued to be scanty in Ahmedabad and Kaira Districts and almost all kharif crops except Bajri suffered. In Broach District, the rains were moderate and the crops thrived well. In Surat District, they were heavy with a record fall of 12 inches in one day (on 28th) and the crop suffered from excess of moisture. In Thana and Kolaba Districts, September rains were below normal and the growth of the paddy crop was slightly checked. October rains continued to be poor in Ahmedabad and Kaira Districts and the cultivators reaped poor harvests of most of the kharif crops. In Broach and Surat Districts, there was a good break during the first fortnight which was very beneficial to kharif crops but there was a heavy rainfall of about 5 inches in one day (on 17th) accompanied by cyclonic wind which caused

considerable lodging of crops. This cyclonic wind was very severe along the coast in Thana District and caused lodging of fruit trees and the garden crops resulting in heavy losses. There were untimely rains in the latter half of November in Broach and Surat Districts which caused continuous wet conditions detrimental to the successful and timely ripening of kharif crops. The kharif season, on the whole, was too dry in Ahmedabad and Kaira Districts and too wet in Broach and Surat Districts of Gujarat. It was good in Thana, Kolaba and Bombay Suburban Districts but there was much damage due to the cyclone, particularly along the coast. The rabi season was fair in Ahmedabad and good in Broach District. The other Districts do not grow rabi crops on a large scale.

Effects of season on different crops.—**KHARIF JOWAR** in Surat District suffered from excess of moisture and was late to mature. The ear-heads were small and the yield was 60 to 70 per cent. normal. In Ahmedabad District, the crop suffered from want of rains and did not produce grain in many places. The quantity of fodder, however, was normal. **BAJRI** thrived pretty well and gave 70 to 80 per cent. normal yield. **RICE** in Thana, Kolaba and Bombay Suburban Districts, was transplanted in time and thrived well. The cyclone accompanied by heavy rains caused lodging resulting in considerable loss particularly along the coast. The yields ranged from 60 to 90 per cent. normal. In northern parts of Gujarat where rice is grown as rain-fed crop, the rains were not sufficient. The crop sown did not make any good growth and gave very poor yields ranging from 20 to 30 per cent. normal. **INFERIOR MILLETS AND PULSES** which are grown on a fairly large scale in Kaira District suffered from want of rains during their growing period and gave poor yields ranging from 20 to 40 per cent. normal. In Panch Mahals they did better and gave yields ranging from 60 to 90 per cent. normal. **GROUNDNUT** thrived fairly well in Panch Mahals and gave 80 per cent. normal yield whereas in Kaira and Ahmedabad Districts it suffered from want of rains and gave only 50 per cent. normal yield. **COTTON** in Surat and Broach tracts, suffered from excess of moisture especially in low lying areas. The season was late and the yields were below normal ranging from 60 to 80 per cent. normal. The ginning outturn and fibre quality were also affected. In Ahmedabad District, the cotton crop suffered very much in the northern parts due to scanty rainfall, matured early and gave very poor yields ranging from 20 to 50 per cent. normal. The ginning outturn and quality of cotton were also poor. The prices realised for cotton were good during the year. **MAIZE** in Broach-Panch Mahals Districts, thrived well and gave normal yield. **TOBACCO** in Kaira District, suffered from want of rains and gave poor yields ranging from 40 to 60 per cent. normal. **RABI JOWAR AND WHEAT** thrived well and gave yields ranging from 60 to 80 per cent. normal in Broach-Panch Mahals and Ahmedabad Districts.

GARDEN CROPS are grown extensively in parts of Thana and Surat Districts, specially along the coast. The cyclone on 16th October accompanied by heavy rains damaged the fruit gardens to a considerable

extent with great loss to the owners. Bearing of graft mangoes was poor during the year. Sugarcane, chiefly grown in Surat District, suffered much from heavy and continuous rains and the quality of gul was inferior. The growth of grass was fairly good in the Division and it was of considerable help to the cultivators.

III—RESEARCH WORK.

(1) *Cotton Breeding at Surat.*—The chief object of this work is to produce an improved type of cotton possessing the yield and ginning percentage of selection 1-A.L.B. and the fibre qualities of 1027 A.L.F.

Comparative tests of improved types.—Four types of cotton, viz., 1027 A.L.F., Seg. 8-1, Sel. 1-A.L.B. and S-9-1-4 were grown in 8 replications. The average performance of five years' comparative trials of 1027 A.L.F., Seg. 8-1, and Selection 1-A.L.B. on Surat Farm shows that for lint yield, Seg. 8-1 is 19 per cent. higher than 1027 A.L.F. (on account of its higher yield of seed-cotton and higher ginning percentage), but 9 per cent. lower than 1-A.L.B. For fibre length, Seg. 8-1 is very nearly equal to 1027 A.L.F. and distinctly superior to 1-A.L.B. On an average, Seg. 8-1 is valued Rs. 15 more than 1-A.L.B., but Rs. 10 less than 1027 A.L.F. With 19 per cent. more lint, Seg. 8-1 is estimated to give 10 per cent. more monetary return to the cultivators than 1027 A.L.F. Moreover, Seg. 8-1 is found to be highly wilt-resistant under field conditions whereas 1027 A.L.F. and 1-A.L.B. are very susceptible. The average results of trials of these strains at five Centres in South Gujarat during the year under report confirm those obtained on the Surat Farm. These cottons have been sent for mill tests and the results are awaited. Arrangements have also been made to grow 8-1 cotton during the current season on an area of 70 acres in the District with a view to judge its performance on a large scale. The type S-9-1-4 is under comparative trial since two years. It is earlier than 1027 A.L.F. by about two weeks. For seed cotton yield, it is equal to 1027 A.L.F., but its ginning percentage is only slightly (1 to 2 per cent.) higher. It is as good as 1027 A.L.F. in fibre length and feel but has somewhat lower fibre maturity. It is valued on "par" with 1027 A.L.F. Work in other selections and crosses was continued and some segregates of 8-1 × 1027 A.L.F. are found specially promising.

Production of selfed seed for further multiplication.—350 lbs. selfed seed of 1027 A.L.F. and 88 lbs. of Seg. 8-1 was produced during the year.

Interspecific Hybridization in Cotton.—This research was originally started by the Bombay Department of Agriculture at Surat in 1932 and has been subsequently financed by the grants from the funds of the Indian Central Cotton Committee. The aim is to explore the possibilities of combining the superior quality of American or Egyptian cottons with the hardiness, adaptability and disease resistance of Indian cottons. These two groups of cotton are, however, widely different in their relationship. The Asiatic cottons have 13 pairs of chromosomes (diploids) and the American have 26 (tetraploids). It is difficult to cross them and the rare hybrids, if obtained, are self-sterile. Fertility has, however, been induced by back-crossing to higher chromosome parents and there

are now 56 first back-crosses on hand, of which 47 are more or less fertile. The progenies of these fertile back-crosses are being studied and some of the selections show better combination of characters than the American parents, which are by themselves ill-adapted to Surat conditions. The first generation sterile hybrids, on treatment with colchicine, became partially fertile. Their progeny proved to be slow growing and late. Pure types and the varietal crosses of Asiatic diploid species, treated with colchicine, proved to be self-sterile. They were found to be female fertile on crossing with cultivated New World cottons as pollen parent. A large population of hybrids between cultivated American cottons (tetraploids) and the artificially created Asiatic tetraploids (used as male parents) was raised. They grew very vigorously but proved to be self-sterile. However, on back-crossing to cultivated American types, stray setting of bolls has occurred. Cytological examinations of the first generation hybrids between American and Asiatic cottons has shown that excepting three cases, all have 39 (26 + 13) chromosomes and that sterility is due to a set of 13 chromosomes remaining un-paired resulting in the formation of unbalanced germ cells. 14 fertile first back-crosses examined, have 52 chromosomes, and the detailed study of chromosome pairing in them explains, in general, the variation in fertility observed and the stable or unstable forms that can be had in their progeny. Cytological examination of the plants treated with colchicine showed that the number of chromosomes were doubled. By such doubling, chromosomes pairing became more regular in the above sterile hybrids, resulting in partial fertility.

(2) *Cotton Breeding work at Broach.*—The research work on the improvement of Broach cotton is entirely financed by the Indian Central Cotton Committee since 1932. The main object is to evolve by hybridization and selection from the local cotton, a highly wilt-resistant (free from mortality and partial wilt), high ginning (40 per cent.), high spinning (30'S) and good yielding strain of cotton to replace the highly wilt susceptible, low spinning (15'S) but high ginning (40 per cent.) Broach Local Cotton (commercially known as Kanvi) grown in an area of about 8 lac acres in the Nerbudda-Mahi zone.

Crosses. As a result of large scale hybridization of the highly wilt-resistant (free from mortality and partial wilt), high spinning (40'S) but low ginning (33 per cent.) strain B.D. 8 with several high ginning types lacking in resistance to wilt and high spinning qualities, many segregates with the required combination were isolated in 1936-37, some of which are under varietal trials on the Farm since 1937-38. During the year under report, 7 segregates, viz., 2 from the straight cross (B.D. 8 × G.A. 26) F-10, 4 from the back-cross {(B.D. 8 × G.A. 26) × B.D. 8} F-8 and 1 from the back-cross {B.D. 8 × (B.D. 8 × S-12-1)} F-6 along with the checks B.D. 8 and Broach Local, were under replication trials. Segregates 76-1, 76-12, 1-2, 1-6 and 5-18 are under continuous replication tests since 1937-38; while Segregates 7-29 and 3-1 are under trial since 1939-40 only. Their average performance from the season of their first trial uptill now indicate that these segregates especially 76-1, 1-2 and 1-6 are nearly as good as local in their yield and almost

as good as B.D. 8 in their quality and resistance to wilt. In addition to these segregates under replication trials, 15 other segregates possessing fairly good combination of ginning outturn, fibre length and high resistance to wilt, have also been maintained in several single plant progenies.

Village Trials.—The promising segregates 76-1, 1-2 and 1-6 along with checks B.D. 8 and Broach Local, were tried for the first time this season at four representative centres (three in black soil and one in gorat soil) to determine their suitability in the Broach District.

The season was highly abnormal. Heavy rains accompanied by storms in the third week of October and untimely showers in November caused widespread lodging of plants and shedding of flower buds. The Broach Local out-yielded both B.D. 8 and the segregates, the order of merit for the latter being 1-6, 1-2, B.D. 8 and 76-1. These segregates, however, have maintained their high ginning outturn in the District. The ginning outturn of segregates 1-2 and 1-6 was even slightly higher than that of the Local. They have also shown very high resistance to wilt. Four full pressed bales—one of each of the Segregates 1-2 and 1-6, and of B.D. 8 and Broach Local—were sent to the Century Spinning and Manufacturing Co., Ltd., Bombay, for mill tests. The segregates and B.D. 8 have been found suitable for 30's with 8 to 15 lbs. more strength than required, while the Broach Local spun only 20's with 2 lbs. less strength than required. Arrangements have been made to grow segregates 1-2 and 1-6 on a larger scale in the District during the coming season with a view to judge their performance on a commercial scale.

Seed Multiplication.—118 lbs. selfed and 89 lbs. open fertilized seed of B.D. 8 cotton was produced which was supplied to the Broach B.D. 8 Seed Distribution Scheme for further multiplication in the District.

(3) *Cotton Breeding work at Viramgam.*—The Cotton Breeding work at Viramgam is partly financed by the Indian Central Cotton Committee, Bombay, since 1937. The object is to improve the Dholleras Wagad Cotton, (a) for yield and quality and (b) for earliness to escape frost. The sanctioned period of five years will be over on 30th April 1942. The stage of the work has now reached four years, of which three years were unusually dry. There is much promising material still under selection and an extension of five years is, therefore, asked for to attain the object of the Scheme. Experience has shown that the results of the scientific botanical research work at Viramgam are not applicable to the important Dholka tract, where the rainfall is more regular and assured and where also the soil is different. The establishment of a small sub-station at Dholka is essential for this tract and it is proposed in the extension. The season during the year under report was extremely dry, the total rainfall being only 11 inches against the average of 22 inches.

The bolls prematurely ripened in December and the yield and the ginning percentage were poor as in 1936-37. The quality was unprecedentedly low.

Variety Trials.—The three old varieties, viz., Local, Wagad 8 and Seg. 4-1 with two new ones, viz., S-89 and H.S.B. 1 were tried in 8 random replications in one series. In the second series the promising selections

115, 126, 89 and Wagad 8 were compared on a smaller scale. S-89 which was found superior in yield to Wagad 8 under irrigation is found to be significantly inferior even to Local Wagad. In spinning value also S-89 and H. S. B. 1 have dropped down very much, while Wagad 8 and Local Wagad have nearly maintained it. Seg. 4-1 has enormously dropped down in spinning value. It has, however, maintained its high ginning percentage of lint. S-305 is practically the best among the straight selections. It is proposed to try these in Dholka tract which has assured and higher rainfall. S-305 will be tried next year in comparative variety tests along with H. S. B. 1. Work in other selections and crosses was continued and some segregates specially from B. C. W. 8 × 22-3-1-3 F₂ are found promising. Crosses of Wagad types with Russian, Persian and early Herbaceums were also under study. Two segregates are found promising.

(4) *Examination of Cotton Samples by the Technological Assistant.*—The Cotton Technological Assistant maintained from the funds of the Indian Central Cotton Committee continued to examine the samples of cotton received from the Cotton Breeders, Surat, Broach, Viramgam and Jalgaon. The services of the Technological Assistant for Gujarat have been extended for five years from 1st April 1940. The Indian Central Cotton Committee has also provided a temporary Junior Tester for 4 months during the cotton season every year to assist the Technological Assistant. The work done by this Section during the year is summarised below :—

(a) *Preliminary Fibre Tests.*—During the year under review, 1875 samples of lint were tested by hand in this way (160 at Surat, 545 at Broach, 710 at Viramgam and 460 at Jalgaon) and the Cotton Breeders were enabled to select their material for the next year's sowing. (b) *Laboratory Fibre Tests.*—During the year 198 samples were received for detailed laboratory tests. Out of these samples, all 198 were tested for Ball's Sorter length, 165 for fibre weight and 78 for maturity. In addition to these, 106 samples for Ball's Sorter length, 30 for fibre weight and 30 for maturity were tested in connection with the research work on hand. (c) *Research Work.*—A study of the fibre properties of lint from wilt-free and wilt-affected plots was undertaken during the year at the suggestion of the Deputy Director of Agriculture, N. D., Surat. For the last three years it has been observed that the Broach segregates give lower ginning percentage when grown in wilt-infected plots than in wilt-free plots. The seed weight was observed to be higher in case of the produce from the wilt-free plots. The higher ginning percentage associated with higher seed weight seems rather unusual. To find out if any fibre property of the produce was responsible for this difference in ginning, 15 samples from the wilt-free and wilt-infected plots were tested. Fibre length, fibre weight and maturity ratio were determined for these 30 samples and irregularity percentage, standard hair weight and weight of lint per seed were also calculated. From these values it may be inferred that the produce from wilt-

infected plots has lower maturity and the weight of lint per seed is also lower. The fibre length is also slightly lower in samples from wilt-infected plots. It is a point for consideration whether it is wilt or soil variability that is responsible for these differences and it is proposed to plan a field experiment to decide it.

(5) *Tobacco Breeding at Nadiad.*—Bidee Tobacco—In yield-trials under replications, K-49 and K-24 gave 8 per cent. more yield than local. In respect of spangle development and smoking strength, K-49 surpasses the other two. In consequence of its strong smoking quality and suitability to dry conditions, the demand for K-49 is increasing. Selection work in Saijpurii variety was in its second year. 96 selections, out of 279 originally selfed plants, were studied for 11 characters with and without nipping. Strain differences are perceptible. Further selections are being restricted to only the higher yielding types. Nipani tobacco was found to be milder than K-49 and appreciably sweeter too as before. Cigarette Tobacco—In the study of virginian varieties, Harrison Special continues to be broadest and longest leaf variety giving the highest yield. Gold Dollar, Bonaza, Cash and Hukory Prior stand next. Cash was the tallest and Gold Dollar was the latest this year. Adcock was found to be the dwarfiest, earliest and has the smallest leaf length and breadth. Studies in the comparative economics of Bidee and Cigarette Tobacco—The average figures for three years show a loss of Rs. 59-10-4 per acre in the production of Bidee tobacco and Rs. 140-1-8 in that of Cigarette tobacco. The cost of irrigation is heavy and irrigation water being saline (114 parts in 100000) the quality of cigarette tobacco is inferior. Seed Multiplication—24 lbs. K-49 and 1½ lbs. G-6, seed was produced on Nadiad Farm for further multiplication in the district.

(6) *Bajri Breeding at Nadiad.*—8 Selections were tried along with Local and 207 in 10 replications by Latin Square method. 4 selections gave higher yield of grain and straw than Local. Selections from 207-10 have topped the list this year. Seed Multiplication—151 lbs. selfed seed was produced in autumn and 1919 lbs. open pollinated seed was raised in summer 1941.

(7) *Castor breeding at Nadiad.*—26 selections in S-20 and 7 selections in S-5-35 were studied in detail for the important characters. Both the types are fixed and no further selection seems to be necessary. Secondary selection for shape and size of the spike have not produced any results. One culture in S-20 (34) raised from a selfed head was found to be early to mature. Its behaviour will be further studied. Seed Multiplication—3 lbs. selfed seed and 327 lbs. open-pollinated seed of S-20, and 2 lbs. selfed seed and 291 lbs. open-pollinated seed of S-5 was produced during the year under report for further multiplication in the district.

(8) *Maize breeding work at Dohad.*—Different methods of selfing were compared again during the year and Arbhavi method was found to be the best. Selections—There were in all 140 lines—52 from plants selfed in 1938-39, 37 from those selfed in 1939-40, 29 from fresh selections, 4 from African white-seeded and 18 from the local Sameri variety. The ran. e

of variation for five economic characters was studied and 426 selfed plants have been selected for further study during the next season. Seed Multiplication—A plot of 1 acre and $12\frac{1}{2}$ gunthas was grown with mass selected seed from the last year's seed multiplication plot. The yield per acre obtained during the year was 2,361 lbs. which is the highest recorded on the Farm.

(9) *Research and experimental work other than cotton breeding on Surat farm.*—Cotton and Jowar Green Manuring Experiments were running their seventh year. The average results of 6 years indicate that Dhaincha Green Manuring alone is more economical than all other treatments. In the new manurial experiment with different dozes of Sulphate of Ammonia with and without green manure Sulphate of Ammonia (20 lbs. N) + Dhaincha gave significantly higher yields than other treatments. In Spacing Experiment cotton dibbled and drilled $6' \times 2'$ gave higher yields than $3' \times 1'$ Control. With a view to combine all green manure treatments in one experiment and to maintain thereby the increased yield of both cotton and jowar crops, the following experiment is laid out during the year under review (i) Control 5 cart-loads Farm Yard Manure per acre once in 4 years to cotton rotated by jowar without any manure. (ii) Jowar with Dhaincha green manure followed by cotton with Dhaincha green manure strips. (iii) Dhaincha green manure fallow in the first year followed by cotton without any manure in the second year, jowar with Dhaincha green manure in the third year, cotton with Dhaincha green manure strips in the fourth year, jowar with Dhaincha green manure in the fifth year and cotton with Dhaincha green manure strips in the sixth year. This is the first year of the experiment and there being no crop in the case of fallow treatment there are no comparisons to be made. Seed Multiplication—The quantities of seed of improved crops multiplied in Surat Farm were 1027 A. L. F. Cotton 21,964 lbs., Budh Perio Jowar No. 53, 11,982 lbs. and Dhaincha 1,042 lbs.

(10) *Research and experimental work other than maize breeding on Dohad farm.*—Five varieties of wheat, viz., Pusa 4, Pusa 52, Pusa 165, Bansipalli 808 and Wajia (Local) were compared in randomised plots replicated 5 times. The experiment was not significant. 7 varieties of Groundnut were compared in randomised plots replicated 7 times. The Spanish Peanut variety of Groundnut is the earliest and gives also good yield. Sann Green Manuring between Maize rows $3'$ apart followed by Wheat v/s the local method of growing Maize $2'$ apart followed by Wheat and Maize with Tur as a row crop v/s Maize followed by Gram (local practice) were the new experiments conducted during the year and the results are not conclusive. Among some feeler experiments conducted on Dohad Farm, Jarila cotton as a dry crop deserves special mention. The yield was 858 lbs. per acre. Seed-rate experiments on wheat and gram, both as dry and irrigated crops, have given an indication that 60 lbs. seed-rate is better than either 40 or 80 lbs. in both the crops. Multiplication of Pusa 4 Wheat seed—In all 3,169 lbs. pure Pusa 4 wheat seed was raised on Dohad Farm for further multiplication and distribution in the district.

(11) *Research and experimental work other than cotton breeding on Viramgam farm.*—4 types of Jowar viz., G. 8-2, G. 10-2, G. 11-4, and W. 3-4 were tested in random replications with local Chhasatio and Utavali as checks. The season was very dry and the yields of both grain and fodder were poor. As G. 10-2 is an early variety and as it is more profitable it is decided to try it against local Utavali in the district. Additional selections made in Jowar will be tried along with G. 10-2 and the two locals.

IV. RURAL DEVELOPMENT WORK.

(1) *Multiplication and Distribution of improved seeds other than Cotton.*—Schemes based on the model prepared by the Director of Agriculture, B. P., Poona, were prepared and submitted to the Collectors and Chairmen of District Rural Development Boards after studying the requirements of different districts. Organisation of Taluka Seed Centres to multiply the farm pedigree seed by the Agricultural Officers in the first stage in the district and its multiplication and distribution through the Village Officers in later stage are the most important features of these Schemes. The Deputy Director of Agriculture attended all the meetings of the Officers and District Rural Development Boards when these Schemes were placed for discussion. He explained the details of various schemes in these meetings and got them sanctioned by the Boards. The Agricultural Officers were at the same time asked to follow up the schemes and to organise the Taluka Seed Centres with a result that considerable progress could be achieved during the very first year. Taluka Seed Centres, for Bajri No. 207 in Ahmedabad and Kaira Districts, for Tobacco K-49 in Kaira District, for Budh Perio Jowar No. 53 in Surat District and for improved strains of paddy in Thana, Kolaba and Bombay Suburban Districts, have already been organised and the crops sown are thriving well. Besides these regular schemes, the District Staff made arrangements as usual with the local seed-growers for storage and distribution of the following quantities of pure improved seed in the Division during the year :—

Bajri No. 207, 11,885 lbs., Wheat Pusa 52, 18,100 lbs., Wheat Pusa 4, 800 lbs., Wheat No. 808, 3,000 lbs., Wheat No. 224, 21,160 lbs., Jowar No. 8, 14,264 lbs., Paddy K-184, K-42, K-540 and Z-149, 97,000 lbs., Tobacco K-49, 3,600 lbs., Castor S-20, 2,545 lbs., Maize-Sameri 5,730 lbs., Groundnut-Spanish Peanut, 4,113 lbs., and Gram-Selected, 6,290 lbs.

(2) *Multiplication and Distribution of Cotton Seed.*—The schemes financed jointly by the Indian Central Cotton Committee and Government of Bombay have continued to operate and are summarised below :—
(a) Multiplication and Distribution of 1027 A. L. F. Cotton Seed in Surat area—The Department controlled 20,640 acres of pure 1027 A. L. F. cotton for seed multiplication which included 1,094 acres grown with Farm Pedigree seed. In all 23,68,355 lbs. seed was distributed during

the year under review (16,74,755 lbs. in the British area and 6,93,600 lbs. in Rajpipla State). The area under 1027 A.L.F. in the British tract lying south of Narbudda was one lac of acres which was approximately equal to that of the last year (1939-40). (b) Multiplication and Distribution of B.D.8 Cotton Seed in Broach District—The Agricultural Department controlled 4,156 acres for seed multiplication which included 1,124 acres grown with Pedigree seed from the Government Farm, Broach. In all 1,69,380 lbs. of seed was distributed from 12 depôts and an area of 9,728 acres was covered during the year under review against 30,951 acres during the previous year. The fall in the area was due to the low premium realised for B.D. 8 Cotton in the previous year.

(3) *Grading and AGMARKING 1027 A.L.F. in Surat area.*—A scheme for the marketing of pure 1027 A.L.F. cotton in the Surat District under the Agricultural Marketing (Grading and Marking) Act, 1937, sanctioned by the Indian Central Cotton Committee was worked during the year. 15 Kamgars trained on Surat Farm were entrusted with field inspection work in various Centres. The cotton Superintendent and his Assistants checked the work of these Kamgars. The total area inspected was 38,631 acres of which an area of 20,410 acres was certified.

The members of the Athwa Group and Nana Varachha Society in Surat area and the members of Hansot Co-operative Cotton Sale Society in Ankleshwar area grew 1027 A.L.F. cotton purer than others. After field inspection, the staff under the scheme worked at the ginning and pressing centres for inspection of the arrivals of certified seed-cotton, supervision of its separate ginning and pressing and its AGMARKING for sale. The scheme was worked in the whole of the Surat protected area lying south of the river Narbudda from 8 centres. During the year under review, Broach quotations and the premium of Surat Local over Broach were high. The buyers were unwilling to give due additional premium for the AGMARKED bales and the cultivators of pure 1027 A.L.F. cotton were greatly disappointed.

(4) *Control of Selection I-A Cotton in Surat area.*—The Indian Central Cotton Committee sanctioned a scheme in the year 1939 but it came into operation in 1940. The object of the scheme was two-fold, firstly to confine the growth of I-A cotton to Olpad Taluka where it was grown on a large scale and secondly, to check the cultivation of this inferior cotton in the rest of the Surat area. To achieve the first object in view the Cotton Transport Act of 1923 was amended and a separate area was created for this Taluka. The import of seed cotton and cotton seed from Olpad into the other protected areas of Surat was altogether stopped by establishing 10 Road Check Stations. The lint was allowed to enter Surat area under licenses for full pressing as the Olpad Societies had no Press in the Olpad area. These full pressed bales were marked and sold as OLPAD and the work of pressing and marking was supervised by an Agricultural Officer provided under the scheme. To achieve the second object in view, it was thought

necessary first to survey the spread of Selection 1-A cotton in the Surat and South Surat areas. Eight special Kamgars were employed for this work and they worked under the supervision of the Cotton Superintendent. In all 202 villages were visited out of the total 427 in the 5 talukas situated in Surat and South Surat areas. Only in Chorashi Taluka the cultivators were found to grow 1027 A.L.F. cotton more or less pure. In the remaining talukas, the inferior variety (Selection 1-A cotton) was found in all the villages visited, the percentage of the area under Selection 1-A varying from 30 to 100 in different villages. On inspection of the fields it was observed that Selection 1-A contained a mixture of 1027 A.L.F. and other varieties indicating the trend of the cultivators to grow mainly 1-A cotton mixed with 1027 A.L.F. in different proportions. The right step to control 1-A cotton would be to introduce 8-1 cotton which is nearly equal to 1-A in yield and ginning and to 1027 A.L.F. in the quality of lint and this step is under consideration.

(5) *Administration of Cotton Control Act.*—The cultivation of inferior Goghari cotton is prohibited by this Act which is in force since 1935-36 and due to this Act its cultivation has been practically eliminated from Surat Protected areas. There were a few individual farmers, however, who grew it in Ankleshwar Taluka and the fields of three farmers have been traced and permission has been obtained to prosecute them.

(6) *Propaganda for Manure.*—A good deal of propaganda for Groundnut Cake was made and demonstrations have been planned for the next season. 546,380 lbs. of Groundnut Cake was used during the year to the knowledge of the District Staff. Dhaincha as Green manure between cotton rows has been found remunerative on Surat Farm. A good deal of propaganda was done for this in Surat district and Village Trials have been planned for the next season. Sann Green Manuring is becoming very popular in Broach-Panchmahals and Ahmedabad Districts. In all 37,480 lbs. of Sann seed is reported to have been distributed for green manuring in the Division.

(7) *Bunding against surface Erosion.*—This work has been undertaken in the Northern Division very recently and the progress during the past two years has been fairly good. 400 cultivator-students were trained in scientific methods of bunding by holding 8 training classes at representatives centres in the Districts of Broach-Panchmahals and Ahmedabad. A good deal of propaganda has also been done in a number of villages. The actual area banded is 2,500 acres (2,000 acres in Panchmahals, 400 in Kaira and 100 acres in Ahmedabad). The Bunding Staff needs strengthening as demand for this work has increased.

(8) *Shikar work.*—During the year under review, 4 more Gun Clubs were started in Borsad Taluka making a total of 10 in Kaira District. These clubs together killed 1,338 "roz" from December 1940 to April 1941. This work has been appreciated by the cultivators and the

Collector was kind enough to give a grant of Rs. 864 to 8 Gun Clubs. Similar work is also in progress in Kolaba District. There are 3 Gun Clubs and these have killed 188 wild animals in all.

(9) *Model Agricultural Project for extension of improvements in the cultivation of crops at Rayam in Surat District.*—A scheme estimated to cost Rs. 10,610 was sanctioned by the Imperial Council of Agricultural Research, the Indian Central Cotton Committee and the Bombay Government during the year. A definite programme has been drawn and the work has been started. This scheme includes 15 holdings and extends over an area of 290 acres. The important items of improvements to be introduced are—(i) Land Development, (ii) Compost making, (iii) Dhaincha green manuring, (iv) Improved methods of tillage, (v) Improved varieties of crops like 1027 A.L.F. cotton, Budh Perio Jowar No. 53, K-184 Paddy and 224 Wheat, (vi) Control of pests and diseases by uprooting cotton stalks with Plant Pullers against Boll-worms and by dusting Jowar seed with Sulphur against Smut, (vii) Co-operative sale of produce through Patidar Ginning Factory at Bardoli. A similar scheme for Mirakhedi in Panchmahals District at an estimated cost of Rs. 18,655 spread over a period of 5 years is under consideration of the Imperial Council of Agricultural Research. This scheme includes 24 holdings and extends over an area of 216 acres. As required by Imperial Council of Agricultural Research, technical programme of work to be conducted at Mirakhedi has been submitted.

(10) *Taluka Demonstration Centres.*—In all there are 17 Taluka Demonstration Centres in the Northern Division. After reviewing the work of these Centres, the Director of Agriculture, Bombay Province, Poona, prepared a Note suggesting certain improvements. These suggestions were given effect to. The sites have been changed where necessary. In all 142 demonstrations were organised in 17 Taluka Demonstration Centres during the year and these received appreciation from the cultivators. Sites for 15 new Taluka Demonstration Centres have been selected. Before starting these new Centres, however, it has been found necessary to get suitable men trained to work as Kamgars and arrangements are under consideration.

(11) *Demonstrations to Officers and Farmers' Weeks on Government Farms.*—As outlined by the Director of Agriculture, Bombay Province, Poona, demonstrations for Officers and Farmers' Weeks were organised on different Farms during the year and all improvements effected by the Department were demonstrated and explained to them.

The Officers took great interest and expressed that they were much benefitted by these demonstrations. The Farmers were those who were selected from different Talukas and it is hoped that they would disseminate the knowledge that they have obtained on Government Farms. In all 59 Officers and 901 cultivators attended demonstrations organised on Surat, Broach, Nadiad and Dohad Farms. It is desirable that such demonstrations to Officers and Farmers' Weeks should be the annual feature of the Government Farms.

V. AGRICULTURAL EDUCATION.

Rural Assistants' Training Centre at Bordi.—In response to Government Memorandum, Revenue Department, No. 797-H/39, dated 20th February 1940, a non-official Centre for training Rural Assistants for Rural Development work in Konkan Districts was established at Bordi in Thana District during the year. The necessary buildings were constructed and the class was opened on 1st May 1941. 27 students are receiving training at this Centre.

Primary and Secondary Schools with Agricultural Bias.—There are in all 16 Primary Schools with Agricultural Bias in Northern Division. The local Agricultural Officers continued to maintain close touch with the working of these classes and conducted the examinations of the same. The Agricultural Class attached to Godhra High School was also examined by the Agricultural Officer, Broach.

VI. MISCELLANEOUS WORK.

- (a) The Deputy Director of Agriculture, Northern Division, attended Anand Institute Meetings and guided the work of agricultural section. He attended the meetings of the Officers and Rural Development Boards of different Districts and explained various Agricultural Schemes that he submitted to them. He also attended the meetings of the Indian Central Cotton Committee to which progress reports of various schemes and proposal for extension of their periods were submitted.
- (b) The Deputy Director of Agriculture, Northern Division, took an intensive tour in Khandesh and Nasik Districts and re-organised the work of Jarilla Cotton Seed Multiplication and Distribution Scheme.
- (c) A Plant Breeders' Conference was held at Surat on 23rd and 24th May 1941 and important points in connection with Cotton, Bajri, Tobacco and Maize Breeding were discussed.

S. S. SALIMATH,

Surat, 10th September 1941.

Deputy Director of Agriculture,
Northern Division, Surat.

Programme of work for the year 1941-42.

RESEARCH WORK.

Cotton Breeding Work at Surat.—(1) Comparative yield trials of 1027 A.L.F., 1-A Long Boll, Segregate 8-1 and S-9-1-4. (2) Preliminary yield tests of bulk seed of 12 promising cultures. (3) Further work in Selections and Crosses. (4) Production of selfed seed of 1027 A.L.F. (300 lbs.), Seg. 8-1 (100 lbs.), B.D. 8 (30 lbs.). (5) Interspecific Hybridization in Cotton—(a) Maintenance of the hybrids and their first back-cross plants. (b) Continuation of the trials for inducing fertility by—(i) Back-crossing (ii) Chemical treatment with colchicine. (c) Study of first back-cross plants and their progenies in succeeding generations. (d) Exploration of the economic possibilities of polyploidy induced by colchicine treatment in cotton. (e) Raising of various foreign cultivated and wild cotton for use in crossing. (f) Cytological study of hybrids, first back-cross plants, their progenies in succeeding generations and colchicine treated material.

Cotton Breeding Work at Broach.—(1) Progeny bulk replication trials of Segregates 76-1, 1-2, 1-6, 5-18, 7-29 and 3-1 along with two checks B.D.8 and Broach Local. (2) Village trials of Segregates 1-2 and 1-6 along with two checks—B.D.8 and Broach Local in one gorat and three black soil centres in Broach District. (3) Spinning tests of Segregates and checks in the Technological Laboratory, Matunga and in Mills. (4) Further work in crosses on hand. (5) Seed Multiplication—Strain B.D.8 will be multiplied on 1 acre nucleus plot as usual. Segregates 1-2 and 1-6 will be multiplied on about 1 acre plot each for procuring seed for village trials and multiplication. (6) New item—New crosses for further improvement in fibre length and feel will be made as mentioned in the 5-year extension proposal of this scheme.

Cotton Breeding Work at Viramgam.—(1) The promising selections 96, 163 and 305 will be tested in replications along with Wagad 8, Local, H.S.B.1, H.S.B.10 and Seg.4-1. (2) The promising types S-89, 293, 305, 115, 126 and 314 and some segregates will be grown so as to produce sufficient lint for spinning tests as well as for supply of seed for trial in Dholka and Dhandhuka tracts. (3) Some promising segregates from crosses with wide opening, will be compared in line trials with local Chokadia, an early, high yielding herbaceous type grown mostly in Baroda State. (4) Selection will be done by growing locals from Porbunder and Junagad. (5) Further work in selections and crosses on hand will be continued.

Examination of Cotton samples by the Technological Assistant.—(1) Preliminary fibre tests with hand and Laboratory fibre tests of samples received from Cotton Breeders. (2) Study of fibre characters of different pickings. (3) Study of fibre properties of lint from wilt-free and wilt-infected plots. (4) Study of variation in fibre properties when the same variety is grown in different localities. (5) Measurements of swollen hair diameter of chief varieties of cotton grown in Surat and Broach tracts.

Tobacco Breeding Work at Nadiad.—(1) Bidee Tobacco—(a) Replication trials of Keliu 49 and Local without irrigation : (b) Replication trials of 7 best selections of Saijपुरi with Local. (2) Cigarette Tobacco—(a) 20 varieties, yield trials in a single series, along with H.S. as standard, (b) Manurial trials with fertilizer mixture : 545 lbs. of the formula 4 : 8 : 4. (3) Maintenance of pure lines 11 in all. (4) Treatment against damping off—in consultation with the Plant Pathologist. (5) Seed production for multiplication—G.6, 5 lbs. and K-49, 100 lbs.

Bajri Breeding Work at Nadiad.—(1) Character study for purification. (2) Yield tests of extreme variants in three selections. (3) Replication trials of 8 selections with Local and strain 207. (4) Trial of plants possessing certain aberrant and genetically interesting characters including selfed *vs.* unselfed seed of the same plant. (5) Hybridization between interesting cultures. (6) Production of selfed-seed of important cultures for further multiplication.

Castor Breeding Work at Nadiad.—Production of selfed-seed of the two selections S-20 and S-35.

Maize Breeding Work at Dohad.—(1) The seed of 426 selfed plants will be grown for further purification and selection. Selfing will be done by the Arbhavi method. Paper method as suggested by Dr. Kadam will be tried. (2) Mass selected Farm Sameri seed will be multiplied. Detasselling undesirable plants, rouging, etc., and further mass selection will be continued. (3) 50 best plants from the mass selected seed multiplication plot will be selected for starting the mass selection method with modifications suggested by Dr. Kadam.

Research and Experimental Work other than Cotton Breeding on Surat Farm.—(1) Dhaincha Green Manuring Experiment on Cotton. (2) Dhainch Green Manuring Experiment on Jowar. (3) Manurial Experiment with Sulphate of Ammonia on cotton. (4) Cotton Spacing experiment. (5) New combined rotational experiment.

Research and experimental Work other than Maize Breeding on Dohad Farm.—(1) Trial of Wheat varieties. (2) Sann green manuring between maize rows followed by wheat (a) as a dry and (b) as an irrigated crop. (3) Maize with tur as a row crop against maize followed by (a) gram as a dry crop and (b) wheat as an irrigated crop. (4) Feeler Experiments—(a) Jarilla and Cambodia (C.O.2) cottons as dry and irrigated crops. (b) Seed-rate experiments on wheat and gram—both dry and irrigated.

Research and Experimental Work other than Cotton Breeding on Viramgam Farm.—Jowar Breeding work will be continued.

District Trials in Cultivators' Fields.

(1) Trial of Bajri No. 207, Wheat No. 224 and Pusa 52 and improved varieties of cotton and jowar in Ahmedabad District. (2) Trial of Bajri No. 207, Tobacco K-49 and Castor S-20 in Kaira District. (3)

Trial of Rabi Jowar No. 8, mass-selected Sameri Maize and selected strains of Cotton in Broach-Panchmahals District. (4) Trial of improved strains of cotton and sugarcane and dhaincha green manuring in Surat District. (5) Trial of improved varieties of rice in Thana, Kolaba and Bombay Suburban Districts. (6) Trial of Groundnut cake on Rice and irrigated crops all over the Division.

Rural Development Work.

(1) *Seed Multiplication and Distribution.*—(I) Multiplication and distribution of 1027 A.L.F. and B.D.8 cotton seeds under the Schemes financed by Indian Central Cotton Committee and Bombay Government, (II) Multiplication and distribution of seeds other than cotton under the schemes sanctioned by the Rural Development Boards last year—(a) Bajri No. 207, (b) Wheat No. 224 and Pusa 52, (c) Tobacco K-49, (d) Jowar Budh Perio No. 53, (e) improved strains of paddy. (2) *Grading and Agmarking of 1027 A.L.F. Cotton.*—If sanctioned. (3) *Control of Selection 1.*—A cotton in Surat area under the Scheme financed by the Indian Central Cotton Committee and Bombay Government. (4) Administration of Cotton Control Act. (5) *Propaganda for manures.*—Groundnut cake, Dhaincha and Sann Green manuring. (6) Bunding against surface erosion especially in Broach-Panchmahals Districts. (7) Shikar work in Kaira and Kolaba Districts. (8) *Model Agricultural Projects.*—The work started at Rayam will be continued with a planned technical programme and that at Mirakhedi will be started when the Imperial Council of Agricultural Research accords its sanction. (9) *Taluka Demonstration Centres.*—The existing 17 Taluka Demonstration Centres will be continued and 15 new ones will be established. (10) *Demonstrations to Officers and Farmers' Weeks on Government Farms.*—These will be continued both in kharif and rabi seasons.

Agricultural Education.

Rural Assistants' Training Centre at Bordi will continue its work and a new Training Centre will be started at Broach. The primary and secondary schools with Agricultural Bias will continue to receive attention of the local Agricultural Officers.

General.

(1) All preliminary work will be undertaken to establish Rice Breeding Station at Nawagam in Kaira District and Bulsar in Surat District after receiving orders from the Director of Agriculture. (2) Meetings of the Officers and Rural Development Boards' meetings (convened by the Collectors) will be attended.

S. S. SALIMATH,

Surat, 10th September 1941.

Deputy Director of Agriculture,
Northern Division, Surat.

APPENDIX C.

SUMMARY OF WORK DONE UNDER THE LIVESTOCK EXPERT TO THE
GOVERNMENT OF BOMBAY FOR THE YEAR 1940-41.

Staff and Administration.—Mr. Edw. J. Bruen, Livestock Expert to the Government of Bombay, held charge of the Livestock Section for the whole of the year.

The work of the Livestock Section had expanded considerably during the year, especially due to the demands of the Rural Development Boards in each of the districts of the Province. In pursuance of Government Memorandum No. 1223-A/39, Revenue Department, dated 21st September 1939, for the centralization of all district livestock improvement work under the control of the Livestock Expert to Government, sanction has been accorded during the year to increase the staff by the addition of two Cattle Breeding Inspectors and 11 Field Kamgars.

The post of the Assistant Livestock Expert to Government was continued to be held by Mr. D. B. Kolhe, for the whole of the year and this is the only post under the Livestock Expert to Government which is in Provincial Class II. The work done by the Livestock Expert to Government may be broadly classified as under :—

(1) Control and guidance in the conduct of Government Livestock Farms and supply of pedigreed livestock for improvement of livestock in villages.

(2) Co-operation with non-official associations or organizations conducting cattle breeding farms for the improvement of cattle.

(3) Supervision and guidance of work at Livestock Research Scheme Farms financed by the Imperial Council of Agricultural Research.

(4) Control and guidance of work done by the district livestock staff for the improvement of livestock in villages.

(5) Initiation of livestock improvement and dairy district schemes for development.

(6) Rural Development work as far as livestock improvement is concerned.

(7) Work in connection with the Provincial Fodder and Grazing Committee.

(8) Work in connection with the Animal Husbandry Wing of the Imperial Council of Agricultural Research.

(9) Organization of Cattle Shows and Rallies in various districts including the All India Cattle Show, and.

(10) Advisory work.

The general account of work done during the year of report covering all the above activities of the Livestock Section is embodied in the report that follows :—

A—LIVESTOCK RESEARCH WORK.

(a) WORK DONE ON CATTLE BREEDING FARMS.

(1) Government Cattle Breeding Farm, Bankapur, District Dharwar.

Charge.—Mr. S. K. Angadi, Manager, held charge of the farm throughout the year.

Object.—The object of the farm is to breed the famous Amrit Mahal breed of cattle and to supply pedigree stock for the improvement of village cattle in the Karnatak. The breeding policy aims at (1) early maturity, (2) regularity in breeding and (3) fixation of characteristic type and conformation.

Reorganization of the Farm.—During the year of report Government have sanctioned the reorganization of the farm and its utilization for the establishment of a nucleus herd of Gir cattle in addition to the nucleus herd of Amrit Mahal cattle, the strength of each herd being restricted to 60. Accordingly, arrangements have been made to purchase the Gir stock (20 cows and 2 bulls) from the Bombay Gowrakshak Mandali's Cattle Farm at Kandivlee, since no good Gir stock is available in Kathiawar, the home of the Gir breed. The Gir breed is famous for its milk yield and is a dual purpose breed. The late Congress Government laid emphasis on breeding of milch cows in preference to draft cattle and buffaloes and hence this reorganization of the farm.

Strength of cattle.—The year opened with 120 heads of Amrit Mahal cattle and ended with 96, consisting of 33 cows, 12 heifers, 19 young bulls and 29 calves, the reduction being due to the sale of animals as per scheme of reorganization mentioned above.

Behaviour and performance of the Amrit Mahal herd.—The entire herd consists of farm bred animals except one breeding bull purchased last year from Mysore for the introduction of new blood. The whole herd is now uniform in size, and conformation. The colour is quite uniform. The great difficulty of obtaining uniform coat colour pattern as demanded by the cultivators, has been overcome, as every calf born has a fawn coloration at birth, which changes later on into light grey which is peculiar to this breed. Improvement as regards early maturity in heifers and regularity of calving in cows continued during the year. One young healthy and thrifty heifer has calved at the age of 2 years and 11 months; two heifers between the ages of 3 to 3½ years and four heifers between 3½ to 4 years. This is a great advance over the cows found in villages. As regards regularity of calving more than two-third of the cows, have calved at an interval varying from 10 to 14 months as against an interval of 11 to 16 months during the previous year.

Supply of pedigree stock.—During the year 46 pedigree stock of Amrit Mahal cattle, consisting of 9 bulls, 9 cows, 20 heifers and 8 calves were supplied in villages for improvement of cattle on the Premium systems, chiefly to the Better Farming Society at Hosritti, Cattle Breeding Society at Hiremallur and to the Premium bull agents.

Cultivation of fodder crops.—The area under cultivation is 30 acres, divided into 10 plots. The land is developed out of the debris of the old fort buildings. On this account there is a considerable difficulty in tillage operations due to the presence of loose hidden stones and bricks. The total cropped area during the year was 43 acres—29 acres under kharif fodder crops and 14 acres under rabi fodder crops. The total fodder production was 451,582 lbs. of green fodder, 82,000 lbs. of dry fodder and 21,675 lbs. of seeds. The Kharif fodder crops were maize, jowar (Nandyal), Ragi, Chavali and soyabans, while the rabi fodder crops were jowar (shalu), oats and peas, Kulthi, Matki and maize. Maize in kharif has yielded about 25,000 lbs. of green fodder per acre while rabi maize has yielded only 12,000 lbs. Nandyal jowar in Kharif has produced 22,000 lbs. of fodder per acre. A small experiment of growing dry Napier grass on 10 gunthas of land was continued during the year. The fodder obtained was 10,660 lbs. from 10 gunthas. This grass on the whole has done better than in the previous year.

Silage making.—There are six kaccha silo pits on the farm and these were filled with about 4 lakh lbs. of green fodder during the year of report. The silo pits are round and are underground. Their diameters vary from 10 feet to 19 feet and the depth from 11 feet to 17 feet. The outturn of silage from the fodder ensilaged during the previous year, varies from 77 per cent. to 90 per cent. The quality of silage was good. The silage was readily consumed by the cattle with very little wastage.

Hay making.—An area measuring about 20 acres was available for hay making. The total quantity of hay made was 60,000 lbs. at a cost of Rs. 1-10-8 per 1,000 lbs. of hay.

Farmers' Week.—The most noteworthy feature during the year, was the demonstration of the actual working of the cattle farm for 5 days on account of "Farmers' Week" organized for the District Officers and cultivators. Some 260 cultivators took advantage of this occasion from 5 talukas—125 cultivators from Bankapur, 30 from Hangal, 30 from Hirekerur, 50 from Ranebennur and 25 from Haveri taluka.

General.—The year was remarkably free from cattle diseases. Preventive inoculations against contagious diseases were carried as usual.

(2) *Government Cattle Breeding Farm, Tegur, Dharwar District.*

Charge.—Mr. B. B. Dundi, Field Kamgar, Haveri, was appointed as the Manager of the Farm from 1st August 1940 and was in charge of the farm throughout the remaining period of the year.

Object.—Production of suitable dual purpose cattle, particularly for the Konkan division, by the establishment of small herds of Dangi and Nimari cattle.

Foundation stock of Dangi and Nimari cattle.—14 Dangi cows and 2 Dangi bulls were purchased in Nasik district at a total cost of Rs. 858 and were received on the farm on 5th December 1940. Similarly, 14 Nimari cows from Barwani State and 2 Nimari bulls from the Pimple Farm, Jalgaon, East Khandesh, were purchased at a total cost of Rs. 878 and were received on the farm on 3rd January 1941. The total cost on account of these two herds including cost of transport was Rs. 2,910.

Behaviour and performance of the Dangi and Nimari.—During the period of their stay at the Tegur Farm, 6 to 7 months, it has been found these cattle thrive very well. Unlike the Amrit Mahal, these cattle are found to be good grazers and graze well in a comparatively small area. During the period under report one Dangi cow and 5 Nimar cows have calved. All the cows have given male calves. The weight of the calves at birth was found to be 54 lbs. for the Dangi calf and an average of 40 lbs. for the Nimar calves. All the cows are being milked from two teats, leaving two teats for the calves. The milk yield of the cows is recorded regularly and will be reported next year, when the lactation periods are completed.

Cultivation of fodder crops.—An area of 17 acres was cultivated for fodder purposes—8½ acres under kharif cropping and 8½ acres under the rabi. The kharif crops were 3 acres maize, 3 acres jowar, 2½ acres paddy; while the rabi crops were 5½ acres kulthi and 3 acres gram. The total production was 63,604 lbs. green fodder, 5,900 dry fodder, 4,860 chaff and 8,500 grains for seeds. Napier grass and Sudan grasses were tried on the farm—each on half a guntha of Masari land and it was found that the Napier grass was much superior to the Sudan grass in withstanding drought conditions. The Napier grass was much more leafy and threw out sprouts in the hot months, while the Sudan grass was withering and dying out.

Silage making.—There are three small Kaccha pits on the farm and these were filled with about 75,000 lbs. of green maize and green grasses in the month of August and September 1940. The pits were opened in January and February 1941. The outturn of silage was 70 per cent.

Hay making.—About 20 acres of grass land was kept for hay making. Due to unfavourable season, the yield of hay was 50,000 lbs.

General.—Health of cattle was well maintained. There were no cattle diseases.

(3) Northcote Cattle Breeding Farm, Chharodi in Ahmedabad District.

The transfer of this farm to the Institute of Agriculture, Animal Husbandry and Dairying, Anand, District Kaira, was effected on 1st April 1940 as per Government orders contained in Government Resolution,

Revenue Department, No. 7243/33, dated 30th March 1940. The transfer of the staff at the farm, to the Institute on foreign service conditions was also carried out as sanctioned in Government Resolution, Revenue Department, No. 7243/33 of 9th July 1940.

The annual report of work done on the farm will, therefore, be published by the Institute.

(4) *The Bombay Gowrakshak Mandali's Cattle Breeding Farms at Kandivlee and Betegaon in Thana district.*

The Bombay Gowrakshak Mandali is co-operating with the Agricultural Department in the breeding and supply of pedigree stock of Gir cattle at their cattle farms at Kandivlee and Betegaon in Thana district since the year 1924-25. The Gir herd now totals about 325 heads of Gir cattle, of which 134 are home-bred heifers. 22 new heifers came into milk during the year as against 16 during the previous year. The average age at first calving varies from 4 to 4½ years. The earliest age at first calving was 2 years 11 months. As regards milk production there are 11 cows in the herd producing more than 4,000 lbs. during their milking periods. On an average there were 47 milking cows and 35 dry cows in the herd, producing about 2 lakhs lbs. of milk during the year. The annual average milk yield per cow (including dry cows) was 2,330 lbs. as against 2,506 during the previous year. The milk is supplied to different hospitals, welfare centres and schools at Bombay and to the Government Physical Training School at Kandivlee. The Mandali supplied during the year 10 Gir cows, 9 breeding bulls and 26 bullocks to the various institutions and agents for improvement of cattle and work purpose. The Mandali has also helped during the year in organising a Farmers' Day at the request of the Collector, Bombay Suburban District, on 9th February 1940, when 400 cultivators were shown round the work working of the farm.

(5) *Nathu Lalji Charity Trust Fund Gowshala at Mulund in Thana District.*

The Board of Trustees of the Nathu Lalji Charity Fund, Gowshala, Mulund, are co-operating with the Agricultural Department in the improvement of Gir cattle since April 1939. The Gowshala had 225 heads of cattle at the end of the year, consisting of 75 cows, 70 heifers, 72 calves and 2 breeding bulls and 6 bullocks. During the year 4 heifers came into milk as against 17 during the previous year. The average age at first calving works out 4 years and 3 months. The Gowshala has 11 farm-bred Gir cows yielding over 4,000 lbs. during the milking period. There were 42 milking cows on an average during the year producing 155,371 lbs. of milk. The average milk yield works out 10 lbs. of milk per day per cow. The cost of milk production is Rs. 7 per maund and the milk delivery charges work out Re. 1-4-0 per maund. The milk is supplied to Bombay.

During the year, the Gowshala supplied 51 Gir cattle to the various Institutes and Premium bull agents. The Gir cattle supplied consisted of 3 breeding bulls, 13 cows, 11 heifers, 13 male calves and 11 working bullocks. The Gowshala exhibited 8 Gir animals at the 4th All India Cattle Show at Delhi in February 1941 and one cow "Sheti" won the first prize; bull "Jasraj" won 2nd prize and two heifers 2nd and 3rd prizes.

(6) *Taluka Development Agricultural Association Cattle Breeding Farms in East Khandesh.*

There are two Nimar Cattle Breeding Farms in East Khandesh conducted by the Taluka Development Agricultural Associations, Jalgaon and Jamner at Pimple and Gangapuri respectively. These cattle farms are at present being subsidized by Government as per Government Resolution, Revenue Department, No. 377/33 of 24th March 1936, with a grant up to a maximum of Rs. 1,000 per year. With a view to achieve economy and efficiency, the Expert Cattle Committee had recommended in paragraph 41 of their report that the two farms be amalgamated into one "East Khandesh Cattle Breeding Farm" for the Nimar breed. During the year of report, attempts were again made to convince the management of these two farms to consider the proposal of amalgamation but they do not favour the proposal. It has now been decided to keep this proposal in abeyance, until such time the farm authorities realise the advantages of the proposal.

(i) *THE PIMPLE CATTLE BREEDING FARM.*

The farm had 131 heads of Nimar cattle at the end of the year, consisting of 33 cows, 51 heifers, 45 bull calves and 2 breeding bulls. During the year, 31 cows were milked, producing 21,500 lbs. of milk. Good cows have yielded up to 1,600 lbs. of milk in a lactation of 9 months.

The Farm supplied 14 Premium bulls and 15 Premium cows and heifers as against 10 Premium bulls and 20 premium cows and heifers during the previous year. Since the commencement of the farm in 1932, the farm has supplied 68 Premium bulls and 36 Premium cows for improvement of village cattle.

The farm has leased out 80 acres of land at Rs. 300 per year for growing of fodder crops. Two-thirds of the area was under fodder crops and $\frac{1}{3}$ rd under groundnut and cotton. The farm has been allotted by Government a kuran measuring 403 acres on lease at Re. 1 per acre in order to enable the Association to carry on cattle breeding. Rotational grazing of the kuran is being followed. During the year 100 acres were utilised for grazing and the remaining 303 acres for cutting green grass for silage and hay making. 162,825 lbs. of green grass was cut for silage and 185,000 lbs. of hay was made. The cost per 1,000 lbs. worked out Rs. 1-12-0 for green grass and Rs. 5 for hay.

The farm authorities took a keen interest in sending Nimar cattle to the 4th All India Cattle Show at Delhi in February 1941. Ten prizes were assigned to the Nimar breed and the farm is to be congratulated on its winning all these ten prizes without a single exception in all classes, viz. (1) Bulls, (2) Cows and (3) Heifers. One cow "Kundal" won the Challenge Cup worth Rs. 500 continuously for three years and a cash prize of Rs. 100. Bulls "Chandrya" and "Narmadya" won the first and second prizes.

General.—The Rural Development Board, East Khandesh, gave grants totalling Rs. 2,980 to the farm. Rs. 1,500 were given for the construction of one Dutch barn for storage of grass, Rs. 500 for the construction of Incubator room, Rs. 530 for purchase of grass moving machine and Rs. 450 for cattle dip.

(ii) THE GANGAPURI CATTLE BREEDING FARM, JAMNER.

The farm had 78 heads of Nimar cattle consisting of 24 cows, 23 heifers, 13 bull calves, 16 young stock and two breeding bulls at the end of the year. 14 cows were milked during the year, producing 2,828 lbs. of milk. Milk is drawn from two teats, leaving two teats for the suckling of the calves. The farm supplied 6 Premium bulls and 4 Premium cows during the year of report. The farm has 60 acres of poor *murbad* lands for growing of fodders and 150 acres of grazing lands have been allotted by Government on lease for 4 years for rotational grazing and silage making from April 1939. This farm had also sent 8 Nimar animals—4 cows, 3 heifers and 1 bull—for the 4th All India Cattle Show at Delhi in February 1940, but was not fortunate in securing any prize. Owing to an outbreak of foot and mouth disease, the cattle were kept separate and fell off in condition.

The Managing Committee of the Farm, especially the Mamlatdar of Jamner, took keen interest in the welfare and proper running of the farm.

(b) POULTRY BREEDING FARMS.

(1) *Government Poultry Breeding Farm, Kirkee.*

Charge.—Mr. V. C. Charanti, Manager, held charge of the farm throughout the year.

Object.—The object of the farm is to test the laying capacity of different breeds of poultry and breed pedigree stock of birds and eggs for distribution in villages. Secondly, the farm imparts practical training in poultry keeping.

Strength of the flock.—There were 917 birds consisting of 325 White Leghorns, 246 Rhode Island Reds, 213 Australorps, 66 White Wyandotte and 67 Black Minorcas at the end of the year.

Egg laying capacity of different breeds of poultry.—15 White Leghorn hens, 6 Rhode Island Red, 6 Australorp and 5 White Wyandotte hens.

were tested from 16th November 1939 to 15th November 1940, for one full year. Their average egg laying capacity for the year was 168, 206, 149 and 197 eggs per hen respectively of the breeds mentioned above. The average weight of the egg of the White Leghorn and White Wyandottee was 2 ozs., while that of Rhode Island Red and Australorp was 1.98 ozs.

Hatching of chicks.—951 chicks were hatched during the year by means of incubators. The percentage of successful hatching was 81 per cent. as against 76 of the previous year. The average cost of hatching a chick works out at one anna and 3 pies.

Supply of pedigree birds and eggs.—150 cocks, 98 hens and 44 chickens were supplied to villagers at a total cost of Rs. 1,017 while 1,005 setting eggs were supplied at Rs. 251. Besides, 349 birds and 604 setting eggs were supplied to professional poultry keepers at full rates realising Rs. 2,166 and Rs. 372 respectively.

Poultry Training.—Two short courses of 3 months each in practical poultry farming were conducted during the year. The number of students were 25 and 16 respectively. Besides, 48 students from the Rural Training Centre, Sabarmati, were given a week's training in poultry keeping.

Turkey Breeding Experiment.—A small turkey breeding experiment was undertaken at the Poultry Farm, Kirkee, since April 1940, with a view to test their adaptability and performance. The stock of turkeys at the end of the year was 5 hens, 57 pullets, 17 cockerels and 1 breeding tom and 16 chickens. The health of the turkeys was excellent throughout the year. The egg laying capacity was noted for a period of 8 months which works out 8 eggs per pullet per month. During the year 253 turkey chicks were hatched. The percentage of successful hatching works out 65.

Supply of birds.—16 turkey birds and 103 setting eggs were sold to cultivators at concession rates.

General behaviour of the turkeys.—It was observed that the turkeys did better on full range having green forage. The turkeys should be provided with shade in the hot season during the day time, while at night time they did well on open air roosts protected with wire-netting.

General.—There was a great demand for supply of turkey birds and eggs during the year.

(2) Government Poultry Farm, Dhulia, West Khandesh.

Charge.—Mr. B. P. Salunke, Manager, held charge of the farm throughout the year.

Object.—The object of the farm is to serve as a training centre for farmers in poultry keeping.

Strength of the flock.—There were 118 White Leghorn, 71 Rhode Island Red and 16 country birds on 30th June 1941.

Egg laying capacity.—10 White Leghorn hens and 4 Rhode Island Red hens were kept under observation in separate pens since October 1940. During the period of 9 months ending June 1941, the average number of eggs laid per hen was 115 and 107 respectively.

Hatching of eggs.—276 chicks were hatched out by means of incubators during the year. It was observed that chicks hatched out during the months of August and January were more vigorous and their mortality was low. The average cost of hatching per chick works out as one and pice five. The percentage of successful hatching was 79.

Supply of pedigree birds and eggs.—81 birds for poultry improvement and 455 setting eggs for hatching were supplied to villagers during the year.

Poultry Training.—During the year, the Manager gave practical training to 14 students. In addition 40 students of the Agricultural School, Dhulia, were given poultry training.

Demonstrations.—Six special demonstrations were arranged during the year for District Officers and cultivators. In all 200 cultivators, 448 school students and 27 officers visited the Poultry Farm during the year.

(3) Government Poultry Farm, Dharwar.

Charge.—Mr. P. S. Inamdar, Manager, held charge of the Poultry Farm throughout the year.

Object.—The object of the Poultry Farm is to serve as a training centre for farmers in poultry keeping.

Strength of the flock.—There were 84 White Leghorn, and 161 Rhode Island Red birds on 30th June 1941.

Egg laying capacity.—18 hens of the Rhode Island Red breed were selected for testing their egg laying capacity with a view to select the best for breeding purposes. They were under observation for 3 months of December, January and February. Further observations would be continued.

Hatching of eggs.—416 chicks were hatched out by means of incubators during the year of report. The percentage of successful hatching was 71.

Supply of pedigree birds and eggs.—69 birds were supplied to farmers at concession rate. Besides 154 setting eggs were also supplied for hatching.

Poultry Training.—Six students applied for poultry training and completed the short course of 3 months' training, during the year of report.

(4) *Poultry Research Scheme Farms financed by the Imperial Council of Agricultural Research.*

Object.—The main object of the scheme is to investigate the possibilities of making the poultry industry more useful and profitable as a home or cottage industry. The scheme is in existence since October 1936 and will terminate in October 1941. The programme of research work approved by the Imperial Council of Agricultural Research is being carried out at three centres, namely :—

- (i) Government Central Poultry Farm, Kirkee, district Poona,
- (ii) American Marathi Mission Vocational Training School, Vadala, district Ahmednagar,
- and
- (iii) Vocational Training School, Ankleshwar, district Broach.

The detailed reports of the investigations carried out at these three centres during the year 1940-41 have been submitted separately to the Imperial Council of Agricultural Research. Important results obtained at the above farms are given below :—

(i) KIRKEE CENTRE.

Results of egg-laying tests.—The flock averages of different breeds of poultry obtained during the year of report were as under :—

Breed.	Flock average of eggs per hen per year No. of eggs.		
(1) White Leghorn	167
(2) Rhode Island Red	205
(3) Light Sussex	170
(4) Naked neck	104
(5) Chittagong	87
(6) Cross of Chittagong and Rhode Island Red (Chittrhode) first generation.			128
(7) Cross of Chittagong and Rhode Island Red (Chittrhode) second generation.			128

Results of testing feeding value of fish meal as against soyabean-meal.—The trial was of 6 months' duration and it has indicated that the feeding of fish meal to poultry increases body weight and egg production better than the feeding of soyabean meal.

Cheap housing of poultry.—The ordinary mud house (10' × 10' × 6½') and the bamboo matting house (6' × 5½' × 4½') have proved satisfactory. The cost of these houses were Rs. 23 and Rs. 7 respectively.

(ii) ANKLESHWAR CENTRE.

Results of egg-laying tests.—The average monthly egg production per hen for Rhode Island Red hens, White Leghorn hens and country selection hens was 11 eggs, 7 eggs and 7 eggs respectively. The highest laying records for the three breeds were 179 eggs, 127 eggs and 118 eggs per hen per year.

Results of comparative growths of pullets of pure bred stock and pullets of crosses obtained by mating country selection hens with White Leghorn and Rhode Island Red cocks have shown that the cross-bred pullets from the White Leghorn weigh 2½ lbs. the cross-bred pullets with Rhode Island Red weigh 3 lbs., while the country selection pullets weigh only 2¼ lbs. at the age of 8 months. All the pullets have had similar feed and care.

Results of hatching eggs under the country broody hens and in incubators, indicate that hatching under the hens both in the monsoon and in the winter was superior to the hatching in incubators. Under the country broody hens, the percentage of successful hatching was 82 to 83 while the percentage of successful hatching in incubators was 58 to 60.

(iii) VADALA CENTRE.

Observations on the performance of the various breeds of poultry permit the following conclusions:—

- (a) The White Leghorn breed is the best suitable breed of poultry in this area.
- (b) Light Sussex did not give satisfactory results.
- (c) White Chittagongs did fairly well.
- (d) The cross-bred pullets of Chittagong hens with Light Sussex cocks laid on an average 115 eggs per year.

(c) IMPROVEMENTS OF THE MILKING GOATS.

(Experiment of breeding of Kamori milch goats of Sind, at the Poultry Breeding Farm, Kirkee).

Charge.—Mr. V. C. Charanti, Manager, Poultry Farm, Kirkee, was in charge in addition to his duties.

Object.—The object is to test the milking capacity of the Kamori goats (which are reputed to be good milkers in Sind) under Poona conditions.

Milk yielding capacity.—This was the second year of the experiment. It may be recalled that 5 Kamori does and one Kamori breeding

buck were purchased in November 1939. During the year of report, four milking does yielded the following quantities of milk :—

Doe No.	Days in Milk	Milk yield in lbs.
(1)	286	785
(2)	111	167
(3)	188	400
(4)	191	392

The does were allowed to suckle their kids. The highest quantity of milk given per day was 7 lbs. and 12 ozs. by one doe "Luch No. 1". The average milk yield per day per doe works out $2\frac{1}{4}$ lbs. The goats on the whole have done much better than during the previous year.

Cost of feeding the goats.—The average cost of feeding the goats works out at Rs. 1-3-7 per month per goat.

(d) BOMBAY SHEEP BREEDING SCHEME FARM, POONA, FINANCED BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

Charge.—Mr. S. S. Khot, Bag., held the charge of the Sheep Farm at Poona, during the year under report.

Object.—The objects of the Sheep Breeding Scheme are :—

- (1) Improvement of the Deccan sheep by selection,
- (2) Testing the adaptability of the Merino breed of sheep,
- (3) Crossing the Deccani sheep with the Merino,
- (4) Miscellaneous problems of sheep husbandry.

This is the 3rd year of the starting of the scheme. Full progress reports have been submitted to the Imperial Council of Agricultural Research. The most important results of general interest obtained during the year are dealt with briefly below :—

(1) *Improvement of Deccan Sheep.*—It has been found that the Deccan sheep can be improved, as regards their wool bearing quality by selection of those sheep which conform to a definite standard obtained from wool analysis methods. The classification of the sheep is made on the basis of wool fibres and hairiness namely 'A' sheep carrying wool fleeces containing no hair and 'B' and 'C' with different degrees of hairiness. Further work will be now confined to the selection of white sheep with 'A' type of wool fleeces, combined with good stamina of the sheep.

(2) *Adaptability of the Merino.*—The Merino rams are now giving satisfactory services. Ten Merino ewes lambed successfully during the year. Considerable difficulties are being experienced in rearing of the Merino lambs due to the fact that the Merino ewes are very poor milkers.

(3) *Crossing of the Deccani sheep with Merino rams.*—The Deccani ewes were served by the Merino rams during the year and 56 cross-bred lambs were obtained; out of these 16 lambs were all black, 16 spotted, 10 white with black face and 14 all white. As regards wool quality, the cross-bred progeny is far superior to the Deccan ewes and almost as near the Merino.

(4) *Miscellaneous problems.*—It has been found that the best time of shearing the sheep is in the month of February. Observations as regards best methods of grazing and meeting the worm troubles are being continued.

During the year of report a small "Wool Research Laboratory" has been established and fitted in the office of the Livestock Expert and a small Sub-station of Sheep Breeding at Javale in Sangola taluka of Sholapur district was also established. One more useful activity was undertaken during the year, namely, starting a small Wool Utilization Section at the main Poona Centre. Sample cloths from different grades of wool were made and it has been estimated that the cloth made from "A" type Deccani sheep wool and from wool of cross-bred progeny pays 3 times and 6 times more respectively than the normal kambli made in the Deccan from the ordinary Deccani wool.

B. RURAL DEVELOPMENT.

(a) CATTLE IMPROVEMENT.

(1) *Working of the Premium Bull System.*—There was a very heavy demand for the supply of Premium bulls both from the Premium bull agents and the various District Rural Development Boards. During the year 236 new bulls were supplied. Out of these 80 bulls were the progeny of the Premium bulls. The number of Premium bulls working in different divisions as compared with the previous year is shown below:—

Name of Division.	Premium bulls working on		Remarks.
	1st July 1940.	1st July 1941.	
(1) South Central	136	194	
(2) North Central	72	96	
(3) Southern	76	125	
(4) Northern	31	41	
(5) Palghar (Bombay Suburban) ..	21	51	
Total ..	336	507	

thus showing an increase of 161 bulls during the year. Besides the above number of bulls, there were 94 bulls working part-time whose term expired before 1st July 1941. An idea of the heavy demand for the supply of the Premium bulls may be gained by stating that as many as 200 bulls still remained to be supplied at the end of the year.

(2) *Working of His Excellency the Viceroy's Gift Bull Scheme.*—Since the inauguration of the scheme by His Excellency the Viceroy of India in July 1936, 322 bulls have been located so far under this scheme during the last five years. Out of these bulls 25 bulls have died and 139 bulls have their periods expired thus leaving 154 bulls working at the end of the year. The location of the Gift bulls while respecting the wishes of the donors was carried out on the following conditions :—

(1) If the agent agrees to maintain the bulls for 3 years at his own cost, the bull becomes the property of the agent after that period,

or

(2) If the agent receives maintenance charges for the bull, it remains the property of Government after that period.

There is no doubt that the scheme has made an effective contribution to the improvement of village cattle in many districts.

With a view to examine the present position of the scheme and to submit proposals for its continued working in the future, the Director of Agriculture appointed a small departmental committee consisting of (1) the Livestock Expert to Government (Chairman), (2) the Assistant Livestock Expert to Government and (3) the Personal Assistant to the Director of Agriculture. The report embodying the present position of the scheme and the proposals for its working have been submitted to Government for their consideration. The orders of Government are awaited.

(3) *Working of the Premium Cow Scheme.*—The Premium Cow Scheme is increasing in popularity. The District Rural Development Boards, Khandesh, Poona, Satara and Sholapur supplied funds for the purchase of Premium cows during the year. 126 Premium cows were supplied as under as against 65 of the previous year :—

Name of the district.	No. of cows.	Breed.	Remarks.
(1) East Khandesh ..	15	Nimar.	
(2) West Khandesh ..	5	Do.	
(3) Do. ..	22	Khillar.	
(4) Poona ..	30	Do.	
(5) Satara ..	15	Do.	
(6) Sholapur ..	6	Do.	
(7) Dharwar ..	33	Amrit Mahal.	.. To Hosritti Cattle Breeding Society on half Premium.
Total ..	126		

(4) *Registration of Cattle.*—The number of pure bred stock registered during the year was 1,691. The following table gives the registration of pure bred stock up to date :—

Division.	No. of cattle registered up to June 1940.	No. of cattle registered during 1940-41.	Total No. registered up to the end of June 1941.
(1) Northern	890	390	1,280
(2) Palghar	959	170	1,129
(3) North Central	806	131	624
	(* 493)		
(4) South Central	1,769	1,000	2,769
(5) Southern	1,105	<i>Nil.</i>	1,105
Total	5,529	1,691	6,907

* *Note.*—Figures of registrations of Panjrapole cattle viz., (313) are omitted.

(5) *Application of the Livestock Improvement Act of 1933.*—The Bombay Livestock Improvement Act of 1933 has so far been applied to 77 villages as reported during the last year. With the help of the veterinary assistant surgeons over 7,600 castrations were carried out in the above villages as well in the villages of the intensive breeding areas.

The Act has worked satisfactorily on the whole with the co-operation of the villages concerned. 11 more villages were surveyed during the year for the application of the Act.

(6) *Cattle Shows, Rallies and Demonstrations.*—16 cheap cattle shows and 41 cattle rallies were arranged and prizes given to the best animals. 17 demonstrations of the working of the cream separators were also arranged on different centres during the year.

The most important of the Cattle Shows was one held at Chincholi village in Jalgaon taluka of East Khandesh in August 1940, when His Excellency the Viceroy of India (Lord Linlithgow) graced the occasion.

(7) *The 4th All-India Cattle Show at Delhi.*—The All-India Cattle Show authorities may justly feel proud on the further progress the Show made during the year. There were not only a large number of exhibit but the quality was for superior. A cow for the first time won

the championship honours. A very successful poultry section was added to the Show this year.

45 cattle and 7 buffaloes were exhibited from this Province. The Northcote Cattle Breeding Farm, Chharodi, sent 7 Kankrej cattle and won the Bharatpur Challenge Cup for the best general utility bull. The Pimple farm, East Khandesh, Jalgaon, sent 13 Nimar cattle and won all the 10 prizes that were kept for this breed. The Gangapuri Farm, Jamner, East Khandesh sent 8 Nimar cattle but due to an attack of foot and mouth, had to content without any prize. Dr. V. H. Patil of Shahada sent 6 Nimar cattle and he is to be commended for his enterprize. One of our Premium bull agent at Dhanwad in Jalgaon taluka, East Khandesh, Mr. Dalpat Fattasing Naik, also ventured to exhibit his Nimar bull. Finally four private breeders of Pandharpuri buffaloes exhibited their best Pandharpuri stock of buffaloes with great enthusiasm. As a result of these exhibitions from the Province, demand for Khillar cattle from the Deccan is growing from Ceylon and is dealt with in the next paragraph.

(8) *Supply of pure-bred stock of Khillar cattle to Ceylon.*—During the year under report 15 khillar cows and 1 khillar breeding bull were supplied to Ceylon Government from the private khillar cattle breeders in Sholapur district. This is the 3rd consignment of khillar cattle supplied to Ceylon. It is reported that the khillar cattle are doing well in Ceylon.

(9) *Supply of stock to Institutions and private persons in the Province.*—The following stock was supplied during the year of report:—

Name of the Institute or person.	Kind of animals No.	Breed.
(1) Bhil Seva Mandal, Dohad	.. 25 cows.	.. Kankrej.
(2) Ravalgaon Sugar Factory	.. 17 do.	.. Do.
(3) Do.	.. 35 buffaloes	.. Surti.
(4) Bochasan Gowshala	.. 5 cows	.. Kankrej.
(5) Mr. V. K. Desai, Chikhali	.. 2 do.	.. Do.
(6) Mr. A. J. Patel, Chikodri	.. 1 cow	.. Do.
(7) Manjri Rural Assistants' Training Centre.	2 buffaloes 1 buffalo bull.	.. Pandharpuri. .. Do.
(8) Do. do.	.. 6 bullocks	.. Khillar.
(9) Modi Bag	.. 2 do.	.. Do.
(10) Mohol Farm	.. 2 do.	.. Do.
Total	.. 98	

(10) *Milk Recording Scheme—Kankrej—Gujarat.*—The total number of Kankrej cows whose milk was recorded and tested fortnightly was 212. Out of these, 137 cows were the progeny of Premium bulls. The full report of the scheme is submitted to the Imperial Council of Agricultural Research.

(11) *The Kankrej Cattle Breeders' Association.*—Steps were taken to organise and form 'The Kankrej Cattle Breeders' Association' at Sanand in Ahmedabad district. Government have sanctioned a grant of Rs. 820 to the Kankrej Cattle Breeders' Association for helping them to meet the pay of the Secretary and other contingent expenditure for propaganda work.

(12) *Scheme for the Development of the Dangri breed and the improvement of the Konkan Cattle.*—A scheme for the breeding and rearing of pedigree Dangri cattle in co-operation with approved cattle breeders and supply of the reared stock for improvement in the Konkan was submitted on receipt of note dated 6th June 1941 from the Adviser to His Excellency the Governor of Bombay (Finance) regarding Agricultural Development and cattle improvement work in the Konkan.

(13) *Palghar Dairy District Scheme.*—As reported during the last year, some 63 milch cattle stable owners in Bombay were asked whether they were willing to erect cattle stables in Palghar taluka on condition of provision of grazing lands at concession rate for the production of milk for supply to Bombay City. Last year 10 applications were forwarded for the consideration of Government. During the year of report one more application was forwarded.

Due to the occurrence of abortion and the visit of the Abortion Investigating Officer, people have now become timid to go out to Palghar. Until we have this matter cleared up, the scheme will have to stand still.

(14) *District Dairy Project, Poona.*—During the year under report, a scheme for the establishment of a "District Dairy Project" was submitted to Government. The main object of the scheme is to provide facilities whereby milch cattle stable owners in Poona City may be induced to remove their milch herds from Poona City and undertake the production of milk under rural surroundings on similar lines of the Palghar Dairy District scheme for the Bombay City.

(15) *Feeding trial of Tivir leaves.*—Dried Tivir leaves were fed at the rate of 5 to 8 lbs. mixed in ration to milch cows at the Kandivlee farm for a period of one month. The trial indicated that the cows relish the dried leaves and increased the flow of milk by 4 ozs. per cow per day. This bush is found in abundance in Seaside creeks and the trial was undertaken to investigate its use as a possible supply of famine fodder.

(16) *Milk plunger trials from Palghar to Bombay.*—Thirty-one trials with four types of plungers devised with the help of the Agricultural

Engineer to Government, Bombay Province, Poona, have indicated that the "Wire plungers" is the most effective in preventing the rise of fat grains in milk cans for the purpose of transport of milk by rail from Palghar to Bombay.

(17) *Acquainting District Social workers with the work done by this section.*—All of my staff endeavoured to their best in making acquaintance with the District Social workers and acquainting them with the work done by the Livestock Section.

(18) *Co-operation with Gowshalas and Panjrapoles in the improvement of cattle.*—The Livestock Expert paid personal visits to the institutions at (1) Barsi, (2) Dhulia, (3) Nandurbar and (4) Sholapur and discussed with their Managing Committee members the good that would accrue to them through co-operation. It was not, however, possible to secure the co-operation of any of the institutes due mainly to faction difficulties in the managing bodies.

The Panjrapoles and Gowshalas at (1) Nandurbar, West Khandesh, (2) Jalgaon, East Khandesh (3) Bochasan and (4) Dakor in Kaira district were supplied Gift bulls and premium bulls on approval of the Collectors and at their request.

(19) *Improvement of the Milch Buffalo.*—According to the scheme sanctioned two years ago, 20 Surti buffalo bull-calves bred at Agricultural College Dairy, Kirkee, have been supplied free to the buffalo bull-keepers in Mehemdabad taluka of Kaira district as against 7 during the previous year, for the purpose of rearing and their subsequent issue as premium bulls.

One Pandharpuri buffalo bull has been supplied to the Rural Assistants Training School at Manjri during the year under report. The total number of buffalo breeding bulls working during the year were 41 as under:—

(i) Premium Bulls	33
(ii) Gift Bulls	8
	—
Total	41
	—

(20) *Village Poultry Improvement Scheme.*—Two schemes for the improvement of poultry in villages (financed from India Government grants), were in progress. These schemes are (1) Scheme for the improvement of poultry in villages and (2) Scheme for the encouragement of pedigree poultry keeping in villages by grant of premia to poultry farmers. Under the first scheme 367 cocks of improved breeds were put out in various districts of the Province; while under the second scheme, six housing premia each of Rs. 100 and eight eggs and fowl premia each of Rs. 75 were given to 14 poultry farmers during the year of report. As a result of introduction of improved cocks in villages the graded pullets are laying more and bigger eggs than the country

hens. The increased egg production is more by about 40 per cent. Four Premium poultry farmers made available 28 improved cocks for distribution in villages.

(21) *District poultry centres.*—These centres are financed by the District Rural Development Boards. There are 6 such centres namely (1) Kaira, (2) Bijapur, (3) Sholapur, (4) Thana and (5) East Khandesh and (6) Satara under the guidance of the Livestock Section. The first three centres have their poultry farms, while the remaining three centres have each employed one poultry kamgar for village poultry improvement work in their district. These centres, have on the whole, continued to do fair propoganda in their respective districts.

(22) *Egg Marketing Scheme, Belgaum.*—This scheme is financed from the Sir Sassoon David Trust Fund. 93,588 eggs were handled during the year. The eggs were graded and sold under the "Agmark" scheme. This scheme will terminate by October 1941 and reference has been made for its transference to the Chief Marketing Officer, Bombay.

C—AGRICULTURAL EDUCATION.

The Livestock Section imparts practical training in poultry keeping to cultivators and students at the Government Poultry Farms at Kirkee, Dhulia and Dharwar. The courses are of 3 months duration.

During the year under report, 41 students at Kirkee, 14 students at Dhulia and 6 students at Dharwar were given training. Besides 48 students from Sabarmati Rural Assistants' Training Centre were given a week's course in poultry keeping at the Poultry farm, Kirkee.

The short course in sheep management, wool classing, shearing, etc., is given at the Sheep Farm. Two men have been already trained and from September we expect to get a fair number of persons for training.

D—ADVISORY AND MISCELLANEOUS WORK.

Since the centralization of livestock work under the Livestock Expert to Government all the enquiries pertaining to livestock improvement work were attended.

The Livestock Expert to Government, Bombay Province, Poona, was the Honorary Secretary of the Provincial Fodder and Grazing Committee until May 1941. He had also to attend the meetings of the Imperial Council of Agricultural Research, Judging of cattle at the 4th All India Cattle Show, Delhi, and the Departmental Livestock and Fodder Committee.

At the request of the Imperial Council of Agricultural Research, Delhi, a model scheme for the formation of Breed Societies for the improvement of cattle was prepared and submitted during the year. A scheme for the vegetable dyes on wool has been submitted during the year to Government.

The general precis of the animal industry in the Bombay Province as required in accordance with the order of Government under Government Resolution, Revenue Department, No. 3520/39, dated 4th December 1940, is attached under Appendix A.

E—PUBLICATIONS.

During the year of report, three drafts for leaflets on (1) Sheep Breeding and the Improvement of Sheep and Wool in the Bombay Province, (2) Groundnut cake as a cheap and useful cattle food and (3) "Grading up" Bombay Province's Village Cattle, Importance of Premium Bull Schemes, were submitted. The first two have been issued as departmental leaflets during the year.

An article on "the study of wool quality as the basis of individual selection in breeding of Deccan Sheep", prepared by this section, has been accepted for publication in the Indian Journal of Veterinary Science and Animal Husbandry.

General.—The work of the Livestock Section has now expanded considerably. The demand from the various District Rural Development Boards for the supply of improved livestock was very great during the year, especially from Poona, West and East Khandesh, Satara, Sholapur and Bijapur and Belgaum districts. All efforts were made to supply the demand as much as possible.

I would like to bring to your notice the keen interest taken in livestock improvement by the following persons :—

- (1) Mr. Haridas Morarji Velji, Honorary Secretary, Bombay Gowrakshak Mandali.
- (2) Mr. V. Isvaran, Collector of Dhulia,
- (3) Mr. J. Booth, Collector of East Khandesh, Jalgaon,
- (4) Mr. S. B. Vaidya, Collector of Kaira,
- (5) Mr. Moulvi Ahmed, Collector of Bijapur,
- (6) Mr. C. N. Millard, Collector of Belgaum, and
- (7) Dr. V. H. Patil of Patilwadi, Shahada.

I feel happy to record that all members of my staff have very willingly worked during a year of heavy work.

Programme of work for the year 1941-42.

(1) Breeding and Improvement of Livestock on Government Farms, on farms subsidized by the Imperial Council of Agricultural Research and on non-official farms cooperating with the Livestock Section of the Agricultural Department ;

(2) Rural Development work pertaining to the Livestock Section ;

(3) District Livestock Improvement work and Propaganda ;

and

(4) Advisory work.

APPENDIX A.

A general precis of the position of Animal Industry in the Province of Bombay.

Introductory.—As per Government Resolution No. 3520/39, Revenue Department, dated 4th December 1940, Government of Bombay have agreed with the Director of Agriculture, Bombay Province, Poona, that the annual report of the Livestock Expert to Government is the proper publication which should contain a section dealing with the animal industry in the Province on the lines, as far as possible, suggested in the letter from the Imperial Council of Agricultural Research No. F. 53 (1)/40 A. H., dated 24th February 1940 and have considered that detailed information required by the Research Council would involve much labour and trouble in its compilation and would not be essential.

The lines on which information was required by the Research Council are set forth in paragraph 4 of their letter above mentioned and is reproduced below :—

“ A section in the annual report of the appropriate department may be denoted to supplying detailed information in regard to the industries named in the list below, in particular, in regard to their rise or fall in the Province as a whole, the influence on them of contiguous diseases, other reasons for fluctuations, and steps taken for improvement.

- (a) Trade in live animals, both inland and for export.
- (b) Production of hides and skins.
- (c) Sheep rearing for wool and mutton.
- (d) Goat rearing for milk and mutton.
- (e) Poultry keeping for eggs and table poultry.
- (f) Horse and camel breeding in the Provinces and States where these industries exist.
- (g) Other livestock industries, i.e. pig rearing.”

Accordingly, Government directed that the Livestock Expert to Government should prepare a general precis of the position of animal industry in the Province from the information available in his office and with other officers in the manner indicated below :—

Subject.	Source.
(1) Statistics of animals slaughtered in recognized slaughter houses.	Bombay Municipality and the Commissioners of Divisions.
(2) Trade in live animals both inland and for export.	Chief Marketing Officer, Bombay, and the Bombay Port Trust.

Subject.	Source.
(3) Production of hides and skins.	Chief Marketing Officer and the Director of Veterinary Services in consultation with the Director of Industries, if necessary.
(4) Horse and camel breeding	.. Director of Veterinary Services.

(Note.—The Officers concerned were requested to furnish the information to the Livestock Expert to Government not later than 31st May every year.)

The following precis is prepared on the basis of reports so far received and the information available in this office :—

A TRADE IN LIVE ANIMALS BOTH INLAND AND FOR EXPORT.

(a) *Cattle*.—The position of cattle stock in the Province of Bombay during the two quinquennial censuses of 1934-35 and 1939-40 is shown in the following table. It shows that the total cattle stock was approximately 74½ lakhs and 72½ lakhs respectively, thus showing a decrease of 2 lakhs cattle in the census of 1939-40. The decrease is most noticeable in the case of female young stock below 3 years and the working bullocks by 1,21,000 and 77,000 respectively. The decrease is attributed to the two scarcity periods of 1936-37 and 1937-38 in Gujarat, Deccan and some parts of the Karnatak.

One more significant feature of the table is that the total cattle male stock is in excess by 12 and 13 lakhs over the total female cattle stock thus showing that the Bombay Province is a deficit Province as regards its supply of working bullocks and is required to import them from the surrounding States and Provinces.

From the figures supplied by the Chief Marketing Officer, Bombay, the Province of Bombay imports yearly 23,000 male cattle as under :—

Imports of cattle from other Provinces and States in the Bombay Province.

	No.
(1) From North of Ahmedabad District ..	3,000
(2) From Central India to Khandesh ..	8,000
(3) From Mysore and Karnatak mostly Dharwar District.	12,000
Total ..	<u>23,000</u>

The cattle are received almost entirely by road and consist mostly of males.

As regards exports to other Provinces and Indian States, the trade is insignificantly small and does not exceed 200 cattle per year. It may

be pointed out here, that as a result of exhibition of the Bombay Province Cattle at the All India Cattle Shows, the Ceylon Government is indenting on this section for the supply of Khillar cattle and this section has supplied 15 khillar cows and one bull during the current year and 20 during the previous two years.

(b) *Buffaloes*.—The position of buffalo stock in the Province of Bombay during the last two quinquennial censuses of 1934-35 and 1939-40 is shown in the following table "B" (attached herewith).

It shows that the total buffalo stock is almost constant, viz. 25 lakhs. At the same time the figures reveal that the female buffalo stock is in excess of the male buffalo stock by about 15 lakhs, thus showing the enormous extent of import of the female buffaloes from the surrounding States and Provinces and the colossal maltreatment of the male stock.

From the figures supplied by the Chief Marketing Officer, Bombay, the Province of Bombay imports 32,000 buffaloes yearly as shown below :—

Imports of buffaloes from other Provinces and Indian States in the Bombay Province—

(1) *By rail*—

(a) *To Bombay and Suburbs*—

	No.
(i) From Punjab and Delhi side	15,000
(ii) From Mehsana	13,000
(iii) From Baroda	1,000
Total	29,000

(b) *To Poona*—

(i) From Punjab and Delhi side	1,000
Total by rail	30,000

(2) *By Road*—

(a) From Central India, Central Provinces and Berar to Khandesh.	600
(b) From Nizam's Dominions to Sholapur district mostly to Barsi.	1,400
Total by road	2,000
Total imports by Rail and Road	32,000

As regards exports to other Provinces and States and to foreign countries, it is nil.

B. Production of Hides and Skins.

The total production of hides is estimated approximately at 11½ lakhs. This consists of 9½ lakhs of dead hides and 2 lakhs slaughter hides.

As regards the production of skins, it is estimated at 23 lakhs, consisting of 18½ lakhs slaughter skins and 4½ lakhs private and religious slaughter skins.

C. Sheep and Goats.

The position of the sheep and goats during the two previous quinquennial periods was as under :—

	Period.		Increase or decrease.
	1934-35.	1939-40.	
Sheep ..	1,681,205	2,097,486	+416,281
Goats ..	2,108,918	2,854,697	+745,779

showing an increase of 4 lakhs in sheep and 7½ lakhs in goats.

The imports of sheep and goats from other Provinces and Indian States are estimated at 6 lakhs per year. The exports to other Provinces and States are exceedingly small and are estimated at 400 sheep and goats annually. The imports are mainly from Bikaner, Marwar, Jaisalwar, Palanpur, Kathiawar and Gujarat States. The foreign exports and imports of sheep and goats are nil.

It is interesting to note that the requirements of Bombay and Bandra municipalities' slaughter houses for sheep and goats are approximately 8 lakhs per year.

C. Sheep rearing for Wool and Mutton.

As mentioned in previous paragraph, the strength of sheep during the quinquennial period of 1939-40 has gone up to 21 lakhs as compared with 17 lakhs during the previous period of 1934-35, thus showing an increase of 4 lakhs. It may be inferred therefore, that there is an increasing tendency in the Bombay Province to rear sheep, as their rearing is both inexpensive and profitable. It is estimated that Bombay Province produces approximately 15 to 18 lakhs lbs. of wool annually and valued about 7 lakhs of rupees. The wool is mainly utilized in the manufacture of "Kambalis", i.e., rough country blankets, for which it is well suited. The value of the annual average import of wool and woollen goods into this province is estimated at one crore of rupees.

This Province is carrying out experiments at the Sheep Breeding Farm, Poona, since the last 3 years to breed better sheep with the help of the Imperial Council of Agricultural Research. The work done so far has sufficiently indicated that the local sheep can be bred to produce better quality wool. The results of the working of this Sheep Breeding

Farm are published in full from year to year and detailed information would be found therein.

D. Goat rearing for Milk and Mutton.

The goats have also increased by $7\frac{1}{2}$ lakhs during the last quinquennial period of 1939-40, when the goats increased to $28\frac{1}{2}$ lakhs as compared with 21 lakhs during the period of 1934-35. The increase, therefore, it may be inferred, is gaining ground in the Bombay Province on account of the utility of the goats for milk, mutton and skins.

A scheme for improvement of the goats was submitted to the Imperial Council of Agricultural Research in the year 1934, which has now been referred back for revision, due to changed condition. Opinions are being invited from the various districts of the Bombay Province, as regards the utility of the goats, as there are strong reasons both in the favour of and against the goats.

The work on testing the Kamori goats of Sind is being carried out since the last $1\frac{1}{2}$ years and is being described in this report elsewhere.

E. Poultry keeping for Eggs and Table Poultry.

The quinquennial census of 1939-40, provides the first census of poultry in the Bombay Province. According to the census, there are approximately 49 lakhs of poultry in the Province, consisting of 48,65,000 of fowls and 30,000 ducks. The fowls are made up of:—

Hens	..	..	..	..	19 lakhs.
Cocks	..	..	..	..	7 lakhs.
Chickens	..	..	..	..	23 lakhs.

It is commonly supposed that producers keep poultry for their own use. In actual fact (as pointed in the report on the marketing of eggs in India and Burma 1938), more than 60 per cent. of the hen eggs and 80 per cent. of the duck eggs are actually marketed.

Out of the total fowls, 19 lakhs are hens and if we take half of them laying during the year at the rate of 50 eggs per hen, it is estimated that Bombay Province produces roughly $4\frac{1}{4}$ crores of eggs worth Rs. $6\frac{1}{2}$ lakhs at the rate of annas 3 per dozen. There is great scope for increasing the egg production of the Deshi hens by grading with improved stock. In the Bombay Province, the improvement of poultry and the distribution of improved stock is being carried out since the last 13 years. With the help of the Imperial Council of Agricultural Research, Poultry Research Schemes were in operation since the year 1936 at Kirkee, Ankleshwar and Vadala. The work done at these centres has been described elsewhere in this report. During the year of report about 800 improved birds and 2,200 setting eggs were distributed in the villages for improvement of poultry.

As a result of putting out improved stock in the villages, it has been found that graded pullets lay more and bigger eggs than their dams. The increase in egg production is 40 per cent. in the graded pullets over

their Deshi dams. In order to realise better profits, a more systematic marketing of graded eggs produced in the villages shall have to be organized and more effective measures taken to control and prevent poultry diseases.

F. *Horse and Camel Breeding in the Province and States where these Industries Exist.*

In the Bombay Province there were 117,600 horses and ponies and 2,424 camels as per quinquennial census of 1939-40, as against 116,600 horses and ponies and 2,372 camels during the previous period of 1934-35.

No work on either of these branches of livestock is being carried out in the Bombay Province.

G. *Other Livestock Industries, e.g. Pig Rearing.*

There were 66,500 pigs in the Bombay Province as per census of 1939-40.

No scientific work on pig rearing is being done in the Bombay Province.

TABLE A.

AGRICULTURAL STOCK.

The Quinquennial Census Figures.

Cattle,	1934-35.	1939-40.
<i>(a) Males—</i>		
(1) Breeding bulls, i.e. entire males over 3 years kept or used for breeding purposes.	34,259	37,099
(2) Working bullocks i.e. bullocks, and uncastrated males over 3 years kept for work only.	3,169,634	3,093,006
(3) Bulls and bullocks over 3 years not in use for breeding or work.	120,387	159,672
(4) Young male stock up to 3 years ..	1,018,869	1,003,902
Total males ..	4,343,149	4,293,679
<i>(b) Females—</i>		
(1) Breeding cows, i.e. cows over 3 years kept for breeding or milk production.	1,796,896	1,974,739
(2) Cows over 3 years used for work ..	171,957	11,690
(3) Cows over 3 years not in use for work or breeding purposes.	59,876	13,119
(4) Young female stock up to 3 years ..	1,076,047	955,384
Total females ..	3,104,776	2,954,932
Excess of males stock over female stock ..	1,238,373	1,338,747
Total cattle (Males and females) ..	7,447,925	7,248,611

TABLE B.

AGRICULTURAL STOCK.

The Quinquennial Census Figures.

Buffaloes.	1934-35.	1939-40.
<i>(a) Males—</i>		
(1) Breeding bull buffaloes, i.e. entire males over 3 years kept or used for breeding purposes.	17,276	16,420
(2) Working bull buffaloes, i.e. bull buffaloes and uncastrated males over 3 years kept for work only.	200,706	168,644
(3) Bull buffaloes over 3 years not in use for breeding or work.	11,452	11,072
(4) Young male stock up to 3 years ..	295,978	267,298
Total males ..	525,412	463,434
<i>(b) Females—</i>		
(1) Breeding she-buffaloes over 3 years kept for breeding or milk production.	1,153,869	1,302,509
(2) She-buffaloes over 3 years used for work ..	94,669	11,942
(3) She-buffaloes over 3 years not in use for work or breeding purposes.	21,773	8,436
(4) Young female stock up to 3 years ..	717,846	698,727
Total females ..	1,988,157	2,021,614
Excess of female stock over the male stock ..	1,462,745	1,558,180
Total Buffalo stock ..	2,513,569	2,485,048

APPENDIX D.

Summary of work done at the Poona College of Agriculture, for the year 1940-41.

This is the thirty third year of the College.

Staff.

I was in charge of the College as Principal excepting from 3rd January to 16th January 1941 on leave when Dr. G. S. Cheema looked after the work in addition to his own duties and Professor K. S. Kulkarny did the work of the Professor of Agriculture in addition to his own duties.

Dr. G. S. Cheema, Horticulturist to Government, Bombay Province, Poona, was on leave for one month and nine days from 1st May to 9th June 1941 and Mr. P. G. Dani, Assistant Horticulturist acted in his place.

Professor J. P. Trivedi, Professor of Agricultural Engineering, Physics and Mathematics, Poona, was on deputation as Secretary, Agricultural Institute, Anand, up to 3rd January 1941. Professor A. A. Vasavada was acting in his post. Professor Trivedi was allowed to retire from 4th January 1941 and Professor Vasavada has been confirmed.

It is to be mentioned with great regret that Professor J. P. Trivedi died on 2nd May 1941 and the College has lost one of the best members of the Staff and a great friend of the students. He used to help many a poor students with money. He was an embodiment of social service and a fine example for the students to follow. He was the original organiser of Inter-Collegiate Sports of Poona and was intimately associated with the Rover movement.

Equipment.

Library.—During the year under report the library received the fourth instalment of Rs. 5,000 of the special grant, and 235 new books were added. During the year, 193 periodicals were received. Back numbers of certain journals were also purchased.

The total number of books in the library up-to-date is 10,734 and the number of complete and bound volumes of periodicals is 3,449 besides a large number of periodicals which still await binding. The library was rearranged in an up-to-date manner. The work of typing index cards, pasting labels and writing numbers on them mentioned in last year's report was continued during the year.

All the books and journals in the College Library have now been systematically arranged according to Dr. Dewy's "Decimal system".

400 volumes were got bound from the Yeravada Prison Press during the year under report.

Laboratories.—The Government were also pleased to give the fourth instalment of Rs. 2,344 for equipping the various College Laboratories during the year under report. These amounts were utilised to equip the laboratories of (1) Agricultural Engineering, (2) Chemistry, (3) Entomology, (4) Botany and (5) Plant Pathology sections.

Curricula.

As mentioned in the last year's Annual Report a new syllabus came into force from 1st May 1941.

Studentship.

The number of students that attended during the year was 89, 62 and 59 in the F.Sc. (Agri.), S.Sc. (Agri.) and B.Sc. (Agri.) classes respectively.

Examination Results.

The number of students that appeared for the examinations was 96 for the F.Sc. (Agri.), 68 for the S.Sc. (Agri.) and 68 for B.Sc. (Agri.) and the number passed was 63, 41 and 38 and the percentage of passing 65.6, 60.3 and 55.9 respectively.

In the F.Sc. (Agri.) examination, 3 scholars from Baroda State topped the list.

Post-graduate courses.

In all, six post-graduate students were working in this College, namely—3 in Botany, 1 in Entomology, and 2 in Plant Pathology sections. Of these, 1 was studying for Ph.D. degree, 2 for M.Sc. degree and 3 for M.Sc. (Agri.) degree.

Out of these, 1 got the M.Sc. degree in botany.

Special Courses.

Special courses were taken advantage of by 17 students—Crop Production 1, Plant Pathology 3, Dairy 9, Chemistry 1 and Horticulture 3.

Training of Rural Assistants.

Forty-eight Rural Assistants from Sabarmati were given training in Agriculture and allied sciences during the period of two months from 16th September 1940 to 15th November 1940.

Agricultural Graduates' Employment Board.

There were 60 registered members on the roll of the Board during the year under report, 23 being the new members.

During the year, 17 enquiries were received from employing agencies and these enquiries were promptly circulated to the registered members.

*Admission for 1941-42 for the Bachelor of Science
(Agri.) Degree Course.*

In all, 93 duly qualified candidates (86 from Bombay Province and 7 from outside the Province) applied for admission to the First Year class. But only 68 candidates (66 from the Bombay Province and 2 from outside) were admitted against the total number of 80 in the last year.

Special Courses.

For these, 3 students were admitted for Crop Production, 1 for Dairy and 1 for Veterinary course.

Scholarships.

The number of scholarships for three years continued to be the same as in the previous year, namely—5 for Backward classes including Intermediate and Mohamedans and three for General Competition in each of the three classes.

Out of 24 Government scholars, 1 failed in B.Sc. (Agri.), 2 in S.Sc. (Agri.) and 2 in F.Sc. (Agri.) in the University examinations.

The Baroda State deputed 5 Government scholars every year with a scholarship of Rs. 30 per month plus college fees, etc. which comes to about Rs. 710 per year, per student. The selection of scholars by this State has been found to be good on the whole.

The Students' Hostel.

There were 131 students in the Hostel during the first term and 132 in the second. Seven messes were working.

Sports and Social Activities.

The College Gymkhana.—The Gymkhana continued its activities of indoor and outdoor sports and athletics, the students' Reading Room and the Debating Society.

For want of good play ground, games like cricket, foot ball and hockey suffered. Tennis, volley ball and gymnasium were most widely patronised by the students. In the Inter-Collegiate competitions, our students put up a much better show as compared to the previous year.

The Annual Social Gathering.—This was held in the second week of September 1940 and Dr. R. P. Paranjpe presided and addressed the students after distributing various prizes.

Rovers.

There were 47 Rovers during the year. This year, Hindi classes were held and about 25 students appeared for the First Examination in Hindi and except 2 all passed. Professor N. Narayana continued to be in charge of the Rovers this year also.

Students' Literary Activities.

The Poona Agricultural College Magazine.—Dr. J. A. Daji continued to work as Editor of the Magazine for the whole year under report. There were in all 390 subscribers—233 students, 41 staff members and 116 others.

Due to war, 5 journals ceased to arrive in exchange. In all 38 journals are received in exchange. Out of the 23 articles published, 8 were from the students, 10 from the College and Departmental Staff members and 5 from outsiders.

The financial position of the Magazine continued to be sound, there being an addition of Rs. 170 to the reserve, during the year under report.

The University Training Corps.

The usual activities of the platoon commenced from the 1st week of July 1940. Lt. V. M. Chavan was transferred to Karjat. But Mr. S. V. Bapat ably carried out the recruitment and training of the platoon during the first term while Sergeant Wagh who was in charge of the platoon from the 2nd term took great pains in bringing up the platoon to the required standard of efficiency.

The platoon consisted of 1 Sergeant, two corporals, 4 L/corporals 14 trained soldiers and 17 recruits, making a total strength of 38 members. Admission had to be refused to many enthusiastic students.

In spite of the heavy work at the College, the attendance of the platoon was the highest in the Company throughout the year.

Mr. B. G. Oka, the past Surgeon of this College platoon, who is now a member of the College staff has been granted King's Commission in the U. T. C. and has been appointed as the Commander of the College Platoon from this year. Lt. Chavan on return to the College has been appointed Second in Command of the 'B' Company of the U. T. C.

Mr. S. V. Bapat has been offered Emergency Commission in the Army as a second Lieutenant and Cadet Halkeri has been granted the Viceroy's Commission. C/L/Cpl. Chopade also has been selected for the Police Training Course.

Co-operative Stores.

During the year under report, the Stores had to restrict its activity to the supply of journals to the various classes.

Aid and Assistance to the Public.

Veterinary Hospital.—The number of in and out-patients during the year was 280 and 4,912 respectively as against 490 and 6,009 respectively in the previous year. The number of castrations performed was 208 and the number of cases supplied with medicines was 89.

Revenue Officers' Training Class.

As decided by Government in 1937 the Revenue Officers' Training Class was held from 9th September 1940 to 20th September 1940 and 11 Assistant and Deputy Collectors attended the class.

Forest Rangers' Course.

Ten Forest Ranger students (6 Bombay Government Nominees, 2 Indian State and 2 Private ones) commenced their course from 1st May 1940 and have already completed their first academic year. All the students have been examined and the progress on the whole has been quite satisfactory.

The period of the Forestry class has again been extended by another two years up to the end of 30th April 1944 by the Government of Bombay (*vide* Government Resolution, Revenue Department, No. 4789-33, dated the 26th April 1941), and accordingly the selection of the candidates of the third batch for the 1942-44 course will take place in due course.

Research and Advice.

This Institution, in addition to teaching, also conducts research into various problems concerning agriculture and allied sciences which makes teaching at the College more realistic. Summaries of research work done by each section are embodied in the Annual Report of the Department.

Visitors.

Following were the visitors during the year under report :—

1. His Excellency the Viceroy accompanied by
2. His Excellency the Governor of Bombay.
3. Mr. J. A. Madan, Adviser to His Excellency the Governor of Bombay.
4. Mr. H. F. Knight, Adviser to His Excellency the Governor of Bombay.
5. Honourable Mr. Fazlul Huq, Minister, Bengal.
6. Mr. I. Chatterjee, Physiological Chemist, Dacca.
7. Deputy Director of Agriculture, Karnatak Division, Raichur.
8. Australian Imperial Troops.
9. Students of various local Educational Institutions from all over the province.

B. S. PATEL,
Principal,

Poona, 1st September 1941.

College of Agriculture, Poona.

Programme of work for the year 1941-42.

1. Administration and control over the teaching activities and welfare of the students of the College.
2. The readjustment and revision of the Post Graduate courses to make them more useful.

B. S. PATEL,

Principal,

College of Agriculture, Poona.

College of Agriculture :

Poona, 1st September 1941.

APPENDIX E.

SUMMARY OF WORK UNDER THE PROFESSOR OF AGRICULTURE,
AGRICULTURAL COLLEGE, POONA, FROM JUNE TO
JULY 1941.

(A) STAFF AND ADMINISTRATION.

Mr. B. S. Patel held the post of the Professor of Agriculture throughout the year except between 3rd January 1941 to 16th January 1941 when he was on leave on average pay. During this period Mr. K. S. Kulkarny held charge of this post in addition to his own duties.

(B) THE SEASON.

(a) *Climate and rainfall.*—The rainfall from June 1940 to May 1941 was 24.43 inches. There were no ante-monsoon showers. Rainfall began in the 1st week of June but in the first three weeks it measured only 1.06 inches which helped the preparation of land. The real useful rain began from the 23rd June giving 3.17 inches in a week with 13 rainy days in the month, 5 days giving less than 20 cents each. Kharif sowings which began with this rainfall were however, often interrupted by continuous drizzles in the first week of July. July was almost wet but recording only 4.20 inches in 26 days with 17 days giving less than 20 cents a day. August was like July, recording a total rainfall of 4.75 inches in 25 days with 13 days giving 1 to 12 cents a day. From the end of August to the 16th September there was a very useful break. September rains however, were heavy giving a total of 6.65 inches in 8 days. The rainfall up to middle of September was never more than 86 cents on any one day. Again there was one more heavy rainfall from 11th to 17th October, giving a total rainfall of 4.11 inches in this month. The months of November and December were practically rainless except for 26 cents at the end of November. January gave only 23 cents.

(b) *Condition of crops.*—The continuous drizzling rain from June to August encouraged the growth of weeds along with the growth of crops, as there was no sufficient break for intercultivation and weeding. The short break in September gave barely enough time for cleaning up fields. The heavy rainfall in mid-September though very useful for *rabi* sowings caused great harm to the standing crops such as *jowars*, *bajri*, chillies, sugarcane, tomatoes and groundnuts. Similarly the heavy stormy rains in mid-October again damaged the standing crops like *bajri*, groundnut, *jowar*, sugarcane and chillies. Thus the *kharif* crop outturns suffered heavily and sugarcane gave poorer gul owing to severe lodging. *Rabi* crops were good on the whole.

(C) AGRICULTURAL EDUCATION.

The revised courses started from the 1st May 1941. During the last two years attempts were made to give more field work in agriculture on the lines of the revised course and this has shown considerable

improvement in the practical work of the students at various examinations. The additional staff of 2 lecturers and 1 Demonstrator sanctioned by Government has now been fully entertained and this has helped considerably in the training in practical field work both in Crop-production as well as animal husbandry.

Special courses.

(a) The Special Courses in Animal Husbandry and Dairying were attended by 9 students. A few of them are doing private business while others are employed.

(b) The Special course in Crop-Production had one student who left after a week.

(c) 48 students training at Sabarmati came to this College for their final training as rural assistants and were given suitable training on the College farm and Dairy.

(d) An Agricultural Training class was arranged for 10 days in September for the Revenue Officers.

(e) Demonstrations were arranged for the public and for the students of various local and outside educational institutions.

(D) RESEARCH WORK.

Experiments on methods of cultivation to economise the use of water, to find out the best variety of sugarcane, to see the effect of onionised water on crops, to see the effect of Farm yard manure on rotting of green manure, to find out the best dose of nitrogenous top dressing, to study the effect of legumes in rotation etc. were carried out to demonstrate different methods of carrying out field experiments and to get results for crop improvements.

WORK DONE BY THE COLLEGE DAIRY.

DEVELOPMENT OF HIGHER MILK YIELD, ALONG WITH EARLY MATURITY AND REGULAR CALVING IN SINDHI COWS AND Surti Buffaloes.

(i) *Sindhi cows.*

In the line of out-crossing with bull Tulip, 3 out of his 6 daughters showed superiority over their dam. One of these Tucas 053 has topped the herd with 5,504 lb. of milk on an average of 8 lactations while another of these Homtul has an average of 4,296 lb. over 4 lactations as against the herd average of 2,208 lb.

Three daughters of the bull Silver Jubilee have finished their first lactation and all have calved 6 months earlier than their dams.

King Canute's daughters have all done poorer than their dams this year also.

Two daughters of bull King Pehlavi calved for the first time at an average of 2 years, 10 months and 4 days as against the dams' average age of 3 years, 2 months and 15 days. Pami No. 106 has given 4,350 lb. in the first lactation as against 3,468 lb. of her dam in her first lactation.

(ii) *Surti buffaloes.*

The following statement shows the performances and various pedigrees of Surti buffaloes:—

No.	Name of daughter.	Annual average lb.	No. of lactations.	Name of dam.	Annual average lb.	No. of lactations.	Remarks.
I. In breeding of Bhagi line by Bull Dairy Butter.							
1	Bhagter I	4,096	6	Bhagi	4,833	6	....
II. Line breeding of Bhagi by Bull Baxi.							
1	Bhixi	4,087	8	Bhagi	4,854	8	....
2	Bhagaxi	..	..	Bhagabai	..	..	Dam sold off as low yielder.
3	Bhabi	2,632	2	Do.	2,419	2	New addition.
III. Line Breeding of Sexta by Bull Dairy Butter.							
1	Suxter I	3,427	7	Sujex	4,735	7	....
2	Suxter II	3,402	2	Do.	3,800	2	....
3	Sujecter	5,031	3	Sujecta	3,954	3	....
IV. In Breeding of Sabar by Bull Dairy Pride.							
1	Sabdip	..	..	Sabar	..	..	Sabdip sold as not keeping well.
2	Sabapride	4,459	4	Do.	4,350	4	
3	Prasaab	3,177	6	Do.	4,522	5	
V. Line breeding by Sexta's blood (Bull sabpran).							
1	Ghocharan	4,542	4	Gondip	4,232	4	
2	Motran	3,529	3	Motide	2,646	3	
3	Laftran	3,576	4	Laffer	3,998	4	

(E) COMMERCIAL WORKING OF THE COLLEGE DAIRY.

(i) The strength of herd started with 224 and ended with 297 heads of cattle made up of 176 adults and 121 young stock.

(ii) *Performance of animals*—The average number of milking cows in 1940 was 31.4 out of a total of 44.7. The average milk yield per head came to 2,208 lb. as actually drawn and 1,924 lb. as after feeding calves against 3,004 lb. and 2,648 lb. respectively of last year. In buffaloes, the average number of milking animals in 1940 was 54.4 out of a total 68.0 giving an average milk yield of 3,562 lb. as actually drawn and 3,369 lb. after feeding calves as against 3,138 lb. and 2,967 lb. respectively of last year. The decrease in milk yield of cows was because we had 52 per cent. of cows which have finished only the first and second lactations and 14 per cent. cows have already completed more than eight lactations.

(iii) The financial aspect of the Dairy for the year under report shows that in 1940, the total milk produced came to 341,124 lb. as against 315,064 lb. of last year. The milk fed to calves came to 27,944 lb. as against 26,296 lb. of last year leaving 313,180 lb. available for disposal as against 288,768 lb. in 1939.

The cost of production per 100 lb. of milk came to Rs. 13.46 and the realisation came to 12.67 as against Rs. 14.55 and Rs. 13.13 respectively of the last year. The decrease in the cost of production is probably due to more animals maintained and therefore more milk produced, the overhead charges remaining more or less the same. Another probable reason may be the reduction of cost of feeding due to cheaper production of fodder, the cost of 100 lbs. being Re. 0-4-11.6 as against Re. 0-5-5.5 of 1939.

(F) MISCELLANEOUS.

(i) *Crops grown in different seasons and for trial*.—*Dudhia* and *Dodaka* mixture planted in May gave 9,419 lb. of *Dudhia* and 2,659 lb. of *Dodaka* per acre as against 18,418 lb. and 799 lb. respectively for November planting. November planting has given higher net income.

Gujarat Cottons.—1027 A.L.F. yielded 1,392 lb. B.D. 8 gave 1,416 lb. and segregate 1-6 gave 1,230 lb. of seed cotton in fields which were last year under irrigated crops.

Tondli.—This crop gave last year a total yield of 27,082 lb. per acre of green fruits while this year the yield came to 30,502 lb. per acre. The best yielding months were June and September, while December and January gave practically no yields. In July the crop suffered from a bad attack of mildew which was controlled by Sulphur dusting.

Season.	Yield in lb.	Money.
		Rs. a. p.
June-September	21,730	949 13 0
October-January	1,815	144 2 0
February-May	6,957	317 7 0
	30,502	1,411 6 0

Lima beans.—Planted in middle of May 1940, the crop started yielding green pods in August and gave a total yield of 11,620 lb. December being the best month with 4,300 lb. In another area these beans yielded as high as 16,000 lb. while double beans gave only 10,770 lb. green pods per acre.

Peas and Oats.—Peas and oats grown for green fodder after a green manure with sann hemp in the *kharif* season gave 33,774 lb. of green fodder under irrigation.

Napier grass.—(i) This was grown on 22 Gunthas of land as a dry crop and it gave 4 cuttings yielding 7,740 lb. of green fodder per acre.

(ii) *Visitors.*—The number of visitors was large, specially on the College farm. 45 visitors were shown round the Dairy.

(iii) *Enquiries.*—The number of enquiries continues to be very large. Over 390 enquiries for seeds and manures alone were attended to. It is evident that the public are taking greater interest in obtaining information on crop growing and dairying.

(iv) *Bull services.*—The College dairy afforded bull services to 21 cows and 15 she-buffaloes belonging to the public.

(v) There was no case of corruption during the year in my section.

B. S. PATEL,
Professor of Agriculture.

Programme of work for the year 1941-42.

1. *Teaching.*—This would be continued as required by the new courses.

2. *Research.*—The following items will be in hand during the year :—

(A) On the Agricultural College Farm.

- (i) Position of legumes and an oil seed in rotation with a cereal.
- (ii) Effective rotting of Sann hemp green manure.
- (iii) Effects of different kinds of preparatory tillage with and without manure for dry crops in the Deccan.
- (iv) Improvement of soil fertility by leguminous green manure crops.
- (v) Modified method of planting sugarcane.
- (vi) Spacing, varieties and number of seedlings of chillies.
- (vii) Spacing, varieties and number of plants in cotton.

(B) On the Agricultural College Dairy, Kirkee.

(viii) Development of higher milk yield in cows and buffaloes along with early maturity and regular calving.

B. S. PATEL,
Professor of Agriculture.

APPENDIX F.

SUMMARY OF WORK DONE UNDER THE PLANT PATHOLOGIST TO THE GOVERNMENT OF BOMBAY FOR THE YEAR 1940-41.

Staff and administration.

Dr. B. N. Uppal held charge of the section throughout the year.

Dr. S. P. Capoor was appointed with effect from April 1, 1941, to the temporary post of Additional Assistant Plant Pathologist under the Bombay Virus Diseases Scheme.

Research Work.

1. *Fusarium wilt in sann-hemp*.—About 3 lb. of nucleus seed of the wilt-immune strain of sann-hemp was produced in the wire cage at Poona. Six pounds of the nucleus seed produced in the previous season was sent to Dharwar for multiplication there in the open. About 40,000 lb. of seed of the wilt-immune strain multiplied at Dharwar during 1938-39 and 1939-40 was handed over to the Rural Development Department for growing on the Deccan Canals.

2. *Wilt in Lathyrus sativus*.—Self-bred progenies of 39 plants comprising four varieties from Indore and one local selection of *Lathyrus sativus*, viz., Indore T-1, Indore T-2, Indore T-3, Indore T-4 and S-1, which, with the exception of Indore T-4, did not suffer mortality from wilt in wilt sick soil in 1939-40 season, were tested in pot culture in the glasshouse, in which air temperature ranged from 24° to 30°C. during the period of the test. Cultures Indore T-2-1 and Indore T-3-8 were completely free from wilt, whilst progenies of a number of plants in other cultures also did not suffer any mortality. Promising plants from amongst the survivals in each culture were selected and transplanted into the infected plot. Further tests will be continued.

In inoculation experiments the Lang (*Lathyrus sativus*) *Fusarium* was not able to infect *Lathyrus odoratus* and *L. latifolius*. The Lang *Fusarium* appears to be a new variety of *Fusarium orthoceras*.

3. *Koleroga of areca-nut*.—It was reported last year that areca-nut trees may harbour infection in their tops without showing any external signs of the disease. Observations made during the year have shown that the tops of some areca-nut trees sometimes develop lesions on their outer surface as a result of infection, which often does not penetrate deep into the cone. The lesions are very small and pass unnoticed. With the further development of the growing point, new leaves are unfolded and the young leaf-sheaths show signs of infection. With the onset of the monsoon the lesions on the young sheaths increase in extent and coalesce, forming diseased areas of considerable size. As the older leaf-sheaths fall from the tree, diseased areas on younger sheaths become fully exposed. The fungus actively grows in these areas and

forms a crop of sporangia. The latter are then blown to the bunches and cause infection of nuts. The fall of diseased nuts early in the rainy season is a characteristic feature of trees harbouring latent infection. Such trees thus constitute a potent source of primary infection in areca-nut gardens. The trees continue to grow for several years without showing any other ill effects. However, when infection of the top becomes deep-seated, it penetrates into the growing point and ultimately kills it. The death of the growing-point is followed by invasion of the top by decay organisms, but since dead or drying tops continue to support growth of *Phytophthora arecae*, they serve as foci from which infection radiates in the garden.

Further cross inoculation tests have shown that the koleroga fungus does not pass to sandal, which has so far been regarded as a collateral host of this parasite.

It was reported some time ago that the heterothallic strains of the fungus are isolated in different areas, and that this localisation of the two sex strains probably explains the absence of oospore formation by the fungus in nature. However, recent observations have shown that the two strains may exist together in a valley; but oospores have so far not been encountered in such valleys.

Spraying trials to test the relative merits of adhesives have shown that spraying with Bordeaux mixture combined with resin soda not only most effectively controlled the disease but resulted in increased yield. Bordeaux mixture alone and in combination with casein and Lothalate Wetting Fluid were effective in controlling the disease in the order of their mention.

Perenox, a proprietary copper fungicide, did not prove better than Bordeaux mixture in controlling koleroga. It is proposed to do these experiments with improved Perenox, Perenox J 29.

A. *Damping off in tobacco seed-beds.*—Experiments on the control of damping off of tobacco seedlings were continued at the Tobacco Breeding Station, Nadiad. Perenox, Mycol and Bordeaux mixture were the fungicides used for disinfection of soil in the beds. These fungicides were used in various concentrations and were applied to the beds at weekly intervals with a pressure sprayer. The first spray application was made after the emergence of seedlings, and in all five sprayings were given.

Due to late sowing, germination of seeds in experimental beds was not uniform. The incidence of damping off in the treated and control plots was very low. Results of the treatments were therefore inconclusive.

5. *Soft rot of ginger.*—The value of growing ginger in flat beds as compared to the broad ridge method of cultivation in the control of soft rot, was tested in experiments laid out at Bassein and at Kachholi in the Surat district. At Bassein healthy rhizomes of ginger were

planted in ten gardens comprising an area of 26 gunthas. At harvest the number of diseased plants in 13 gunthas laid out as broad ridges was 120 as against 450 in flat beds comprising the same area. Results of similar experiments done at Kachholi showed that, whilst there were 77 diseased plants in an area of 10½ gunthas of broad ridges, the number of diseased plants in flat beds prepared by the local method was 1,520. These results conclusively prove the value of growing ginger on broad ridges as a method of control of soft rot.

6. *Rust on chrysanthemum*.—Spraying trials on the control of chrysanthemum rust were continued at Walhe. Bordeaux mixture 2-2-50 and 3-3-50 alone and in combination with Agral I (Agral I was added in the proportion of 1 oz. to 25 gallons of the spray) were used in these trials, and spray applications were made with a Sapperlot Suction sprayer, which develops very high pressure. The first application was made when the buds develop, followed by a second application a month later. Rust was completely controlled in all treated plots, and the addition of Agral I appeared to increase the adhesive power of spray mixtures. Control plants were heavily rusted.

7. *Panama disease of bananas*.—In heavily infected soil at Rajuri, four rows of the *Basrai* variety of bananas were planted alternately with one row of *Sone*, a highly susceptible type. The *Basrai* plants all remained free from the disease, but the *Sone* plants were infected.

It is proposed to discontinue the trials.

8. *Black spot of mango*.—Inoculation of *Alphonso* and *Piarie* mango fruits showed them to be susceptible to *Actinodocheium* sp. In controlled experiments necrotic areas on the fruits were at first limited in extent but rapidly enlarged in humid conditions, ultimately involving the whole fruit. Physiological relations of the fungus have been studied.

9. *Bacterial leaf-spot of Desmodium*.—Detailed studies of the physiology and morphology of the bacterium causing leaf spot of *Desmodium diffusum* have been made. The pathogen belongs to the *Phytomonas campestris* group of organisms producing yellow pigment. It grows well in synthetic media, with inorganic nitrogen as the only source of this element, produces H_2S , and does not utilise asparagin as a source of carbon and nitrogen. The pathogen is restricted to its host and on inoculation did not pass to any of the legumes tested. The organism is now considered to be a new species of *Phytomonas*.

It is proposed to write up the results of this investigation.

10. *Twig blight and fruit rot of mango*.—Examination of the fixed material showed that the fungus penetrates into the wounded stem-pieces more readily than the unwounded. In the unwounded stem the fungus is able to penetrate into the host tissue by dissolving the cuticle and then passes through and between the underlying epidermal cells. After entry into the host is effected, the fungus spreads mainly in the superficial region of the cortex.

Diseased twigs of mango collected in winter and early summer bore perithecia in addition to pycnidia. Cultures derived from single ascospores and pycnosporos were able to infect pieces of mango stems, but the formation of perithecia has not yet been obtained in culture.

Examination of the fruits arriving at the Poona market during 1940 season showed that about 0.5 per cent. of the fruits were affected by the fungus, which is provisionally referred to as *Macrophoma* sp.

11. *Cotton Wilt Breeding Schemes*.—The following is a brief summary of the work done during the year:—

(a) One culture of B.D. 8 has reached homozygosity for 100 per cent. wilt resistance.

(b) *Broach crosses and back-crosses*.—(B.D. 8 × G.A. 26) F_6 has become homozygous for 100 per cent. wilt resistance. Material of the composition (B.D. 8 × G.A. 26) F_8 was free from wilt in pot culture tests in the current season.

Some of the families of the Broach back-cross, viz., (B.D. 8 × G.A. 26) × B.D. 8 have reached homozygosity for 100 per cent. wilt resistance.

Some of the families of (B.D. 8 × S. 7-1) and (B.D. 8 × S. 12-1) × B.D. 8 have become homozygous for 100 per cent. wilt resistance, and others are practically free from wilt.

(c) *Genetics of wilt resistance in Indian cottons*.—As a result of studies in the inheritance of resistance to wilt in cotton, some tentative conclusions have been reached, and these may be summarised as below:

Results of F_2 and back-cross families of *Gossypium herbaceum* cross, viz., K. F. 3 × 1027 A. L. F. showed that resistance to wilt was due to a single genetic difference, whereas in *G. arboreum* var. *neglectum* crosses, viz., Dhulia 2 × N.M.D. and Dhulia 2 × Chinese R_1 Spotless 51 this character involved three complementary genes. In all crosses resistance was incompletely dominant. The occurrence of a proportion of fully susceptible plants (i.e., plants that wilted) in the F_1 's may be explained on the assumption that the resistant parents are heterozygous for the modifying factors which they carry.

Further work is in progress.

(II) KHANDESH SECTION.

(a) *N.M.D.*—This strain is homozygous for 100 per cent. resistance and shows a high grade of resistance.

(b) *Jarila selections*.—Seed of six plants of Jarila, showing a high degree of field resistance, was supplied by the Cotton Breeder, Jalgaon, in 1939, and tested in pot culture. Tests were continued in the current season, and culture (N.V. 56-3-68-8-3-3) has been retained for further study.

(III) SURAT SECTION.

Owing to adverse seasonal conditions prevailing during the season, the quantity of seed produced by the different crosses was so small that no selection on the basis of agricultural characters was possible.

Seg. 8-1 did not suffer mortality from wilt when grown in wilt sick soil at Shera ; but it still shows some partial wilting. The material will now be tested in pot culture at Poona.

12. *Long smut of Andropogon purpurea* var. *sericeus*.—A smut of *Andropogon purpurea* var. *sericeus* was collected in Khandesh. The smut resembles the smut of *Andropogon sorghum* caused by *Tolyposporium ehrenbergii* in the measurements of the spores, but differs from the latter in the length of the sori and of spore-balls. The fungus appears to be a new variety of *T. ehrenbergii*. It is proposed to write up the results of this investigation.

13. *Plant Virus Research Scheme*.—The following is a brief summary of the work done during the year :—

(a) *Yellow Vein-mosaic of Hibiscus esculentus*.—*Bemisia gossypiperda* is able to secure the virus of yellow vein-mosaic in a much shorter time if made to fast immediately before being fed upon a diseased plant. Post-infection fasting (i.e., fasting after feeding on a source of infection) induces increased efficiency of *Bemisia gossypiperda* as a vector. The minimum incubation period of the virus in its vector is 7 hours. The white-flies, once proved to be infective, retain the power of infection until death. In addition to hollyhock, it is easy to transfer the virus to *Hibiscus abelmoschus*.

(b) *Mosaic disease of Datura alba*.—It has been shown that *Nicotiana glutinosa* and *Petunia hybrida* are also infected by this virus. The latter acts as a symptomless carrier. Some of the physical properties of the virus have been studied.

(c) Two sap-transmissible viruses of chillies have been collected. The symptoms of the diseases in chillies have been studied.

(d) *Mosaic diseases of brinjals*.—Probably a new, sap-transmissible virus of brinjals, *Solanum melongena*, has been discovered. The symptoms on brinjals have been studied.

(e) The following virus diseases of plants were also collected during the year :—

- (i) Yellow vein-mosaic of *Ageratum conyzoides*.
- (ii) Yellow vein-mosaic of *Eclipta alba*.
- (iii) Yellow vein-mosaic of *Sida* sp.
- (iv) Yellow vein-mosaic of *Vernonia anthelmintica*.
- (v) Yellow mosaic of *Corchorus trilocularis*.

(f) *Physiological studies on Yellow vein-mosaic virus*.—Results of experiments on the relation of mineral nutrition to susceptibility of

bhendi to yellow vein-mosaic virus show that, whilst the deficiencies of phosphorus and nitrogen resulted in delaying the appearance of yellow vein-mosaic symptoms, lack of potassium induced much earlier infection. Potassium deficiency further increased the number of positive infections. A deficiency of nitrogen not only depressed growth but gave the least percentage infection.

Results of chemical analyses of healthy and diseased *bhendi* plants show that the proportions of protein and other nitrogen fractions in diseased plants (exclusive of roots) or in diseased leaves are not appreciably different from the proportions in healthy plants or leaves. But diseased fruits contain higher total N, protein N and inorganic nitrogen as compared with healthy fruits.

The total carbohydrate content of diseased leaves is less than that of healthy leaves. The same conclusion holds good in the case of above ground portions of diseased and healthy plants. On the other hand, the carbohydrate content of diseased fruits is higher than that of healthy fruits.

There is an increase in the fat content of diseased plants, and this feature is more marked in diseased fruits.

(g) "*Katte*" disease of cardamoms.—With a special grant of Rs. 4,000 made by the Government of Bombay, a glasshouse cum insectary has been constructed at Sirsi for the investigation of "*katte*" disease of cardamoms. Work on elucidating the nature of this disease has now been taken up.

14. *Wilt in Cajanus cajan*.—Work on the development of wilt-resistant varieties of *tur* (*Cajanus cajan*) was continued on the Arbhavi Farm in collaboration with the Deputy Director of Agriculture, Southern Division. Results of trials in wilt sick soil have shown that none of the selections is promising in respect of wilt resistance. It is proposed to link up this work with the Pulse Breeding Scheme under the charge of the Economic Botanist to Government.

15. *Scheme for varietal trials of Indian potatoes*.—In view of the complete cessation of supplies of seed potatoes from Italy, Government sanctioned a scheme for conducting trials of different types of seed potatoes produced in India and Burma, with a view to determining their relative suitability for general cultivation in the potato-growing tracts of the Poona district. These trials were laid out at three important centres of potato cultivation, and the "lay-out" of the experiments at each centre was a randomised block arrangement of five replications of eight varieties of potatoes, viz., *Numbri*, *Sitbo*, *Darjeeling Red*, *Magnum Bonum*, *Gola*, *Phulwa*, *Great Scot*, and *Italian White Round*.

The *Numbri* and *Sitbo* varieties of potatoes (both "Up-to-date") were the most successful both from the point of view of yield and of suitability of type, e.g., shape, size, etc. These varieties have also been found to have excellent flavour on cooking, but they do not possess

the same firmness after cooking as is shown by the Italian potatoes. In the latter respect *Darjeeling Red* is more suitable than the *Numbri* and *Silbo* varieties, but the red skin of tubers of the former variety is considered objectionable by the trade. It is proposed to continue trials with these three varieties of potatoes.

16. *Wheat Rust Scheme*.—The construction of the glasshouse, office room, etc., at Mahableshwar and a glasshouse at Poona has been completed. At Mahableshwar a bore has been sunk in order to supply water in the glasshouse. Work under the scheme could not be undertaken during the year as the officer appointed by Government was not able to take up his duties.

Advisory and Development work.

A large number of enquiries on plant diseases were, as usual, dealt with during the year, and advice and assistance were promptly given whenever required. It is to be noted with much satisfaction that the cultivators are now taking greater interest in the prevention and control of plant diseases and are making full use of the facilities which the plant pathological service of the Agricultural Department offers.

A further grant of Rs. 3,000 was made by Government for continuing demonstrations of methods of control of mango hoppers and mildew. These demonstrations were carried out in selected gardens at Dharwar and Belgaum in the Karnatak, at Vengurla, Ratnagiri and Mandwa in the Konkan, at Borivli and Chembur in the Bombay Suburban District, and at Bajipura in South Gujarat. These demonstrations proved once more that sulphur dusting is an effective remedy against mango hoppers and mildew. Since *Idiocerus clypealis*, the species of hoppers prevalent in the Konkan and Karnatak, is susceptible to the action of sulphur, not more than three to four applications of sulphur to mango trees are required for effective control of hoppers. In Gujarat and the Bombay Suburban District, however, the predominant species of hoppers are *I. atkinsoni* and *I. niveosparsus*. As these two species are less affected by sulphur, nine to eleven dusting of sulphur are often necessary to check the hoppers. It is proposed to discontinue further demonstrations.

Agricultural Education.

The Plant Pathologist to Government was assisted by the Assistant Professor of Mycology and the Assistant Mycologist in the teaching of plant pathology and agricultural bacteriology.

A special lecture demonstrating the diseases of crop plants and their methods of control was delivered to the Civilian class held during the year.

A special course of training in recognition of common plant diseases and methods of control was arranged for teachers of Rural Assistants' Training Centres.

A number of students applied for admission to the post-graduate course in plant pathology but were refused admission as members of the staff were fully occupied with the large programme of research work undertaken by the section. There were three post-graduate students engaged in research, one of whom was preparing for the Ph.D. degree and the other two for the M.Sc. (Agri.) degree of the University of Bombay.

Miscellaneous Work.

Dr. B. N. Uppal continued to work as Secretary-Treasurer of the Agricultural Graduates' Employment Board, which is doing useful work in finding suitable employment for agricultural graduates. In order to encourage agricultural graduates to become registered members of the Board, the membership fee has been reduced from Rs. 10 to Rs. 5 for a three-year period. It is suggested that officers of the Agricultural Department should, when filling up vacancies under their charge, give preference to agricultural graduates, who are registered members of the Board.

Seven meetings of the Insect Pest and Plant Disease Committee, of which Dr. B. N. Uppal is the Secretary, were held during the year. A large programme of work on insect pests and plant diseases was dealt with at these meetings. The value of the Insect Pest and Plant Disease Committee in organising propaganda and research work on insect pests and plant diseases in the Province has been fully justified. The minutes of the meetings of the Committee held during 1938 and 1939 were printed as Departmental publications.

Dr. B. N. Uppal acted as Secretary of the Pests and Diseases Section of the Second Conference of Research Workers on Cotton in India held at Bombay in January 1941.

Work on the disease survey of the Province was continued during the year. Seventy-four new records of parasites on 104 hosts have been made since the publication of "The Fungi of Bombay". Of these records, 3 are Schizomycetes, 5 Phycomycetes, 12 Basidiomycetes, and the rest are included in the Fungi Imperfecti.

PUBLICATIONS.

(1) PADWICK, G. W. and B. N. UPPAL. The problem of inter-provincial plant quarantines in India. *Indian Jour. Agri. Sci.* 10, 697-706. 1940.

[The conclusion reached is that the only strong case for inter-provincial quarantine is in the temperate crops of restricted distribution (the temperate fruits of the hills). There may perhaps be one or two special cases in virus diseases of vegetatively propagated crops on the plains, but national regulations are dependent on survey work for which at the present time India has no facilities.]

(2) UPPAL, B. N., Y. S. KULKARNI and J. D. RANADIVE. Further studies in breeding for wilt resistance in cotton. I. Isolation of wilt-resistant types. *Proc. 2nd Conf. Sci. Res. Workers on Cotton in India.* (In press.)

[Cotton strains and segregates of crosses that had been inbred for several years and grown in wilt sick soil in the field were found to be highly segregating for wilt resistance in pot culture tests. These strains and segregates became homozygous for 100 per cent. wilt resistance when selection for this character was made in self-bred progenies grown in pot culture under conditions of infection approaching the optimum, over a period of three or four years. Pot culture tests will thus enable the plant breeder to accomplish what is obviously an impossibility under field conditions.]

(3) UPPAL, B. N., Y. S. KULKARNI and J. D. RANADIVE. Further studies in breeding for wilt resistance in cotton. II. A preliminary note on genetics of wilt resistance in Indian cottons. *Proc. 2nd Conf. Res. Workers on Cotton in India.* (In press.)

[Evidence of monohybrid segregation for wilt resistance was obtained in F_2 generation of *Gossypium herbaceum* cross, viz., K.F. \times 1027 A.L.F. On the other hand, *G. arboreum* var. *neglectum* crosses, viz., Dhulia 2 \times N.M.D. and Dhulia 2 \times Chinese R₁ Spotless 51 indicated that this character involved three complementary genes.]

(4) UPPAL, B. N., M. K. PATEL and M. N. KAMAT. Powdery mildew of the mango. *Jour. Univ. Bom.* 9, 12-16. 1941.

[A detailed technical description of *Oidium mangiferae* Berthet, the causative fungus of powdery mildew of mango, is given.]

B. N. UPPAL,
Plant Pathologist to Government.

Programme of work for the year 1941-42.

- (1) *Fusarium wilt in sann-hemp*.—Nucleus seed of the wilt-immune strain of sann-hemp, D-IX, will be multiplied and maintained. Study in the genetics of wilt resistance in sann-hemp to be undertaken.
- (2) *Fusarium wilt in Lathyrus sativus*.—Study of the wilt organism to be continued. Work on selection of wilt-resistant types of *Lang* to be continued.
- (3) *Fusarium wilts in tur and gram*.—Work on the development of wilt-resistant varieties of tur (*Cajanus cajan*) and gram to be undertaken in collaboration with the Economic Botanist to Government.
- (4) *Wilt in Pyrethrum*.—The organism causing wilt in Pyrethrum to be studied.
- (5) *Twig blight and fruit rot of mango*.—Work on establishing relationship between the perithecial and pycnidial stages to be continued. Work on conditions affecting development of pycnidia in culture, on histology of affected plants, etc. to be continued.
- (6) *N-fixation in rice fields*.—Study of various types of rice soils in relation to *Azotobacter*.
- (7) *Soft rot of ginger*.—To test the value of broad ridge versus flat bed method of cultivation in control of soft rot, in experiments to be laid out on randomised block design.
- (8) *Nematode of betel vine*.—To test the value of trap crops and certain cultural operations in reducing populations of nematodes in betel vine soils.
- (9) *Koleroga disease of areca-nut*.—Work on carry-over of the organism to be continued. The value of clean-up measures in control of Koleroga to be demonstrated in the 25-acre garden area taken up for the purpose. The value of adhesives to be tested.
- (10) *Damping off of tobacco seedlings*.—Work on the treatment of tobacco seed-beds with different fungicides for the control of damping off to be continued.
- (11) *Rust of Chrysanthemum*.—Field trials to be continued at Walke and near Saswad.
- (12) *Diplodia on mango*.—Study of the causative organism.
- (13) *Black spot of mango*.—Further study of the causative organism.
- (14) *Downy mildew of maize*.—An oospore-producing *Sclerospora* of maize has been discovered and will be further studied.
- (15) *Cotton Wilt Breeding Scheme*.—As per programme approved by the Indian Central Cotton Committee.
- (16) *Wheat Rust Scheme*.—As per programme approved by the Imperial Council of Agricultural Research.
- (17) *Plant Virus Research Scheme*.—As per programme approved by the Imperial Council of Agricultural Research.
- (18) *Disease Survey*.—Work to be continued.
- (19) *Varietal trials of potatoes*.—*Numbri, Sitbo and Darjeeling Red* will be grown in kharif and rabi seasons.

B. N. UPPAL,

Plant Pathologist to Government.

APPENDIX G.

SUMMARY OF WORK DONE UNDER THE ECONOMIC BOTANIST TO THE
GOVERNMENT OF BOMBAY FOR THE YEAR 1940-41.

ADMINISTRATION.

Professor L. S. S. Kumar held charge of the section throughout the year except from 10th January to 8th February 1941, when he proceeded on leave. In his absence, Mr. V. M. Chavan held charge of the post of the Economic Botanist in addition to his duties of Assistant Professor of Botany. Mr. Chavan who acted as Crop Botanist to Government of Bombay reverted to his substantive post of Assistant Professor of Botany, with effect from 7th September 1940. He was on leave from 18th April to 3rd May 1941.

Mr. A. Abraham was appointed to the post of Cytologist under the scheme of Research on the Cytology of the Papaya with effect from 1st July 1940.

RESEARCH.

1. *Striga* Scheme.

During the year under report, it has been conclusively proved that 35°C is the optimum temperature for inducing the maximum attack of *Striga lutea*. The resistant seedlings of "Bilichigan" and "Muddinandyal" varieties of *jowar* are now being tested under these conditions.

Application of farm yard manure to *murum*, river and black soils did not prevent *Striga* attack. In sand cultures, the amount of attack of *S. lutea* and the damage done was inversely proportional to the strength of the nutrient solution added. *S. densiflora* appears much earlier than *S. lutea* and appears to do more damage. Both the species can attack the host throughout the year.

Bonganhilo, a supposedly 100 per cent. resistant variety from Africa, has proved susceptible to *S. densiflora* under field condition and to *S. lutea* in the soil temperature tanks held at 35°C.

2. *Linseed* Breeding Scheme.

During the year under report, district trials of improved linseed strains have again confirmed their superiority over the local—both in yield and oil percentage. The increase in yield for different strains in different centres and years varies from 7 to 21.5 per cent. and increase in oil percentage from 7 to 13 over the local. A few of the hybrids in "F₂" generation seem to combine heavy yield, high oil content, bold seed size and earliness in maturity.

3. Oil-seeds Breeding Scheme.

Sesamum.—Selections from Burma and Ceylon types have consistently shown quite a high oil percentage of 54 to 55. Besides, the Burma selections mature by about a month earlier than local selections. A few local selections, combining high yield and high oil percentage, have been obtained.

Niger.—A few selections appear to be promising for high yield and high oil percentage, while a large number of selections possess either the one or the other of the two important economic characters. Selections, especially from Palghar, appear to be very early maturing.

Safflower.—A few selections have shown consistently high yield and high oil percentage and are in the stage of replicated trials on the Farm plots.

4. Scheme of Research on the Cytology of Papaya.

This scheme financed by the Imperial Council of Agricultural Research, commenced working from 1st July 1940.

The object of the scheme is to make a cytological study of the different sex forms of Papaya to gain a clear understanding of the mechanism of sex distribution in this plant. This knowledge may help to prevent the waste at present involved in not being able to avoid growing economically useless sex types.

More than 100 samples of seeds of different varieties of Papaya have been collected from different parts of the world, and about 50 of these are being grown in Poona. Cytological study on the different sex forms occurring in these varieties is being made.

5. Grass Experiments.

Rotational grazing.—The large scale experiment at Mangdara Kuran was discontinued.

Acclimatisation of exotic grasses and legumes.—Seeds from abroad were grown in beds and pots, and their germination was satisfactory. Australian clovers grew better in pots. American grasses do not show progress.

Giant star grass.—This *hariati*, introduced from Africa and which is believed to be somewhat harmful to cattle on account of its prussic acid content, has been grown under irrigated conditions at Poona. It was fed to cattle and was found to be harmless. The grass will be studied further.

6. Orobanche Experiment.

A collection of tobacco seeds from different provinces of India, Burma and Ceylon were made and of these six types were tested. A few resistant plants have been selected and these together with the remaining extra-provincial types will be tested in the coming year.

7. Miscellaneous Experiments.

White flowered groundnut.—By a comparison with the yellow type of Poona, it was found that the white flowered type is in no way different in

economic characters from the yellow flowered type. This experiment will be discontinued. Crosses between the above types and another between small Japan and white flowered type are being studied.

African Bajri vs. local Bajri (Str. 59).—It was proved by a comparative trial that African *bajri*, if sown with a spacing of 18" × 12" and one month in advance of the usual time of sowing *bajri* in Poona, gives significantly higher yield than the local *bajri* sown at the normal time, either with a spacing of 18" × 12" or of 18" × 4". A trial on split plot design will be attempted.

Intergeneric cross.—The promising fodder types from the cross between maize and *Euchlœna* are being tested.

Inheritance studies.—Studies on inheritance of plant characters in chilli and castor crosses are in progress.

Weed killing.—The trials with sodium chlorate to control weeds were repeated with satisfactory results.

Trials with hedge plants.—Six different types of plants are being tested for recommending as live fences.

8. Seed Testing.

Preservative effect of Jaipur talc.—The results of this trial showed that Jaipur talc was ineffective in preventing damage by insects to grains during storage.

Longevity test.—The preliminary test on storage life of grass and vegetable seeds without impairing their viability was concluded. Longevity tests of other vegetable seeds will be taken up. Fifty seed samples were received for germination tests.

Teaching.

The Economic Botanist was assisted by the Assistant Professor of Botany and Demonstrator in Botany in carrying out the teaching work at the College of Agriculture, Poona, satisfactorily.

A special demonstration lecture on seed-testing, methods of improvement of grasslands, eradication of weeds and preparing cheap fences from hedge plants, was arranged for the Assistant and Deputy Collectors.

The section held a refresher's course in Plant Breeding for the Junior Staff of the Agricultural Department.

Miscellaneous Work.

Herbarium.—Plant collection was made whenever possible. 164 plants were identified during the year. Herbarium sheets of collected plants were supplied to the Forest Research Institute, Dehra Dun, and the Jute Investigator, Bengal.

Economic enquiries.—69 enquiries were attended to and exhaustive note on fibre plants for paper manufacture was supplied to the All India Village Industries Association, Kagaz Centre, Poona.

Survey of Agave plantations.—Plantations of Agave at Shrigonda and Mundharva were surveyed and estimates for renovation were prepared.

Seed Supply.—Collection of grass seeds, cowpeas and sesamum were supplied to Australia, United States of America and to enquirers in India.

Statistical course.—Notes taken of lectures delivered by Mr. S. S. Iyer were submitted to him for correction. Final notes will be prepared for circulation to the Departmental Staff.

Provincial Fodder and Grazing Committee.—The Committee held no meeting during the year under report after the one held on 6th June 1940. The following actions were taken on proposals made in the previous meeting. The sub-committee appointed to go into the question of the survey of grass lands submitted its detailed report, the Chief Conservator of Forests submitted his scheme for the improvement of wells and tanks to Government for approval and financial sanction, and the Economic Botanist continued his experiments on Giant star grass and Kiwæ (Algeroba) tree.

The Grass Drying Scheme and the Marl-land reclamation scheme approved by the Provincial Committee have been sanctioned by the Imperial Council of Agricultural Research and Bombay Government respectively.

The suggestion for exchanging literature between the Central and various Provincial Fodder and Grazing Committees has been put into effect.

Prof. L. S. S. Kumar was appointed the Joint Hony. Secretary of the Provincial Committee in place of Mr. E. J. Bruen, with effect from 19th May 1941.

District Fodder and Grazing Committees.—During the year, Fodder and Grazing Committees were constituted in all the Districts except the Sholapur District. The Thana District Committee was dissolved and its work was transferred to the District Rural Development Board. With the exception of a few, all Districts held periodical meetings and considered various problems affecting grazing and improvement of grasslands.

PUBLICATIONS.

- (1) Kumar, L. S. S. .. Flowering Plants which attack economic crops, *I. Striga*. *Indian Farming*, Vol. I, No. 12, December 1940, pp. 593-595.

- (2) Kumar, L. S. S., & Solomon, S. The influence of light on the germination of species of *Striga*. *Current Science*, Vol. IX, No. 12, December 1940, p. 451.
- (3) Kumar, L. S. S., & Ranga Rao, D. S. Studies in blooming in three Punjab types of *Sesamum* in the Bombay-Deccan. *The Journal of the University of Bombay*, Vol. IX, Part 5, March 1941, pp. 69-77.
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- (5) Kumar, L. S. S., & Deodikar, G. B. *Commelina alisagarensis*, Kumar & Deodikar, a new species from Hyderabad-Deccan, India. *Proceedings of the Indian Academy of Sciences*, Vol. XIII, No. 3, Section B, March 1941, pp. 168-170.

AGRICULTURAL COLLEGE :
Poona, 23rd July 1941.

L. S. S. KUMAR,
Economic Botanist to Government
of Bombay, Poona.

Programme of Work for the year 1941-42.

(1) *Striga on Jowar*.—Further selection and purification of resistant plants will be carried out. Physiological studies of the effect of attack will be undertaken.

(2) *Cytology of Papaya*.—The technical programme approved by the Imperial Council of Agricultural Research will be followed.

(3) *Orobanche on tobacco*.—Different species of *Nicotiana*, other than cigarette and *beedi* tobacco's, will be tested for resistance to *Orobanche*. A collection of many of the existing species of *Nicotiana* will be made for inclusion in the experiment.

(4) *Linseed Breeding*.—Study of the F_1 to F_3 generations and back-cross will be made and promising selections will be isolated for further tests. District trials will be carried out to test the superiority of the selections compared to the local.

(5) *Oil Seeds Breeding*.—Improvement of previous year's selections for their economic characters will be undertaken.

(6) *Grass Experiment*.—Acclimatisation of exotic grasses will be continued. Collection of legumes suitable for introduction in grass *kurans* will be undertaken.

(7) *Hedge plants*.—The studies on the economics of live fence and the time taken to prepare it will be carried out.

(8) *Inheritance studies*.—Inheritance of characters in castor, chilli, groundnut and *Euchlena* × maize will be continued.

(9) *Induction of polyploidy*.—The effect of colchicine in inducing polyploidy will be studied.

(10) *Agave Experiment*.—Plots suitable for experimental cultivation of Agave will be selected and plant material obtained from different provinces and States will be tested for obtaining higher yielding types having desirable fibre characteristics.

AGRICULTURAL COLLEGE :

Poona, 23rd July 1941.

L. S. S. KUMAR,

Economic Botanist to Government
of Bombay, Poona.

APPENDIX H.

SUMMARY OF WORK DONE UNDER THE AGRICULTURAL CHEMIST TO THE GOVERNMENT OF BOMBAY FOR THE YEAR 1940-41.

Staff and administration.—Dr. J. A. Daji held charge of the office and laboratories of the Agricultural Chemist throughout the year.

Analytical and Advisory.—Six hundred and nineteen samples were received for analysis during the year under report. As usual the number of samples received from the public was very small. The nature and number of samples received for analysis was as under :—

Nature of samples.	Government samples.	Private samples.
Soils	310	7
Waters	2	17
Manures	40	18
Foods and Feeding-stuffs	55	5
Dairy products	1	1
Seeds and Grains	25	1
Tobacco	40	....
Miscellaneous	97	....
Total ..	570	49

Eighty soil samples were analysed for the Professor of Agriculture, Poona, in connection with a green manure experiment carried on by him at the College Farm. Another 16 samples of soil were analysed for the same officer for his experiments on the rapidity of decomposition of green manures. The Deputy Director of Agriculture, Surat, sent 24 soil samples in connection with the reclamation of salt lands. Four soil samples were received from the Director of Public Health, Poona, in connection with an inquiry into the cultivation of melon, etc., in river beds. The Superintendent, Surat Farm, sent 48 samples of soil for analysis in connection with some of the rotational and green manure experiments carried on by him at that farm.

Six samples of water were analysed for the Institute of Agriculture, Anand. The Professor of Agriculture, Poona, sent 8 manure samples for analysis. Five samples of manure were analysed for the Superintendent, Kopergaon Farm, and four for the Manager, Agricultural College Dairy, Kirkee.

Forty-nine samples of various seeds were analysed for the Superintendent, Cereal Breeding Station, Niphad, for their food value. The Live-Stock Expert to the Government of Bombay, Poona, sent three samples of grasses and three of leaves for determining their food value. Thirteen samples of *hariali* were analysed for the Economic Botanist to the Government of Bombay, Poona, to determine their prussic acid content.

The Tobacco Breeder, Nadiad, sent forty samples of tobacco in connection with his studies on the different methods of curing tobacco. Forty-eight samples of cultures were analysed for the Plant Pathologist to Government, Bombay, Poona, in connection with a joint study on nitrogen fixation.

Research Work.—The study on the fixation of nitrogen by *azotobacter* in collaboration with the Plant Pathology section was continued. When the effect of mannite and molasses on the nitrogen-fixing power of *azotobacter* was tried on the basis of their carbon content it was noticed that molasses was less efficient than mannite. At very low levels the amount of nitrogen fixed increased with the amount of energy material supplied. After a certain level, represented by 0.03 to 0.04 gm. of carbon, the organism became less active with increasing quantities of the material added, thus confirming the results obtained last year.

The manurial experiments on *mosambi* were continued. Of the four sites selected one having young trees belonging to Dr. P. G. Gune at Ashwi, which have just begun to bear, showed signs of improvement. The trees put on a more vigorous growth and though the yield of fruits was not by any means large the size of the fruit was definitely bigger than that of the fruit of other *mosambi* plantations in the same orchard. The application of manures to *mosambi* plants in the orchard belonging to Mr. F. Tyabji at Vadala Pravara that was affected with disease has not materially improved the plants, though the death rate has decreased to a certain extent. Of the other two plantations which have both young non-bearing trees, one of Mr. T. R. Oturkar's at Devgaon is progressing well but the other belonging to Mr. F. Tyabji is not doing quite as well as it seems to be suffering very probably from improper management.

The study of the physico-chemical nature of soil type developed under different climatic conditions was continued. When the nature of the clay formed under low rainfall conditions at four different places was examined it was noticed that at all these places weathering had taken place to an equal extent indicating that the type of soil formed at different places under similar climatic conditions was not dissimilar. Three more soil profiles were collected during the year.

Investigations into photo-chemical fixation of atmospheric nitrogen in soil could not be taken up.

Agricultural Education.—The teaching of chemistry and soil science to the first and second year students at the Agricultural

College was carried on with the help of the Assistant Professor and Lecturer. This section was also responsible for the teaching of soils to the students of the Forest Rangers class. There were no post-graduate students during the year under report. One special student was trained in practical methods of analysis of soils, manures, waters, etc.

Miscellaneous work.—Sixty-three enquiries were received from the public which were all attended to and information supplied wherever necessary. The Agricultural Chemist worked as staff editor and treasurer of the Poona Agricultural College Magazine and the Assistant Professor as Rector of the College Hostels and as a library-adviser.

No cases of corruption occurred in this section during the year.

Publications.—The following papers were published during the year :

1. The use of Zinc oxide as a clarifying agent in sugar analysis ; by V. K. Lele and N. Narayana ; Poona Agri. Coll. Mag. (1940), 32, 57-59.

When compared with standard clarifying agents zinc oxide gave satisfactory results. Unlike basic lead acetate it had no action on fructose. Moreover, the use of this reagent possesses certain advantages over the usual clarifying agents.

2. Biochemical studies in the growth and ripening of banana ; by V. K. Lele, N. Narayana and J. A. Daji ; Jour. Univ. of Bombay (1940), 9, 180-200.

The banana fruit took about 120 days to mature on the plant and another eight to ten days to ripen after the mature fruits were removed from the plant. The main activity of the fruit during growth, which was at its highest during the second thirty days, was concentrated round the synthesis and storage of starch. During ripening almost the whole of the starch was hydrolysed into sugars. Potash constituted a major portion of the total mineral content of the fruit. Most of the phosphorous was present in an organic form.

3. Preparation of vinegar from fruit juices ; by V. S. Abhyankar, N. Narayana and J. A. Daji ; Poona Agri. Coll. Mag. (1940), 32, 170-173.

Vinegars prepared from toddy and from sugarcane, *Karavand* (*Carissa carandas*) and *jambul* (*Eugenia Jambolana*) juices were found to contain between three and four per cent. acid. They compared favourably in composition to malt vinegar of foreign manufacture.

Programme of work for the year 1941-42.

1. Manurial experiments on *mosambi*.
2. Nitrogen fixation by *azotobacter*.
3. Physico-Chemical nature of soil types.

J. A. DAJI,

Agricultural Chemist to Government,
Bombay, Poona.

APPENDIX I.

SUMMARY OF WORK DONE UNDER THE CROP BOTANIST TO THE
GOVERNMENT OF BOMBAY, FOR THE YEAR 1940-41.*Administration.*

(1) *Charge.*—Dr. B. S. Kadam returned from leave of absence abroad on 29th of August, 1940 and took over charge of the Section the next day from Prof. V. M. Chavan, who rejoined as Assistant Professor of Botany at the College of Agriculture, Poona.

RICE BREEDING STATION, KARJAT.

(1) *Zinya (a) Selections.*—Four promising selections were compared for the third year with Zinya local and the improved strain, Z-149. The differences in yield are not significant.

Final selections from a new lot of 174 selections will now be made.

(2) *Synthetic material (a) K-540 × Z-149.*—From this cross both mid-late and late strains have been isolated. One of these, Z-31, will be given out for district trials next season.

(b) *K-226 × Z-242.*—From this cross 7 promising strains are now available.

(3) *Bhadas—(a) Selections.*—During the season 10 strains were replicated with a local from Mahad as check. The strain, 1-B-12-11, has again given a significant increase over the local.

(b) *Synthetic strains.*—From a cross of K-226 × B-52 two good strains have been isolated. Both of these will be given out for district trials next year.

(4) *Miscellaneous varieties.*—Promising selections were made during the season from a number of coarse-grained varieties from Konkan.

Multiplication and distribution of seed.

The total quantity of seed distributed, for the 1941 crop season, was 7,147 lbs.

RICE BREEDING STATION, VADGAON.

During the year under report a new Rice Breeding Sub-station was opened at Vadgaon, in Poona district, for genetic improvement of rice varieties of Poona and Satara districts.

Preliminary rice surveys of Satara and Poona districts were made during the season and a large number of bulk samples of various varieties were collected.

During the year the work was mainly concentrated on Ambemohor and Chimansal, which are the most important varieties of the Maval tract.

CEREAL BREEDING STATION, NIPHAD.

Improvement of Bajri.

(1) *Hybrid seed.*—Further comparison of inbred, groupbred, F_1 s and F_2 selections of direct, back—and out—crosses were made during the season. It has been confirmed now for three years that crosses between inbreds, i.e., hybrid seed, gives better yield than any other combination.

(2) *Mass selections.*—Mass selections of early and late plants made during 1938–39 and 1939–40 were compared in 6 replications with local. The former significantly out-yielded the local by 17 and 19 per cent. in grain and fodder respectively. The mass selection of 1939–40 was also better than the local.

(3) *Inbred and groupbred strains.*—Three cultures of 28–15–1, three of Akola 297–6 and one groupbred culture from an African-local cross were compared with local in 6 replications. The synthetic groupbred strain and a culture of 28–15–1 out-yielded local significantly.

Improvement of Wheat.

(1) *Trials on the Farm.*—The new strains, Niphad–81 (formerly B.G. 8–1), and Niphad–31 (from Baxi–33 \times B–808) were compared with Bansipalli–808 and local in replications. Niphad–81 again proved significantly better over Bansipalli–808; and better than local, the difference in yield during the year being 23.8 and 4.3 per cent. respectively. This strain has been producing consistently higher yields. The average yields per acre from the last six seasons' data are as follows:—

Niphad–81 ..	..	∴	793 lbs.
Bansipalli–808	..	∴	750 „
Local ..	..	∴	752 „

Thus N-81 is about 6 per cent. better than the local. It has a better grain, and also gives equally good yields of bhusa. It is earlier to local by about a week.

The trials will be continued.

(2) *Baxi–33 \times Bansipalli–808 (F_3).*—Four sub-strains of Niphad–31 along with other strains were compared with local in a replicated trial. All of the N–31 sub-strains were better than local. Since all of these strains are morphologically alike they will be treated henceforth as one. The poorer strains from the cross have been rejected.

(3) (a) *Polish \times Bansipalli–808 (F_7).*—Out of the 5 derivatives, compared by drilling, only one selection has shown better performance over Bansipalli–808. Two others are somewhat better. These strains have been retained for further trials.

(b) *Polish* × *Bansipalli-808* (F₆).—Three promising selections from the large-seeded family, 5-67, were compared on row scale in nine replications, and all have proved significantly superior to *Bansipalli-808* and one of them better to N-81 by 6.5 per cent.

(4) *Baxi-33* × *Bansipalli-808* (F₈).—The *Baxi*-like derivatives were compared with local *Baxi* and *Baxi-33*. Two strains 114-17 and 165-6 proved significantly better than the local and *Baxi-33* both of which, however, were more severely attacked by stem-rust. Trials will be continued.

(5) *Bansipalli-809* × *Pusa-4* : (F₉):—The so called "fanned" sub-type of the strain, 51-3-38-5, proved morphologically the same as both "fanned" and "non-fanned" earheads were produced by the same plant. The strain is now being called *Niphad-4*. It has out-yielded *Pusa-4* again this year, but the difference was not significant. *Niphad-4* has been showing consistently higher yields since the last 4 years and shows an average increase of 5.6 per cent. over *Pusa-4*. The strain will be released for district trials next year.

(6) *District Trials*.—*Niphad-81* was compared with local wheat and *Bansipalli-808* by Student's method at three places. It gave increased yields ranging from 3.6 to 9.6 per cent., all differences being significant. Trials will be continued.

(7) *Multiplication of seed*.—The standard strains *Bansipalli-808*, *Niphad-81* (formerly B.G. 8-1), *Bansi-168* and *Bansi-224* were multiplied to maintain a chain of pure seed supply.

Improvement of Gram.

(1) *District Trials*.—*Niphad-816* continued to prove better in yield in trials in Nasik district. It was compared by ABBA method at Newargaoon in Yeola taluka where it out-yielded the local by 17 per cent. Another trial was conducted at Kothure in *Niphad*-taluka and here the strain has shown an increase of 31 per cent.

Trials in Shahada, however, did not show any advantage of N-816 over the Khandesh local this year, although last year it was 9 per cent. better in yield of grain.

(2) *Seed multiplication*.—It is intended to undertake trials on large scale next year for which 200 lbs. of N-816 are available.

Improvement of minor crops.

A number of improved strains have been obtained from *tur*, *til* and safflower.

Advisory Work.

Inquiries from the public and various states regarding the suitability of various strains of rice and wheat were promptly attended.

Dr. Kadam visited Baroda during the year to discuss rice-breeding work which is being financed by the Imperial Council of Agricultural Research. The work on the improvement of maize, which is being conducted at the Agricultural farm, Dohad, was discussed in detail, and necessary suggestions were made on the technique of bagging maize plants and on the methods of comparing inbred and mass-selected strains.

The Crop Botanist prepared two schemes for spread of improved strains of rice in Kolaba and Thana districts and sent these to the respective chairman of the Rural Development Boards.

Post-Graduate Education.

Mr. Rui Da Cruz, B.Sc. (Hons.), who had been visiting Karjat station to familiarize himself with various aspects of rice-breeding during the year, has now joined as a post-graduate student under Dr. B. S. Kadam.

Miscellany.

(1) Precision experiments were continued and necessary data were supplied to the Agricultural Meteorologist, Poona.

(2) Soil samples from research stations at Karjat and Niphad were supplied to the Assistant Professor of Botany, Royal Institute of Science, Bombay.

(3) Three meetings of the Plant Breeding Committee, of which the Crop Botanist is the Secretary, were held during the duration under report. Twenty-five subjects were discussed.

(4) Demonstrations for officers of various Departments in the Nasik district and for Farmers' Week, were held during the month of January at the Cereal Breeding Station, Niphad. Both the events were a great success. Nearly 30 officers and 267 farmers from all over the district visited the farm. Such demonstrations will acquaint the public more thoroughly with the Department's work, and will greatly help in popularizing improved strains of crops.

(5) The Crop Botanist is a member of the Rural Development Boards of Thana, Kolaba and Bombay Suburban districts. A number of meetings of the Boards during the year were attended by him.

PUBLICATIONS.

(1) KADAM, B. S. and V. K. Patankar. (1938), Inheritance of aroma in rice, *Chro. Botanica*. 4: 496-497.

A non-scented variety, Kolamba-226, was crossed with a highly aromatic variety, Sukhadasi, from Sind. The character of aroma was partially dominant in F_1 . Out of 445 plants in F_2 , 186 were scented and the rest had no aroma. The segregation indicating presence of mainly three complementary genes. The F_3 generation confirmed the F_2 behaviour. The genes for aroma are designated O_a , O_b and O_c .

(2) KADAM, B. S., R. K. KULKARNI and S. M. PATEL. (1938), Flowering and pod setting in gram, *Cicer arietinum*, L. *J. Ame. Soc. Agro.* 30: 547-557.

Flowering in gram under Niphad conditions continues from 3 to 5 weeks. Early types commence blooming a week earlier than late ones. The average number of flowers in early and mid-late types is more or less the same, but the late types show much smaller averages. Basal flowers commence to open first, and flowering in a sub-branch or a branch is independent of others. Blooming is retarded by cloudy weather, the normal time being from 11 a.m. to 2 p.m. Early types set more pods than late ones and are thus higher yielding. The average correlation between number of flowers and number of pods of earlier types is significantly larger than that of late types.

(3) KADAM, B. S. and S. M. PATEL. (1938), Anthesis in flax. *J. Ame. Soc. Agro.* 30: 932-940.

Under Niphad conditions flax (linseed) flowers commence to open at 7 a.m. and complete the process by 10 or 10-30 a.m. Blooming is delayed on colder days and may be completed as late as 2-30 p.m. The flowers bloom again the next day, but the second opening is invariably earlier than the first. Anthers always dehisce before the flower opens fully. Strain differences in the modal blooming of flax were observed.

(4) KADAM, B. S. and K. RAMIAH. (1938), Symbolizations of genes in rice. *Imp. Bureau Plant Breeding & Gen.* pp., 1-23 (mimeographed).

The authors' survey of the existing genic symbolization in rice revealed great confusion due to assigning of the same letters to genes for various characters. It is proposed that symbolization of genes should be standardized and be based more or less on the same principles as are followed in maize, with, however, such modifications as are necessary due to the peculiarity of the rice plant. A list of genes used by various workers to denote characters in rice and a proposed list of genes for various characters in rice accompanies the article.

(5) KADAM, B. S., S. M. PATEL and R. K. KULKARNI. (1940), Consequences of inbreeding in Bajri. *J. Heredity.* 31: 201-207.

The inbreeding of bajri (*Pennisetum typhoides*) has shown six recessive types of chlorophyll deficiencies. It has also revealed four types of recessive sterility, and a recessive dwarf type, due most probably to gene mutation. Inbreeding of bajri results in greatly reduced vigour, the inbred material showing differential response in this respect.

(6) KADAM, B. S., S. M. PATEL and V. K. PATANKAR. (1941), Two new genes for corolla colour in *Cicer arietinum*, L. *Curr. Sci.* 10: 78-79.

The genic analysis of flower colours in gram has so far revealed four genes, W, B, P and C. These genes cause the familiar pink petaled

gram and blue, white and greenish-white flowers. The authors describe two new distinct flower types, salmon and purple-veined, which are caused by genes S_a and P_u respectively.

B. S. KADAM,

Karjat, July 25, 1941.

Crop Botanist to Government,
Bombay Province.

Programme of work for the year 1941-42.

Rice-Breeding Station; Karjat.

Improvement of rices from Thana and Kolaba will be continued.

Rice-Breeding Station, Vadgaon.

Selection work in Ambemohor and Chimansal will be continued.

Cereal Breeding Station, Niphad.

Major crops.—Improvement in bajri, wheat and gram will be continued.

Minor crops.—Improvement in minor crops like, *til*, safflower, *tur*, etc., will be continued.

B. S. KADAM,

Karjat, July 24, 1941.

Crop Botanist to Government,
Bombay Province.

APPENDIX J.

SUMMARY OF WORK DONE UNDER THE AGRICULTURAL ENGINEER TO THE GOVERNMENT OF BOMBAY, FOR THE YEAR 1940-41.

Staff and Administration.

Rao Bahadur C. G. Paranjpe was in charge of the Agricultural Engineering Section upto 2nd March 1941, the date of his retirement. Mr. P. J. Patel, who was in training from 13th February 1941, took charge of the Section on the above date and held it upto the end of the year.

Research on implements.

Seed Drill.—Further trials were taken with the improved wheat drill and the local drill at the Jalgaon Farm by the Farm Superintendent to test the effect on yield, with equal seed rate. It is found that the result is encouraging like previous years as the yield in the case of the improved drill is greater by about 7.5 per cent. than that obtained in the case of the local drill. Further trials will be continued to test whether the advantage observed is consistently obtained.

Ground Nut Digger.—This machine has been designed to harvest the deep rooted variety of ground nut. It worked satisfactorily in Belgaum and Ahmednagar Districts, but was found to be weak in the Sholapur District, due to stiff soils. The frame and the blade support have been now strengthened, but could not be tried this year due to unfavourable season. It will be tried next year.

Winnowing Fan.—It was stated in the last year's report that some modification was felt necessary in the mode of fixing the fan to the stand so that its direction can be changed with the changing wind direction. A clamping arrangement has now been provided so that the position of the fan can be easily changed in any direction and level. With this arrangement, the direction of the wind blast, artificially created by the fan, can be brought in the same direction as that of the natural wind, while the winnowing operation is in progress.

Hay Drying Machine.—A new hay drying machine was built on the experience gained on the previous year's model, during the current year. Extensive trials were not taken as the machine could not be built before the setting of the season. Its capacity was found to be low and the loss of heat by radiation was great.

A special machine of larger capacity, with better insulation and a detachable furnace is proposed to be built next year. The results of its operation will be given in the next year's report.

Ball Bearing Cart Wheels.—A pair of wheels built on the hub, in which ball bearings were fixed at the shop, was supplied to the Agricultural College Farm and was kept under observation, during the current year. It has been found that the wheels are giving satisfactory work and have developed no weakness in any of their parts. Further tests as regards

the suitable rim width are to be carried out in the succeeding year and its results will be given in the next year's report.

Soil Scooper.—This implement was designed for preparing the soil so that it can absorb maximum amount of moisture during rains, particularly for the dry farming methods. The model supplied to the Sholapur Farm worked satisfactorily but one sent to the Bijapur Farm did not work satisfactorily due to the peculiar soil conditions of the place. It was modified to suit the local conditions and was again tried at Bijapur this year. It is reported that it works satisfactorily now at Bijapur.

Milk Can Insertions.—Two more types of the milk can insertions were designed and supplied to the Agricultural Officer In-charge of Cattle Breeding, Palghar, for further trials. The results of these are awaited and will be given in the report of the next year.

Advisory and Development Work.

The total number of enquiries on various problems made and dealt with were about 127. Mainly they were pertaining to the pumping plants, boring, mechanical cultivation, agricultural machinery and improved implements.

Hire of Machinery.—As usual the boring machines, pumping plants and other machinery were given out on hire and the total amount of Rs. 8,749-15-4 was realised in the form of hire and service as detailed below:—

		Rs.	a.	p.
Hire of seven boring machines	..	5,832	12	10
Hire of pumping plants	..	968	15	4
Hire of tractors.	..	1,744	0	0
Hire of tools and charges for mechanical service		204	3	2
		8,749	15	4

Over and above the receipts stated above, Rs. 2,686-9-0 were realised from the sale of two boring machines, tools and accessories.

Mechanical Help.—Mechanical help was given to the cultivators and the departmental institutions by the district as well as the head quarter staff. The details of the above are as under:—

Item of work.	Mechanical Assistant.			Head quarter staff.	Total.
	Poona.	Dharwar.	Surat.		
Sites surveyed ..	18	7	7	10	42
Estimates supplied ..	9	7	2	..	18
Erections made ..	14	1	3	4	22
Advice given and repairs carried out ..	14	10	10	6	40
Plants inspected ..	45	28	22	2	97
Miscellaneous works ..	1	3	7	4	15

Agricultural Education.

The special class for training the cultivator's sons in running and maintaining oil engines and pumps was conducted during the year. The training period was for three months commencing from the 1st of January, April, July and October. No fees are charged for the above training and the instructions are given in Marathi and English. In all fourteen students were trained during the year under report.

Miscellaneous Works.

General.—During the year under report a number of the departmental constructional works were entrusted to this section and the drawing section was very busy with preparing the drawings and the estimates and also supervising the constructional works. In all, 78 drawings, 48 tracings, 27 sketches and 56 estimates were prepared.

The workshop also was kept continuously busy throughout the year. Five F₃ Calyx Boring machines were reconditioned at the workshop. A special grant of Rs. 6,880 was sanctioned by Government for the above purpose. One Musto Patent Power Boring Machine was assembled from the available loose parts and the rest were purchased new from the market.

The Nangaon Pumping Plant was worked for the cultivators of the locality during the months of December and January as the crops were suffering due to the scarcity of rainfall. The actual cost of running the plant was borne by the cultivators except the driver's wages, and 125 acres were given two waterings.

Special Works.—A great number of the constructional works was assigned to and executed by the Section during the current year. All of them, except the Manager's quarters at the Sheep Breeding Farm, Poona, were completed. The above work is in progress and will be completed soon. The following is the brief summary of works completed during the year :—

- (1) Completion of the Glass House for the Wheat Rust Research, at Mahableshwar, complete with the sanitary, drainage, water supply and fencing arrangements.
- (2) Completion of the bore at Mahableshwar for the above scheme and installing a hand pump on the same. It gives a discharge of 125 gallons of water per hour.
- (3) Construction of a Glass House for the Wheat Rust Research Scheme at Poona, for the Plant Pathologist to Government.
- (4) Construction of an Insectary for the Plant Pathologist to Government, at Poona for Virus Scheme.

- (5) Construction of an all steel Glass House for [the Katta Disease of Cardemum Scheme at Sirsi for the Plant Pathologist to Government.
- (6) Construction of a new Cattle byre, modification of the old buildings and putting a fence at the Tegur Cattle Farm for the Live Stock Expert to Government.
- (7) Construction of a Poultry Yard 48' X 10' at Dhulia Poultry Farm for the Live Stock Expert to Government.
- (8) Construction of the Hostel with a kitchen and a dining room at the Sheep Breeding Farm, Poona, for the Live Stock Expert to Government.
- (9) Construction of the servants' quarter, bullock and implement shed, store room, latrines and fencing at the Rice Breeding Station, Vadgaon, for the Crop Botanist to Government.
- (10) Construction of a store room and Gurhalshed for the Rural Assistants Training Centre at Manjri.
- (11) Construction of a complete set of buildings for the Rural Assistants Training Centre at Dhulia.
- (12) Construction* of a complete set of buildings at the Rural Assistants Training Centre, Devihosur.

P. J. PATEL,
Agricultural Engineer to Government,
Bombay Province, Poona.

Programme of work for the year 1941-42.

1. Research on implements their modifications and test.
 - (a) Modifications and tests of the wheat drill, ground-nut digger, ball bearing, cart wheels, tyne cultivator, ridging implement, Clod crusher, winnowing fan and milk can insertions.
 - (b) Trial with the Hay Drying Appliance to determine its capacity, efficiency and economy.
 - (c) Study of indigenous implements and design of new implements.

2. General Work
 - (a) Inspection of the pumping sites on big rivers in the Province.
 - (b) Purchase, sale, hire maintenance and inspection of the departmental machinery.
 - (c) Advice to the departmental institutions and the public on engineering matters.
 - (d) Training of the cultivator students in operating engines and pumps.

3. Constructional Work
 - (a) Construction of the Insectary for the Professor of Entomology, Poona, Manager's quarter, Sheep Breeding Farm, Poona; Extension of the hostel, Agricultural School, Devihosur; buildings at the Dharwar and Dhulia Poultry Farms; buildings at the Rice Breeding Station, Igatpuri; buildings at the Tobacco Breeding Station, Soundalga; buildings at the Dry Farming Stations at Jeur and Chas and the milk room at Bankapur Cattle Farm.
 - (b) Water supply arrangements at the Dharwar and Dhulia Poultry farms; Cattle Breeding Farm, Bankapur and Rural Assistants Training Centres at Dhulia and Devihosur.

P. J. PATEL,

Poona, 6th September 1941.

Agricultural Engineer to Government,
Bombay Province, Poona.

APPENDIX K.

SUMMARY OF WORK DONE UNDER THE HORTICULTURIST TO GOVERNMENT OF BOMBAY FOR THE YEAR 1940-41.

Staff and Administration.

Mr. P. G. Dani, Assistant Horticulturist with his staff was transferred to work in the Department of Agriculture after the deamalgamation of the Rural Development Department from the 1st of January 1941.

Research work.

1. *Laboratory Research.*—Further observations on dried Karvanda fruit show that it can be stored in good condition for a year. No damage of any kind either due to moth or mould has been recorded in the laboratory sample during storage. This work is now successfully concluded and can be demonstrated if opportunity to do so arises.

2. Observations on bottling of mango juice show that it can be preserved in good condition if it is preheated to 80°C., sealed and pasteurized at 80°C. for 25 minutes. It is intended to follow this work on a large scale with a view to apply these results to trade.

1. *Cold (Gas) Storage Research.*—Gas storage trials of Alphonso mango and Nagpur orange were carried out with 5, 10 and 15 per cent. carbon dioxide at 45° and 48°F., and 45° and 52°F., respectively. It was observed that the fruit under gas storage conditions either suffered from internal breakdown or rotted more quickly on account of *Penicilium* growth than that stored under ordinary cold storage conditions.

The determinations of acidity and sugars in delicious apples and Kashmir pears stored at 32°F. showed that the percentage of acidity decreased during storage. In pears, there was no change in the percentage of total sugars, but in Delicious apples the percentage of total sugars showed an appreciable increase.

Work done at the Ganeshkhind Fruit Experiment Station, Kiree and Modibag, Agricultural College, Poona, No. 5.

Manuring of Basrai banana.—A new plot has been laid out to test the value of different doses of caster cake and sulphate of ammonia with and without sulphate of potash having 0.4N. as basis. The main idea is to fix the proper dose of manure for basrai banana.

Manuring of Basrai Banana (Different dose of F. Y. M.).—This is the second trial of the experiment. During the year under report, varying doses of F. Y. M. viz. 40, 80, 120 and 160 lbs. were tried. Data in regard to yield is not yet available as the harvesting of the crop is due in the latter part of the year 1941.

Grape vine Manurial Trial.—This is the third year of trial. The treatment "A" (8.2 ozs. Niciphos + 14.8 ozs. bonemeal + 9.2 ozs. sulphate of potash) has given 8 per cent. higher yield as compared with control (80 lbs. F. Y. M.).

Mango Manurial Trial.—Four combinations of inorganic and organic manures are being compared with F. Y. M. alone. The plantation is only 3 years old and, therefore, the effect of manures is being observed only in the vegetative growth of the trees.

Mosambi Manurial Trial.—The yield of "E" treatment (80 lbs. F. Y. M. + 10 lbs. Castor cake) has given 26 per cent. increased yield over no manure.

Grape vine and Mosambi Irrigation Experiments.—Furrow system of irrigation consumes 31 per cent. more water and gives 16 per cent. more yield than ring method in grape vine.

Furrow system of irrigation consumes 29 per cent. more water and gives only 5 per cent. increased yield in regard to the number of fruits as compared with the square basin system in Mosambi.

Improvement of Guava by selection.—This work is concluded. L. 49 strain is superior in quality as compared to other strains. Its commercial value on field scale has not yet been finally ascertained as the observations have to be made on crops of several successive seasons.

Improvement of Pomegranate by selection.—Selected strains of pomegranates are being propagated vegetatively and will be planted on field scale for further tests. G. B. No. 1 is the best in quality.

Jamburi Rootstock Spacing Experiments.—The spacing experiment of Jamburi stocks has not shown any appreciable difference in the growth of budded plants. The experiment is being repeated.

Alternate bearing of mangoes.—It is observed that only seven shoots out of 500 shoots marked for study in 1937 have borne blossom successively.

Citrus stock Experiments.—A scheme to test the influence of various citrus stocks on the quality and yield of mosambi is already prepared. The stocks to be used in these investigations are being propagated.

Bagging of Basrai Banana bunches.—The Basrai banana fruits were found to mature uniformly and early when bagged. The fruits were also found to be bigger in size.

Chilli and Brinjal Selection.—Although the scheme is closed, pure seed both bagged and unbagged has been collected with a view to distribute it in the districts for trial. Vegetable improvement work is now transferred to the Professor of Agriculture, College of Agriculture, Poona.

Rural Development.

The Assistant Horticulturist spent 148 days on tour and visited 120 different localities in the districts during the year under report.

He inspected 302 gardens. He held 7 orchardists classes which were attended by 176 students and held 8 fruit shows. One mango show was also held at Jalgaon where he selected Borsha and Naralia varieties as the best exhibits. 1,100 enquiries have been replied. The subordinate staff has visited 354 localities and has given help in 603 gardens in pruning trees, budding, grafting and spraying fruit trees.

A good deal of effort was made to ensure adequate supply of reliable plants to the fruit growers in the cyclone area. A contact was established with large number of nurseries where stock was inspected and arrangements were made to supply plants at reasonable rates to the growers.

The Assistant Horticulturist has spent a good deal of time in selecting early bearing mango trees in the Ratnagiri District. He has inspected large number of sites for Mass planting of mango trees in the Bijapur District.

The area under fruit crops is increasing rapidly and this is principally due to the departmental propaganda in favour of fruit cultivation.

Agricultural Education.

(a) The Horticultural teaching work is done by the Professor of Horticulture assisted by Demonstrator in Horticulture. One candidate has completed his post-graduate studies.

(b) *Special Training Courses.*—Three students attended the special course in fruit preservation at the College of Agriculture, Poona, including a member of Sind Agricultural Department.

The Horticultural Training Class at the Ganeshkhind Fruit Experiment Station, Kirkee, was attended by 60 students. 51 students appeared for the final examination. 20 students were awarded the scholarships of Rs. 10 per month each, while two students were given mali-in-training scholarship of Rs. 15 per month each.

(c) Miscellaneous.

Fruit and Vegetable Committee.—The Departmental Fruit and Vegetable Committee met for the first time on 29th April 1940. Six meetings have been held so far. Number of schemes such as citrus rootstock experiments, chickoo rootstock experiments, establishment of basic nursery, survey of fruit areas, layout of experimental plantations at other farms such as Arbhavi, Kumta and Ratnagiri, Anand Scheme, Chilli Improvement Scheme in the Karnatak, mass planting of mangoes in Bijapur District and such other important items affecting the development of fruit industry in this Province were discussed.

A fruit Survey in the Province of Bombay.—A fruit survey work was started in Poona, Ahmednagar, East Khandesh, Satara, Sholapur and

Bijapur. Information regarding orchards is being collected according to the plan from all talukas in these districts. The chief idea of this survey is to locate areas suitable for the cultivation of commercial fruit crops and to make extension wherever possible. The survey of the district of Karwar was also included in this programme at the request of the Collector of Karwar.

Refereeing and reviewing work.—Large number of scientific research papers were refereed and some books and publications also were reviewed.

Introduction of new varieties.—Out of all the foreign varieties of fruit crops under trial at the Ganeshkhind Fruit Experiment Station, Kirkee, the cultivation of grape fruit is more promising. Grape fruit plants are bearing a normal crop and give a very high income. Its cultivation now is being taken up by some growers in the districts. Nearly 6,000 grape fruit plants have been sold during the last five years.

PUBLICATIONS.

1. SAYED, I. A.—
Botanical study of Exotic Pineapple varieties. Jr. University of Bombay, 1940, 8 : 75-81.
2. KARMARKAR, Dr. D. V.—
Cold Storage of Indian Fruit. Indian Farming, 1941, 1 : 173-177.
3. KARMARKAR, Dr. D. V., and Mr. JOSHI, B. M.—
The Relation of the Size of fruit to the Loss in weight in Storage. Ind. Jr. of Agricultural Science, 1940, 10 : 1021-1029.
4. KARMARKAR, Dr. D. V., and Mr. JOSHI, B. M.—
Investigations on the Storage of Onions. Ind. Jr. of Agricultural Science, 1941, 11 : 82-94.
5. DUBHASHI, R. S.—
Methods of Propagating Fruit trees. Indian Farming 1941, 2 : 29-31.

G. S. CHEEMA,
Horticulturist to Government,
Bombay Province, Poona.

Programme of work for the year 1941-42.

1. *Manurial Experiment*—
 - (a) Fixing proper dose of manure based on 0.4N. and its economics in the case of Basrai Banana.
 - (b) Mosambi.
 - (c) Grape vine.
 - (d) Mango.
2. Planting of pomegranate selections for field test.
3. Alternate bearing of mango to be continued.
4. Establishment of basic nursery. (This work is already started.)
5. Organization of horticultural classes.
6. Survey of fruit areas in the Province to be continued.
7. Preparation of material for citrus and chickoo rootstock experiments.
8. Establishment of tree planting nurseries and organization of mass planting of trees.
9. Organization of fruit shows.
10. Gas storage trials regarding mango and santra.
11. Bottling of mango juice.
12. Bagging of banana bunches on field scale.
13. Selection of early bearing mango trees in Ratnagiri District.
14. Mass planting of mango trees in Bijapur District.

APPENDIX L.

SUMMARY OF THE WORK DONE BY THE PROFESSOR OF AGRICULTURAL
ECONOMICS, COLLEGE OF AGRICULTURE, POONA,
FOR THE YEAR 1940-41.

Staff and Administration.

Dr. M. B. Ghatge continued as Professor of Agricultural Economics throughout the year. Messrs. K. S. Patel and L. H. Mirajkar continued as Demonstrator and Investigator in Agricultural Economics respectively.

Research Work.

1. The scheme to start collecting data with a view to studying the economics of betelnut industry and the allied crops in Kanara mentioned in the programme of work for 1940-41 in the last year's report could not be commenced as the funds were not available. It is, however, hoped to start this work during 1941-42.

2. The scheme to ascertain the effects of combination of all possible improvements suggested by the Agricultural Department on cultivator's farms is still under consideration of the Director of Agriculture and hence the work could not be started during 1940-41.

3. The scheme for investigation of the fodder supply to the Poona market from the surrounding villages with a view to making suggestions to the cultivators of the fodder-supplying villages to take to dairying as subsidiary occupation was approved by the Director of Agriculture in the meeting of the Departmental Livestock and Fodder Committee held on 21st October 1940. It was decided to restrict the enquiries, in the first instance, to the problem concerning the supply of milk to Poona City and to find out where the milk comes from, the quantity supplied from the surrounding villages and the proportion locally produced. Later, if the results warranted enquiries in surrounding villages they were to be undertaken in order to ascertain whether the cultivators rather raise cattle than transport and sell fodder in cities.

In accordance with the first part of the decision the existing staff set on collecting information regarding the total consumption of milk by the residents in Poona which is made up of the total production of milk in Poona and the supply of milk from the surrounding villages. In order to ascertain the latter the area of the investigation had to be extended over the area bounded by octroi limits. The octroi cordon includes Poona City, Poona Cantonment, Poona Suburban Municipality and Kirkee Cantonments.

A detailed survey of all the cattle sheds in the area of the above mentioned octroi cordon except Poona City has been made with a view to ascertain the total number of milking and non-milking or dry animals, their daily milk, yield quantity of milk sold and consumed for domestic

purposes by the *gawalis* themselves. Further work of ascertaining the arrival of milk and fodder from the surrounding villages is in progress and will be continued during the year 1941-42.

4. The compilation of data collected for the farm costing and farm family budgets studies was completed and prepared into a final report for publication. Their summaries are sent for publication to the Indian Journal of Economics, Allahabad, and the Journal of the University of Bombay, respectively.

Agricultural Education.

During the year, for the B.Sc. (Agri.) examination of the University 68 students appeared in Agricultural Economics—the subject taught by this section, out of which only 12 students failed.

As in the previous year, on one morning in September, topics pertaining to the economics of agriculture and agriculturists were discussed with the civilians who attended the course in agriculture at this college.

The Professor of Agricultural Economics delivered a series of lectures in Agricultural Economics and Marketing to the special training class organised in Poona by the Bombay Bank's Association.

Miscellaneous Work.

The Professor of Agricultural Economics attended the Agricultural Economists Conference held in February 1941 at Lahore and read a paper on the Economic Planning in Agriculture.

PUBLICATIONS.

1. Unemployment of Farm Labour in Charotar of Kaira District in Bombay Province by Dr. M. B. Ghatge and Mr. K. S. Patel—"Rural India", Vol. III, No. 12, 1940.

The article gives facts and figures with regard to unemployed period of man, woman and bullock labour of agriculturist in the Charotar tract of Gujarat. It points out that man remains unemployed to the extent of 25.6 per cent. and bullock to the extent of 65 per cent. of the available time. Woman is fully employed. But in addition to seasonality the unemployed period is of few hours only on certain days.

2. A few facts about agricultural land in the Deccan of Bombay Province by Dr. M. B. Ghatge and Mr. L. H. Mirajkar—"Rural India", Vol. IV, No. 2, 1941.

In the Bombay Deccan peasant farming is predominant as is shown by the fact that about 80 per cent. of the holders cultivated their lands themselves, while about 17 per cent. of the holders, owning about

23 per cent. of the land, rented it to tenant-cultivators. It is necessary to check the tendency of gradual reduction in the size of holdings in the small groups *e.g.*, those below 25 acres each, by necessary legislation regarding the division and sale of landed property.

3. The position of the Proprietary holders in the Rayatwari Tract of Bombay Province in the last quarter of a century, by Dr. M. B. Ghatge and L. H. Mirajkar—"Mysore Economic Journal"—Vol. 27, No. 4 and No. 5, 1941.

It is a retrospect of the whole province as such, with respect to the holders and their acreages in the Raytware tract of Bombay during the period of the last quarter of a century. It points out that the number of proprietors has increased at a rapid pace. Consequently there is a constant decrease in acreage per proprietor.

College of Agriculture :
Poona, 17th July 1941.

M. B. Ghatge,
Professor of Agricultural
Economics.

Programme of work for the year 1941-42.

In addition to teaching agricultural economics to B.Sc. (Agri.), students the following would be attended to during the year :—

1. Investigation into the supply and demand of milk and utilisation of fodder produced roundabout Poona.
2. To start collecting data with a view to studying the economics of betelnut industry and the allied crops in Kanara.
3. To work out a scheme to ascertain the cultivating and economic holding in a dry tract area of Poona District as a basis.
4. To collect necessary information so as to be able to prepare a map of a Taluka in Poona District showing economic homogeneity.

College of Agriculture :
Poona, 17th July 1941.

M. B. Ghatge,
Professor of Agricultural
Economics.

APPENDIX M.

SUMMARY OF WORK DONE UNDER THE PROFESSOR OF AGRICULTURAL
ENGINEERING, PHYSICS AND MATHEMATICS, COLLEGE OF
AGRICULTURE, POONA, FOR THE YEAR 1940-41.

(A) STAFF AND ADMINISTRATION.

Professor J. P. Trivedi who was on deputation as Secretary, Institute of Agriculture, Anand, retired on 4th January 1941. The undersigned was in charge of the section throughout the year and was confirmed as Professor of Agricultural Engineering, Physics and Mathematics, from the date of Professor Trivedi's retirement. The section attends to the teaching duties at the College, research on Soil Erosion and district inquiries and advice on Land Development.

(B) RESEARCH WORK.

1. *Study of Soil Erosion.*

(i) *30-acre plot near Chaturisingi hill.*—The plots were plowed. June, July and August received an even distribution of rainfall about $4\frac{1}{4}$ inches each. There were two days of heavy rainfall of about 1.5 inches in September and October. The heaviest recorded rainfall being 3.8 inches in September.

The average rate of silt washing was 3.3 to $5\frac{1}{4}$ tons per acre from the cultivated plots and $4\frac{1}{2}$ to $6\frac{1}{4}$ tons per acre from the uncultivated plots. The average depth of washing is 0.014" to 0.022" in the cultivated plots and 0.018" to 0.026" in the uncultivated ones. Owing to the heavy rain of 3.8 inches in September the silt washing this year is comparatively higher than that of last year.

In the above plot two gullies were under observation as regards the erosion of bed and banks. Lines on steep and moderate grades were similarly under observation. Some of the terraces in the Katraj valley have been levelling up. Terraces in Divaghat area show silt filling.

The above observations have been carried out for a sufficient length of time. A large number of Bench Mark stones have been removed from their places in almost each of the observation centre as the area is exposed and unattended. The continuity of observations is difficult to maintain. It is therefore proposed to drop them from next year. Further research and similar observations require to be carried out on typical agricultural areas in different localities of the province. This will be possible when the proposed scheme for Soil Erosion fructifies.

(C) ADVISORY AND DEVELOPMENT WORK.

The cultivators of Kharpudi Budruk, Poona District, desired to carry out a joint Bunding scheme in the whole village area on a co-operative

basis. The matter was referred by the Rural Development Department for investigation and opinion. The matter was investigated and a report was submitted to the Director of Agriculture.

Other places were visited to see the Land Development work and erosion conditions in the locality.

(D) AGRICULTURAL EDUCATION.

1. *Agricultural College Courses.*—Two subjects, Physics and Mathematics and Agricultural Engineering, together with their laboratory and field work, are taught by this section, to the Agricultural students. The students did well in both the subjects as is seen from the result of the University Examinations held in March 1941, where 97·8 per cent. passed in Physics and Mathematics and 89·6 per cent. passed in Engineering.

Forestry Ranger Course.—The subjects of Physics, Surveying and Levelling and Drawing, both in theory and practicals and field work were taught by the section to the Forestry Ranger students of the College during the year under report.

2. *Special Training Courses.*—Two Intensive Bunding classes (the first from 16th September to 15th December 1940 and the second from 16th December 1940 to 15th March 1941) were conducted by the undersigned. A temporary staff of one Agricultural Graduate and 3 Kamgars was appointed to attend to the class. On the whole 44 students (Gujarat Districts 4 in the first class and 6 in the second one, Maharashtra Districts 13 in the first class and 12 in the second one, and Kannada Districts 4 in the first class and 5 in the second one) recommended by the Collectors of districts and the Rural Development Department and 3 deputies (one Agricultural Graduate and 2 fieldmen) from Baroda State were trained.

Most of them were young men of 18 to 25 years of age. Four of them were above 30 years old. They were lodged in a house close to the College. The sanitation was satisfactory. The students worked from 8 to 11-30 a.m. and 2-30 to 5-30 p.m. The attendance was regular. They also attended other extra class activities on week days till 6 to 6-30 p.m. and visited the College sections and other local institutions of interest on Sundays and holidays.

Both the classes were taken on a week's tour to visit important schemes and problems connected with bunding and soil erosion. Places in Nasik, Ahmednagar, Poona, Sholapur and Bijapur districts were visited.

There were periodical tests and a final test at the end. They did well in their tests.

There was a keen demand for admission and out of 350 applicants only 48 were selected for the two classes.

COLLEGE OF AGRICULTURE :
Poona, 2nd September 1941.

A. A. VASAVADA,
Professor of Agricultural Engineering,
Physics and Mathematics.

Programme of work for the year 1941-42.

- (1) Visits and advisory work in the districts for Land Development.
- (2) Compilation of the erosion observation data collected so far.
- (3) Proposed research and other items of investigation and execution that would be sanctioned during the year.

COLLEGE OF AGRICULTURE :
Poona, 2nd September 1941.

A. A. VASAVADA,
Professor of Agricultural Engineering,
Physics and Mathematics.

APPENDIX N.

SUMMARY OF WORK DONE UNDER THE PROFESSOR OF ENTOMOLOGY,
COLLEGE OF AGRICULTURE, POONA, FOR THE YEAR 1940-41.

(A) STAFF AND ADMINISTRATION.

Dr. V. G. Deshpande, the Professor of Entomology has been on leave on medical grounds from the 26th of June 1940 and the charge of the section was held by Mr. B. S. Patel, the Principal of the College till my appointment on the 31st of January 1941. I continued to hold charge till the end of the year.

(B) RESEARCH WORK.

1. EXPERIMENTS AND DEMONSTRATIONS OF SULPHUR DUSTING
AGAINST MANGO-HOPPERS (*IDIOCERUS* spp.).

This year, the flowering of the mango, although a bit late was very profuse in almost all the mango-growing tracts of this province. Demonstrations of sulphur-dusting were arranged in cultivators' gardens at Mandwa (near Alibag), Borivli, Ratnagiri, Vengurla, Belgaum, Dharwar and Bajipura (District Surat) as in the two preceding years. There was a severe attack of hoppers at all places except Bajipura. The predominating species of hoppers was *Idiocerus clypealis*, Leth in all places this year. In the past, this species was found mostly in the Konkan and Karnatak while *I. niveosparsus* Leth was the dominating species in the Bombay Suburban areas and South Gujarat. The latter species is not so very susceptible to the action of sulphur as the former and thus requires a larger number of dustings. But this year, *I. clypealis* being the main species in all localities, the pest could be very well controlled by 3 to 4 dustings only at an interval of 10 days. As the incidence of the pest was very severe the differences between the dusted and the undusted trees were quite marked and very much appealed to the garden owners.

2. GRASS-HOPPER PEST IN THE BELAPUR AREA (*HIEROGLYPHUS*
BANIAN VAR *ELONGATA*).

The experimental work on this pest has now been completed and the remedies such as ploughing of the infected areas, spraying of crude oil along the bunds in the initial stages, mixing crude oil with the irrigation water and beating down the pest into it, hand collection of insects and dragging of iron sheets with molasses applied to them have been found to be successful. These are now being demonstrated by the Divisional Superintendent of Agriculture, Deccan canals, to the cultivators in the tract. The results are being published in the form of an article in the Indian Farming.

3. STUDY OF THE FRUIT FLIES (*CHAETODACUS* spp.).

The Mango, Guava, Citrus and Cucurbits are badly affected by the fruit flies almost every year. During the year under report the Superintendent, Ganeshkhind Garden, was requested to keep an account of the number of affected and healthy fruits of guava and mosambi at each harvest.

The data of the whole season showed that 58 per cent. of the guava fruits and 19 per cent. of the mosambi were destroyed by the fruit flies. It was not possible to keep a similar account of the mango crop, as the same was sold through contractors.

The trapping of fruit flies was attempted throughout the year by means of traps with Clensel (1 : 30) in all the three crops as in the past.

In spite of this trapping of flies some damage still continued, which showed that trapping alone was not enough to control the trouble. Sweetened poison sprays with sodium fluosilicate and copper carbonate were, therefore, tried on a small scale in conjunction with the traps in the mango season.

A smaller number of flies was attracted in the blocks treated with poison sprays which appears to be due to their being killed by the poison. Poison sprays appear therefore, to be quite promising. The experiments are being continued.

CONTROL OF HOPPERS ON FIG (*TYPHLOCYBA* sp.).

This pest occurs only in the gardens round about Saswad. With a view to control this pest spraying with fish oil rosin soap in the usual strength of $\frac{1}{2}$ lb. to 4 gallons of water was tried. Three sprayings at an interval of 15 days were given in the months of November and December. Although the nymphs were killed after the spray, the severity of the infestation did not go down appreciably showing that there was immediate reinfection. This shows that some deterrent like sulphur against mango hoppers is necessary. Further trials could not be undertaken as the plants did not produce any fresh foliage owing to the scarcity of irrigation water in the tract. It is proposed to try deterrents like sulphur and Bordeaux mixture next year.

5. BETELVINE BUG (*DISPHINCTUS MAESARUM*).

This was the fourth and the last year of the scheme financed from the Sir Sassoon David Trust Funds. The study of the life history of the pest has been completed. Of the several contact poisons tried, tobacco extract, fish oil rosin soap and nicotine sulphate have been found to be the most effective, the percentage of kill being about 85 per cent. in each case. The cost of one spraying per acre comes to Rs. 5, Rs. 7 and Rs. 12 respectively. It thus seems that tobacco extract is the best and

the cheapest remedy. Large scale trials are being carried on to find out the number of sprayings required, the interval between two sprayings and the economic aspect of the treatment. The scheme has been extended for another two years.

6. GRAPEVINE BEETLE (*SCELODONTA STRIGICOLLIS*, M.).

This is the second year of the scheme also financed from the Sir Sassoon David Trust Funds. The study of the life history and habits of the beetle has been completed and has been confirmed. The study of control measures will now be undertaken. Hand collection of adults, destruction of larvæ and pupæ by frequent stirring of the soil and spraying with stomach poisons seem to be the possible methods of control and these are being tried.

7. LANG POD BORER (*HELIOTHES OBSOLETA* F.).

The pest appeared this year in a severe form in the month of December. The Rural Development Inspector, Broach, was supplied with Sodium fluosilicate and lead arsenate for comparative trials against this pest. The Agricultural Officer, Broach, reports that a trial was made only at one place but no results have been given.

8. TRIALS OF INSECTICIDES.

The following insecticides were tried by this section during the year under report :—

Name of insecticide.	Pest against which it was tried.	Remarks.
1. Cymag	Crabs	Only one trial was given in comparison with cynogas "A" Dust. Results not conclusive.
2. Toximal	Castor semi looper and Pyrrilla.	Not effective.

(C) ADVISORY AND DEVELOPMENT WORK.

A large number of enquiries on insect pests were received as usual during the year under report from public and officers of the Agricultural and Rural development departments. Also demands regarding the supply of silk worms, etc., were made by various institutions. They were all complied with.

(D) AGRICULTURAL EDUCATION.

This section has to teach two subjects, viz., Zoology to the first year students and entomology to the final year students. Out of the 100

students in the first year, 93 per cent. passed in Zoology while in the final year, out of 68 students 93 per cent. came out successfully in Entomology. One post graduate Student admitted in 1937 submitted his thesis this year and got the M.Sc. degree. Another student has been admitted for M.Sc. this year.

(E) MISCELLANEOUS WORK.

The Professor of Entomology toured during the year for 33 days and visited 17 places for advisory and investigation work. The Lecturer toured for 71 days and visited 32 places. In addition to this, touring was done by other members of the staff in connection with demonstration trials of mango-hoppers at various centres.

The Professor of Entomology attended 7 meetings of Insect Pest and Plant Disease Committee and took part in the discussion that took place.

Lastly, I would like to add that all the members of the staff of my section worked satisfactorily. A permanent post of a clerk for this section has been sanctioned by Government in view of the increase in clerical work. This will greatly facilitate the office work. Owing to the increase in the Zoology course according to the revised syllabus the need of a demonstrator in Zoology is keenly felt.

P. V. WAGLE,

COLLEGE OF AGRICULTURE :
Poona, 1st September 1941.

Professor of Entomology,
College of Agriculture, Poona.

Programme of Work for the year 1941-42.

1. Study of the harmful species of mango-hoppers prevailing in the different tracts and the action of sulphur on each one of them.
2. Field trials of poison sprays against fruit flies.
3. Betelvine Bug—Field trials of insecticides to determine the number of sprayings, the interval between 2 sprayings and the economic aspect (scheme financed from the Sir Sassoon David Trust Fund).
4. Grapevine Beetle—Trials of remedial measures (scheme financed from the Sir Sassoon David Trust Funds).
5. Trials of insecticides.

P. V. WAGLE,

Professor of Entomology,
College of Agriculture, Poona.

**List of Agricultural Bulletins published by the Department of
Agriculture and kept for sale at the Government
Book Depot, Bombay.**

[N.B.—Bulletins marked in asterisk are out of stock and not available for the present.]

No.	Year.	Subject.	Price.	
			Rs.	a. p.
32	1908	Locusts in India, by H. M. Lefroy, Imperial Entomologist, Pusa	0	8 0
33	1909	Cultivation of Broach Cotton in Dharwar, by M. L. Kulkarni, Divisional Inspector of Agriculture, S. D.	0	4 0
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