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# AGRICULTURE IN MYSORE

DEPARTMENT OF AGRICULTURE

MYSORE STATE

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# REPORT

ON

## THE PROGRESS OF AGRICULTURE IN MYSORE

*(Second and revised edition)*



BANGALORE :

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## PREFACE TO THE SECOND EDITION.

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The first edition of this Hand Book was published more than twelve years ago on the occasion of the visit to the State of the Royal Commission on Agriculture in India. The object of the publication was to acquaint the members of the Commission with facts and figures pertaining to agricultural conditions in the State, indicating the lines of improvement that were being attempted by the department and the results that had been achieved till then. Besides serving the purpose indicated above, for which it was specially written, the book has been of considerable help to all the Officers of the department, engaged each in his own line of work, in giving them that comprehensive view of the work of the department as a whole that is so essential for a proper co-ordination of their individual efforts in achieving the common goal of all, *viz.*, the improvement of the lot of the Mysore raiyat.

Officers of other departments and non-officials interested in agricultural improvement in the State have also found it a valuable book of reference.

Marked improvements have been effected in the agricultural practices of the State during the last twelve years and considerable progress has been made in almost every line of work the department has been pursuing.

The following are but a few of the outstanding items that deserve mention in this connection :—

(i) Soil survey of the Irwin Canal Tract, the establishment of the Irwin Canal Farm and the phenomenal expansion in the cultivation of sugarcane which has resulted in the starting and successful working of one of the biggest Sugar Factories in India.

(ii) A state-wide survey of soils and conditions suitable for tobacco and the introduction into cultivation

on over 5,000 acres of a new variety of cigarette tobacco with the aid of the Mysore Tobacco Company.

(iii) The starting of a Cattle Breeding Station at Ajjampur for a more intensive work on cattle breeding both for draught and milk.

(iv) The starting of the Serum Institute which has enabled the Civil Veterinary Department to tackle cattle diseases and epidemics more effectively and expeditiously.

(vi) Large scale production of clean jaggery which promises to increase the profits from sugarcane cultivation by at least 15 per cent in localities not served by the Sugar Factory

(vii) Attempts at popularising the manufacture of compost from farm refuse which, should they succeed, promise to confer a double blessing on the rural population of the State by enabling them to keep their surroundings clean and healthy and at the same time adding to their stock of valuable organic manure.

The demonstration staff of the department has been considerably strengthened and arrangements made to carry successful results of research to the very doors of the raiyats by thousands of demonstration plots distributed all over the State.

All these and other changes that have taken place during the last twelve years have been incorporated in the present revised edition.

It is earnestly hoped that this second edition of "*Agriculture in Mysore*" will be found as useful as the first to all those that are interested in, and working in several different ways for, the betterment of the Mysore raiyat.

Before concluding I desire to make special mention of the retirement from service in February 1934 of Dr. Leslie C. Coleman the first Director of Agriculture in Mysore, who organised the department in its present form and guided almost every line of its varied activities for over twenty-five years. The good work recorded in these pages is due as much to the solid foundations laid by Dr. Coleman and the far-sighted policy pursued by him as to the willing and loyal co-operation he had from his colleagues.

The policy and programme of the department continue on the general lines chalked out by Dr. Coleman and I confidently hope that with the increased interest that Government and other public bodies have of late been evincing in Agriculture and Rural Development, the Department of Agriculture in Mysore will avail itself to the full of the numerous opportunities it now has for useful service in the cause of agricultural improvement.

BANGALORE, }  
*9th February 1939.* }

T. G. RAMA IYER,  
*Director of Agriculture.*

## PREFACE TO THE FIRST EDITION.

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The object of this Handbook is to give a rough outline of the work of the Agricultural Department since its inception ; while the present organisation as a Department was sanctioned in 1914 the period covering the activities which led up to the present organisation lies between 1900 and 1914 and this period is included so that the actual report covers the years from 1900 onward.

There have, however, been many interesting, though periodic, activities in Botanical, Horticultural and Agricultural work dating back as far as the latter part of the 18th century and which have influenced later work, so that for this reason and for historical completeness, I think it advisable to give a short account in this introductory chapter.

Both Hyder Ali and his son Tipoo Sultan did much to improve Agriculture and Horticulture. The development of the Amrut Mahal Breed of cattle dates from that time. Sugarcane was brought from the low countries and some of Tippoo's officers from Mauritius brought new varieties from that country.

Hyder Ali established the Lal-bagh at Bangalore and Tipoo greatly developed it. Fruit cultivation was encouraged and grafting practiced and some of the old mango trees are even to-day standing as witnesses of those days.

After the fall of Seringapatam, the Lal-bagh was placed in charge of the East India Company Botanist and many varieties of vegetable and fruits were introduced and grown.

In 1819, Major Waugh, in a memorial sent through Mr. Cole, the then Resident at Mysore, offered the Lal-bagh, as his garden, to the Government of Fort St. George. The Governor-General (the Honourable Marquis of Hastings) accepted the gift and after consultation with Dr. Wallich directed that the garden should be placed

under the administration of the Calcutta Botanic Garden and the maintenance be paid from Imperial funds.

In 1836, Sir Mark Cubbon started a Horticultural Society to whom His Highness the Maharaja Sri Krishna Raja Wodeyar III, made over the garden. The Society ceased, however, to exist in 1842 and the garden reverted to Government. In 1857, on the recommendation of Dr. Hugh Cleghorn, the garden was constituted as a Government Botanic garden and Mr. New was sent out from Kew as the first Superintendent. He brought out a number of Australian plants from Kew and others were, in the subsequent years, introduced. The large *Araucaria*, *Eucalyptus*, *Grevillas*, *Dalbergias* and *Casuarinas* date from that time.

In 1862, an Italian gentleman, Signor de Vicchy introduced a number of varieties of mulberry plants and some improved races of Japanese Silkworms, but the work seems to have been dropped as the disease then prevailing among the silkworms could not be eradicated.

Some attention was paid to the improvement of pasture and the introduction of Australian Rams by Sir Mark Cubbon but this was abandoned in 1862.

In 1869, the then Conservator of Forests Mr. Von Somerin did a good deal in the study of the indigenous Flora of Mysore and had published a booklet on the trees of Coorg. The Forest Department, as then constituted, was abolished as a separate department in 1878 and was attached to the then Agricultural Department, but was revived in 1895.

During that time an agricultural farm was opened under one Mr. Hermann very near to the present Sunkal Experimental Farm but was subsequently abandoned.

In 1874, after the death of Mr. New, Mr. Cameron was appointed as Superintendent of the Lal-bagh and with Mr. Ricketts, who was then Conservator of Forests and also acted in Mr. Cameron's place during 1886-87, much useful work was done. The Hebbal Butts plantation was then established and many new trees introduced, such as Rain tree, Ceara Rubber, Shingle tree, etc. Considerable work was done in the introduction and distribution of imported good varieties of potatoes and the kidney variety, now largely grown, still goes under the name of "Rickett". Mr. Cameron continued to be in charge of the Lal-bagh till



his retirement in 1908. During his time a great amount of useful economic work was done in the introduction and cultivation of fruits and vegetables, cottons, coffee grafting experiments, introduction of sisal hemp, etc., as also in the development of the ornamental side of the Lal-bagh. The area of the Botanic Garden was extended from about 50 acres to 100 acres which is the present area of the Lal-bagh, and a number of new parks were laid out. A large conservatory costing Rs. 75,000 was built in 1889 in Lal-bagh. Mr. Cameron also compiled a Catalogue of plants in the Botanic Garden and its vicinity. The preparation of the botanical drawings was started. A school for Apprentice Gardeners was opened.

In 1899, Dr. Lehmann was appointed as Agricultural Chemist and on his work (separately described) is based the formation of the present Agricultural Department.

With the appointment in 1908 of the undersigned as Economic Botanist and Superintendent, Government Gardens the development of Horticulture and Economic work was organised on its present lines which is described in one of the following chapters.

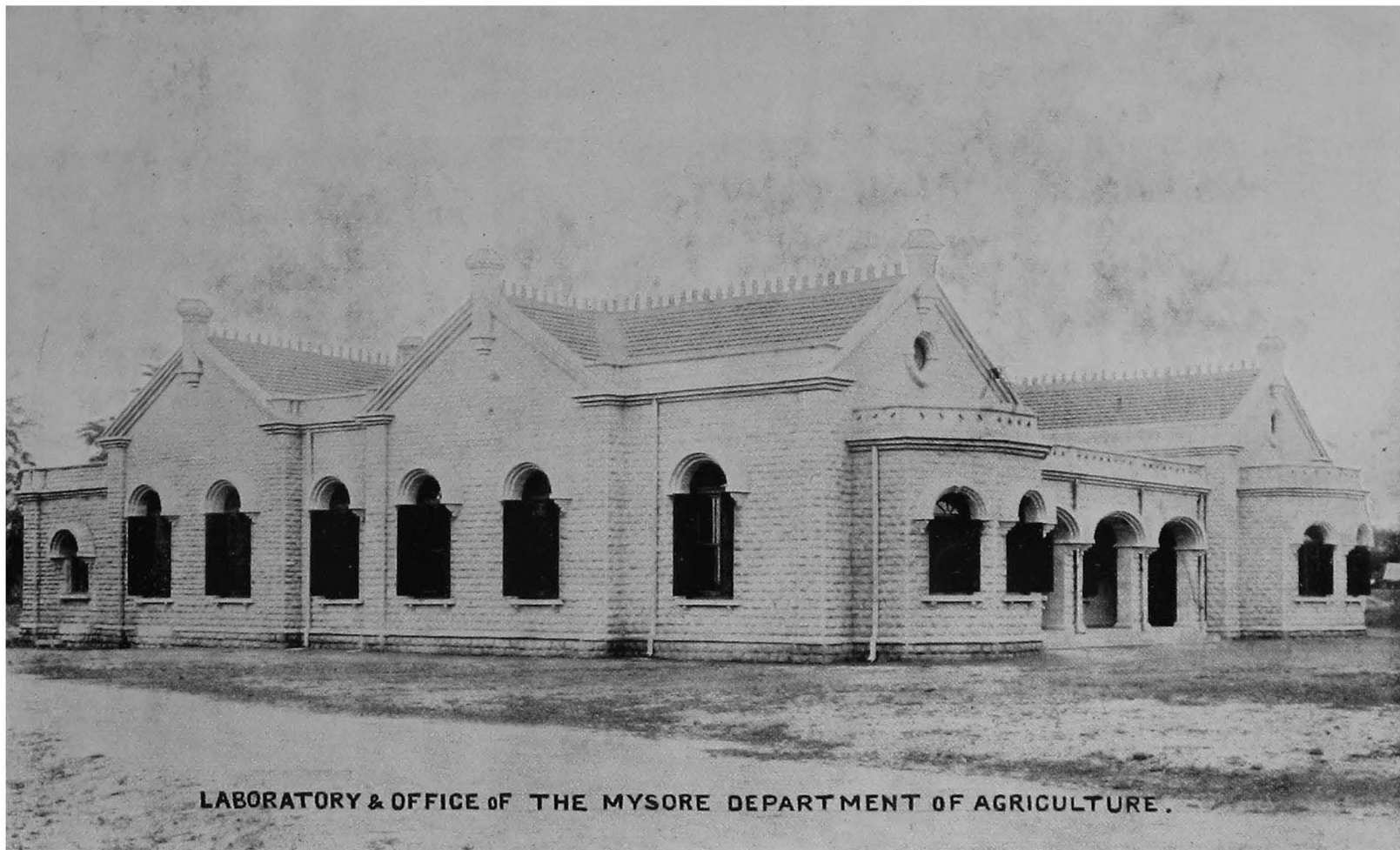
In the following notes, the chapters dealing with the work of the different sections and allied departments have been written up by the officers in charge and the general compilation has been in the hands of the Deputy Director Mr. Yegnanarayana Iyer.

G. H. KRUMBIEGEL,  
*Offg. Director of Agriculture.*

## CONTENTS.

CHAPTER.	PAGE.
I. The Agricultural features of Mysore: a brief description. ...	1
II. Lines of improvement and work accomplished ...	12
III. The Department of Agriculture and allied Agencies...	27
IV. Resumé of work of Sections	
Research :--	
1. Chemical Section ...	32
2. Entomological Section ...	42
3. Mycological Section ...	51
4. Botanical Section ...	58
5. Agricultural Engineering Section ...	104
V. Research ( <i>Continued</i> )	
The Experimental Farms :--	
(a) The Hebbal Farm ...	106
(b) The Marthur Farm ...	108
(c) The Babbur Farm ...	109
(d) The Paddy Breeding Station ...	112
(e) The Coffee Experimental Station ...	113
(f) The Kar Ragi Breeding Station ...	116
(g) The Irwin Canal Farm ...	116
VI. Extension, Popularisation or District Work ...	120
VII. Agricultural Education ...	131
VIII. Department of Sericulture ...	136
IX. The Civil Veterinary Department ...	151
X. The Live Stock and Amrit-Mahal Department ...	156
XI. The Serum Institute ...	162
XII. The Department of Horticulture ...	166
XIII. Agricultural Co-operation ...	187
XIV. Publications and the Agricultural Press ...	191
XV. Summary and Conclusions ...	195

APPENDICES.		PAGE.
I.	Map showing the location of the Farms, Laboratories, Schools, Depots and other institutions of the Department of Agriculture.	
II.	Personnel of the present staff of the Department of Agriculture. ...	201
III.	Diary abstract headings of the Agricultural Inspectors. ...	209
IV.	List of publications of the Department of Agriculture	210



LABORATORY & OFFICE OF THE MYSORE DEPARTMENT OF AGRICULTURE.

# AGRICULTURE IN MYSORE.

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## CHAPTER I.

### The Agricultural Features of Mysore.

#### A BRIEF DESCRIPTION.

The Mysore State comprises a tract of country lying between the  $11^{\circ} 38'$  and  $15^{\circ} 2'$  parallels of North latitude and between the  $74^{\circ} 42'$  and  $78^{\circ} 36'$  East longitude, comprising an area of 29,305 square miles or roughly equal in extent to Scotland. It is completely landlocked in nature having no sea-board or outlet to the sea. The Western Ghats with its outlying spurs form the western boundary dividing it from the coast districts of the Bombay and Madras Presidencies, the shortest distance to the sea being 10 miles. The Eastern Ghats comprised of broken chains of hills, enclose it on the East, dividing it from the plains of the Madras Presidency below. The country is thus a huge plateau lying between the two Ghats which, however, unite into the Nilgiri Hills in the south, forming the southern boundary of the State. The whole country slopes from west to east, and with the solitary exception of the Sharavathi river, all the large rivers which drain the country flow eastward. The plateau has a general elevation of 2,000 feet above sea-level. In general aspect, the country is exceedingly undulating, the western half of the State being very hilly with rugged and steep hill slopes, while the eastern half consists of extensive undulating plains alternating with wide valleys. The country may be said in this respect to be divided sharply into two zones, the hilly country to the west and the plain on the east, called respectively, the Malnad and the Maidan with correspondingly sharp differences in their agricultural features.

The climate is mild throughout the year in marked contrast with that of the country below the plateau. In

the winter months of December and January, the mean temperature ranges from 62° in the western districts and the high altitudes to 67° in the eastern districts. Summer temperatures seldom go above 100°, while the mean summer temperature ranges from 83° to 87°. Crop raising is possible throughout the year, the temperature never going down so low as to arrest growth. The mildness of the climate is indeed one of the marked features of the State, which allows of its being able to grow a variety of special crops to perfection which cannot be thought of in the plains.

The rainfall varies from a maximum of over 300 inches in the Malnad down to as low as 10 inches in some of the eastern taluks. The whole State may be divided into three zones in this regard: (i) the Malnad with its average rainfall of about 60 inches and attaining in certain places as high as 360 inches. The rainfall in this region is confined to the South-west Monsoon season, being practically concentrated in the months of June, July and August. The rains are torrential and incessant in these months and the maximum in 24 hours goes up to as high as 22 inches; (ii) a zone with an average rainfall of about 30 inches may be taken as the general type of the Maidan or plain country, the portion lying west being more favoured by the South West Monsoon, while the eastern tracts are favoured by the North East Monsoon; (iii) a zone of poor rainfall with an average of 17 inches comprises the taluks lying in the North-east. On the whole, the State may be said to have the benefit of both the South-West and North-East Monsoons, the rains lasting, that is to say, from the middle of May to the middle of November.

The predominant type of soils in the State is a red loam, deep and uniform in character and free, easy working and responding well to good cultivation. Soils due to mixtures of sand, gravel and stones in varying proportions also cover extensive areas. The "black cotton" soils are also met with in large stretches in the Mysore, Chitaldrug and Kadur Districts. Rich clayey soils are general in the irrigated lands under most of the irrigation tanks. The soils of the western part of the State including those on the hill slopes and the plantations are highly lateritic and clayey. In chemical composition, the most notable feature is the high percentage of iron and aluminium. All the soil types are poor in nitrogen which ranges from .04 per cent to .15 per cent and poor likewise in phosphoric

acid which ranges from 0·02 per cent to 0·10 per cent; they are all well provided in potash and lime, the black cotton soils being specially rich in the latter.

The total area classified as fit for cultivation is 8,955,288 acres, while the area actually under cultivation in 1935-36 was 6,313,561 acres. The total area under occupancy in 1935-36 was 7,864,134 acres although only 6,313,561 acres was actually under cultivation. Culturable land which was left uncultivated is about 20 per cent.

The area still available for being taken up for cultivation was 1,091,154 acres which taken together with the 1,550,573 acres of occupied land left uncultivated is a measure of the improvement remaining to be effected in regard to the extension of cultivation.

The size of the average holding in Mysore is about seven acres. The total area under cultivation is classified as regards the size of holdings as below :—

Holdings	below	1 acre	...	...	1,70,883
Do	between	1 and 5 acres	...	...	5,15,382
Do	„	5 and 10 „	„	...	2,69,962
Do	„	10 and 50 „	„	...	1,51,009
Do	„	50 and 100 „	„	...	14,990
Do	„	100 and 500 „	„	...	2,481
Do	above	500	...	...	94

The bulk of the holdings are, moreover, composed of fields scattered and far removed from each other with all the disadvantages such a system implies. Both an increase in the average individual holding as well as a consolidation of the fields composing such holdings are very desirable improvements, though the difficulties of bringing about such a change are almost insuperable.

The cultivation in the State falls into three classes, *viz.*, (i) the dry land cultivation as distinguished from irrigated or wet cultivation. This is the predominant form of cultivation. Out of the total area of 6,313,561 acres actually cultivated 5,230,618 acres or about 83 per cent is under dry cultivation. The main food crops of the people, *viz.*, ragi and jola which afford at the same time the fodder for the raiyat's cattle, are raised as dry crops. Depending, as this cultivation does, solely upon the rainfall, it is subject to the chances of more or less failures. In addition to these main food crops, a number of inferior food grains and the whole of the pulse and oil seed crops are also grown only as dry crops.

(ii) The "wet" cultivation or cultivation under irrigation:—The area under this method of cultivation is about 1,082,943 acres. Irrigation is certainly the most important factor in crop production in the State, and provided water is given, there is no season of the year when crops cannot be raised to perfection in the State. Both to prevent crop failures and to obtain satisfactory yields, irrigation is all important. From time immemorial, this has been realised, and the State possesses a most extensive system of irrigation works. All the large rivers and streams are dammed along their course and channels are drawn off for irrigation. The Cauvery river channels form the most extensive system of irrigation in the State. Throughout the State and especially in the eastern districts, irrigation tanks are numerous, so much so, that it may be said that practically every eligible site has been made use of for the purpose. Irrigation wells, both large and small, are also very important irrigation sources, especially in the north eastern taluks with their low rainfall. Channels drawn off from the under-ground supplies in the rivers and spring heads also constitute a feature of the eastern taluks. Though much has been done by the State and the people, there is still scope for a great deal of work in the improvement of existing irrigation sources, the construction of new works and a great expansion of irrigation wells. The State at present possesses over 1,000 miles of river channels, 25,000 irrigation tanks and some 40,000 irrigation wells.

(iii) *Garden Cultivation*.—Crops raised under well irrigation and gardens of perennial crops like the areca nut and the cocoanut under irrigation tanks or other sources are classed as garden or *bagayat* cultivation. These are very valuable properties and are generally protected by the provision of good irrigation wells in addition to the irrigation from tanks. The gardens are naturally in the possession of only well-to-do cultivators, and also pay a higher land tax than the other two classes of land.

*Implements of husbandry*.—The Mysore raiyat possesses a variety of agricultural implements appropriate to the different agricultural operations. All of them are, however, only small scale implements, are simple and inexpensive and are capable of easy repair locally. A variety of ploughs of different sizes, ingenious but simple seed drills of different designs, blade hoes of different sizes



and the *piccotah* and *kapile* water lifts are some of the most important.

The plough is the ordinary wooden plough which ploughs a V shaped furrow. Many sizes, however, exist, suited to different kinds of work. Very light ploughs are used in paddy flats, a somewhat larger type is used for dry land, a heavier one still is used for the Black cotton soil, while for special hot weather ploughing of this type of soils, a very heavy and massive plough requiring six pairs of bullocks is used. Blade hoes and harrows of many sizes are used for further preparation of the soil. Seed is sown by seed drills, of which there are many sizes and even varieties in design. Interculture has appropriate tools, both for bullock draught and for manual use. Harvesting is done only by the sickle, while threshing is done by hoary time-honoured methods, though these are being replaced rapidly by improved methods. Sugarcane is crushed in small iron mills and the juice boiled in open pans over an open fire. Water is lifted by *piccotahs* of different shapes and sizes and by the *kapile* or bullock lift.

Nearly all these appliances, though they do more or less thorough work, are slow and wasteful of labour, and have to be replaced by labour-saving substitutes which will enable the farmer to handle a larger area. Already the improved plough, cultivator, cane mills, threshing rollers, and even pumps and engines are widely appreciated and in the following pages will be found details regarding the work actually accomplished in the popularisation of improvements in this respect.

*Crops.*—The State produces a great variety of crops, and the soils and climate and other physical features are such that there is hardly a tropical crop of any importance which cannot be grown within the State. In the plains as well as in the Malnad, the most important irrigated food crop is rice; the most important dry crops are the grains ragi and jola, the pulses, avare, thogari, horse gram, Bengal gram, etc., the oil seeds castor, gingelly, groundnut and niger. Sugarcane is the most important money crop under all sources of irrigation—particularly in the area in the Mysore district which has recently been brought under irrigation by the construction of the Krishnarajasagara across the Cauvery, while tobacco, chillies and a number of miscellaneous money crops are grown under well cultivation.

The arecanut, pepper, cardamoms and coffee are the peculiarly *Malnad* crops. The most important perennial crops of the plains are arecanut and cocoanut. Mulberry is one of the unique crops of the State and is grown especially in the Mysore, Bangalore and Kolar Districts where the silk industry is of great importance. The money crops tobacco and chillies are raised extensively as dry crops also, the former in the Mysore, Hassan, Kolar and Bangalore Districts, and the latter in almost all the *Maidan* Districts. A great impetus has been given to the cultivation of a special variety of cigarette tobacco by the starting early this year of the Mysore Tobacco Company. Cotton, of which two varieties are grown, is of importance in the Chitaldroog and Mysore Districts, on the black cotton soils. The Dharwar American Cotton, which unlike the local cotton grows in the red soils also is of considerable importance in the Chitaldroog and parts of the Shimoga, Kadur and Tumkur districts. This is however being replaced by an improved upland variety known as M. A. 2. Plantations of fruit trees and trees of economic importance are also numerous in the *Maidan* districts, the most notable among them being the mango, casuarina, tamarind and hongey.

The acreage under the most important crops during the year 1935-36 is given in the following table:—

<i>Chief crops</i>	<i>Acreages in</i> 1935-36.	<i>Chief crops</i>	<i>Acreages in</i> 1935-36.
Paddy	... 7,44,472	Cotton	... 87,384
Ragi	... 2,204,802	Coffee	.. 1,06,968
Jola	... 6,79,909	Arecanut	... 40,015
Horse gram	... 7,78,044	Tobacco	... 22,596
Thogari	.. 1,18,524	Mango	... 18,758
Gingelly	... 76,529	Cocoanut	... 1,64,722
Groundnut	... 1,87,471	Mulberry	... 24,445
Castor	... 1,01,526	Chillies	... 72,762
Sugarcane	... 50,448	Plantains	... 19,463

The money value of the total crop production of the State in years of normal rainfall may be roughly estimated at some 18 crores of rupees.

*Manures.*—The raiyats' chief and, in most places, the only manure known is cattle manure or sheep manure. The available supplies of these are hopelessly inadequate to the needs of cultivation and the gradual reduction in the area available for grazing is bringing about a reduction in the number of cattle kept and consequently of the cattle

manure available. The raiyats' cattle stalls have no good floor, the urine generally soaks in the ground, and except in the Malnad no litter is used. The manure itself is thrown in a loose heap subject to the action of sun and rain. There are notable exceptions here and there but the general practice is as described. Thus, even such cattle manure as can be had is being collected and preserved so carelessly that it is very poor in quality.

Green manures of different kinds, principally the leaves of the hongey trees are largely used in paddy cultivation, especially in the eastern districts where these trees abound, and where they are also raised as plantations for this purpose. In the channel areas of the Mysore district, many pulse crops are sown on the paddy lands to be eventually ploughed in as green manure. Elsewhere this practice is either not known at all or is not in vogue.

Oil-cakes of the hongey, castor and groundnut are being used as manure especially for sugarcane in the Kolar and Bangalore districts largely but the practice has now been introduced generally throughout the State by the efforts of the Agricultural Department in recent years. Lime is never used as a manure, its use as a manure being almost unknown except on the Coffee Estates which have, under the influence of the Agricultural Department, during recent years included periodical liming as one of the regular agricultural operations. Artificial manures like sulphate of ammonia, bonemeal and superphosphate of lime, etc., are coming into use, due also to the work of the Agricultural Department. The manufacture of compost from agricultural and habitation waste, started first by the Mysore City Municipality, is also gaining ground particularly on the several Experimental Farms of the Department of Agriculture. The natural manurial resources in the State are quite insufficient and unless greater use is made of all available waste and oil-cakes and other concentrated manures are used in conjunction with the local manures in a liberal measure, the crop yields will continue to be low.

*Live Stock.*—The live-stock of the State comprises cattle, sheep and goats. Pigs are kept by wandering tribes, and poultry by nearly all farmers. Oxen are the only draught animals used both on the farm and for ordinary road transport. Cattle on the farm are kept for draught and other farm work such as, working the *kapile*

lift, for dairy purposes and for producing manure. Mysore is the home of the finest draught cattle in South India and the Cattle Breeding Industry is a source of great wealth to the State. In fact, it is one of the main sources of income to the raiyats of the breeding and rearing tracts of the State. Highly priced cows are kept and served by specially selected bulls. There are, however, very few breeders who keep herds and make a business of the Cattle Breeding Industry, but the breeding is in the hands of ordinary raiyats who keep only a few head, about two or three, of breeding cows each. The male calves are largely sought after and secure very handsome prices. A large number of cattle fairs are held in the State in connection with the annual festivals at some of the famous temples; and traders and raiyats from the Madras and Bombay Presidencies flock to these fairs to purchase cattle. As a fast trotting, highly spirited type, the "Amrut Mahäl" breed is famous in South Indian history; the Hallikar and the Mahadeswarabetta breeds are other highly famed Mysore types and are preferred for heavy farm and road haulage work. The industry is capable of great expansion with profit to the State and the raiyat.

As a dairy animal, the cows of none of these breeds are of any special merit; all the cows are poor milkers and cow keepers in the cities look as much to the male calves that may be born to these cows as to the milk, to make the milk vending trade pay. The buffalo is the special dairy animal, principally in view of its rich milk which furnishes all the butter and ghee of the trade. Except in towns, few or none keep any dairy herds and farmers generally keep only a few head of cattle of all kinds. It is note-worthy that for dairy purposes foreign breeds, either pure or cross-breeds, are popular among the dairy men in the cities. Buffaloes from Dharwar, Ahmedabad and Jafferbad are very much in evidence as well as cross-bred cows with Ayrshire, Jersey or Short-horns blood in them.

The cattle feed consists of the dry straw of the cereal grains, of horse gram and cotton-seed—this especially to working cattle—oil-cakes and bran for dairy animals particularly in the towns—and of ordinary grazing on the village grazing grounds. These latter are exceedingly poor as grazing grounds; it is only in the rainy season that some grazing can be had; in the summer, they are

dry and parched and devoid of anything green except scrub jungle.

Except to a very small extent, no fodder crops as such are raised and no enclosed pastures or paddocks exist anywhere. The bulk of the cattle are very ill-cared for and any prolonged drought or delay in the springing of grass on the waste land spells ruin to them. Barring the stacking of dry straw, there is no other system of fodder storage. The years 1922 to 1924 were years of great fodder scarcity and cattle perished in thousands. There was a like scarcity though less severe during 1934-35.

The sheep of the State which numbered about 2,595,359 in the last Census are of a decidedly superior type to what obtains on the plains of South India. They are, however, nowhere as compared with European or Australian sheep. The wool is coarse, the staple short and the fleece which is cut twice a year seldom weighs more than half lb. per clip. Except where a head or two is kept for household purposes, in general they depend mainly upon the scanty jungle growth or the stubble of the field crops for their feed. Their small size and the general poverty of the feed they have to depend upon reduces their value as meat animals very much.

Goats are also kept in large numbers; it is not, however, the raiyat alone that keeps them but practically every villager keeps a few, except those who are forbidden by custom to do so. They are hardy and multiply rapidly; the unrestricted freedom they enjoy and the destruction they mean to cultivated crops, young plantations, avenue trees and really all manner of the vegetation has given rise to frequent representations for some kind of restriction. Their hardy and prolific nature can be judged by the fact that in the great fodder distress of 1922-24 when the rest of the cattle population diminished by 50 per cent and in certain areas even 70 per cent the goats increased by nearly 50 per cent. The goat is however, the poor raiyat's wealth and adds materially to his slender income. The goat is looked upon solely as a meat animal, and neither good milch goats nor wool types exist in the State. These however, are very promising lines of improvement for being taken up.

*The Raiyats' Economic Condition.*—The economic condition of the Mysore raiyat is certainly low, judged by even very ordinary standards. The vast majority of them even in the best seasons are only just able to carry on.

The country being predominantly a dry farmed country, the vicissitudes of the seasons affect the raiyat profoundly. In an average season and on an average holding of the seven acres mentioned, it must be a hard struggle to wrest a living from the land. Assured sources of irrigation alone mitigate the situation but though in irrigated tracts, the condition of the raiyat may be somewhat different and existence may not be so hard, still even there the earnings will cover little more than the ordinary needs of the farmer. Having little or no reserve, the raiyat has invariably to resort to the money lender or to his wealthier brethren for loans in cash or kind to tide over the periods of want which are only too frequent. High rates of interest on money borrowed for working expenses or house hold expenses and the marketing of produce through the money lender himself help the farmer still further on the road to ruin and selling out. Even the larger landholders cannot be said to be in affluent circumstances by any means. Most of the valuable land, such as the wet lands and garden lands, are in the hands of people who either do not belong to the cultivating class or who have given up the holding of the plough. If 80 per cent of the total population of the State should be taken to depend materially on the land and the total value of the agricultural production at present is reckoned as eighteen crores of rupees, the earnings per head of the population per year works up to only about Rs. 35. Land in spite of its low return, still continues to be the sole form of investment for people who make money in other walks of life. The consequence is absentee landlordism and cultivation by poor tenant farmers with all the evils well known in such an arrangement. The tenant is left with little more than wages for his labour, while the landlord complains that his own share barely amounts to even reasonable interest on his investment.

Moving in a vicious circle of cause and effect, the raiyats, both large and small, can be said to merely earn enough to maintain their present standard of living, and if additional forms of expenditure, such as the changing times demand should be thought of, they can be secured only through borrowing. As a matter of fact even at present, the total indebtedness is high. The situation is that land is the sole wealth of the country and it has to maintain not only the tillers of the soil and the capitalist money lender and landlord, but all classes of people, and

unless the land is made to produce a vast deal more than it is doing and the excessive burden on the land is relieved by new avenues to the employment of labour, the situation as regards poverty and indebtedness will remain unchanged.

In what ways the former at least of these two solutions can be brought about, what measures of State action can be taken, what progress has been achieved by the Department in these directions and what further action is proposed and should be taken up are narrated in the next chapter.

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## CHAPTER II.

**Lines of Improvement and Work Accomplished.**

In this chapter we shall discuss the broad lines along which the agriculture of the State admits of improvement so as to increase not only the actual production but also the money income of the raiyat. As regards the bulk and the nature of the work accomplished during the last twenty-five years by the State Department of Agriculture and the departments allied to it, we shall deal only with the more noteworthy among them in this chapter, as a full account of each of these departments and sections appears in the succeeding chapters.

*Extension of Cultivation.*—“Is all the land that is fit for cultivation actually under cultivation?” may be asked as the very first question. The total area classed as fit for cultivation is about 89 lakhs of acres in the State and the area actually taken up for cultivation is about 79 lakhs of acres leaving 10 lakhs of acres or about 11 per cent of the total area still to be taken up. What is more important is however that even of the 79 lakhs of acres which are under occupation only about 63 lakhs of acres are on the average actually under cultivation every year so that a total of about 26 lakhs of acres or 30 per cent of the culturable area has still to be put under crop. That gives us a measure of the improvement to be effected in this regard.

It may be added that a great extent of land on hill slopes or valleys fit for the raising of plantations of Coffee, Tea and Rubber and land that can be set free from forest areas, from reserves of date groves or “Amrut Mahal” kavals have not been taken into consideration at all. If those also should be taken into calculation then there are still vast stretches of land awaiting to be taken up for crop raising. In recent years, a great extent of waste land, some part of the Amrut Mahal kaval (pastures reserved for the Government cattle herds) lands and date groves have been thrown open for cultivation, but little more than the areas near to existing villages has been taken up. The rural population is averse to move out and migrate far.



It is also the case that with the present primitive small scale implements the limits of cultivation by the available agricultural labour have almost been reached and an expansion of cultivation needs either a larger population or better implements. Remembering further that dry farming is mainly extensive farming, where the meagre and uncertain income per acre is too insufficient except when a large acreage is farmed, the State Department has tried to solve the problem by the introduction of better implements, especially the improved ploughs, for it is undoubted that with such a plough one can farm twice the area that can be farmed with the present country plough.

The first improved plough popularised by the Agricultural Department is known as the Kolar Mission Plough, a small American-made plough imported by the Kolar Mission Institute and costing about Rs. 25. Other mould board ploughs, large and small, have also been introduced and the number in use in the State at the present time is over 23,000. When it is remembered that only about 25 years ago the idea of the raiyat using iron ploughs costing even Rs. 15 was quite new, this rate of increase in the use of the improved plough has been wonderful.

The Department has also devised and put on the market the "Mysore Plough" which has a bar-share arrangement with a view to reducing the cost of replacing the share which is a draw-back of the Kolar Mission Plough. The Kolar Mission Plough is largely copied locally and shares are made and repaired also. To that extent, the improved plough may be said to have become a common feature of agriculture in the State.

In addition to ploughs, what is known as the six shovel cultivator is also sold in large numbers, a set comprising a Kolar Mission Plough and cultivator, being capable of handling two or three times the area that a country plough can.

Comparing equal areas, it may be said that in no part of India has the improved plough come into as large use as in the Mysore State and to the larger and larger use of such implements should one look for solving the problem of cultivating a larger area with the present agricultural labour. The work before us can be realised when it is noted that there are still about 822,000 country ploughs to be replaced by the improved ploughs.

In addition to the extension of arable farming by the introduction of the improved plough and other new implements, there is the additional solution of the planting up of the uncultivated land with perennial plantation crops, that is to say, an extension of coffee and tea in the *malnad* and of the mango, cocoanut, tamarind and other economic crops in the *maidan*. The labour requirements are much less than for arable farming and the plantations add to the permanent assets of the country; to the large landholders especially who for lack of labour leave large stretches of land uncultivated plantations afford an admirable solution. Already this idea has been taken up and there is great activity displayed and the aspect of certain parts of the country completely changed as the result; but the room for expansion is very great and both stimulus and assistance by Government are called for.

Is land under cultivation producing the maximum crops that it ought to? Most decidedly not; and it is here that there is room for practically unlimited improvement. The soils of the State are such that, provided there is an abundance of water for irrigation, the land will yield in plenty. Irrigation is the most important factor in crop production in Mysore as it is in many other parts of India.

If the present irrigation tanks are improved, their feeder channels kept in order, the tanks themselves kept in better repair, the water in the tanks, when they do fill, better regulated in the distribution, if liberal encouragement is given to the digging of independent and subsidiary wells, if deeper underground water is arranged to be tapped and efficient pumps and engines provided for these deep wells, if all the water in the rivers of Mysore can be harnessed to the use of Mysore Agriculture either by channel irrigation or by pumping machinery within the water rights appertaining to the State, the gain to the wealth of the State will be incalculable. When it is remembered that ordinary dry land hardly worth Rs. 50 an acre appreciates in value to Rs. 1,000 an acre when irrigation water is assured to it throughout the year, an idea may be had of the benefits of irrigation and increased production from the land.

What has the State done in recent years? Action has been taken on all these lines. Two of the finest irrigation works, the Krishnarajasagara and the Vani Vilasasagara are monuments to the beneficent action

of the State. Between these two a very large tract of country has been brought under irrigation. The Anjanapur Project in the Shimoga district and the Marconahally Project in the Tumkur district will in the near future bring further tracts under irrigation.

In other directions also something has been attempted; *takavi* loans are granted for well sinking; pumps and engines are sold on the hire purchase system; large pumping installations on river margins have been encouraged, cheap electric power is furnished along the electric power lines and Tank Panchayets are constituted to regulate distribution of tank water; nevertheless only a beginning can be said to have been made and the ground to be covered is vast.

The second important factor keeping down the yields of crops, be they on the dry lands or the wet or garden lands, is the lack of sufficient manure. With adequate manuring the yields of most crops can be increased twice, if not threefold. One has only to glance through the figures giving the average yields of the different crops in the State and compare them with the yields on well-manured areas to realise the magnitude of the increase possible. The good yields even now obtained by careful agriculturists and the average State yields are put down side by side to indicate the possibilities.—

	Average	Good yields	Very good yields
Paddy ...	8 pallas	20 pallas	30 pallas
Ragi ...	4 „	8 „	12 „
Sugarcane ...	100 maunds of jaggory.	300 maunds	500 maunds
Arecanut ...	15 maunds	30 „	60 „

It is in this branch of work that the efforts of the Agricultural Department have borne fruit. Numerous demonstrations have been held on raiyats' holdings to demonstrate the effect of manuring with concentrated fertilizers, and with the co-operation of many farmers, both large and small, good manuring has been extensively popularised.

A great part of the output of oil-cake of the local oil mills in the State is being locally absorbed. The sale of

superphosphate of lime, of sulphate of ammonia, of bone-meal, sulphate of potash singly and in mixtures according to the recommendations of the Department, run now into thousands of tons. During the season 1936-37 alone, the total imports of manures of all kinds went up to over 2,43,283 mds. valued at Rs. 11,20,000. What is more encouraging is that technical advice is largely resorted to by raiyats for manuring not only valuable crops like sugarcane or paddy or potatoes but also ragi, groundnuts and other dry land crops for many of which the Department puts up special mixtures tested on the Government Farms. The sales are growing to such a magnitude as to be taken up by regular dealers, setting, thereby, the Department free for the really technical part of the work of experiment, advice and supervision.

The cheap forms of manuring are by no means neglected. The practice of raising green manure crops is being widely popularised in places where it is not known. The raising of Honge plantations is encouraged by special concessions in particular areas and attempts are being made to popularise the utilisation of habitation and agricultural waste by making it into compost.

Gratifying as these results may be, compared with what remains to be done, they amount to very little, for the ground to be covered is again immense.

It may be also mentioned that within the last twenty years about a dozen Oil Pressing Factories have been started in the State to utilize at least a portion of the rapidly growing oil seed production. Rotary mills, screw presses and "Anderson Oil expellers" exist in both Bangalore and Mysore; as thus the production of oil-cake increases, the local demand is made to keep pace with the supply through the agency of the Agricultural Department.

A Company has just been started for the manufacture among other useful chemicals of all the sulphate of ammonia required in the State for use as manure for sugarcane, coffee and other money crops.

Next to irrigation and manures comes the cultivation of higher yielding varieties as a factor in increased production. The isolation and testing of pure strains and the multiplication of the best among them, the evolution of altogether new and improved varieties or strains by well known methods of plant breeding and later the large scale trials on raiyats' holdings and then their introduction into

general cultivation, have received a great deal of attention and the efforts of the Department have been attended with marked success. Ragi, the staple food crop of the people and the most widely cultivated local crop in the State has been taken up first and more than one pure and higher yielding strain evolved and put out. The H 22 Ragi has been the most notable of these; it has been taken up most extensively, the area now reaching more than 3,39,000 acres. In many a village the old varieties have given place almost entirely to the new strain. An increased yield of about 20 to 30 per cent over the local mixed strains can be claimed for the new strain, and the increased production due to this one variety alone can be readily appreciated. A new cotton selection is another important item evolved by the Department; with a ginning percentage of 28, of good white colour and an even staple with good strength the variety Sel. 69 is a great improvement over the local "Sannahatti." The cotton growers have appreciated its superiority and during the year 1935-36 alone, an area of over 12,200 acres has been sown with this particular strain. Other lines of improvement in respect of cotton are also in progress.

Another notable achievement is the evolution of some excellent new varieties of seedling sugar canes. H.M. 544, H. M. 320, H. M. 553 and several other cane varieties which are now rapidly being introduced into general cultivation have all been evolved by the Department. CO.281 and CO.290 are among the seedling canes of the Sugarcane Breeding Station Coimbatore that have been found suitable for certain tracts. G. E. B. 24 Paddy, a selection of the Madras Agricultural Department, has become very popular in the canal tract of the Mysore District. Improved varieties of groundnut and castor evolved by the Department are also being introduced in several parts of the State.

The work of evolving superior varieties has become the most popular line of work in all Departments of Agriculture and deservedly so; in Mysore we have made a very good beginning and though already marked success has crowned our efforts, still the scope before us is vast and will require the sustained labours of a well equipped staff for as long as we may care to think of. One has only to look at the long list of the important crops of the State and consider that what has been done for ragi, sugarcane, cotton and groundnut will have to be done for each one

of them. Even with these four crops there is nothing like finality, there is always the matter of something better, and that of even new and choice varieties becoming 'played out.'

These remarks need not be confined to the field crops alone; there are the horticultural crops, the flower, fruit and vegetable crops and plantation crops like coffee and the cocoanut. Similar work has been started in regard to these crops also. If what has been accomplished can be taken as an indication of the possibilities of the future, there is no reason why production should not be increased by at least some 50 per cent by this one agency alone.

Though not coming strictly within the scope of plant breeding work, the distribution of short duration or early maturing varieties of various crops, and of the transfer of superior varieties to places where they may not be known, is also a factor of increased production in as much as often two crops are possible to be raised where only one was being grown in the season, and that furthermore, crops are made possible with supplies of water which with the ordinary varieties would not suffice to mature a crop. The short duration erect varieties of groundnuts called Spanish and Small Japan, illustrate the first point and the early maturing paddies—Banku, Kapilesanna, Chinthamani-sanna and Halubbalu illustrate the second. These new varieties of groundnuts now occupy whole taluks in the Chitaldrug and Mysore districts and the paddies are being distributed in yearly increasing quantities; about 250 pallas of seed paddy are supplied yearly by the Department, the groundnut itself having become an article of the Seed trade now in the hands of regular suppliers.

The matter of increased crop production by direct methods described above, is closely connected with the reduction of losses due to crop pests and diseases. These inhibitory causes account for the reduction of crop yields to an extent which is seldom realised, because the raiyat feels helpless and puts it all down to the inevitable decree of Fate. There is not a single crop in the State on which pests and diseases do not take a heavy toll, and the loss in the aggregate even in good years is stupendous. Ragi, the staple food crop, which fortunately is the one crop which is singularly free, is still subject to the ravages of the Kamblihula at the young stage, and later the grain is

subject to smut. Jola is the exact reverse of ragi being subject to pests and diseases from start to finish. The Kamblihula wipes it out in its young stages, and the grasshopper is a periodical visitor. Grain is subject to smut and is preyed upon and ruined by the jola fly; in storage again, the grain is attacked by weevils. The pulses are damaged by pod eating insect pests and later, in storage are seriously damaged by weevils. Sugarcane is damaged by the borer in all stages of its growth. The cotton is subject to the boll weevil, stem-borers, aphis and so on which reduce the yield and the quality of the cotton seriously. Castor is often wiped out by the leaf-eating semi-looper.

Paddy is subject to the attack of caseworm and stem borers and to fungus diseases. The potato, tobacco and chillies, all valuable crops, likewise suffer. The arecanut is subject to the "Kole roga," "Anabe" and other fungus diseases while the cocoanut is subject to the ravage of the beetle and to "stem bleeding" and other fungus diseases. The coffee with its "black rot", stem borer and scale insects also suffers serious loss. Sandal constituting the unique forest wealth of Mysore is threatened with extinction by the "Spike disease." The fruits and vegetables have each their enemies which often work absolute ruin. A successful combating of these pests and diseases will mean, in many cases, the saving of the whole crop from destruction while in other cases, very material reduction of the loss.

Unfortunately, almost every one of these pests and diseases requires prolonged and patient investigation by well trained and highly qualified men before any reliable remedy, lying within the means and resources of the poor raiyat, can be recommended. Nevertheless, the Department has already a splendid record of achievements in this direction, which has meant material relief if not actual saving of the crops from wholesale destruction.

The remedy for the "Kole roga" of the arecanut for which the Mysore Agricultural Department was the first to devise a remedy and adopt it with success, forms really a splendid achievement. It has meant the salvation of the *malnad* garden-owner. It has been taken up by the bordering British district *malnad* areca tracts, which also thus share in the beneficial results of the work of the Mysore Department. When it is noted that there are at present more than 8,000 sprayers in use owned by the

garden owners of the *malnad*, it may be realised to what extent and how cheerfully the garden owners themselves have adopted the recommendations of the Department.

On the Entomological side many a cheap and inexpensive remedy has already been devised and put into the hands of the raiyat. The 'Kamblihula' campaign is the most notable; the raiyat has taken readily to this simple remedial measure and many a large tract in Shimoga, Chitaldrug and Kolar where the pest was working havoc has not only been cleared but the raiyats have been educated to know and to do what should be done when they are faced with an invasion by the pest. The case-worm of paddy, the sugarcane borer, the pulse beetles, and the coffee borer have also been handled successfully.

In the case of a serious pest on coffee—the coffee stem-borer—the aid of Legislation has also been sought. Were it only possible to deal satisfactorily with even a few of the more serious pests, a most material addition to production in the State can be assured. To take only one instance *viz.*, the cotton weevil, in field upon field it will be noted that not a single boll is free, sometimes one, sometimes all the four capsules will be attacked, the former resulting in shrunken and only half-opened bolls and the latter, in un-opened bolls. A cheap and satisfactory remedy means the increase in the yields by at least 50 per cent. It will be easy to give similar figures in respect of other crops, but the point hardly needs labouring.

*Increased money return to the raiyat*—Does the Mysore raiyat use such methods of cultivation and methods of preparing produce and grow such crops as will give him the highest money return to his labour? This may now be considered. This question relates firstly, to the best methods of preparing produce, such as sugarcane into jaggory, of the curing of tobacco, the curing of areca, coffee and cardamom, the preparation of butter and other dairy products; and secondly, the adoption of cultivation methods by which the expenses may be reduced without affecting the yield; and thirdly the growing of money-crops in order to give the raiyat the best money return for his labour and investment.

In every one of the methods of preparing produce indicated, there is such a difference between good and poor methods that the advantage of having raised a big crop at great expense may be completely neutralised by



poor methods of manufacture. Especially in the case of sugarcane, the full advantage of a heavy crop is seldom realised except in the neighbourhood of the Sugar Factory at Mandya; poor and inefficient mills are used, indifferent methods of boiling the juice are adopted over furnaces exceedingly wasteful of fuel, with the result that sometimes the jaggery does not set at all, or sets into a black and soft mass of low value. In the curing of tobacco too, while good methods turn the crop into the best priced commodity, poor methods convert the stuff into an article fit only for manure. Similar remarks apply to the other crops mentioned.

As regards the sugarcane, though the present iron mills are a great improvement upon the old wooden mills which have altogether gone out of use, they are not the best by any means even as bullock-driven mills go, while compared with even small power-driven mills, they are a long way behind. At present, only about 55 to 60 per cent of the juice is extracted; 60 to 65 per cent is easy with better bullock-mills, and 75 per cent likewise with small power-driven mills.

The Department is recommending the use of the Nahan, Madurai and other improved sugarcane mills which are better than the older ones and through extensive village demonstrations has succeeded in making them very popular. More than a thousand of these are now in use in the State sold through the Department of Agriculture. The "Madurai Mill" is the product of a local foundry owned by Mr. Madurai Mudaliar of Bangalore who has with the help and under the guidance of the Department of Agriculture succeeded in placing on the market this moderately priced but very efficient local substitute for the more costly imported ones. Installations of power-driven mills and large scale furnaces can be seen in the State in a few places on the larger holdings, but expansion here must be slow as it is dependent upon the growth of co-operative methods. There are now about 180 power-driven mills in the State. The jaggery boiling work is on the whole an operation in which the aid of the Department is frequently sought and very material assistance is rendered.

In the areca tract an imported areca drying apparatus and an adaptation of the same with local materials has greatly minimised the chances of deterioration of the produce and has rendered the drying practically independent

of the vagaries of weather conditions. In the methods of butter making again, local methods have been attempted to be replaced by the use of a cream separator and the barrel churn and in the first years of the campaign several such outfits were sold through the Department.

Changes in cultivation methods proper are about the most difficult to introduce, but even here, practices, such as economic transplanting of paddy and the planting of sugarcane in wider rows have been extensively adopted, with a very material reduction in the cost of seed and with an increased yield per acre also.

The extension in the area under money crops, both dry crops and irrigated crops, not only enhances the money returns to the raiyats, but also paves the way for the investment of funds whether from Government or private agencies upon irrigation schemes which otherwise would be considered unremunerative. Among irrigated money-crops, sugarcane and the mulberry rank foremost. The Department has, from the beginning been engaged in the extension of the cultivation of the sugarcane crop, distributing seed far and wide, establishing seed centres, excusing transport charges on seed sets, awarding money prizes, and so on, and thus introducing the cultivation in all suitable tracts, notably in the *Malnad*. With the extension of irrigation facilities consequent on the opening of the Irwin Canal and the starting of the Mysore Sugar Company the area has increased by more than 10,000 acres during the last five years.

The mulberry is Mysore's unique and valuable money-crop, and as a subsidiary occupation, the rearing of the silk-worm is a most important and lucrative industry. By methods much like those detailed above for sugarcane, the area is being steadily increased; a special section of the Department of Industries and Commerce looks after the interests of Sericulture; improvements in rearing and reeling methods, the evolution of new strains of worms, methods of combating disease in the worms and other matters are receiving attention. The supply of disease-free eggs on a large scale from Government grainages and farms, the designing of a domestic filature unit and the evolution of a cross-bred type of worm which yields a larger quantity of silk and also matures earlier than the local worm, may be mentioned as work accomplished so far.

A most notable money-crop in recent years is the groundnut which, from being a completely insignificant crop about 25 years ago is now grown over an area of 1,90,000 acres and is still on the increase.

For the extension in the cultivation of these and a number of other money-crops including fruits, flowers and vegetables we shall have to look to a larger and larger amount of propaganda technical advice, demonstration areas and other activities of the Agricultural Department. There need be no fear of Mysore not growing enough food because the money-crops are stimulated ; for even were food crop areas greatly curtailed the same quantity of produce may still be raised by improved methods of cultivation with better varieties and liberal manuring. The State has wonderful advantages in climate, soil, facilities of irrigation, knowledge of the technique of cultivation and a State Department composed of specialists and it will not be wisdom if these are not taken advantage of to raise the most paying crops.

Closely allied to this subject is that of the growing of fruits, flowers and vegetables not so much as field crops as of garden patches and as a subsidiary occupation. There is great scope for this side of Agriculture to be developed. If every backyard in the 17,000 and odd villages of the Mysore State should have one good fruit-bearing tree, a grape vine or a fig tree, a few papaya or even a few plantain trees, kept alive merely from the sullage of the houses, the State would produce fruits enough not only to sweeten the coarse and poor diet of the ordinary villager, but even to have a surplus for export ; and yet this is by no means impossible or difficult. Nurseries at convenient centres or at least on the Government Farms, an agency to supply the proper plants, to supervise and advise regarding manuring, pruning, and other technical matters will have to be organized if this object is to be secured within a reasonable period of time. Through the Department of Horticulture and Gardens, a beginning has already been made, much interest has been aroused in the planting of grapes and apples, mostly imported from Australia. A number of orchards have, in recent years, been started and the examples of the older ones among them which are paying handsomely is acting as a stimulus and an object lesson in and about Bangalore especially. The State, in addition, grants

special loans at a low rate of interest to those who propose to start such orchards; and applications for the grant of land for the purpose are also viewed favourably.

A most important subsidiary occupation which adds materially to the labour income of the raiyat is the breeding of sheep and cattle. It has already been pointed out that the climate, situation and other physical features of the State coupled with its tradition as a great cattle centre, give Mysore a most valuable advantage over the rest of South India. It may be further added that it will be generally found in the villages that only such raiyats as annually rear and sell a head or two of cattle, a few sheep or at the weekly fairs, some poultry and eggs, are those that command some ready money. Furthermore, the question of improved implements and the farming of larger areas with fewer men is intimately bound up with an improvement in the type of the farm bullocks. The State, no doubt, possesses the finest breeds of cattle in South India, but efforts have to be made to see that the number of these is so increased that every raiyat can afford such plough bullocks and that in time the scrub cattle of the country side give place entirely to the celebrated Mysore type. A large and steady supply of breeding bulls readily available at reasonable prices to the villagers, will automatically bring about the desired change. Efforts are being made by the Live Stock Section of the Department to utilise the Amrut Mahal or Government herd to meet the requirements of the situation.

Connected with the supply of breeding bulls is the question of fodder supply in the villages. Without an adequate supply of fodder, especially in the hot weather, we should never be able to sustain the progress of cattle improvement. Probably dire necessity, consequent on the shrinkage of the grazing area before the advance of cultivation, will force raiyats not only to reduce their scrub cattle but also to raise fodder crops. That, however, will take a long time to come. Meanwhile, enclosed fodder reserves, the raising of fodder crops and the system of ensilage making as a reserve of cattle feed that does not admit of being sold away or damaged by fire, will have to be encouraged by special measures.

The cattle breeding industry has, from time immemorial, been heavily handicapped by the prevalence of serious cattle diseases. The Rinderpest is the most serious of these, and, as a calamitous epidemic, is of

frequent and widespread occurrence. The losses due to mortality are enormous. Other diseases also take a heavy toll and one of the most important lines of State action lies along proper preventive measures against these epidemics. In the "Serum Simultaneous" and the Goat Virus methods of inoculation against the Rinderpest a satisfactory solution of this one problem at least is to hand and the Veterinary Department of the State has been conducting an intensive campaign of preventive work along this line. Mortality among cattle has been decidedly on the decrease and that through Rinderpest during the year 1935-36 was the lowest on record. In further suppression of this and other cattle diseases, will lie to a large measure the prosperity of this important industry of the State.

The improvement of local sheep has been attempted more than once by the Government. In the old days, Sir Mark Cubbon had a Government Sheep Farm on which local ewes were crossed with imported Merino rams. This Farm was later wound up. Cross-bred sheep are so vastly superior to their local parents that the improvement should be considered very material. Thus in regard to wool alone, first crosses give 150 per cent over the country parent per year, while the quality is very much superior. When it is remembered that such improvement can be effected in less than a couple of years, it will be realised how readily the sheep-breeding industry lends itself to improvement. Government, at present, maintains a small Sheep Farm, but the number of cross-bred rams it is able to supply is negligible. A small organisation of Sheep Breeders has also been working in conjunction with the Farm. But a great expansion is called for more especially as the prospects of gain both to the raiyat and the State, are not only substantial but almost immediate. Attempts are being made to popularise Bee-keeping and Poultry Farming.

Experiment, in the introduction of wool-goats such as the Angora, for crossing with local breeds is also worth considering, in view of what has been said about the hardiness of the goat in the country. Further intensive and sustained work to improve Live Stock Industry as a whole (the cattle, sheep, goats and poultry) is earnestly to be desired.

We next come to the safeguarding of the raiyats' efforts and earnings against exploitation, to his being helped to

obtain the working capital for his business at reasonable rates of interest, to his being able to buy and sell without paying anything more than reasonable charges for the services rendered, because the drawbacks that at present exist take away from the raiyats, in a great measure, much of the profits of his labour and cripple him seriously. State action in Mysore for affording credit to the agriculturist was set on foot in the year 1895 and it took the form of Agricultural Banks to which Government advanced loans to the extent of about 15 lakhs of rupees. Due to various causes, most of these banks had to be wound up, though a few lingered on for many years. Meanwhile, the Co-operative Credit movement took its place and the State fell into line with the British Indian Provinces in this respect and work has been carried on much on the same lines, and perhaps with results practically similar. Societies in the State are mostly banking societies, and the relief afforded to the cultivator falls far short of his requirements. The chief reason is the vast disparity between the huge indebtedness of the people and the slender finances of the societies. With the limited means at their disposal these institutions have helped the raiyats with working capital for the purchase of seeds and manures, bullocks, etc., at easy interest and for the length of a crop season or more in cases of crop failures.

Co-operative Societies for purely agricultural purposes such as Irrigation Societies, Jaggery Boiling Societies, Produce Selling Societies, etc., have also been tried, and although some of them have had to be abandoned there are still a few that are doing very useful work. The success of these will it is hoped act as an incentive for further efforts in this direction.

One noteworthy manner in which Co-operative Credit Societies have been associated with the Agricultural Department is in these societies taking up the sale of improved implements, seeds and manures, in the joint owning of cane-crushing mills and jaggory boiling pans.

Having thus indicated the lines along which Mysore Agriculture can be improved, we shall, in the next chapter, take up a description of the various agencies which are engaged in bringing about these results, their organisation, equipment, nature of work taken up and accomplished and their programme.

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## CHAPTER III.

**The Department of Agriculture and Allied Agencies.**

The Mysore Department of Agriculture had its beginning in the appointment of an Agricultural Chemist in the year 1899. This was in conformity with the ideas of scientific agriculture prevalent in those days especially with the recommendations which were made to the Government of India by Dr. Voelcker for the improvement of Indian Agriculture. The officer selected for that appointment was Dr. Lehmann M.A., B.S.A., Ph.D., The present laboratories and pot-culture house were designed and fitted up by him and the Hebbal Farm was also opened and laid out by him. He was also entrusted with the supervision of the chemical work of the Geological Department, the chemical assistants of that Department were placed under him and so was the laboratory of that Department which was the nucleus of the present buildings. An assistant for agricultural chemistry was later appointed and the staff of agricultural chemical assistants was later added to. It had however to be urged on the Government what indeed was realised from the beginning that the problems of Mysore agriculture were too complex for an agricultural chemist alone and that as a measure of immediate importance the services of a specialist in plant diseases should be secured. Accordingly in 1908 Dr. Leslie C. Coleman was appointed as Entomologist and Mycologist, with competent Indian Assistants. The Marthur Farm was opened during the period for experimental work on the "Koleroga" of the arecanut for which the present successful remedy was evolved. The term of engagement of Dr. Lehmann's services expired in 1908 when he severed his connection with the Department. In accuracy and thoroughness of work, in extreme caution in the drawing of conclusions, and in the scientific planning of the laboratory and field experiments with a view to arriving at results of undoubted reliability, Dr. Lehmann has left an indelible mark on the work and traditions of the Department. On Dr. Lehmann's retirement, two of the assistants were sent to Europe for advanced training, and this policy inaugurated then has

been steadily followed so that at the present time among the Departmental Officers, the Deputy Director of Agriculture, the Live-stock Expert, two Assistant Directors, the Mycologist, the Biochemist, the Vice-Principal, Hebbal School and a number of other officers have all received training in Europe.

It was only in the year 1914 that the Department was reorganised in something like its present form with Dr. Coleman as Director of Agriculture. It was at this time that a section for what is known as District Work *i.e.*, for advice and popularisation of improvements among raiyats was constituted, the State being divided into two divisions and placed under the charge of a Deputy Director and an Assistant Director with a small staff of Agricultural Inspectors. From this time onwards both the work, staff and equipment have steadily expanded. An Assistant Botanist, for work on plant breeding, was appointed in 1914 and the notable results achieved by this section even during the early years of its existence in evolving superior varieties of Ragi, Sugarcane and Cotton which are becoming increasingly popular all over the State, led to its expansion to its present strength with the Economic Botanist at its head and a number of assistants under him working on different crops. The Babbur Farm was opened in the year 1916 to serve the extensive black cotton soil tract of that part of the State and at the same time to serve the tract newly brought under irrigation under the Vani Vilas Sagar. The Nagenahally Farm in the Mysore District opened in the year 1917 for the trial and multiplication of varieties of sugarcane for the channel irrigated area of that District was later converted into the Paddy Breeding Station for extensive work on this important crop of this tract. A Kar Ragi Breeding Station was started at Hunsur in the Mysore District on the Coorg border for studying problems peculiar to what is known as the 'Kar' sown tract.

An Agricultural Engineer was appointed in 1915. The School of Agriculture at Hebbal was opened in 1913 as an institution giving a two-years' course, and was later on in the year 1920 reorganized and the course made into one of three years. Three Vernacular Agricultural Schools giving a one-year's course have been opened. Two of these—one at Chikanahally in the Tumkur District and one at Ramakrishnapur in the Bangalore District—are the result of private benefactions and the third owes its exis-



tence to the enthusiasm and enterprise of the Hassan District Board.

In the year 1920, a Live Stock Section was created and Mr. Davison was appointed Live Stock Expert. A Sheep Farm was also opened at Yelachihally in the Mysore District. Mr. Davison, however, resigned his appointment in 1925. In the year 1920 the Department of Sericulture was placed under the control of the Director of Agriculture and so was the Civil Veterinary Department. The former was however later transferred to the control of the Director of Industries and Commerce. In 1923, the Amrut Mahal Department was also transferred to the control of the Director of Agriculture.

In the year 1924, a well-boring section was organized and placed under the control of the Director of Agriculture. This Section was also transferred to the control of the Director of Industries and Commerce and later to the Bureau of Sanitary Engineering, Department of Public Health.

A detailed soil survey was conducted of a large tract of land (about 1,20,000 acres in extent) recently brought under irrigation by the waters of the Krishnaraja Sagara and to facilitate a proper study of the many problems connected with the development of this area the Irwin Canal Farm was started near Mandya in the Mysore District. The rapidity with which sugarcane cultivation has extended in this tract and the starting of the Sugar Factory are the direct result of the success of the experiments on sugarcane cultivation conducted on this Farm. Valuable and interesting results are expected of the work now in progress on several other crops.

The starting of the Coffee Experimental Station at Balehonnur in 1925 and the Cattle Breeding Station at Ajjampur in 1929 both in the Kadur District has facilitated greater attention being paid to the investigation of problems connected with coffee and cattle.

The Government Serum Institute at Bangalore started in 1927 has been supplying all the Sira and vaccines required by the local Veterinary Department for combating cattle diseases, selling its surplus at a small profit to several Departments outside the State.

The present composition of the Department of Agriculture in all its different Sections is given in Appendix 2.

The Department of Horticulture and Gardens, although closely allied to the Agricultural Department, is

an independent Department under the control of a Superintendent. The organization and the work of this Department are separately dealt with.

The Department of Co-operative Societies was constituted in the year 1905 and has since steadily grown. The movement is mainly a credit one and specially concerns rural credit. The work of this Department in respect of agricultural co-operation is also dealt with separately.

Mention should be made of the Agricultural and Experimental Union, which was started in the year 1918. The Union is composed of members who are actually in charge of cultivation of their land in strong contrast to the type of agricultural associations which were started in various parts of India, not excluding Mysore itself, and none of which led anything but a nominal existence. The Agricultural and Experimental Union of Mysore forms a link between scientific investigation and general agricultural practice. The new methods, new manures, new varieties of crop, etc., recommended by the Department, are first tested on trial plots on the holdings of the members about as accurately as on the Government Farms and on the successful results of these trials depends the popularisation of the same among the general body of agriculturists. It is an unique institution, based more or less on the model of the institution of similar name in Ontario, Canada. Under the auspices of the Union are published a quarterly Agricultural Journal in English with a very wide circulation both in India and other parts of the world and a Kannada Monthly whose circulation is practically confined to the rural parts of the State.

Mention must be made of the results accruing to Mysore Agriculture by the work carried on in the Palace Estates and Gardens Department, particularly in His Highness the Maharaja's Dairy Farm at Rayanakere, and the extensive orchards and gardens of His Highness the Maharaja in Bangalore and Mysore. The Rayankere Dairy Farm has been laid out and equipped with buildings and machinery on very efficient lines; fodder crops are raised on a large scale using large scale power machinery for the various operations, and silage and hay are made on a commensurate scale. The Dairy herd consists of Scindi cows which are being crossed with Holstein bulls. Half breeds of outstanding superiority over their Scindi mothers and vastly superior to the cows of the local breeds

are being raised to stock the Farm. The evolving of a suitable commercial dairy animal for Mysore which alone can lead to a Dairy Industry of any importance in the State, is the work that is being attempted on the Farm. The Farm and its dairy herd have aroused a great deal of interest among the prominent agriculturists of the State. Likewise the gardens and orchards in which many imported varieties of apples, peaches, grapes, guavas, oranges and other fruit plants, ornamental trees and shrubs have been got out and planted on a large scale not only form centres of great agricultural interest but are influencing greatly, though silently, the fruit-growing and horticultural interests of Bangalore. Many a foreign introduction of fruit and vegetable in Bangalore can be traced to these orchards, and the term "Rajamaharaja" applied to some of these varieties of fruits and vegetables in the city, is a synonym for choiceness of quality.

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## CHAPTER IV.

**Resume of work of Sections—A. Research.**

## 1. CHEMICAL SECTION.

The Section of Agricultural Chemistry may rightly claim to be the nucleus of the present Department of Agriculture, having been instituted as long ago as 1899 with Dr. Lehmann as the Agricultural Chemist in charge of all agricultural work with the help of an Assistant Chemist.

The earlier years were naturally taken up with equipping the laboratory and planning out small scale and large scale field trials with all the important crops of the State; and when in 1904 the Section was in full running order, it was felt necessary that Dr. Lehmann should be given more adequate assistance. The staff was therefore strengthened by the employment of post-graduate students firstly as probationers and finally as Assistant Chemists in the permanent cadre.

With the retirement of Dr. Lehmann in 1908, the post of Agricultural Chemist was abolished temporarily and the work was continued by the Assistant Chemists and Analytical Assistants till the reorganisation and formal constituting of the Department of Agriculture early in 1914. From 1914-19 the staff of the Section of Chemistry, now one of the several scientific sections, consisted of—

A Chemist for Agricultural and Geological  
Departments, and  
Three Senior Assistant Chemists.

The appointment of Agricultural Chemist was revived in 1914, but was not filled up till 1919 when Mr. B. Narasimha Iyengar, B.A., who had been sent to Germany for advanced training in Agricultural Chemistry in the University of Gottingen, returned after taking the Ph.D. degree of that University and was appointed Agricultural Chemist. Subsequently several changes were made



Pot culture house.

both on account of the changing conditions and the needs of the State ; and the present staff consists of—

One Agricultural Chemist,  
 One Bio-Chemist,  
 Three Assistant Chemists,  
 Three Analysts,  
 One Agricultural Inspector, and  
 a Fieldman attached to the Pot-culture House and for general assistance in field work.

It is to be noted that the Chemical work of the Geological Department was conducted in this section for over 25 years from 1899 to 1927.

This pleasant and helpful association had however to terminate as with increasing work and restricted space it was felt necessary for that department to have separate laboratory accommodation. New laboratories having been completed in 1927 the Chemical Section of the Geological Department transferred its work there.

The *work of the section* has been generally on the lines chalked out with considerable foresight by Dr. Lehmann who designed and fitted up the laboratories and the Pot-culture House, opened and laid out the Hebbal Farm for accurate manurial and other field experiments and inaugurated carefully planned laboratory and field investigations on almost all the pressing problems connected with our soils and crops. Additions and alterations have however been made in respect of certain details in consonance with recent advances in agricultural science.

In view of the increasing importance of a statistical control of field and laboratory trials, the lay out of experimental plots adopted in the beginning could not be considered sufficiently accurate and it was therefore so modified that plots are now laid down and results interpreted according to standard statistical methods.

The principal items of work carried out and the results obtained so far may be summarised as under :—

(i) *Development of Scientific manuring of crops.*—

Since manures play a very important part in the increase of agricultural production, a large part of the work of the Section has been in connection with the availability of various manures under local conditions of soil and climate and the manurial requirements of the principal crops of the State with reference to the soils on which they are

grown. The results obtained so far show that most soils in Mysore are deficient in both nitrogen and phosphoric acid and a dressing of nitrogenous and phosphatic fertilizers and manures is more often than not essential for a successful growth of crops. It is also found that ordinarily very good results are obtained when the ratio of nitrogen to phosphoric acid is 2 : 3

Except for commercial crops like sugarcane, the most economic dose for field crops like paddy and ragi seems to be about 15 lbs. of nitrogen and 25 lbs. phosphoric acid, supplemented with about two or three tons of cattle manure; when large quantities of green manure are applied as in the case of paddy fields only about 10 lbs. of nitrogen per acre seem to be sufficient.

Of the various forms in which the plant-foods have to be given sulphate of ammonia and oil-cakes have been found to be the best as sources of nitrogen and superphosphate as the source of phosphoric acid.

*Sugar-cane* has responded splendidly to artificial manures. A dose of three to four tons of farm yard manure supplemented with one or two cwts. of concentrated superphosphate per acre and seven to ten cwts. of sulphate of ammonia has raised the yields from 30 tons to 50 tons of cane per acre on good soils with good cultivation and timely irrigation in the Irwin Canal tract.

While response to nitrogenous and phosphatic manures has been satisfactory in the case of sugarcane, paddy and ragi, the response to the use of potash manures has not been very significant. Further experiments are under way on the Irwin Canal Farm, Mandya to critically examine the optimum potash level for crops and also to test the effect of potash fertilizers on the quality of crops—particularly in respect of sugarcane and tobacco. The Overseas Potash Syndicate, India, has been co-operating with the Section in conducting these trials.

*Coffee*.—Experiments conducted both on the Coffee Experimental Station Balehonnur and on some private Estates have established the fact that regular and adequate manuring improves the yield of coffee by over 50 per cent; differences in yield between the lean and the bumper years lessened; and the quantity of undeveloped and under-developed berries is reduced to a minimum. An annual application of 20 lbs. nitrogen, 30 lbs. phosphoric acid and 40 to 60 lbs. potash per acre has generally proved very successful.

It has also been found that for a successful growth of coffee, the reaction of the soil should be very nearly neutral and this is in agreeable confirmation of the Departmental practice of periodically liming of coffee soils.

Work on the nutritional requirements of coffee bush at different stages of its growth—from the opening of the blossom to the setting of the berries—has shown that a large amount of potash is stored in the blossom just before it opens and sets, thus emphasising the need for potash for a successful setting of the blossom with a moderate shower of rain. Further experiments are under way to study the time and the method of application of the requisite plant foods.

*Areca.*—Another important crop of the Malnad, *i.e.*, region of heavy rainfall is areca. By an application of artificials similar to coffee, it has been found possible to raise the yield of nuts from 20 to over 30 maunds per acre and it has also been found that when once a garden is brought into a good bearing condition by judicious manuring for about five or six years, the yields do not fall off even if application of artificials is omitted for a couple of years afterwards. Moreover it is seen that, provided the usual local practices of cultivation and mulching are kept up, an application of artificials in a prescribed dose, once in three years is not only adequate but maintains the trees in good condition.

The results of these various trials are embodied in a Departmental Circular on “Manurial Formulæ for the principal crops of the State”. The recommendations contained in the circular apply to average soils and normal conditions of climate and rainfall. Cases of difficulty and doubt requiring special treatment are however separately investigated and suitable recommendations made.

(ii) *Work on Animal Nutrition* carried out on the Palace Dairy Farm at Rayanakere has indicated that a mixed ratio of wheat bran and groundnut cake is very useful for young growing stock and that cake has some influence in hastening the maturity in heifers. Experiments on milch cows have indicated that a mixture of concentrated feed containing a certain amount of rice bran in it, maintains milk yield better than one without it.

(iii) *Investigation on “Spike” disease of Sandal.*—On and off for over 50 years attempts had been made by the Forest and the Agricultural Departments to enquire



into the causative factors of the Spike disease of Sandal—a disease which affects one of the most precious products of the State Forests and which has caused during this period a total loss of over a crore of rupees to the State, but it was only during the latter part of 1927 that a comprehensive scheme for an intensive study of the causes of the disease and of the preventive measures against its spread came into operation where each and every aspect of the subject—Chemical, Botanical, Mycological and Entomological—was worked out by a co-operative body comprising of all the various scientific sections concerned. This kind of organised team work was almost the first of its kind in India and has since been adopted all over the country for investigations of various kinds and varied order.

Chemically, the disease presents all the peculiarities of a virus disease having more starch, less total enzymatic activity and less total energy giving factors altogether. The disease occurs at all stages of the plant. But one redeeming feature in this chemical degeneration is that once the oil-giving heartwood has been formed, the disease, when it attacks such a tree, has no influence over either the quality or quantity of the oil obtained. Further more, no ordinary means of destroying the diseased tree alters the quality of the oil. Attempts are in progress to induce the disease by chemical means and to thus obtain measures of control in the same manner.

The scheme in its composite form has had to be suspended from 1st July 1934 due to financial stringency, but particular aspects of the subject like characterization of the virus, and chemical transmission are continuing to receive regular though necessarily slow attention.

(iv) *Use of indigenous plant substances as insecticides.*—The problem of providing cheap and efficient plant insecticides has always been a pressing one in India as owing to the general poverty of the raiyats the imported insecticides which are uniformly costly and often universally toxic cannot be advocated. Fortunately recent investigations all over the world have pointed to the fact that there are several plant substances which can be effectively used as insecticides. To such a group belong several indigenous plants often used as fish poisons by villagers which occur in large quantities in our State forests. Investigations were therefore undertaken jointly by the Entomologist and the Chemical Section five years

ago to classify the plants that were reported to possess insecticidal properties and to further examine in detail such of those which were available in abundance and gave also a large amount of toxic material. About forty different plant substances available in large quantities have been definitely found to be plant insecticides and work was taken on hand on a selected few of these plants to extract the active principle with a view to its large scale production. It was found as a result of this that several parts of the Hongey tree could act as efficient insecticides and that Hongey Oil could be successfully used in place of fish-oil resin soap, large quantities of which were hitherto being imported into the State. The co-operation of the Government Soap Factory has been obtained in the manufacture of this Soap so as to make it cheaply available in sufficient quantities to the raiyat population of the State. It is gratifying to note that the Hongey Oil resin soap is now being indented for from outside the State as well.

Till the beginning of the year 1936 this important work could be carried on only as part of the several activities of the Department and work had therefore to proceed at a fairly slow pace, but during the last two years work has gone on more briskly owing to the special staff detailed for this investigation with the help of a grant sanctioned for the purpose by the Imperial Council of Agricultural Research of the Government of India. Two plant substances—*Mundulea suberosa* and *Tephrosia candida*—are found to possess considerable insecticidal activity and have been examined in detail. A crystalline active material from the former and a highly active concentrate from the latter have been obtained. Large scale preparation of these substances so as to make them available to the raiyat at as cheap a price as possible is under examination.

(v) *An intensive survey of the Irwin Canal Area for growing sugarcane and other irrigated crops.*—A notable item of work conducted by the section is the intensive survey of a tract of land about 1,20,000 acres in extent recently brought under irrigation by the Krishnarajasagara. The object of the survey was to study the variations in the depth and nature of the soil and sub-soil with a view to demarcate areas suited for the raising of sugar cane and other valuable crops from those that were considered to be unsuitable for such crops. It may be

claimed that the rapid extension of sugarcane cultivation and the success of the Mysore Sugar Factory are in no small measure due to the preliminary survey of the tract and the experimental work on the Irwin Canal Farm specially started to study agricultural problems peculiar to this tract.

(vi) *Reclamation of alkali lands.*—The formation of the Irwin Canal and the consequent opening up of a vast tract of land in that area for intensive cultivation has brought forward the question of utilization of alkali waste lands which form an appreciable portion of that tract.

Effective draining of such soils is one of the methods adopted for this purpose. Besides these experiments have been laid out on the Irwin Canal Farm, Mandya, a typical part of this country, to reclaim alkali lands by the use of sulphur and sulphurous fertilizers on the one hand and by molasses on the other. The availability of this latter substance in large quantities and at a very low cost is an added advantage in the use of this reclaimant. Though these experiments have been under way for only two to three seasons, indications have been obtained to show that molasses can be successfully applied to reclaim 'alkali soils'. Where it was difficult to grow even a blade of grass two successful crops of paddy have been harvested.

As a result of these experiments a new set of large scale trials on approved statistical lines have been laid down and the results when ready are expected to throw further light on this important question in regard to the development of this tract.

Experiments on the use of molasses as fertilizer are also being conducted though indications are that the substance is of doubtful value in that connection.

(vii) *Economic utilization of Habitation and Agricultural Waste and preparation of Compost.*—During the last eight or nine years, the Mysore City Municipality has been utilising its street sweepings and night soil in preparing a highly valuable manure about thrice as rich in essential plantfoods as the ordinary farm yard manure. Encouraged by the success of this venture and with a view to meet part at least of the increasing demand that has arisen for organic bulk manures, the section has attempted to conserve all available sources of organic rubbish by converting it into an available form of manure. Composting is a well known process for such a result and of

several methods in use, two methods—the shallow pit method and the heap method—were tested on several of the Government Farms. From the results obtained it is found that Compost can be prepared successfully and at little cost by individuals as well as by organised units such as Village Panchayets and Town and City Municipalities. Its preparation and storage are cleaner than that of farm-yard manure. It confers a double blessing on the raiyat by improving the sanitation of his surroundings and adding to his stock of manure.

Further experiments are under way to study how and to what extent the nitrogen status of the finished product can be improved.

#### SUGARCANE VARIETIES AND MANUFACTURE OF JAGGORY AND SUGAR.

Besides experiments pertaining to manurial requirements of sugarcane referred to above, the following other problems on sugarcane varieties and manufacture of Jaggory and Sugar have been under investigation :—

(a) Composition of different varieties of sugarcane—indigenous and imported and seedling canes evolved by the Economic Botanist.

(b) Effect of planting cane at different seasons on the period of growth and maturity.

(c) Losses of sugar occurring in boiling the juice into jaggory and means of minimising them.

(d) Preparing clean jaggory, Mogadam sugar and white sugar by the open pan method.

The results may be summarized as under :—

Of the indigenous varieties of cane grown in the Province, the Pattapatti or the striped cane is found to be the best, yielding a very rich and pure juice containing over 20 per cent of sucrose and less than 0·5 per cent of glucose. Several of the seedling canes evolved by the Department on the Hebbal Farm have been found to be superior to Pattapatti in respect of several agricultural qualities such as vigour, yield and adaptibility to varying soil and climatic conditions and quite equal to Pattapatti in richness and purity of their juice. H.M. 320 and H.M. 553 are the two best known among these seedlings which have displaced the local canes on thousands of acres all over the State.

Two among the seedling canes evolved by the Imperial Sugarcane Expert at Coimbatore—Co. 290 and

Co. 281, have also been found to be very well suited to some portions of the sugarcane area in the State. The season of planting has a great influence not only on the yield of canes, but also, on the quality of juice obtained from it. The results of experiments conducted on the Hebbal Farm during the earlier years of this investigation had shown that cane may be planted from November to March or April without in any way affecting the yields or the quality of the juice. Recent experiments on the Irwin Canal Farm have shown that so far as tonnage is concerned H.M. 320 cane can be planted throughout the year except in the summer months of April to June and is therefore superior to most other canes in that locality. It is however found that H.M. 320 cane planted in the first half of the year matures in  $11\frac{1}{2}$  to  $12\frac{1}{2}$  months after planting and has poor keeping quality on the field after maturity that is to say should be harvested as early as possible after maturity to prevent deterioration and loss of sugar.

On the other hand the same cane planted in the second half of the year matures in  $12\frac{1}{2}$  to  $13\frac{1}{2}$  months and keeps thereafter on the field for over six weeks without much deterioration. In view of the admitted importance of this factor in any planting programme, both from the point of view of the agriculturist and that of the sugar manufacturer the results are being further critically examined; and comparative studies with other canes are also undertaken to ensure correctness of interpretation.

Investigation into local practices of milling showed that, fully  $\frac{1}{4}$  to  $\frac{1}{2}$  of the quantity of juice contained in the cane was left behind in the begasse. This led to the introduction of a new type of Cattle Mill the Naham Mill of the Punjab and the Madhurai Mill of Bangalore for the small land-owner and a Power Mill from Glasgow for large sugarcane growers like Mr. N. Krishna Iyengar of Oorgahally. Till very recently most of the cane grown in Mysore was being milled for the preparation of jaggory. Even to-day more than 60 per cent of the total crop is being converted into jaggory and to a small extent into local 'mogadam' or rubbed sugar.

Experiments on the manufacture of cream and clean jaggory by using activated carbon from vegetable matter (paddy husk for example) were started recently and have given very encouraging results. The jaggory obtained is of a very superior type with a pale cream to yellowish

cream colour and likely to fetch a better price than the best jaggery so far produced by the raiyat. The yield of jaggery is also quantitative, recovery being nearly 96 per cent of the possible factor. Arrangements are being made to popularise this method of making jaggery by intensive propaganda and demonstration. A few qualitative studies on the keeping quality of jaggery has again emphasized the proper neutralization of the juice in as much as jaggery from both underlimed or overlimed juice has poor keeping qualities, the former being highly hygroscopic and the latter becoming progressively discoloured.

Attempts were also made during the early years to prepare clean white sugar straight from the juice using the open pan system and a centrifugal. Unfortunately with the mechanical appliances then available, the recovery of sugar being but 8 to 9 per cent against 18 to 20 per cent of jaggery was hardly encouraging to admit of further progress. Recent advances elsewhere in India in this direction have been so convincing that the question of direct sugar making of the open pan system wherever factory facilities are wanting or cannot be afforded is again engaging the attention of the Section.

#### DEMONSTRATION OF RESULTS OBTAINED.

The work of demonstrating results of investigations is ordinarily entrusted to the district staff—Agricultural Inspectors and Fieldmen under the control and general guidance of the Officers in charge of the circles. In the case of manurial experiments, results obtained in the Pot-culture House and Experimental Farms are tested further on private lands in selected localities before they are handed over to the district staff. The members of the Agricultural and Experimental Union have always taken an active interest in these large scale trials.

Of the many trials conducted in this way on private lands, two instances deserve special mention as showing what scope there is for scientific manuring in increasing food production and how an enterprising capitalist land-lord can help his tenants to get higher yields from his lands, thereby benefiting himself and his tenants as well.

One item of this work was in connection with paddy manuring in a locality under the Krishnarajasagara where it is difficult to get either cattle manure or leaf manure.

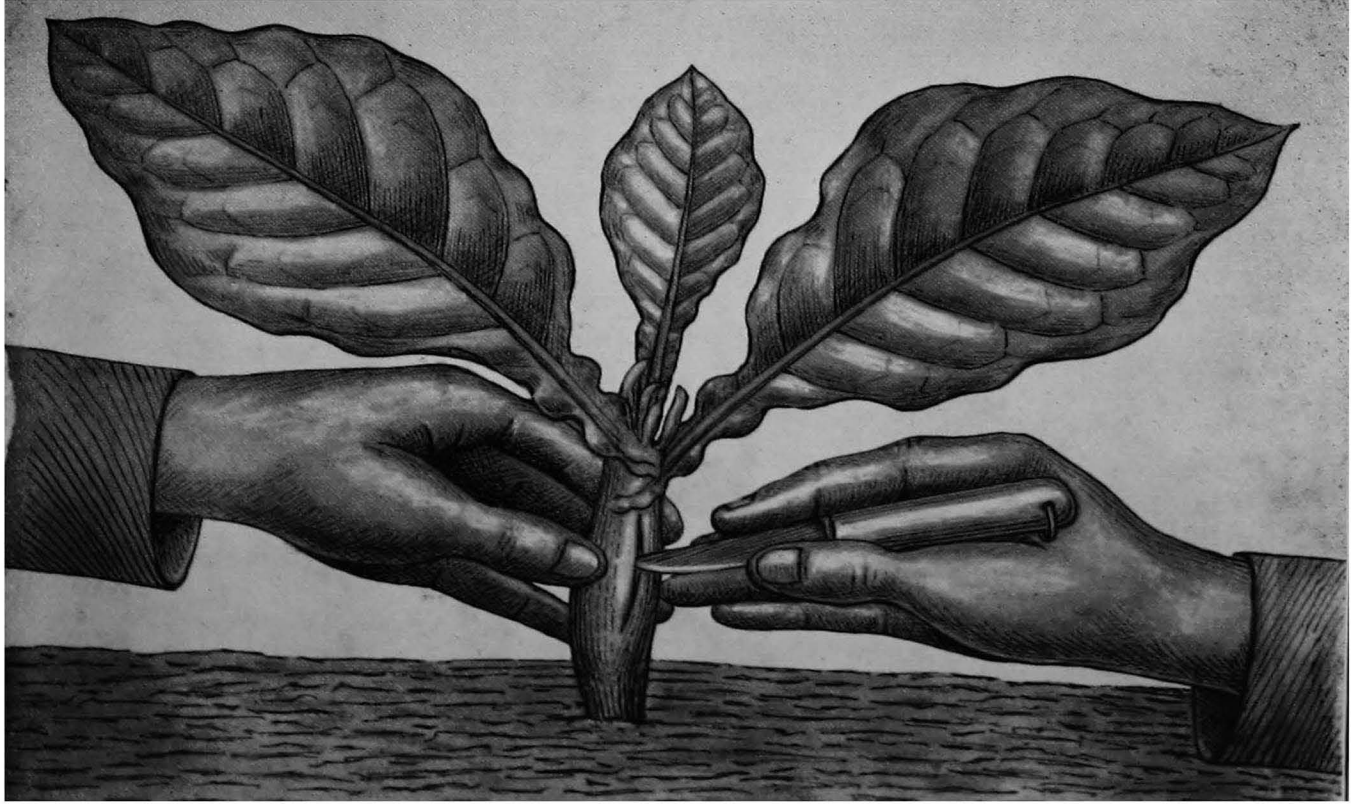
The experiment was made on 27 acres of land all in one block and cultivated by about a dozen tenants on "varam" or 'share' system. The average yield per acre before the application of artificial manures was about 235 seers of paddy per acre or 6,400 seers for the whole area. During the very first year of an organised application of manures consisting of a mixture of oil-cake and superphosphate the yield actually trebled itself and went up to 19,400 seers or very nearly 720 seers per acre with corresponding increase of straw as well. During the second year the total yield was 25,186 seers or nearly 933 seers per acre.

The second item of work relates to sugarcane experiments conducted on 9½ acres of land near Bangalore, cultivated on the 'varam' system by 33 raiyats. In addition to the usual dose of farm-yard manure and oil-cake, the whole area had been manured with superphosphate at the rate of 350 lbs. to the acre and sulphate of ammonia at 250 lbs. to the acre. The yields in former years without the use of artificial manures used to vary between 150 to 250 maunds of jaggory per acre whereas during the first year after the application of artificials the yields varied between 280 to 450 maunds per acre and the average from the whole area was about 370 maunds to the acre.

It is however to be noted that these are two rare instances in which a land-owner has co-operated with the Department to try out the results of experiments obtained on Experimental Farms on a large scale on private lands at his own expense. The pace of agricultural improvement in the State would be considerably accelerated if more and more of the comparatively well-to-do among our agriculturists co-operate with the Department in conducting similar trials on their own lands and thus not only convince themselves but become centres of organized agricultural activity.

## 2. THE ENTOMOLOGICAL SECTION.

This section of the Department was started in the year 1908 with the appointment of Dr. Coleman as Entomologist and Mycologist and Mr. K. Kunhi Kannan, as Assistant with two fieldmen and a laboratory man. In 1911 an additional Assistant was appointed and a teaching Assistant in 1913. With the organization of the Department in its present form in 1914, Dr. Coleman was elevated to the position of Director of Agriculture



**Tobacco stem borer.**



and the Entomological work was almost entirely under the direction of Mr. K. Kunhi Kannan, Senior Assistant Entomologist. In 1920 this Officer was deputed to visit important Entomological Laboratories of Egypt, Europe, the United States of America and Japan. He did, in addition, entomological research in the Stanford University of California, for which he was admitted to the degree of Ph.D. After his return he was appointed as Entomologist. In August 1931, on the demise of Dr. K. Kunhi Kannan, Mr. T. V. Subramanyam the then Senior Assistant Entomologist was appointed as the Entomologist. The Section now consists of the Entomologist, one Senior Assistant and two Junior Assistants, seven field-men and one laboratory man.

Pests are selected for study in the order of their importance and intensive investigation is undertaken till a remedy is found. In devising a remedy, the aim is steadily kept in view that it should be simple and within the means of the poorest raiyat. The abundance and cheapness of labour in the villages is not lost sight of.

Several of the following remedies devised in the Section will bear out the principles enunciated above. They are, all of them, original and recommended for the first time by this Section.

**Hairy Caterpillars (*Amsacta albistriga* Wlk).**—A serious pest destroying the seedlings of most of the dry crops in three of the Districts of the State. The caterpillars pupate in the fields beyond the reach of improved ploughs and the moths emerge after each shower of the first six weeks of the monsoon. The remedy recommended is the following :

The moths which are white and sluggish are collected by village children and destroyed. Each female moth being capable of producing a thousand caterpillars, the collection effectually prevents the out-break. (Original). Campaigns for collection of moths in the affected villages during the monsoon season organised by the Section with the help of several Village Panchayets of the area, have been very effective in checking the severity of the pest.

**The Rice Case Worm (*Nymphula depunctalis* Guen).**—A serious pest of rice, particularly in the malnad parts of the State, is amphibious, and this feature has been taken advantage of in devising a remedy which consists in placing a rag soaked in kerosene at the place where water

enters the field. The kerosene film so produced kills the caterpillars when they are disturbed on to it. (Original).

**Ground Beetles** (*Gonocephalum hofmannseggi* Stev).—The larvæ of these are root feeders of several cereals and potatoe and cause serious damage in certain years. Fresh roots of grasses pulled out are placed about the field and the adults attracted are gathered and killed. This attraction to roots has been confirmed by investigators in Russia of an allied species. (Original).

**Pulse Beetles.**—These attack stored pulses and cause serious damage. It was found for the first time that adults come to the top surface of the pulses for purposes of copulation and egg laying. A layer of sand one inch thick on top of the seeds will allow the beetles to pass to the surface but they fail to get back to the seeds and so die without laying eggs. The pulses are thus saved. The withdrawal of the pulses is through a hole in the bin at the bottom. This remedy dispenses with fumigation with poisonous or inflammable chemicals. The sand-layer method has recently been found to answer equally well, on a small scale, against other store beetles (*Tenebrionidae*) affecting some cereals like ragi. The powder obtained from the stem and root bark of *Mundulea suberosa*, a shrub growing extensively in the State forests in some dry parts of the State and one of the many vegetable fish poison plants that are being tested in the Section for their insecticidal value, has lately been found to kill the pulse beetles outright, in less than 24 hours, when spread as a thin layer on the top of infested grains in any receptacle. Further infestation of the grains is also thoroughly prevented. (Original).

**Sugarcane Borers.**—(*Argyria sticticrasis* Hmp and *Diatroea venosata* Wlk). The caterpillars boring into young shoots are reached with difficulty. The moths have, however, been successfully attracted to small heaps of cane-trash placed in the cane field which at the time of visit of the moths are usually bare of vegetation and afford few hiding places during the day. The moths are easily collected by children and destroyed. The collection has to continue for about two months and will not cost more than Rs. 2 per acre. This method is especially valuable for control in small plots. (Original). (Account published in the *International Sugar Journal*, January 1923.)

Effective cultural methods of control, namely earthing up of the soil along the rows of young cane introduced by the Entomologist and Mr. C. V. Ramiah, Superintendent, Irwin Canal Farm, Mandya, and removal of the first leaf sheath in young cane, have been lately developed. Earthing up has been found to be a very effective cultural method for controlling the pest. About 1,900 acres of cane in Mandya and Maddur Taluks were saved from borer attack by these methods during the year 1935-36.

A biological method of control of cane borers, by means of mass production of an egg parasite (*Trichogramma minutum* Riley) of the borer moths and its liberation in the fields, was taken up first in 1931. Preliminary experiments with methods of rearing the parasite on a suitable laboratory host was started by the late Dr. K. Kunhi Kannan and the methods were further developed later by Mr. T. V. Subramanyam and liberation of the parasite on a small scale was done in the Irwin Canal Farm near Mandya for a period of three years; the results obtained were so encouraging that a special parasite laboratory for the sole purpose of mass production of *Trichogramma* was established by the Government in 1935-36 at Mandya where the Sugar Factory is situated. Parasite liberation was then undertaken on a field scale and during the summer of 1936 about 40 acres of young cane were covered with the egg parasites, the benefit derived by the liberation of parasites has been evident in the increased tonnage in cane yield varying from 2 to 8 tons per acre. The Sugar Company has this year contributed some funds for extending the equipment of the Parasite Laboratory, so that the out-put of parasites can be doubled and large areas of the Company's sugarcane can be covered with the parasites in addition to treating raiyats' cane in the Mandya and Maddur areas. More than 200 acres of young cane have been treated with the parasite during this summer 1937. A good number of parasite egg cards were sent on request to the Sugarcane Borer Entomologist of the Imperial Council of Agricultural Research for trial against the cane borers at Cuttack.

**Lime Tree Borer (*Chelidonium cinctum* Guer).**—Adult beetles emerging in May, lay eggs in the fork of small twigs. The larvæ emerging, girdles the twig to cut off the sap and then goes into the twig where it remains for a month or more before descending to the main tree. The girdled twig which dries is conspicuous and breaks off

easily. The remedy consists in breaking off the twigs in time by means of a forked stick. The twig is caught in the fork of the stick and the stick is given a sharp turn when the twig breaks off. (Original).

The Orange Borer in Coorg considered for many years as a different species has been found by this Department to be identical with the lime tree borer and therefore susceptible to the same treatment.

The Rice Grasshopper (*Heiroglyphus banian Fab.*)—A pest on paddy and sugarcane in certain parts of the *malnad* and Mysore. The eggs are laid on the bunds in which the young remain for a few weeks. The insects are then caught in bags swept over the bunds. (Cost about Rs. 4 per acre).

The Jola Grasshopper (*Colemania sphenarioides Bol.*)—A serious pest on Jola and allied crops in certain parts of Shimoga and Chitaldrug Districts. Eggs are laid in the fields and the hoppers emerging from them feed on the young crop. They are caught in bags swept over the crop. (Cost about Rs. 4 per acre).

A hopper dozer, specially devised to suit field and soil conditions, has also proved to be very effective in trapping the grasshoppers.

Green Bug on Coffee (*Coccus colemani Kann.*)—A serious pest of coffee in years of drought. Controlled by spraying hongey oil resin soap when bugs begin to multiply. Till about 1931 the material commonly used for spraying plants against sucking insects like the coffee green bug, mealy bug and aphid (plant lice) was fish oil resin soap; this soap was first prepared at the instance of this Section and according to the formula given by it. The Madras Fisheries Department sells this material even now extensively all over India and Ceylon. Later, however, as a result of investigation into the insecticidal nature of certain indigenous plants, a soap was prepared from Hongey Oil, derived from the seeds of the Hongey Plant (*Pongamia glabra*) and was found to be a very effective substitute for fish oil soap; the hongey oil soap has the further advantage of not possessing the objectionable odour of fish oil. The Government Soap Factory at Bangalore has been regularly preparing large quantities of this soap and tons of it are being sold every year to the coffee planters and orchardists all over the State.

The Avare Pod-Borer (*Adisura atkinsoni M. O.*)—The caterpillar bores into pods of *Dolichos lab-lab* and causes

much damage estimated at several lakhs of rupees annually. The few moths which appear about the time the young pods appear on the crops, lay eggs on them and so start the first generation. Village children rub off these eggs from the pods and kill the caterpillars twice at an interval of a week. Damage is thus very much reduced.

A dilute solution of Bleaching Powder with some cheap sticker added, has been successfully tested against this and other borers of Lab-Lab. The solution sprayed on to the blossoms and young pods prevents oviposition by the parent moths; the pods and blossoms remain unharmed and develop normally. This remedy has not yet been recommended for general adoption. (Original).

**The Jola Ear-Head Fly (*Contiarinia andropoginis* Flt).**—These minute flies lay eggs in the developing grains of jola and so destroy them. A broad piece of cloth about two or three square yards covered with a mucilaginous substance is carried as a canopy over the crop and the crop is shaken. The flies which usually oviposit in the mornings are then disturbed but on flying upwards are caught in the mucillage and killed. (Original).

**Coffee Borer (*Xylotrechus quadripes* Chev).**—A serious pest of coffee, tunnelling the stems and causing damage extending to several lakhs of rupees in the State. Adults emerge during October to December. A 10 per cent emulsion of coal tar distillate of high boiling point or of wood tar distillate, has been tested as a stem wash with good results; the main stems of affected coffee plants are swabbed with emulsion during the month of October when egg laying by the parent beetles and tunnelling by very young grubs under the bark commence. The eggs and young borers are killed by the emulsion. The cost of the treatment works out to Rs. 6 to 8 per acre, depending on the age of the plant. This remedy has now been taken up widely by the coffee planters in Mysore. (Original).

**Coffee Berry Borer.**—A very thorough search for *Stephanoderes hampei*, a very serious coffee berry borer of Java, which was suspected to have been introduced into India in the early part of 1930, was made in all the coffee growing areas of Mysore. (The services of an Officer of this Section were lent to the Coorg Government for investigations in Coorg in this connection for a period of four months.) The investigations indicated that *S. hampei* is not present in the coffee areas and curing centres. Numbers of suspicious looking borer beetles

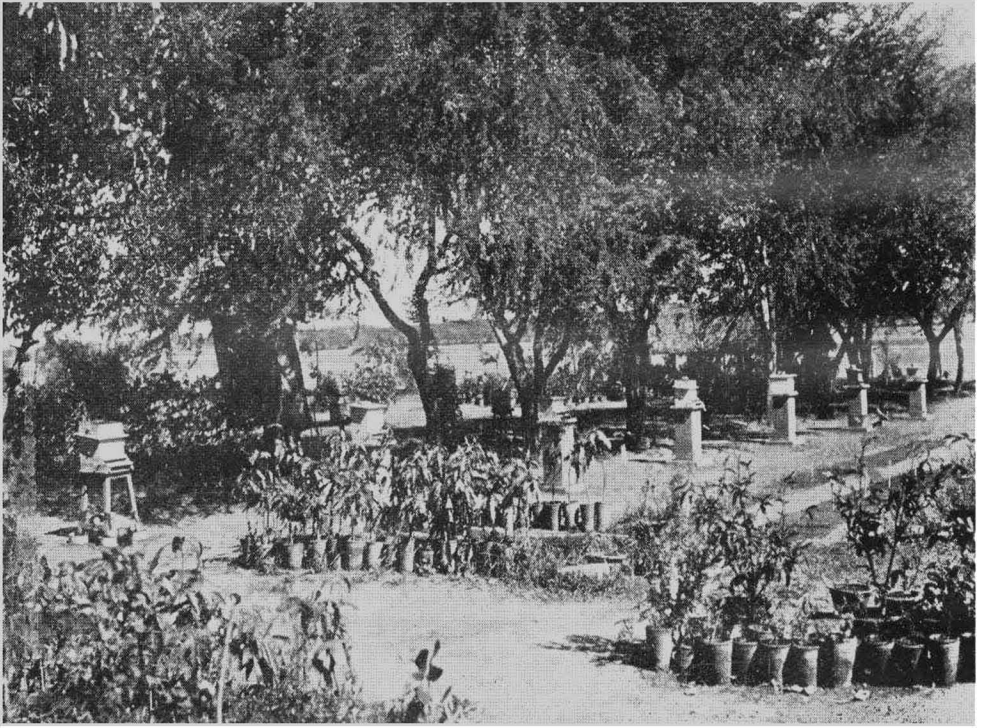
were sent to the Imperial Institute of Entomology for definite identifications. In 1935 the identifications were received here and not one beetle collected on coffee in the field and in the stores, proved to be the dreaded *S.-hampei*. Other berry borers are present here but they have been found to be of minor importance.

**The Potato Epilachna (*Epilachna 28-punctata Fabr.*)**.—In recent years this beetle pest of potato has assumed considerable importance and large areas of potato are affected in the districts of Kolar and Bangalore. Spraying the crop with calcium arsenate was demonstrated in all the areas and now the cultivators have taken up spraying as a regular seasonal operation and during the years 1934-36 about 310 lbs. of calcium arsenate have been sold out in the several potato growing areas.

**Cockchafer Beetle (*Holotrichia serrata F.*)**.—A serious pest of sporadic occurrence affecting the roots of sugarcane, potato and other vegetables and seedlings of fruit and ornamental flower plants and plantation crops like areca and coffee. They are controlled by treating the soil with a dilute solution of a cold emulsion of carbon-disulphide; while the insects are killed, the roots remain unaffected. (Original).

**Jasmine Blister Mite (*Eriophyes Sp.*)**.—A serious trouble affecting Jasmine over large areas in Bangalore and Kolar Districts; dusting finely divided sulphur recommended by the Section, has been adopted by a number of flower gardeners and very good control has been obtained.

**Vegetable Fish-Poison Insecticides.**—In January 1935, the Imperial Council of Agricultural Research sanctioned the scheme worked out by late Dr. K. Kunhi Kannan for investigation into the insecticidal value of vegetable fish poisons and other forest products; a special staff of one Junior Assistant and one maistry and one fieldman sanctioned under this scheme, is also attached to the Section and is working under the guidance of the Entomologist. Out of about 40 plants and parts of plants tested, the extracts made out of the seeds of some species of *Tephrosia*, particularly, *Tephrosia candida* and *Tephrosia villosa* are found to have as effective an insecticidal value as that of Nicotine sulphate which is a standard contact insecticide. A plant of great insecticidal value namely *Derris elliptica* has been imported as an important supplement to the indigenous plants; cuttings received from Java have given



Hebbal Apiary.

rise to luxuriant growth of plants not only in Bangalore but outside as well. Powders and extracts derived from this plant are also being tested.

*Bee keeping.*—Bee-keeping on improved lines has made considerable progress during the last ten years. Nearly 150 improved bee-hives have been distributed all over the State. Advice and other help needed by parties are freely given and occasional supervision also undertaken. Special classes in practical Bee-keeping are held every year in the Entomological Laboratory.

Numerous enquiries and demands for help from individuals and institutions interested in Bee-keeping are received from outside the State.

*The Gochineal insect.*—The cochineal insect imported into India from Ceylon for the first time in 1927 by the late Dr. K. Kunhi Kannan was first multiplied in the laboratory and on a few pear clumps in the proximity of the Lal-bagh; later a widespread introduction of the insect to parts of the State where the weed is present was undertaken. The destruction of prickly pear by the insect has been remarkably thorough and large areas originally thickly covered by the weed, are now free and under cultivation or otherwise utilised.

#### DISCOVERY OF THE PRESENCE OF LANTANA SEED FLY IN INDIA.

The presence of this fly in India was not known till 1934 when, following the several unsuccessful attempts made by the Section in the past to introduce the fly, well known to be a very powerful destructive agent of Lantana in Hawaii Islands, consignments of Lantana berries were obtained from a number of places all over India and from Burma and subjected to a thorough examination; it was found that most of the consignments revealed the presence of the fly; but the percentage of fly infested berries was so low that any marked benefit from the work of the flies in killing Lantana could not be expected. The causes, however, that have kept this fly in check in India are not yet fully known.

*Sandal Spike Investigation.*—A survey of the insect fauna of Sandal was made for a period of five years and the periodicity of occurrence of the Sandal insects was definitely ascertained. Some selected species of insects (bugs—*Homoptera*) were fed on infected Sandal and then confined on healthy Sandal for varying periods



and during different seasons to get at the real transmitting agent if any. But no definite results could be obtained. Several seedlings treated with infected insects are still under observation.

The following pests are also being investigated;— although the work has not progressed sufficiently to suggest any remedial measures:—

- (i) Cotton stem Borer beetle.
- (ii) Mango hoppers.
- (iii) Paddy stem borer.
- (iv) Beetle-vine earth-worm.
- (v) Plantain sucker Weevil.
- (vi) Shot-hole borer of coffee.

In addition, the following subjects of scientific interest are being investigated when time can be spared from other work of a more urgent character.

- (i) The suctorial apparatus of Homopterous insects.
- (ii) Strepsiptera. (A group of interesting parasites on certain insects.)
- (iii) Aphididæ of Mysore. (The group of plant lice of economic importance.)

Bee-keeping as a cottage industry is receiving greater attention every year. The introduction of suitable plants yielding honey in areas where such are not found to exist or exist in insufficient numbers will be part of apicultural work. One such plant has already been introduced from America.

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### 3. THE MYCOLOGICAL SECTION.

The Mycological work of the Department commenced with the appointment of Dr. Coleman as Mycologist and Entomologist in the year 1908. Towards the end of this year one Assistant Mycologist was appointed. With the reorganization of the Department in 1914 with Dr. Coleman as Director of Agriculture, the post of Mycologist and Entomologist was abolished, the Mycological work being done by a Senior Assistant Mycologist and two Junior Assistants, one of whom had to do the teaching work in Elementary Botany and Mycology in the Hebbal Agricultural School. The late Dr. Venkata Rao was deputed to Europe and America in 1919 for advanced training. He returned in the year 1922 after having taken the Cambridge University Diploma in Agriculture, and the Degrees of M.Sc. and Ph.D., of the University of California and was appointed as Mycologist in 1923. The late Dr. Venkata Rao was appointed as Deputy Director of Agriculture to the newly formed Coffee Circle in April 1930 and Mr. M. J. Narasimhan was appointed as Mycologist. The staff at present consists of the Mycologist, a Senior Assistant Mycologist, two Junior Assistant Mycologists and field staff.

With the appointment of Dr. Coleman as Mycologist and Entomologist, the private laboratory of the Agricultural Chemist was rigged up as a Mycological laboratory and accommodation soon became insufficient. The grant of some funds out of the Sandal Spike Investigation Scheme enabled the Department to put up a new laboratory to accommodate the Mycological and Botanical Sections and the Artists. The new laboratory was occupied during October 1929, and the old one made over to the library.

The work of the Mycological Section has consisted of two different types of activity (a) the actual investigation of diseases including their causes, the conditions under which they become prevalent and the means for their control and (b) the organization of practical control measures in the field. In this connection it is pleasing to

note that this Section has been directly responsible for the establishment of two farms of the Department, *viz.*, the Marthur Farm for the investigation of the diseases of arecanut, more particularly the Koleroga, and the Coffee Experimental Station, Balehonnur, for the investigation of the diseases of Coffee and the organization of practical remedial measures, especially for perfecting the technique of spraying and spraying machinery. The appointment of a Special Officer, Mr. W. W. Mayne, by the United Planters' Association of Southern India to work in co-operation with our staff on the Coffee Experiment Station from October 1928 has greatly helped work in the Coffee Experiment Station.

### Investigation.

The main lines of investigation undertaken by the Section are as detailed hereunder together with the results so far obtained:—

The work of outstanding merit has been:

(1) The discovery of the organism causing the Koleroga of areca, and the working out of its complete life-history.

(2) The study of "Anabe-roga" of areca and cocoanut palms.

(3) The study of coffee diseases and the technique of spraying.

(4) The discovery of intra-cellular bodies in the Spike disease of Sandal.

*Koleroga of Arecanut.*—This disease is caused by a fungus called *Phytophthora arecæ* first described from this laboratory. It causes a nut-fall and bud-rot of the palms. The same or a similar disease has been found on quite a large number of secondary hosts present in the neighbourhood of areca gardens. A closer study revealed the existence of at least two different strains of this fungus present on different hosts. It has been found that for the production of the perfect stage or oospores or sexual spores which tide the fungus over the hot weather, the mixing of these two strains is necessary. This phenomenon is known as heterothallism. The discovery in the Mysore Strain of Chlamydospores or vegetative resting spores, which are also capable of tiding the fungus over the summer months, has dispelled the doubts that existed at one time that the Ceylon and Mysore strains may be different ones.



Areca spraying.

Other work of importance in connection with this disease has to do with improvements and cheapening of the spray mixture used including the adhesive, which helps to stick the mixture to the nuts during the heavy monsoon rains and improvements in the spray nozzle which will enable a more economical and effective application of the spray. The sprayer used in this work, *viz.*, the one-gallon pneumatic Sprayer manufactured by Gebruder Holder, Metzingen, Germany, was first introduced into India by this Department. About 6,000 one-gallon sprayers and 1,000 two-gallon sprayers have been sold so far by this Department.

#### **Anabe-roga of Arecanut and Cocoanut Palms.**

This disease is due to a fungus called *Ganoderma lucidum*. It causes a root disease of the palms, and in the cocoanut especially is accompanied by a heavy bleeding of the affected palms which has led to some confusion, because there is another Stem-bleeding disease of the Cocoanut which is not so serious in that it rarely brings about the death of the affected tree. The work done here shows that this fungus is a very slowly active parasite. The fungus has been known to secrete the enzymes diastase, laccase, invertase, protease, coagulase, rennetase and oxidase but does not secrete maltase, lipase and catalase. It grows best at P.H. 6.5, but is capable of growth between P.H. 3.0 to P.H. 7.0, and increases the initial acidity of the solutions. Field experiments have shown that the application of sulphur dust to the soil round about the palm has a beneficial effect in controlling the disease.

#### **Coffee Diseases.**

Black-rot or Koleroga of coffee caused by *Corticium koleroga* (Cooke) von Hohn. has two distinct developmental stages, *viz.*, the early pellicle stage, and a late sclerotial stage. The basidiospores occur on the pellicle stage, and the basidia bearing mycelium is more whitish and brittle than the sterile stage. Bridging hyphæ and anastomoses have been observed. The fungus penetrates into the leaf during the late sclerotial stage and induces a blackening of the leaves presumably by the secretion of an oxidase.

The teleutospores or the resting spores of the coffee leaf disease or rust were independently discovered here

recently and their germination studied. Mr. Mayne, Scientific Officer of the U. P. A. S. I., has investigated the seasonal variation of coffee leaf disease and the conditions under which the disease spreads and his studies have given valuable information as to the time when spraying must be done to give satisfactory results. He has likewise established the existence of three different physiological strains of the leaf disease fungus, each behaving differently on certain varieties of coffee. It is believed that a study of the inheritance of resistance of coffee to these three strains of the fungus will lead to the establishment of a variety of coffee resistant to leaf disease.

The die-back of coffee and stump rot are other diseases receiving attention.

Another aspect of this work that is being carried on at the Coffee Experiment Station, Balehonnur, lies in the testing of different types of sprayers and different spraying materials. The D. S. P. sprayer, a double-suction pump, has become a favourite with coffee planters and the success of its work has led to its manufacture by local mechanics. In the question of adhesives it has been found that although resin-soda is a very good adhesive, it is not popular because of the trouble involved in its preparation. It was soon replaced by casein and latterly vegetable oils like linseed oil, groundnut oil, gingelly oil and honge oil have been found to be very good as spreaders. The importance of the oils lies in the fact that they also act as fungicides to a certain extent. The addition of molasses to Bordeaux mixture as a sticker has met with some amount of success.

### **Spike Disease of Sandal.**

Earlier studies of this disease revealed definitely that it could be communicated to healthy plants by grafting. It was also shown that healthy plants attaching themselves to diseased plants by their haustoria in the roots could become infected. The recent discovery of intracellular bodies in the cells of leaves attacked by the disease marks a distinct step forward, as it seems quite definitely to connect this disease with a number of virus diseases under study in Europe and America where similar bodies have been discovered. These bodies are round, vacuolate in structure and closely attached to the nucleus of the cell or occasionally free from it. There is in each



D. S. P. Sprayer in action.

cell only one such body ; sometimes two or three can be made out. A similar disease has been noted on a number of different host plants.

### Other Diseases.

Work in other directions has consisted of:—

(1) Studying the life-history of the smut on jola and comparing it with work done elsewhere and advocating the steeping of seed in copper sulphate solution before sowing.

(2) Studying the ring-disease of potatoes.

(3) Study of the diseases of sugarcane, particularly Mosaic and the behaviour of the Hebbal seedlings in relation to this disease.

(4) Study of diseases of tobacco and developing a campaign for spraying against a damping-off of seedlings and the powdery mildew. The discovery of *Sclerotium rolfsii* on this and a number of other host plants has shown to what a serious extent the fungus is present in our soils.

(5) Study of the diseases of apples particularly the root-rot caused by *Sclerotium rolfsii*.

(6) Trunk-splitting disease of arecanut supposed by the garden owners to be the result of spraying has been proved to be due to sun-scald and the association of a wood-rotting fungus, *Lenzites*.

(7) Study of *hidimundige roga* of arecanut, which was at one time supposed to be a physiological disease or bacterial in origin, has been found to be associated with an internal injury of the crown as a result of which growth is arrested and inflorescences die away even when covered by the spathes. Some oligochæte worms have been met with occasionally, but as to whether they can cause the disease only further observations will have to reveal.

(8) Early blight of potatoes caused by *Alternaria solani*. Life-history studies and control by spraying with calcium arsenate 1 lb. in 50 gallons of water.

(9) Cereal diseases like ragi smut, *Helminthosporium* on ragi, *Piricularia* on ragi and paddy, *Ephelis* on paddy and *Cercospora* spots on ragi leaves.

(10) Mildews. This group of diseases affecting various crops like betel vine, grape vine, peas and apples have been controlled by spraying with Bordeaux mixture and oil. The independent discovery of the Downy mildew of grapes in Bangalore and surroundings.



(11) Diseases of plantains. A disease caused by *Sclerotium rolfsii* has been controlled by painting the pseudo-stems with Bordeaux mixture.

(12) The study of *Azotobacter* and the nitrate and nitrite bacteria in our soils.

(13) The discovery of bacteria in casuarina root-nodules.

(14) Independent discovery of the Sclerotial stage of *Sclerotinia ricini* causing a mould of the castor bean.

(15) A disease due to a sp. of *Rhizoctonia* on gingelly, potatoes and watermelons was independently discovered here.

(16) Successful budding of plants belonging to different orders, as Sandal, *Zizyphus*, etc.

(17) The discovery of a disease due to a sp. of *Thielaviopsis* on plantains and another on the arecanut palm.

(18) The discovery of Yeast organisms in green bugs.

(19) The collection and study of the Phalloids of Mysore.

(20) The study of an eelworm causing leaf-galls on *Andropogon pertusus* Willd. This has proved to be a new species and has been described as *Anguillulina cecidoplastes* n. sp., Goodey.

(21) The study of ecological factors on *malnad* flora.

(22) The study of some entomogenous fungi like *Isaria* on mango-hoppers and sugarcane borer, a *Metarhizium* on the rhinoceros beetle larvæ, and *Empusa* and *Cephalosporium lecanii* on green bugs in coffee. The introduction of the last named fungus from Mysore into Seychelles Islands has proved to be a great success there.

(23) The study of the diseases of cardamoms. A presumably degeneration disease called locally by the name "*Katte roga*" seems to embrace quite a variety of symptoms.

(24) The collection of herbarium material of the phanerogamic and fungus flora of Mysore which was attempted in the earlier days has unfortunately had to be given up for want of adequate staff for collection and identification work.

(25) The study of *striga* on Jola and sugarcane.

(26) The study of Seegade Satte, an algal weed (Chara) in paddy fields and its eradication by flooding with copper sulphate 1 lb. in 3,000 and 6,000 gallons of water.

(27) The study of Soy-bean nodule bacteria.

(28) The study of a disease of *hagevu* stored ragi grains caused by *Heterosporium*.

### Organisation.

This section directly supervises the field work through fieldmen permanently employed and local men temporarily engaged during seasons of stress. The season for spraying being short, large numbers are employed for a short season only. The men are trained for the work and will be useful in their locality even when they are not in the service of the Department. In addition to organising spraying on large areas with the co-operation of the garden owners which has become possible by the introduction of the Pest Act, this section has co-operated with the Madras and Bombay Agricultural Departments in introducing spraying in the areca gardens of North and South Canara and has been instrumental in supplying materials to both these administrations as well as a few Co-operative Societies. Quite recently some Co-operative Societies have come forward to take up the work of sale of spraying materials. The total money transactions go up every year to Rs. 60,000 to Rs. 70,000. The busy period extends from April to October every year and the rest of the year is taken up by getting ready indents for the next year and ordering supplies. Starting from small beginnings the spraying of Areca has extended to about 12,000 acres annually and of Coffee to 25,000 acres annually. To cope with this work, sale depots are organised in different places to suit the convenience of planters and garden owners. The materials are advanced to them at the beginning of the season on six to eight months credit without interest. Interest is charged only on default.

### Future Programme.

Work will continue on the same lines as in the past and the items of work which have been only partly carried out will be carried to completion. Special attention will have to be devoted to the study of some virus diseases. The mosaic diseases of sugarcane, tobacco and cardamoms will be studied. Diseases of areca and cocoa-

nut and of coffee will continue to receive increasing attention. The study of the preparation of Bordeaux mixture and the perfection of the spraying machinery will be continued. Study of diseases of the betel vine will be pursued and other diseases that might come to the notice of the section will also be taken up.

#### 4. BOTANICAL SECTION.

##### Crops and their Improvement.

For over a century and a quarter, new varieties of plants, flower and vegetable seeds and economic crops of importance have been imported and tested by the Department of Government Gardens. The Superintendent of the Government Gardens was also the Economic Botanist. To a great extent the wealth of the flora of the State has been enriched by the labours of capable officers of that Department. A good herbarium was built up, many coloured drawings of rare flowers, plants and fruits have been made. Two valuable books have been published describing the flora of Mysore.

Introduction of new crops and seeds of promising varieties of staple crops was being done ever since the "Model Farm" was started in Bangalore near Lal-Bagh over fifty years ago. Mr. A. Rangaswami Iyengar, B.A., Revenue Commissioner successfully introduced early maturing strains of paddy into Mysore. Since the inception of the Agricultural Department and the establishment of the Hebbal Farm this work has been carried on in a systematic manner. During the time of Dr. Lehman, Java seedling sugarcane, B. 208 and White Striped and Red Mauritius canes were introduced and tested on a large scale. Java and Red Mauritius canes are still grown to some extent in the Malnad Taluks.

Systematic Plant Breeding Work was organised by Dr. Coleman, after the reorganisation of the Agricultural Department. Mr. V. K. Badami, L. Ag., was appointed as the first Assistant Botanist in July 1913. Between that year and 1923 many improved selections were made in Ragi and Castors. Intensive work was done in raising new sugarcane seedlings. Hybridization work on groundnut was started and many thousand potato seedlings were raised. Mr. V. K. Badami was later deputed to Cambridge to study Plant Breeding under Sir Rowland H. Biffen, M.A., F.R.S., for two years, during which period

he also visited the important Plant Breeding and Seed Improvement Stations in Denmark and Sweden. The post of Economic Botanist was created in 1928. A Seed Production and Distribution Officer with a staff was appointed in May 1929. As a measure of retrenchment the post has been kept vacant since September 1931. The Section has developed rapidly and it has now separate farms for carrying on Breeding work on Paddy at Nagenahalli and Kar Ragi and Kar Crops at Hunsur. Portions of other farms are set apart for the Breeding Work on other important staple crops. On the Hebbal Farm, work on the Breeding of Ragi, Sugarcane, Groundnuts, Castors, Potatoes and Grasses is in progress. Work on the improvement of Cottons, Cocoanuts and Jolas is conducted on the Babbur Farm. There is a subsidiary farm at Singapur Kaval for working on American types of cotton under Bain-fed conditions. Malnad paddies are being improved on the Marthur Farm. On the Irwin Canal Farm all new introductions are tested. The Central Laboratory at Bangalore is well equipped and the large breeding cage provides facility for carrying on Critical Breeding Work under controlled conditions. Seed testing and Cytological investigations are carried on at the Laboratory. The staff has been greatly strengthened. Often many research students are admitted to work on special problems and many of them have found employments in various institutions in India.

The staff now comprises of the following officers :—

#### ECONOMIC BOTANIST.

- One Senior Assistant Botanist at Babbur in charge of cotton and jola work.
- One Senior Assistant Botanist. Seed Production and Testing and Distribution work. Now vacant.
- One Junior Assistant Botanist at Nagenahalli Paddy Breeding Station.
- One Junior Assistant Botanist at Kar Ragi Breeding Station, Hunsur.
- One Junior Assistant Botanist at Bangalore. Laboratory Assistant and in charge of the Botanical Work at Hebbal. He is also taking classes in the Agricultural School at Hebbal.
- Six Agricultural Inspectors, one on each farm and one in charge of Seed Testing Work at Bangalore.

Imperial Council of Agricultural Research Scheme.—

#### BREEDING THICK SUGARCANES.

- One Senior Assistant Botanist and one Junior Assistant Botanist.

### Indian Central Cotton Committee Scheme.—

Breeding Red Leaf Resistant American Cottons. One Junior Assistant Botanist.

The results obtained so far may be summarised as follows :—

1. *Ragi (a) Hain Ragi Area.*—Results of cultural operations conducted on the Hebbal Farm over a series of years have given the following results :—

- (i) Ploughing with a mould board plough gives a better yield of ragi than ploughing with a country plough.
- (ii) Ploughing soon after harvest gives a better result than ploughing in spring.
- (iii) Ploughing in green manures is beneficial and a crop of cowpea ploughed in is better than sunn-hemp or ordinary farm yard manure.
- (iv) A rotation of legumes with ragi is highly desirable and a groundnut crop gives the best results.
- (v) Growing a pure crop of ragi is better than having lines of avare and other crops for timely ploughing and cultivation.

Over 300 collections were made from various localities in the State and studied. They were grouped into about a dozen classes. The best of them have been maintained as standard types for the purpose of comparison. A number of varieties from other parts of India and Africa were collected and tested. Most of the varieties were found to be mixtures. They were purified to the type and tested. Under Hebbal conditions which represent the Hain Ragi area the Local Hullubele has given the best yields in the collection of varieties and it is now used as the standard check.

The following observations were made in the varieties :—

- (i) Varieties with small ear-heads tillered freely and usually possessed thin straw.
- (ii) Bigger and heavier ear-head in variety, the plants had fewer tillerings.
- (iii) In general open ear-headed varieties were more suited to droughty conditions and compact headed varieties were suited to moist situations or heavy rainfalls.
- (iv) A pure type gave higher yields and came to an uniform maturity resulting in the production of high grade seeds.
- (v) Continued selection of earheads increased the size and number of spikes in the earheads, but a continuous selection was found to be necessary to keep up the improvement.

Plant selections were made on a large scale in 1913 and their progenies studied in succeeding years. Many selections were found to be superior to the varieties from which they were selected. The best of these in each variety were grouped together and tested in the plots from five to ten years and the most promising ones were tested against the Local Hullubele for yields. Those that were found superior to the standard local check were tested in various localities and promising ones were multiplied and distributed to the raiyats. The most popular ones were, H. 22, H. 2, H. 13, H. 40 and H. 44. Out of these only H. 22 and H. 2 remain as favourites. H. 45, H. 55 and H. 75, H. 80, H. 92 are promising in the trial plots and they await testing in the villages before release for general distribution.

H. 22 the most popular one is the one improved type which has spread over several hundred thousand acres in the State and in the bordering districts of the Madras Presidency. "A" grade seed farms produce pure seed in large quantities and these are multiplied in the "B" grade seed farms by the District Staff for general distribution. These seed farms are opened on private estates and to encourage the influential raiyats to open seed farms they are given a premium of 10 per cent on the value of the seed purchased from them. H. 22 has given 20 to 30 per cent more yield than the local varieties in many places. Its drought resistance, heavy yield of good grain and a large amount of straw, have made it a popular variety in the State.

(b) *Kar Ragi (Kar area)*.--Early sown ragi is generally found in the South-Western part of the State. Over 300,000 acres are sown yearly. It is sown in April or May and harvested by September. Hain ragies when sown here will not ripen before the rains are over. If the rains hold up in the North-East Monsoon the Hain crop will be a total failure. Early experiments at Mysore and Nanjangud showed that the Kar ragi crop required a good deal of improvement in the methods of cultivation, manuring and sowings. The universal practice of sowing by broadcast consumes more time. The raiyat has only the "Plough" for all his cultural and sowing operations in this tract. There is a very good scope for the introduction of drills, harrows and cultivators.

Preliminary experiments showed that.--

(1) Drilling seed in rows gave higher yields for all varieties,

- (2) Broadcasting gave more straw.
- (3) Compact ear-headed varieties had the heaviest ear-heads.
- (4) Violet open ear-headed variety gave the highest yield.

Plant selections and testing of varieties were continued from the material collected before and further selections made in the districts after the Kar Ragi Breeding Station was opened at Hunsur in 1928.

Out of the many promising selections, violet compact variety H. K. 13 is very promising. It is closely followed by a green compact type K. 1. These two do well in most of the soils and produce very much heavier yields than the local kar ragi mixtures. But for richer and moisture soils, H. K. 82 is better suited. It takes a slightly longer time to mature but heavy yields of grain and straw are obtained. These new varieties indicate that with the help of improved strains it is possible to obtain in the Kar areas yields as high as those of the Hain tracts.

(c) *Garden Ragies*.—Under irrigated conditions it is possible to manure heavily and secure higher yields of 15 to 20 pallas per acre. Varieties with many branching ear-heads as in H. 41 and H. 42 which do not tiller well may be transplanted closely for securing high yields. K. 1, and Kar ragi selections can be transplanted at any time of the year before the seedlings are 30 days old. The Hain ragis H. 41 and H. 42 can be planted only in the Hain season. It always pays to transplant on ridges and furrows used for irrigation. Much propaganda is needed to persuade the raiyats to give up the system of flooding the square beds. Ragi does not tolerate water logging.

*Malnad Ragies*.—Ragi is grown in small areas in the malnads on the dry lands. Sometimes very good crops are harvested. Hain Ragies and Kar Ragies have not done so well as the local ragies on the Marthur Farm. M. M. 1, and M. M. 2, two selections made on the Marthur Farm out of the local ragies, were found to be better than the others. M. M. 1 is a violet variety with many spikes in a compact head. It has been multiplied and distributed to some extent, but it was a failure at Hebbal and Hunsur. C. 5 Nasik, C. 6 Nasik, C. 3, C. 4 C. 1 and C. 2 of Ratnagiri were tested. They produce very little straw and low yields of grain. Some of them are early ripeners.

2. Paddy.—Nearly a million acres of paddy are grown every year in the State: With the expansion of irrigational facilities more areas are brought under cultivation. Paddy is grown under heavy rainfall conditions of the Malnad, under the canal systems of the perennial rivers and under the numerous tanks. Scores of varieties are grown in the State. Usually coarse types are grown in the Malnads fit for preparing par-boiled rice. Under the canals coarse, fine and medium types are grown. Below the tanks under punaji system of cultivation, coarse varieties are grown. Most of the summer varieties are coarse. The best known ones are the following:— In the Cauvery valley the following varieties are largely grown. Kaddi, Kembuthi and Pattasamanahalli. In the Eastern part of the State under tanks the following paddies are popular. Maralakanthi, Bolamallige, Alur Sanna, and Doddabyra. In the malnads, Jaddu, Hasadi, Walya, Togarina, Hejje and Dabbanasala are well-known. Among the summer varieties Halubbalu is the most popular one. Fine grained varieties are grown in several places. The following are well-known in Mysore—Kempuraja, Natanahalli Sanna, Yelandur Sanna, Bangara-theega, Gunasale and Gandasale.

Many varieties tested on the various farms showed promise but on release for distribution they did not prove the success that was hoped of them. The establishment of the Paddy Breeding Station at Nagenahalli provided facilities for systematic work. Over 300 varieties have been collected from different experimental stations in and outside India. In the first instance they were all purified and the pure strains were tested for yield. None of the introduced varieties was found to be superior to the local variety either at Hebbal, Nagenahalli or at Marthur. A selection from Coimbatore Paddy Station introduced in 1921 has spread very widely all over the State on account of its fine grain, high percentage of rice and nonlodging stand in the field. The yield and quality of straw are rather disappointing. On account of its good milling characters and high prices it has begun to spread widely even in the Malnad areas though the yields are not so high as the local coarse rices and the common Dabbanasale. Nearly 400 pallas of pure seeds of G. E. B. 24 are sent out from Nagenahalli. As the demand is very great it is now being multiplied for distribution on the Irwin Canal Farm. In the Eastern Taluks and round about Bangalore,



Gunasale is popular. In the summer crop areas Basumathi, Kempuraja, Chintamani Sanna and Halubbalu are very successful.

Over 300 collections are grown in the observation plots on the Paddy Breeding Station. Nearly a hundred of them have been tested for yields. A series of experiments carried over several years have shown that the right age for transplantation of seedlings is when they are 30 days old and that is the standard age now observed for transplanting all varieties. Twelve varieties were found to be early ripeners, being ready for harvest in 80 to 100 days after transplantation. Of these, two are fine and the rest are coarse. The finest ones are Bangarkaddi and Yelandur Sanna. About 30 varieties were found to ripen in 100 to 110 days after transplantation of which six are fine varieties. Basumathi, Kempuraja and Chitawani Sanna are the best among the fine varieties. There are 15 varieties which take a medium time of 110 to 120 days to ripen after transplantation of which only two Alur Sanna and Natanahalli Sanna are fine types and the rest are coarse. Among the late ripening varieties which take between 120 to 130 days to ripen there are 20 varieties of which seven are fine and thirteen are coarse ones. It is only in this group that fine varieties with high yielding capacities are present. The most promising ones are Maharajabhoga, G.E.B. 24, Delhi Prayag and Bylunda. Eight varieties were found to be very late ripeners, taking over 130 to 150 days to be ready for harvest. There were no coarse types in this group. They give heavy yields of grain and straw and are well suited to localities having irrigational facilities for over six months. Medium grained ones are Kembuthi, Pattasamanahalli, Kaddi and Rangoon Red. The fine ones are Nagpur Sanna and Saklathi.

In general the coarse varieties give higher yields. Most of the varieties on an average yield a low percentage of grain to paddy. To combine high yields of grain and straw in finer varieties many plant selections have been made and tested. As a result of such work several strains have been isolated and multiplied for distribution. About 30 selections were promising in the test plots. Out of them S. 169, a Kaddi selection; S. 67, a Kembuthi selection; and S. 236, a Nagpur selection have been found to do well in several places and they are slowly spreading, S. 236 being a finer grain than G.-E. B. 24 is much in demand.

The following new strains are full of promise and require to be tested in the districts before they could be released for general distribution.

Pattasamanahalli selections	... S. 363, S. 364, S. 476, S. 477, S. 590 and S. 581.
Nagapur Sanna selections	... S. 574 and S. 248.
Alur Sanna selections	... S. 197 and S. 199.
Gunasale selection	... S. 268.
Maharajahbrogam selections	... S. 615, S. 617, S. 624, S. 625 and S. 657.
G. E. B. 24, selection	... S. 661.
Do hybrids	... Segregates 4, 18, 27, 50, 194, 478 and 514.
Halubbalu Selection	... S. 317.
Banku selection	... S. 328.

Improvement of Malnad paddies was taken up only in 1929. Previous to that year a collection of local strains was made and tested for over ten years and on several occasions the stock was purified by rouging out mixtures. In the tests Musalli, Malligge Walya and Hosahalli Bili have given from 25 per cent to 40 per cent more yield of grain than G. E. B. 24, but the finer grain of G. E. B. 24 is much in demand by the mills. The spread of this fine variety will seriously affect production of grain and straw. Fine Java varieties, Gabah, Skivimankotti, Gabah Tongsan, Gabah Tyena, Gabah Temas and Gabah Rosaki have been failures in the area. Out of the large collection in the Rice Breeding Station at Karjat in Bombay, a collection of 52 varieties was made and tested at Marthur. A large number of them are early ripeners and are unsuited to Malnad conditions. Four of them M. Burma I, S. G. 114, Ramasal and S. G. 226 have been very promising, producing larger quantities of grain and straw than G. E. B. 24. Burma 355 has given over 6,360 lbs. of straw. In the Malnads where fodder problem is acute, the yield of straw is a great concern especially so when the local varieties do not yield more than 2 or 3 thousand pounds of straw.

A large number of plant selections were made in all the varieties and tested. About 40 of them were found promising. The following eight strains have given over 30 per cent to 60 per cent more yield of grain than G. E. B. 24. They are being tested on the farm for release to the raiyats:—H. O. 1129, H. O. 1329, W. 529, H. O. 829, H. B. 1729, H. O. 1629, H. B. 1929 and W. 429.

Earlier selections Ho. 529 and W. 3629 have done well on the raiyats' fields. Large scale demonstrations and production of sufficient pure seed for seed distribution are necessary now.

Much work remains to be done on summer paddies. A list has been prepared at Hebbal to show that a large number of paddies grown in the monsoon are not suitable for summer cropping as they only produce vegetative growth at the time and never flower and set grain. A testing station is necessary in Kolar District. At present only the following varieties could be recommended. Basumathi, Kempuraja, Chintamani Sanna and Halubbalu.

Cooking tests have been conducted over 150 varieties and it was found that in general finer varieties absorb more water and expand more than the coarser varieties. Nutritive values of coarse and fine varieties require to be investigated early before replacing the Malnad varieties by improved strains.

Transplanting in the Maidan areas and sowing in drills in the Malnads seem to be the most profitable methods. Thin sowing in seed beds and transplanting one to three seedlings 6" to 9" apart of 30 days seedlings have given the best yields. New strains planted in fields well manured with about two to four tons of green leaves and a complete mixture of N. K. P. artificials have given very heavy yields of grain and straw.

### 3. JOLA.

Jola is an important food grain in the State. Over 220,000 acres are under cultivation in the *mungar* area round about Mysore and nearly 300,000 acres of *hingar* crop is sown in the black cotton soils of Chitaldrug, Shimoga and Tumkur. No work has been done in the improvement of *mungar* crop. Over 60 varieties were tested on the Hunsur farm but this locality is not suited for the jola crop. There are about six main types varying in the compactness of heads and the colour of the blooms. Plant selections in the raiyats' fields have been started in 1937. They will be tested on the Irwin Canal Farm along with the selections obtained from the Millet Station of Coimbatore. A large number of over 60 collections have been maintained on the Babbur Farm for over 20 years. Preliminary observations have been made and many ear-



Varieties of Sugarcane.



Varieties of sugarcane on Hebbal Farm. From left to right. — Hm. 320,  
P.O.J. 2878, Ek. 28, P.O.J. 104.

head selections have been made from time to time. Nine varieties stated below are promising.

Bili jola of Gannaikanahalli, Chitaldrug jola, Bili jola, Sorghum No. 2, Maldandi, Shahabad Jawari, Doodia, Lamshai. Out of them some plant selections have been made and Gannaikanahalli No. 57 and No. 34, Bili jola No. 33 and Maldandi are the best. They require to be tested in the fields for distribution.

Fodder jolas are very popular in Mysore. Kaki jola is largely grown in the mungar season. Two types, compact and open head are grown in lines as a mixed crop with hain ragi and bili jola is grown largely during hingar season. Large quantities of Bili jola seed are tested and distributed to raiyats during seasons of drought by the Department. Senedia javar has been successfully grown as an early ripening fodder crop on the Hebbal Farm. Amber sorghum and Corghum collier have been tested on the Hebbal Farm. Plants have been found to vary in sugar content from 4 per cent to 15 per cent. Plant selections have been made to establish fodder jolas with a high sugar content.

African Kaffir corns, Durrhams and Milos have been tested on the Hebbal Farm and found to be unsuited to our seasonal conditions.

On the Irwin Canal Farm many early ripening varieties of jolas were tested under irrigation. Selections out of Chitra cholam from Coimbatore Millet Station are promising and one of them is now being multiplied for general cultivation during the summer months.

#### 4. SUGARCANE.

Work on sugarcane in Mysore has shown what organised effort and working to a plan can do to help an industry. Cultural experiments, manurial requirements of the crop and the breeding of improved varieties were in progress and had yielded valuable results before the impetus to sugar industry was given by the protection duty. It was therefore possible to extend the sugarcane cultivation and establish a factory in an amazingly short time. During the very first year it was possible to declare a fairly good dividend.

The original canes in Mysore were Cheni and Marakabbu. They were both hard rinded reed canes. Rasthali was grown to some extent. It was a thick cane but was

not rich in sugar. About 150 years ago Pattapatti cane was introduced into Mysore by the officers of Hyder Ali and improved methods of cultivation were introduced by the French settlers from Mauritius. Sugar was prepared at Ganjam. By 1850 a Sugar Refining Factory was established at Palahally and the sugar prepared by the Ashtagram Sugar Co., won medals in the two great exhibitions at Crystal Palace, London. Later the Sugar Factory at Goribidnur worked successfully for a long time. Dr. Lehman did yeoman service to the State from 1898 to 1908 in threshing out the various problems connected with sugar making, jaggery making and the cultivation of sugarcane on improved methods. During his time White Mauritius, Striped Mauritius, Red Mauritius, Java, Elephant cane and B. 208 were introduced. None of them were economically superior to the rich Mysore Pattapatti cane. B. 208 was a rich cane but it had no vigour. Red Mauritius was found to be vigorous but it had a poor juice. Java was an early rich cane but it flowered freely and gave low yields. Java and Red Mauritius canes are still grown to some extent in the Malnad Taluks.

Preliminary cultural experiments have shown that planting in continuous rows 3 to 4 feet apart gave the best yields and reduced the seed rate. Planting in furrows a foot deep and gradually filling up the furrow as in Java has given higher yields and prevented lodging of canes. Wrapping and tying of clumps encouraged better growth and protected canes against sun and ravages of jackals and affords scope for clean cultivation. Heavy manuring is necessary for harvesting good crops. Three tons of groundnut cake gave better results than castor or Honge cake. Heavy doses of Ammonium Sulphate even over 10 cwts. per acre have been given and crops over 80 tons to the acre have been harvested. The land requires a thorough cultivation and a heavy dose of compost or organic matter to the extent of 30,000 lbs. to the acre is necessary as a basic manuring. Heavy doses of Ammonium Sulphate according to the fertility of soils tempered with 2 to 4 cwts. of Super will produce good crops with rich juice in about a year.

Dr. Lehman found that by adding lime to the cane juice to neutrality and removing the scum while the juice is boiling, good, clean, hard jaggery could be prepared. Recent researches in India have shown that by the use of vorret or activated carbon jaggery with a light cream

colour could be prepared. With slight modifications the Chemical Section has been able to evolve methods of making such jaggery which the raiyats can easily adopt. Intensive work was done by Dr. Lehman in connection with sugar making in the open pans and the centrifugal. It was found possible to make good white sugar and prepare an inferior kind of jaggery from the molasses but economically it was not a paying method. So long as there was good market for jaggery, it was not paying to prepare sugar in the open pan system. The market for the inferior kind of jaggery from molasses was found to be very restricted. Researches were therefore directed to the production of vigorous rich canes, to the improvement in the methods of cultivation and irrigation and to the improvement in the methods of making good jaggery which would not run during the monsoon rains.

Improvement of sugarcanes by raising seedlings was started in Coimbatore in 1911 and 1912 and plenty of material was collected in Mysore for that work in 1913. When it was found that the Mysore Plateau was congenial for the cane to flower and set seed, evolving new seedling canes was started in 1913. While Coimbatore confined its activities to the evolution of canes for Northern India and hybridization work for combining desirable characters suitable to the conditions existing there, Mysore confined itself to the evolution of thick tropical canes to suit the local conditions. All the exotic and indigenous canes of India were collected and the standard collection thus made has been maintained all along. The best known canes from the important centres of sugar production are found in the collection. They afford material for comparison and for breeding work. Most of the canes which produced fertile flowers and set seed proved to be highly heterozygous in character and a wide range of variations was found in the seedlings raised. This advantage has been fully utilised in raising a large number of seedlings for making selections. Most of the exotic canes flower between September and January and set seed in about a month. Methods were perfected to raise seedlings successfully on a large scale for field work and most of the canes were studied as to their suitability as parents in breeding work. B. 208 and Barbados canes produced rich canes but they had no vigour. Demarara and East Indian canes produced seedlings with a wide range of variations but so far seedlings with great vigour and high sucrose

have not been obtained. Similar results were obtained in Mauritius canes. But the vigorous Red Mauritius cane produced a large number of non-arrowing seedlings of great vigour. A few of them had a high sucrose content and such ones were selected for yield tests. These seedlings varied in their morphological characters and agricultural qualities. Good tillering habit, vigorous growth, yellow or orange colour, striping habit of leaves, absence of bristles on the leaf sheaths, erect growth and non-lodging habits were the points which were studied in making the selection. Non-flowering canes produced the greatest tonnage of canes as they had a full period of growth for ten months and a ripening period of two months. If the seedlings flowered early, vegetative growth was arrested and the tonnage was reduced. On the other hand if the canes flowered after ten months or as late as possible in the season, the growth was not checked and heavy yields were obtained. But in such cases the value of tops as fodder is lost. The ideal for Mysore conditions is a non-arrowing cane which ripens in twelve months gives an extraction of 70 per cent in a bullock power mill and has a sucrose content of over 20 per cent and a low glucose value of below 0.2 per cent. Under good cultivation the yields should go up to 50 to 80 tons per acre. On this basis all the selections have been made. Seedlings like H.M. 544, H.M. 320, H.M. 312, H.M. 553, H.M. 315, H.M. 89, H.M. 87, H.M. 14 and H.M. 600 were promising and they were tested in the districts for yields. H.M. 544 and its bud striped Sport spread widely in the State, giving over 50 tons on good heavy soils. It was found to be fourteen months cane and it has rapidly given place to the more productive H.M. 320 which ripens in 12 months and has a richer juice. H.M. 553 is popular in Chitaldrug district and in parts of Malnad. H.M. 544 and H.M. 320 have spread over the Bombay Presidency in the canal areas as raiyats' canes. H.M. 87 has come to stay in Konkan. H.M. 320 and H.M. 608 have spread in Janjira State and some of these have been successfully grown in Hyderabad. In Mysore H.M. 320 has spread over fifteen thousand acres in the districts as the most suitable cane for the raiyats and it is at present the principal cane feeding the Sugar Factory at Mandya. Ten to fifteen thousand acres are said to be grown round the factory. It has become an all-round cane, being planted in every month and allowed to grow from twelve



to eighteen or even more months before it is harvested for the factory. The sugar recovery in the Factory is said to have varied between 10 per cent to 12 per cent on the weight of cane.

There was a break of about five years in the work and in 1928 it was renewed by raising a large number of fresh seedlings from various parents. Out of them a large number of seedlings obtained by crossing H M. 544 and P. O. J. 13 were secured. Many of them have proved to be vigorous and rich in sugar. They have over 13 per cent of fiber and do very well on poor gravelly soils water-logged soils and saline soils. A few of them like H.M. 607 and H.M. 609 resist drought very well. H.M. 606 evolved by inbreeding selected seedlings of Striped Mauritius cane is promising. It is doing well at Padegaon. H.M. 608 another cane evolved by inbreeding strains of seedlings from Striped Mauritius has given the richest juice in our seedling work. It does not flower and is erect. When it is fourteen or fifteen months old the juice shows a brix content of over 28 per cent and a sucrose of 25 per cent to 26 per cent. The percentage of glucose is only about 0.07 per cent. Such canes have been multiplied for tests and distributed to various parts of India, South Africa, Formosa and the United States of America.

Evolution of new seedlings has a great future before it. Within six years after the evolution of the first batch of seedlings, over several hundred acres were under them and at the present time the indigenous canes have been practically displaced almost wholly by the improved varieties of seedling canes. These seedlings have helped to a great extent the success of the Mandya Sugar Factory which crushes nearly 1,500 tons of cane a day and works for a larger number of days than any factory in India.

While the breeding work was in progress in the State, the Department was in close touch with other sugarcane breeding stations. The improved sugarcane seedlings from Coimbatore have displaced over 75 per cent of the indigenous canes in Northern India. A large collection of the most promising ones have been obtained and tested at Hebbal. They are all medium or thin canes having a high sucrose content and early maturing habit. Under our conditions they flower early in September or October and become very pithy before the next planting season. The following have done fairly well at Hebbal and they will be tried on field scale on the Irwin Canal Farm.

Co. 205, Co. 213, Co. 281, Co. 290, Co. 313, Co. 360 and Co. 419. Out of them Co. 290 seems to be well suited for saline and heavy water-logged soils. Co. 360 and Co. 419 require to be carefully tested. The Sugarcane X Sorghum hybrids flower very early and produce arrows with long stalks. The yields are very low and they are of no economic value to Mysore. Seedlings of outstanding merit from Hawaii and Java have also been secured and tested. H. 109 a seedling from Hawaii which has given over a hundred tons in that place flowers early at Hebbal and gives very low yields. P.O.J. 2878 the famous seedling cane of Java has been an early flowering cane here with a low production when planted in the main season in January. If it is planted in June or July it grows well in the canal area producing over 40 to 50 tons of cane as it skips over the first flowering season and has a period of long growth. But H.M. 320 planted in the same season gives a higher yield. P.O.J. 2878 has a rich juice but it is known to be difficult to clarify. It cannot replace H.M. 320 as a cane for all seasons. Other Java seedlings P.O.J. 100, P.O.J. 2883 and P.O.J. 2725 are not satisfactory. All these seedlings have set seed freely and provided material for further work. Many vigorous rich seedlings have been already obtained from P.O.J. 2878 and Co. canes and they are being tested for their productivity.

The introduction of a large number of seedlings into the State introduced the mosaic disease along with the seedlings. At one time in 1935 the spread of the disease on H. M. 320 cane caused a great anxiety. Fortunately H. M. 320 cane was discovered to be highly tolerant to mosaic. By rigorous seed selection and planting only healthy material, the spread of the disease has been checked and the disease itself has been brought under control. New seedlings raised from P. O. J. 2878 seem to be quite resistant, or free from mosaic in addition to being heavy yielders with rich juice. The destruction caused by the borer has been effectively kept under control by the Parasite *Trichogramma* and by earthing up the furrows when the canes are still young.

In 1933 the Imperial Council of Agricultural Research sanctioned a sum of about Rs. 21,000 spread over five years for Breeding work on thick Sugarcanes. With this subvention one Senior Assistant Botanist and one Junior Assistant Botanist were appointed to help the Economic

Botanist in his cane breeding work. An X-ray apparatus also was specially got manufactured for the purpose of treating sugarcane buds with X-rays to induce bud mutations. Local Pattapatti cane was selected to work with X-rays. In the apparatus used, 220 volts current in the mains is converted into 60,000 volts and for working, energy from 60 k. v. p. to 90 k. v. p. were used. The amperage varied between 5 m. a. to 10 m. a. A large number of single buds were germinated and treated under exposures varying from half an hour to three hours. It was possible to obtain over 40 per cent of mutations in the treated material. The mutants varied in colour, size, vigour and sugar content. From the banded Pattapatti cane red canes, yellow and orange with various shades, thick and medium canes have been obtained. Many of them vary in vigour and the sucrose content varied from 15 per cent to 22 per cent. Some mutants arrowed and set seed. These results show that by using an external physical energy it is possible to bring about changes in the structure and character of chromosomes and genes and bring about variations. Some of the canes thus evolved are far superior to the parent Pattapatti in vigour and possess bright yellow golden colour. All such mutants have been termed "Mysray" with numbers. The success of the work opens up a new line of investigations in plant breeding. It could be used with all plants which do not flower and set seed like potato and plantain. Also variations can be induced in fruit and flowering plants. Sugarcane breeding work can be taken up in temperate climates where the cane does not flower and set seed. There is a likelihood of South Africa and Formosa following our work. At present the X-ray energy has been used to induce variations in H. M. 320, Red Mauritius, Q. 813, H. M. 544, H. M. 89 and a number of striped canes. Sir John Russel, D.Sc., F.R.S., Director of Rothamstead Experimental Station in England and Agricultural Expert Adviser to the Government of India who was deputed to inspect this work and report on it has amongst other remarks made the following observation.

"Beside the plant breeding on the classical lines proceeding at Coimbatore, a special method involving mutilation or destruction of some of the chromosomes by X-rays is being tried by Dr. Badami at Bangalore and whether this produces better sorts or not it promises to give new material of possible value for the breeder. His

experiments should certainly be continued." "X-ray treatment of sugarcane seeds in Trinidad, Hawaii, Mauritius and Java does not seem to have yielded results, but Dr. Badami attributes this to their using seeds from heterozygous canes." "Work by Dr. A. E. Murneck on bud variations in the apple caused by X-ray is recorded by Stadler (Journal of Heredity, 1930, Vol. 21, pp. 3-19) but I know of no work on Sugarcane buds comparable with Dr. Badami's."

This scheme was sanctioned in the first instance for five years. It has now been extended for another year pending further sanction for continuing breeding work on a large scale on the Irwin Canal Farm.

#### 5. GROUNDNUT.

Groundnut crop is in cultivation for a long time. A long duration variety known as Mysore nut was being grown as a garden crop. It has a long pod with a large number of seeds varying from 3 to 7 at times. This has a low percentage of oil. With the spread of Mauritius varieties in Madras, groundnut became a field crop in Mysore also. Before the Great War there were about 50,000 acres under this crop and large quantities of oil were imported. By 1916 the total area under groundnut was above 200,000 and in 1929 it had increased to 323,738 acres. It is now fluctuating round about 300,000 acres. The extension has been rapid by the introduction of new varieties specially by the short duration strains getting into cultivation in Chitaldrug District where formerly there was no cultivation of this crop. From about 20,000 acres in 1915 it has spread to over 100,000 acres. The amazing progress may be judged by the progress made in the taluk of Honnali. From 30 acres in 1915 the area has now increased to over 10,000 acres. In extent and importance groundnut has outstripped cotton in Chitaldrug and in the State. Area under cotton has dwindled down from 1,20,000 acres to about 80,000 and 90,000 acres. The value of the groundnut crop at the present prices may be roughly put down at Rs. 70 lakhs as against Rs. 25 lakhs of cotton. Cultivation of Sannahatti cotton is confined to the black soil area in the North and Nadam type cotton is grown to a small extent in the South Eastern part of Mysore District. Unless suitable types of American cottons are evolved for growing under irrigation or for

growing as dry crops on red and sandy soils there can be no further extension of cotton crop in the State. While investigations on the improvement of cotton on these lines are in progress groundnut has established itself as a very important commercial crop in the State. It has been definitely shown that the groundnut cake has a higher nutritive value as a human food than soy beans and it is said to be superior to it being more easily digestible. In a country where cereals form the bulk of the food and the feeding value of the daily food is poor, as a cheap and efficient source of proteins required, groundnut deserves serious consideration. As a feed for animals and as a manure for commercial crops, groundnut cake is largely used in the State. Bearing these factors in mind, the Department organised the testing and distribution of varieties in the districts. In the course of about 15 years a crop of no consequence has become a major and a very important commercial crop. There is much scope for further extension and improvement of the crop and the Department has organised research to help the industry. The introduction and extension of this crop has been one of the successful labours of the Agricultural Department in Mysore.

Extension of groundnut cultivation need not cause anxiety about the production of food grains. Experiments on the Hebbal Farm have shown that when groundnut is grown in rotation with ragi there is an increase of ragi grain production by about 30 per cent. If the average area under ragi is taken as about 2.5 million acres, then there is ample scope for increasing the area under groundnut by at least 200 per cent more. If the area extends to about 800,000 acres and the average yield raised to about 1,200 lbs. of pods per acre, this crop alone will bring to the hands of the Mysore raiyat a sum of over two crores of rupees and in addition provide a large quantity of nutritious feed and fodder for his animals and enrich the soil for growing other crops. Such is the potential capacity of this crop for Mysore.

There are two main types of groundnut grown as field crops. The spreading varieties take longer time to mature and require early sowing in April to June. They produce larger crops but require a large number of people to dig and pick the crop. Erect or tufted varieties produce all the nuts at the base of the plant in a bunch and it is very easy to lift the crop requiring less labour. They are mostly

short duration varieties and require to be sown during the monsoon as other dry crops. They are admirably suited for growing under irrigation in summer. As dry crops the tufted varieties give less than 50 per cent of the yield of the spreading varieties. If the monsoon is successful and the rains are well distributed they produce good yields. Spanish and Small Japan varieties contain more oil than the old spreading varieties of Mauritius, Big Japan or Virginia. The oil mills therefore demand the seeds of these erect varieties but the raiyat will not be the gainer by growing these as they are low yielders. In the northern part of the State only early varieties can be grown and any improvement in yield or oil content should be combined with the early habit of growth.

Various experiments conducted on the Hebbal Farm show that it is better to shell the pods, dry the seeds in sun for four or five days before sowing. If the seeds are soaked in water for a couple of hours and heaped in a warm corner of the house they begin to germinate in 24 to 36 hours. By sowing only the germinated seeds a quick germination and a full stand is obtained. Sowing in lines allows space for weeding and cultivation. In all our experiments close planting has given the highest yields; the optimum distance is about 6 inches either way. Flowering of all varieties begins in about five weeks after sowing and lasts for about four weeks. If that period is moist and cloudy the largest number of pods are produced. On the other hand if the weather is dry few pods are produced and the plants make only a leafy growth. When the late rains set in many pods are produced which do not ripen before the cold dry weather sets in, resulting in a large percentage of hollow or empty pods. Soils which are poor in lime produce thin shells and poor crops. A dressing of lime improves the yield, increases the thickness of the shell and therefore reduces the percentage of seed to the pod both in weight and in volume. The mills are disappointed if the percentage of seed to pod is low. Here again there is a conflict between the trade and the interests of the raiyat. It is possible to fix up a standard for a healthy crop of every commercial variety and remove this obstacle in the way of introduction of improved methods in cultivation and manuring. The erect varieties are highly subject to the leaf spot disease known as 'ticcæ'. Sometimes the damage caused is heavy. The dark green tufted varieties resist this disease to a great extent and in

due course when they displace the old types there will be no cause for anxiety. As good price for groundnut depends upon the quantity of the free fatty acids every attempt should be made by the trade to store the pods dry and keep down the percentage of free fatty acids to about 5 per cent in the kernels.

In order to secure the most desirable varieties to suit different conditions of soil and climate in the State a large number of varieties have been collected and tested for their yield and quality. From 1913 to 1927 there were 12 varieties but at present there are seventeen spreading varieties and twelve erect varieties on the Hebbal Farm. They represent the most important commercial types from the well known groundnut exporting countries in the world. Among the spreading types the following five varieties have given over 30 to 40 per cent more yield than the local Sogatur variety. Senegal, Mauritius, Refisque, Barbados and Bassi. Considering the labour required in harvesting, the low percentage of oil and the longer duration of the crop attention is diverted more towards the improvement of erect varieties. The hardness of the spreading varieties, the size of the pod and the larger number of seeds contained in them are characters which are useful and they are being combined with erect varieties. Out of the erect varieties, Valencia, Small Japan, Spanish, Tennessee White, Bunch Virginia and African White are promising. The last two are very hardy but they are late maturing. Tennessee White has the biggest pod with a large number of seeds often numbering seven but it is late and poor in oil. Small Japan and Spanish have seeds rich in oil often having over 50 per cent oil in seeds. But they are very much attacked by the leaf spot disease. The pods are small and a greater weight is sold by the raiyats to the mill for a unit volume. This again is a disadvantage to the raiyat. Selling by weight with safeguard against adding water seems to be a desirable practice. The red colour of Small Japan is a draw back as the international market does not encourage coloured seed. Spanish seed has a good cream colour and possess 50 per cent oil and is a highly desirable commodity for the market. The further improvement lies in producing strains with these qualities combined with greater productiveness and resistance to disease and drought. Fortunately in Mysore there is no serious insect pest at present.

A very large number of plant selections were made in all the varieties to improve the crop. A uniformity in the appearance of the pods and size was attained but it was no improvement in the production. Selection of pods varying in the number of seeds in each pod from one to four were made for improving the size of pods and number of seeds. Experiments were continued for over ten generations. It was not possible to fix the character for size or number of seeds. Continued selection seems to be necessary to keep up good size and larger number of seeds. By judicious screening of pods through standard sieves it may be possible to remove low grade pods for sowing and also put on the market, a standard quality for each variety. Such a practice if rigorously observed will create a good reputation for Mysore nuts.

In the course of varietal tests a natural cross between Spanish and Big Japan was observed. Out of the four plants raised from it, one was erect, two were semi-erect and the fourth was spreading. On further selfing these plants, the erect one has established a pure strain of erect plants with big pods of commercial size having many seeds like Big-Japan. On the further plot tests it was found to yield nearly as well as spreading varieties and very much more than the Spanish or Small-Japan varieties. It was however a medium variety taking a fortnight more to ripen than the early maturing varieties now largely grown in the State. It branches freely and possessing a dark green healthy leaf, is highly resistant to the leaf-spot disease. As a summer crop on the Irwin Canal Farm this strain which is well known as H. G. 1 has produced more than 40 pallas of pods and many raiyats have secured over 25 pallas in their plots. The pods of this strain have all commercial qualities required by the trade. It is now being very widely distributed. Grown either as an irrigated crop or as a dry crop H. G. No. 1 has a total oil content of about 48 per cent against 46 per cent of Spanish or Valencia varieties. Under about 300 atmosphere pressure H. G. No. 1 has yielded 37 per cent of oil against 31 per cent and 35 per cent of oil in Spanish and Valencia. The quality of Small-Japan is very similar to that of Spanish. H. G. No. 1 and Valencia have however thick husks thereby giving about 5 per cent to 8 per cent of less seed by volume than Spanish. By weight the difference is only about 4 per cent to 6 per cent. If the prices are settled on total oil and kernal weight the trade will be helping



the raiyat to grow a high grade variety. H. G. No. 1 is now spreading in some districts of Madras. It is grown in Hyderabad also to some extent, and is also being tested in the Punjab.

With a view to combine the desirable qualities in the bunch varieties and the spreading varieties a large number of crosses between the various varieties were made in 1922. Since the plant flowers above ground and the fertilised ovary turns down into the moist soil and develops into a pod there, there were great difficulties in evolving methods of hybridization. They were perfected in 1921 and utilised fully in intensive breeding work between 1922 to 1928. In the first instance crosses between Small-Japan X Virginia produced many interesting segregates in the F. 2 generation giving scope for making 200 selections. The gaint form of H. G. No. 2 and many pigmy forms of small seeded varieties were evolved. Later more than thirty to forty combinations were made. The interesting results obtained were incorporated in the "Thesis" submitted by the Economic Botanist to the University of Cambridge as a part work for his Ph. D. degree. Out of over a thousand segregates selected for observation there are now nearly 320 segregates under observation. Sixty-eight of them have given over 500 lbs. per acre. Nearly ten of the segregates have yielded over 1,000 lbs. of pods to the acre. They vary mainly in habit of growth, colour of leaf, size and quality of pods and seeds, colour of seed-coat, hairiness of stem and leaf and resistance to drought and disease. They require to be multiplied and tested where irrigation facilities exist. The collection of varieties and segregates form a good foundation stock for further investigations and afford valuable material for other workers in groundnut.

Groundnut has now become the most important commercial crop in the State which brings in money, which improves the soil and affords a source of good and cheap nutritious food for man and feed for cattle. A system of standardising and marketing the nuts has become quite urgent. The recommendations of the "Groundnuts Conference" held at Bombay in September 1937 require to be modified and adopted to suit Mysore conditions to enhance the value and reputation of Mysore nuts.

Standard types :—(Decorticated groundnuts).

(a) *Khandesh*.—Small round kernels weighing not more than 37 grammes per 100. This applies to Spanish and Small-Japan types grown in Chitaldrug.

(b) *Coromandal*.—Medium long kernels weighing more than 35 but less than 50 grammes per 100. All the spreading varieties and H. G. No. 1 belong to this type.

(c) *Bold-large*.—Long kernels weighing not less than 48 grammes per 100.—H. G. 2 and many new segregates come under this class. In all the weight of 100 largest kernels should not exceed the weight of 100 smallest by more than 10 grammes.

Samples should have about 48 per cent oil and not contain more than 5 per cent of red seeds. The amount of moisture after drying in the sun for one hour should be fixed about 5—6 per cent. Foreign matter and dirt allowed is 4 per cent. Damaged kernels allowed is 2 per cent. Allowances of 25 per cent for split kernels and 10 per cent for broken kernels are allowed. We have to grow good nuts and market them in a condition which would create a steady good demand.

*Potato*.—The high land parts of Bangalore and Kolar Districts are well suited for growing successful crops of potato. At one time over 10,000 acres were under this crop. In Kolar mulberry displaced it to some extent. Small areas are often found in Shikarpur also as a dry crop. Large quantities were exported to Madras and Colombo. The rapid extension of potato cultivation on the Nilgiris and the dumping of Australian and Italian potatoes on Colombo have greatly affected our market. Ring disease is a great check to potato cultivation in Mysore. Dr. Leslie C. Coleman worked on this disease and suggested that the only effective remedy lay in the breeding of disease resisting varieties. Once the ring-disease—*Bacillus Solanacearum*—got into the land and contaminated it, even if the field were put under other crops for several years, crops of potatoes grown later get affected with this bacterial disease. By careful selection of disease free seed and lifting the crop a little before it is fully ripe the losses caused by the bacteria can be mitigated a little.

The original "Natigadde" is an irregular shaped tuber with an yellow flesh. It is grown in two seasons once in May to October during the monsoon and as a cold weather crop in November-March. During the first season the crop is often grown in light dry soils with the help of rain alone. During the cold season several well known English varieties are grown mixed under the collective name of "Ricketts gadde." They were introduced

between 1885 to 1895. A very large number of European and American varieties have been tested by the Government Gardens before 1908 and by the Agricultural Department afterwards. They have done well for a season or two and succumbed to ring disease. Large quantities of Italian potatoes were imported by the trade yearly to replace the local variety. For some time the method was promising and successful. At present Great Scot and British Queen are the only two varieties grown in some places. The bulk of the crop is either local yellow or Ricketts on an area of about 5,000 acres.

Recently a large number of varieties were secured from Darjeeling and tested both in the monsoon and cold weather. They are very well known in Europe as Arran Banner, Arran Chief, Ben Cruchan, Majestic, Bishop, British Queen, Darjeeling, Factor, Great Scott, Kirrs Pink, President, Talisman, Upto-date and Windsor Castle. In June planting Great Scott yielded over 360 maunds or 9,000 lbs to the acre and Arran Chief, British Queen, Talisman and Windsor Castle have yielded over 6,000 lbs. to the acre. During the cold weather Arran Bannar, Great Scott, President and Majestic have given good results. Seed Farms are necessary at Hosakote, Devanhalli and Sidlaghatta to multiply and distribute good seeds. Once in four or five years a fresh consignment may be had from Darjeeling till we open up a "Hill Station" seed farm somewhere on the Kalhathi or Bababudans.

In 1922 there was a free blooming of potatoes in Mysore. Some ripe berries were obtained and over 11,000 seedlings were raised, probably for the first time in India. Most of the plants in Ricketts produced seedless berries. It was only in the 'Local' variety that the seed was secured for our breeding work. The yellow tuber of the local showed itself to be highly heterozygous. Size and shape of tuber varied much. Colour of skin and flesh ranged from pink to white. The yielding capacity also differed from plant to plant. Very heavy yielding strains of over 10 tons to the acre were isolated. When some of them were tested in the areas where ring disease is common, they got wiped out. Much of the material was lost during the heavy summers of 1924 and 1925. At present the following four are found to be highly resistant to ring disease and they are also good yielders. B. Q. 39, Sel. 284 H., 384 and B. T.

The climatic conditions of Bangalore are well suited for conducting Breeding work. It seems possible to raise varieties which would give twice the yield of our present maximum crops of 400 maunds to the acre. Indications are that it is even likely that strains may be secured to grow successfully at lower elevations or even in the hot fertile plains of South India.

Since 1930 a large number of fresh seedlings have been raised and tested. Very recently a Mysore student studying at Kiel in Germany has collected about 67 varieties of potatoes and sent them over here for trial. With the help of the Mycologist those which are known to be highly susceptible to wart disease have been eliminated. While the area is dwindling the use of potato as a common food is increasing. Though the "Alternaria" disease and the "Epilachna beetle" are kept under control by spraying, a situation might soon arise converting Mysore from an exporting country into an importing one. There is an immediate need for efficient seed farms for raising healthy tubers for distribution.

*Cotton.*—There are two tracts in Mysore fit for growing Indian types of cotton. The largest area of about 300,000 acres of "Black Cotton Soil" is situated to the north-east of the Bababudan Hills. The main variety grown is *G. herbaceum* (Sannahatti) and this comes under the commercial classification of 'Kumptas' of Bombay. About 120,000 acres were grown with this crop formerly but now owing to trade depression and competition of other commercial crops like groundnut the area has dwindled down to about 80,000 acres a year. A small tract of about 5,000 acres of Black Cotton soil is found in the Mysore District lying to the North-East of the Niligiris. Annually about 2,500 acres of Nadam cotton, *G. obtusifolium* are grown in this tract. In parts of Hassan, Chitaldrug and Shimoga about 5,000 acres of an acclimatised type of upland American cotton locally known as Doddahatti is grown as an early crop on red soils. This type was exported as Banavar Cotton. The area of Black Cotton Soil is limited and any extension in cotton cultivation should take place on the red soils either as rain-fed crops or as irrigated crops. Annually about 50,000 bales of cotton are now being used by the cotton mills in Mysore and the local production is quite inadequate to meet this demand successfully. If a suitable type of American type of cotton which can withstand "Red leaf"

disease and drought, is evolved and successfully cultivated on the red soils it seems quite possible to meet the local demand and in addition put on the Bombay Market about, 100,000 bales of good long staple cotton.

Mysore cottons were studied in 1917. The two main types were found to be *G. herbaceum* (Sannahatti) and *G. obtusifolium* (Nadam). Sannahatti was found to be a mixture of many types. Some of them like the naked seeded ones were found to be highly heterozygous in nature. A few strains were found to be more productive than others. In 1915 a large number of plants were selected round about Davangere. They were studied for quality and ginning percentage in the Laboratory. The best ones grown in pure line cultures. S. 69 which has now practically spread over the whole of Northern area in Mysore was isolated out of these cultural line tests. It has a good yield and is superior to local cottons. In some areas it takes a slightly longer time to mature but it has come to stay as the main commercial type in Mysore. Pure seeds are being ginned on the Government Farm at Babbur and the Co-operative Society at Maradhally has over 2,000 acres under its control to produce certified good seed. Attempts are being made to open some more centres in the cotton area for seed production.

In 1924 Mr. V. N. Ranganatha Rao, Senior Assistant Botanist, working at Babbur crossed *G. arboreum* with *G. herbaceum* to develop a variety to equal Broach cotton in quality and suitable for cultivation in Mysore. For this purpose he selected S. 69 having yellow corolla, fuzzy seeds and shallow broad lobed leaf and crossed it with the arboreum type generally grown near temples having long white strong lint, red corolla, green seeds and deep narrow lobed leaf. The corolla colour, seed colour and the leaf shape of *G. arboreum* were dominant in F. 1 and in the later generations selection for such useful characters as earliness, low fruiting branches, ginning out-turn and lint quality was pursued in the eight possible classes given by the different combinations of the dominant and recessive conditions for the corolla, seed and leaf characters. Many cotton workers in America had indicated that the chances of success were little in developing commercial types through interspecies hybridization. In this work two valuable strains have been produced and the qualities of one of these, H. 190 are quite as good as Broach Deshi 8 or Surat 1027 A. L. F. It has a broadly

lobed leaf, yellow corolla and green seeds, staple length  $\frac{1}{2}$ " to 1", ginning out-turn of 30 per cent, good quality and good class lint spinning 32s to 35s giving a test of 80 to 85 lbs. at 19s and with a good colour. They yields are nearly as good as those of the local sannahatti but the strain is highly susceptible to wilt. The green colour of the seed is useful as a "Hall-mark" for identification in the field after the fruit opens. A large number of test plots have been laid out in the District to find out areas where this strain can be safely distributed. Strain 19 has red flower and green seed which would enable the grower to easily distinguish it in the field from other cottons grown in the locality. It has a ginning out-turn of 30 per cent but for other characters it has to be tested under field conditions. Jayavant and Dharwar No. 2 are highly resistant to wilt and give yields of seed cotton as good as those of S. 69 or local sannahatti, but the ginning percentage is lower.

An inferior variety of cotton belonging to *G. neglectum* locally known as Bokada is spreading into our tract through Bellary District. It is a heavy yielder and has a high percentage of lint, but the lint is short and coarse. With a view to evolve superior varieties to replace this undesirable one Mr. Ranganatha Rao crossed Cernum with Nadam. We have now promising strains with long staple and high percentage of ginning. They are being tested for yields. Some of them are highly resistant to wilt. The most promising strains are Nadam-like 21—22 and Nadam-like 149—152. These crosses have given valuable material for further work on breeding wilt resistant strains. A few strains are early ripeners and annual in their habit and they require to be critically tested in the Nadam area of Mysore District.

Improvement of Dharwar-American (Doddahatti) was found necessary to extend the cultivation on the red soils. Many exotic hirsutoms were obtained and tested. Columbia, Durango, Lone Star, Forlus Red Eye and Cambodia were considered at one time to be promising. Local Doddahatti was found to be the best yielder. All the hirsutoms were badly attacked by the "Red Leaf" disease. The Peruvian tree cotton was found to be less subject to this disease. Mr. Ranganatha Rao crossed the local Doddahatti with the Peruvian tree cotton in 1919 to evolve better types of American cottons. In addition he crossed Bourbon and Cambodia. Over 400 plant selections were made in Cambodia in 1921 and six of the

best were selected in 1922. As none of them was useful the work was dropped. Seventeen plants raised from Bourbon-Cambodia crosses were also rejected in time. By 1922 work on crosses between Peruvian tree cotton and Doddahatti was showing hopeful signs. In the F<sub>3</sub> generation about 35 plant selections were made and they were fairly free from "Red Leaf" disease and possessed good lint. Out of them Mysore-American (M.A.) IV and M. A. II were multiplied for tests and distribution. In a series of years and at several places M. A. II has given very good results and it is likely to replace the local Doddahatti in the Banavar cotton area.

Breeding work on American cottons was conducted at Babbur with the help of occasional irrigation. The crops were sown in September along with Sannahatti. The yields were comparatively low. When seasonal sowing experiments were conducted it was found that by sowing early in May or June heavy crops could be secured. In order to test all the material available under rain-fed conditions near the Banavar area an out-station was opened on the Singapur Kaval about 9 miles from Chitaldrug on the road to Holalkere. Many strains unsuited to dry cultivations were eliminated and it is found that M. A. II and local Doddahatti are about the best types suited to these localities. Selections from M.A. IV are promising and they are under observation. Selections made in Doddahatti round about Arsikere have shown to be better than those made near Davangere. Before distributing M. A. II seed on a large scale it seems necessary to make a large number of plant selections in local Doddahatti to secure and preserve the best strains for further work. The reputation of Banavar cotton requires to be revived and every attempt should be made to evolve a suitable type for the area and extend its cultivation. A large stretch of flat level land in Abbanaghatta Kaval within a mile and a half from the Arsikere Railway Station seems to be well suited for starting a first class Cotton Breeding Station. A stream separates the red soil block from the deep black cotton soil area. There is sufficient water in the stream for irrigating a few acres of land. A central Station here would give ample scope for breeding cottons for all conditions of soil. Arsikere being a railway station it will be within easy reach of Bangalore to obtain all laboratory help. Babbur Farm and Singapur out-station would be useful for multiplying the seeds

available for those areas. Irrigated types will be tested both at Babbur and on the Irwin Canal Farm.

As an alternative crop to sugarcane cotton varieties were tested on the Irwin Canal Farm. In the first instance it was found that by sowing in May or June soon after the heavy rains a very good stand can be obtained and yields of over 40 maunds of seed cotton have been obtained with M. A. II and CO. 2 cottons. The second sowing in September does not yield well. A large number of American cottons and Indian cottons were tested and it was found that the locality required a late maturing crop which would burst its capsules only after the heavy north-east monsoon rains. A crop of M.A. II sown in May and left over till May next has yielded well over 60 maunds in the experimental plots. A summer crop of groundnuts followed by CO. 2 or M.A. II will be a very good substitute for sugarcane. Cotton can even be successfully grown in the dry block also. Ultimately there is scope for growing at least 25,000 acres in this area and even with an average crop of 20 maunds to the acre it may be possible to supply our mills with 6 to 7 thousand bales of lint. Here again "Red Leaf" disease is present but the two varieties CO. 2 and M. A. II are fairly tolerant to it. A power mill has already been installed on the Irwin Canal Farm to gin the seed cotton under supervision for obtaining good seed for distribution.

The Indian Central Cotton Committee sanctioned a scheme for breeding strains of cotton to resist "Red Leaf" disease in Mysore in February 1935 for a period of three years at an average cost of Rs. 2,814 per annum. With the staff provided by the scheme intensive work on the testing of well known varieties and hybridization are in progress at Hebbal, Central Laboratories and on the Irwin Canal Farm. M. A. II and CO. 2 resist the disease to a great extent and in spite of the appearance of the disease during July to September, rather heavily, the yields of seed cotton have been promising. Gadag, 285. F, Aslioni, Uganda and Sea Island are highly susceptible to this disease. There seems to be a correlation between the season of sowing, the virulency of the disease and yield of cotton. No variety is quite immune to the disease. Over 380 crosses have been made between varieties and species to see if any set of complimentary factors exist which when brought together would produce resistant or tolerant strains. Crosses between Sea Island X Lone



Star and Sea Island X Bourbon are full of promise. They are being back crossed to their parents to intensify the characters. It is very interesting to note that Sea Island by itself has no vigour and is highly susceptible to "Red Leaf" disease but when crossed with other hirsutums the hybrids show a remarkable vigour of growth.

A large collection of wild types of cotton have been made from all parts of the world and we have now at present *G. Harknessi*, *G. Armorianum* with and without petal spots. *G. Davidsonii*, *G. Strutii*, *G. Trilobum*, *G. Taitense*, *G. Darwinii*, *G. Tomentosum*, *G. Schlotzianum* and *G. Stocksii*.

In addition a collection of all the important commercial Indian cottons also have been maintained. They represent the main types belonging to *G. arborium*, *G. obtusifolium*, *G. neglectum*, *G. indicum* and *G. herbaceum*. By soaking the seeds in water to the swelling point and gently cracking the hard seed coat it was found possible to easily germinate the wild cottons. The stock of wild cottons have been multiplied and given to other workers also. *G. Strutii* and *G. Tomentosum* have not yet flowered here. All the American wild cottons having 13 chromosomes freely hybridise with the cultivated forms having 26 chromosomes but the flowers of F<sub>1</sub> plants are sterile in general. Back crossing with their respective parents has been a failure. But in some cases the pollen seems to be effective in these hybrids. Since the plants are very healthy and highly resistant to "Red Leaf" disease they will be fully utilised for a series of back crosses. The interesting fact that comes out of this work is that the difference in the number of chromosomes between the Asiatic and American types of cottons does not seem to be the main cause for the failures in hybridization. There may be other causes which require to be investigated. It was further noted that the wild American cottons did not hybridise with Indian varieties of cottons though both of them have 13 chromosomes, haploid. While a large number wild cottons with 13 chromosomes are in the New World the cultivated forms of hirsutums, *Barbadenses* and *Peruvianum*s have 26 chromosomes. On the other hand the only one wild cotton of Karachi, *G. Stocksii* has 13 chromosomes and it has not been successfully crossed with the Indian cottons. The material now collected in Bangalore will afford much scope for workers in Cyto-genetics.

The red colour of the leaves in the "Red Leaf" disease has been found to be due to the pigment anthocyanin. It is turned green by Ammonia and again into red by hydrochloric acid. The pigment is usually found in the upper epidermis and often in the smaller bundles and secretory cavities. The actual production of red colour is preceded by the disintegration of the chloroplasts. The red colour usually appears in the epidermis invariably adjacent to the stomata, the guard cells remaining unaffected. The latter spread, coalesce and form patches. In badly affected leaves the disintegration of chloroplasts is complete. Attempts have been made to induce "Red Leaf" by physical injury to the plant with some success. Budding of different varieties on the same stock has shown that varieties have different degrees of susceptibility to "Red Leaf" and that the disease is not transmitted through the soil.

In the Laboratory, germinated and resting seeds, young seedlings, ovaries and pollen grains have been treated with X-ray to see if any new strains of utility could be evolved. Exposures ranging from  $7\frac{1}{2}$  minutes to 30 minutes have been used and the latter dose seems to be very near the lethal dose. There was a greater mortality in the germinated seeds. Suppression of branches, malformations of leaves and flowers were noticed in the treated material. Young buds 2 to 3 m. m. in diameter were exposed for 2 to 4 minutes and they dropped off after a time. Pollen grains exposed for 2 minutes and dusted on emasculated flowers have set fruits. We have been treating material sent to us from Coimbatore in this work. So far no result of economic importance has been achieved. In case we can break down the number of chromosomes in the American types or secure successful crosses with Asiatic X American types then X-ray will surely be an useful aid in cotton breeding work.

*Tobacco.*—In the North-Eastern part of the State tobacco is grown on heavy irrigated soils in the cold season mainly for chewing purposes. In the Hunsur area Bettadapur tobacco is grown as a dry crop on red soils. In all about 25,000 acres are under cultivation. The prices have fallen down in recent years. Varietal tests of indigenous and imported varieties at Hunsur have shown that the selections from the local varieties, Pusa selections and Harrison Special are well suited to the

locality. Under the local method of curing 30 to 40 maunds of cured leaf could be obtained. Over eleven varieties are now under observation. After the advent of Harrison Special variety, a cigarette type, curing barns have been built in Hunsur area, Bangalore District, and Goribidnur Taluk. High grade golden-yellow leaves have been cured and they have met with a good demand on the market. As a result of the success of the experiments conducted by the Agricultural Department and the Department of Industries, the Mysore Tobacco Company has been floated and further extension of work is now being looked after by the Company. Harrison Special variety has given very good yields of good quality in the light soils of Goribidnur under controlled irrigation. Mildew and leaf spot have been kept down by spraying. In the Whitefield area the quality of leaf produced is good but the uncertain rainfalls have been responsible for failures of crops. In the Hunsur area heavy yields of even over 15,000 lbs. of green leaf to the acre have been harvested but the leaves do not cure well. The heavy monsoon rains often stunt the crop and bring on a heavy attack of mildew and leaf spot disease. Very careful investigations are necessary to keep in check the diseases. Improvements in the methods of curing are quite essential to secure a higher percentage of first-class leaves. Cultural and manurial experiments are essential to improve the quality and the "body" in the leaf. Careful plant selections and breeding of desirable strains to suit the various localities are necessary to keep up a high class type of Harrison Special tobacco since the F1. and F2. seeds imported from America and Chirala segregate very badly.

On the Irwin Canal Farm under irrigation, Anaikudi and Pusa Hyprid 177 have given over 68 maunds of cured tobacco. Maryland, Havanna and cigar types have also done well. Harrison Special has also given over 50 maunds of cured tobacco. A barn has been built on the Farm and the flue-cured leaves have given satisfactory results. There is every likelihood of this cigarette tobacco becoming an important crop in the canal area along with groundnut and cotton.

On the Babbur Farm Harrison Special made a good growth and yielded heavily but the attack of mildew and leaf spot disease was severe. On the other hand a crop on the black soil was very successful. It had a

healthy growth and the leaves cured to a golden yellow colour with a good body. Where water is easily available to water seedlings after transplantation till they strike root, it is worth while extending this crop in the Chitaldrug District.

*Castor.*—The average area under this crop in Mysore is roughly about 100,000 acres. Chitaldrug has about 30,000 acres with over 25,000 acres in Challakere, Jagalur and Hiriyur Taluks. Challakere Taluk alone has over 16,000 acres under castor and is the most important taluk in the State for this crop. The whole district of Tumkur has about 27,000 acres and it is evenly distributed over all the Taluks. In Mysore District, the area is about 22,000 acres and large areas are found in Gundlupet, Chamarajnagar and Nanjangud. Kankanhalli, Closepet and Magadi form a block in Bangalore District with about 9,000 acres. Though the climatic conditions are well suited for growing this crop we are importing about 30,000 maunds costing nearly half a lakh of rupees in excess of exports. The average yield of castor is about 200 lbs. per acre and if this is increased by even 8 or 10 lbs. we can check the imports considerably. An extension of cultivation by about 3,000 acres will be sufficient for the present. Challakere Taluk alone can stop this import by raising the average yield by 50 lbs. to the acre. Such a thing is quite possible by growing better varieties and by using a moderate dose of compost. Very good castor crops have been secured at Biligere in Mysore District by using the compost from Mysore City. When rational feeding is fully appreciated and balanced rations is generally adopted by us, groundnut cake will not be available for manuring our commercial crops. For a crop of sugarcane of 50,000 acres at 3 tons of cake we require over 150,000 tons of castor cake representing nearly 350,000 tons of seed. To produce this quantity an area of nearly 3·5 million acres or a little over half the cultivated area in the State may be required. Castor is an important commodity and we are already short of our requirement. By growing improved strains and adopting rational system of manuring we can considerably increase the output.

For over 20 years 40 different strains collected in the districts are under observation. Of these collections, Channapatna, Chittaharalu, Settihally, Bukkapatna and Bommanahalli varieties have given between 300 to 350 lbs.

of seeds per acre at Hebbal. They were tested at Hunsur and it was found that though the castor crop made a good growth there the insect attack of borers and semiloopers was heavy. The varieties vary from the small seeded Chittaharalu to the big, bold white seed. In habit they vary from annual forms to perennial tree castors which are largely used as shade to ginger crops.

Twenty plant selections are under observation. H. 2 and H. 10 have given over 400 lbs. to the acre. H. 2 has given as high an yield as 485 lbs. to the acre. They are closely followed by H. 12, H. 7, H. 6, which yield nearly 400 lbs. H. 16, H. 5, H. 3, H. 17 and H. 8 have all given over 350 lbs. to the acre. As castor has male and female flowers separately on the same stock they are cross fertilised freely. By careful bagging and plant selections the purity of the crop can be kept up. The selected strains should be multiplied in isolated plots, heavily rogued and pure seeds obtained for distribution.

*Cocoanut.*—Over 50 lakhs of rupees worth of copra and cocoanuts are exported from the State and it is the most important commercial crop. The total area is about 160,000 acres, of which 60,000 acres are in Tumkur District. Nearly half the area is located in one compact block spread over Channarayapatna, Arsikere, Tiptur, Gubbi and Chiknayakanhalli. Tiptur Taluk alone has over 28,000 acres under cocoanuts. In this main area cocoanut is grown as a dry crop and a very efficient method of dry farming system is adopted in its cultivation. Copra produced here is ripened on the tree and has a good demand in Northern India. There is good deal of variation in production in plants, in the number of nuts produced and in the quality of copra obtained from nuts. They vary in size, shape, colour, thickness of shell, thickness of kernel and percentage of copra to nuts. There is a good deal of variation in the quantity of husk in the varieties. Coir making is practically unknown here as the nuts are ripened on the trees and the husk is used only as fuel. Since there is a large cocoanut trade there is no reason why the simple methods, adopted in the west coast should not be copied here as a cottage industry. At present large quantities of coir are imported from Malabar.

On the Babbur Farm work on cocoanut has been seriously taken up by the Department. About 9 acres have been planted with selected nuts from the Huliya

gardens and there are about 350 palms available for making plant selections. The plantation is very young and the average yield has varied between 45 to 66 nuts per palm. Selections have been made for size, yield and quality of kernel in the copra. A large number of seedlings raised from selected palms have already been distributed. Scientific Assistants have also been sent out to Tiptur to inspect the gardens and select the best palms in all the important villages. Nuts from the best palms have been used for raising seedlings for general distribution. It is hoped to have a large number of progeny rows, of the best palms available in the State at Babbur. If the cotton station is established on the Abbanaghatte Kaval the lower reaches fringing the tank bed will afford an ideal place for growing the seedlings of the best plants for producing nuts for general distribution.

A number of exotic varieties have also been tested before. Dwarf nuts from Malaya were a failure. There is only one early bearing palm from Bansda State just now bearing at Babbur. Several plant selections brought by Dr. Leslie C. Coleman from Java are now making a somewhat tardy growth at Babbur. It is necessary to make a large collection for comparative study, of all Indian varieties and exotic ones at Babbur Farm. They will be highly useful for hybridization work in due course. A beginning may be made by introducing tested varieties from Malabar, Travancore and Cochin.

*Wheat.*—The total area of wheat in the State is only about 2,000 acres and it used to be very much more. Kadur Taluk has about 800 acres and Chitaldrug and Hiriyur Taluks come next in importance. Consumption of wheat is steadily increasing in the State. About 23 lakhs of rupees worth of wheat and wheat-flour are now being imported. Though the low prices on the market make it difficult for us to grow wheat cheaply, it is worthwhile extending the areas to prevent the heavy imports. Promising strains from Pusa have been tested on the Irwin Canal Farm during the cold season. If sowings are made in the middle of August the crops flower in November and fair yields are secured. P. 52, P. 4 and P. 101 have given over 250 lbs. of grain per acre. P. 80-5, P. 12, P. 3 and P. 114 have also been tested and they have given over 200 lbs. per acre. If the seasons are favourable about 600 lbs. of grain could be harvested. If suitable

strains are secured both for the black-cotton soils and the irrigated areas, we have to extend the area to about 80,000 to 100,000 acres under wheat to produce our requirements.

*Togari.*—There are about 120,000 acres under this crop. Mysore, Tumkur and Chitaldrug are the important areas. In Mysore District alone there are about 25,000 acres and the other two districts have similar extent under Togari. Togari is largely imported from outside the State. Nearly 70 lakhs of rupees worth of pulse grains are often imported. The present area should be trebled or the yield raised by 300 per cent to provide our own requirements of pulses. Togari in Mysore is grown mostly as a dry crop. Pusa selections have given very heavy yields on the Irwin Canal Farm. T. 51 has given the highest yield of 800 lbs. per acre. T. 41 and T. 16 come next with yields of 666 lbs. and 533 lbs. Other types T. 80, T. 82 and T. 50 have also been tested. Some of them produce heavy tonnage of green matter and are well suited as green manures especially where the Sann-hemp crop is badly attacked by the moth.

*Bengalgram.*—Bengal-gram is largely used in the diet of Mysoreans. Over 50,000 acres are grown annually. Nearly half of this area is cultivated in Mysore District. The crop is usually a mixture of several types. The colour of the seed varies from black to light-brown. The crop is subject to pod borers. It is mainly a cold weather crop. Successful crops of Pusa types have been grown on the Irwin Canal Farm. November was found to be the best time for sowing there. T. 58 has given the best yield of 635 lbs., T. 25 has given 393 lbs. and T. 17 only 302 lbs. On the Hunsur Farm Bengal-gram is taken as a second crop after Kar-Ragi. A collection of local varieties and testing them against new types from other stations will have to be taken up early to evolve types suitable for all areas.

*Other Pulses.*—Nearly 780,000 acres are under horse-gram. Mysore, Tumkur and Chitaldrug are the important districts. Mysore District alone has over 280,000 acres. It is taken as a second crop after jola or Kar-ragi. The system of cultivation in Tumkur is the best. There are several varieties grown. A preliminary cytological study has been made. Being the most important pulse crop both for cattle and man the crop requires immediate attention for improvement. Forms which would produce

more green matter are highly useful in the Cauvery valley where it is extensively used as a green manure crop.

Avare is by far the most important legume largely used in the diet of the cultivators in the rural parts. Nearly 150,000 acres are under cultivation. It is largely grown in Kolar, Bangalore, Tumkur and Mysore Districts. There are many varieties. They vary in shape of pod, size and form of seed, colour of seed and productivity. Usually the flowers are white but some types have flowers of crimson colour. The infestation of pod borer is very heavy. Varieties vary in their resistance to pod borers and the store pest of Bruchid. In the Malnad areas where only one crop of paddy is taken it is worthwhile growing the winter crop of Avare usually grown after paddy in the Konkan districts. It is a small poded variety called "Val." Arrangements are being made to test it at Marthur.

Cowpeas are largely grown in Mysore for the seed. As a green manure for paddy is popular in the Cauvery valley. Experiments on the Hebbal Farm have shown that they are good as green manures to the Ragi fields. The small seed varieties known as thadagani are grown for seed. Large seeded ones are called "Alasandi." Rangoon varieties produce more leaf as green manure crops. American cowpeas specially the iron cowpeas ripen early at Hebbal and produce good yields of seed. Punjab varieties also thrive here. As a cheap and easily digestible source of protein cowpeas are a great asset in the diet of the people. At present there are only about 14,000 acres under cultivation. Production of good seed for green manure purposes is a great necessity.

Soy beans have failed as field crops. Varieties from China and United States grow here but do not develop the nodules. Two varieties from Java have done very well in garden lands and under tanks. They have succeeded as field crops on the black cotton soils. Many cooking experiments have been conducted to see if it could be easily recommended to the raiyats. But it does not lend itself easily to our local preparations. It does not cook well like our local pulses and is highly indigestible. The varieties contain under our conditions about 15 per cent to 17 per cent of oil.

*Gingelly.*—The area under gingelly in the State is about 76,000 acres of which 29,000 acres are in Mysore



and 19,000 acres are in Chitaldrug District. The value of exports is about 12 lakhs a year. There are several strains and seasons for cultivating them. Black gingelly is the main type. Recently a type of white gingelly from Raichur District has been introduced. Though it takes about three weeks longer to ripen the yields are heavier and the oil content more than the local black gingelly. Arrangements have been made to import a large quantity of seed from Raichur for distribution. This white variety fetches a higher price and it has done very well at Adivala near Hiriyur under irrigation. As a dry crop at Hebbal it was very promising. In addition to the oil the flowers are very useful as bee-feed.

Local black and white gingelly are being tested at Hunsur. Many plant selections have been made and a few are worth noting. As the flowers are cross pollinated by bees and other insects the breeding of this crop is a costly and laborious one. Since it is an important agricultural produce of export it requires a careful consideration.

*Coriander.*—There are only about 5,000 acres under this crop. Kadur, Mysore and Hassan Districts grow this crop but Ajjampur is the main trade centre. Often up to 4 lakhs of rupees worth of coriander is imported into the State. The black soils round Ajjampur are highly suited for this crop and its improvement will be taken up on the Ajjampur Cattle Farm. A large collection of samples of coriander have been secured from different parts of India and they will be sown next season. The coriander used in medicine is a small seeded variety of Russia. It is highly scented. Arrangements are being made to secure this seed.

*Chillies.*—This is a very important crop as it supplies a necessary article in our food preparations. There are over 70,000 acres under chillies chiefly in Mysore, Hassan, Shimoga and Chitaldrug. Many plant selections have been made at Marthur and the long fruited ones are popular. Further selection work is in progress on the Hunsur Farm. As an irrigated crop on the Irwin Canal Farm as much as 80 maunds of dried chillies have been secured per acre. Everywhere there is a big local demand and there is some export trade from the Malnad areas of Shimoga District. Just now a demand for improved types has been created near Hunsur.

### Plantation Products.

*Coffee.*—The most important plantation product is coffee. Over 107,000 acres are under this crop in Kadur and Hassan Districts. This is the largest area producing coffee in India. Mysore coffee had a good reputation on the market but in recent years the quality is said to be deteriorating. The old Giri coffee is still popular. The heavy attack of leaf rot is now successfully stemmed by spraying. By an organised campaign of pulling out dead bushes and treating the stem with "Tar Distillate Emulsion" the havoc of the borer is kept in check. The introduction of Robusta, Liberica and other hybrid varieties has not improved the industry. On the other hand by a free hybridization of various varieties by bees and other insects the stock of good coffee plants is being slowly replaced by doubtful plants. Great care is necessary to select plants of the true Mysore type and multiply them. The Coffee Breeding Station at Balehonnur is doing work on these lines. Many promising plant selections are being multiplied. Grafting experiments have been successful and the method is being advocated for propagating desirable plants. Attempts are being made to isolate strains to resist the leaf disease. Germination tests made at Bangalore show that the vigour of the seed for germination can be safely predicted by observing the percentage of germination on the fourth day.

*Areca.*—There are 44,000 acres of arecanut gardens. They are mostly found in the regions of heavy rainfall in Shimoga and Kadur Districts. Areca is grown in Maidan taluks also in small patches under tanks. Kole-roga has been successfully checked by spraying in the Malnads. Anabe is causing some anxiety in the Maidan parts. There are many varieties in the nuts. The coarse Rama Adike is of not much use but its greater resistance to Kole-roga may be useful in breeding work. Kalasa variety was tried at Marthur and the palms that are now bearing show no greater resistance to Kole-roga than the local ones. A sweet husked variety has also been noticed. Classification of the existing varieties and comparing their respective yielding capacities and the qualities of the different grades of nuts prepared are points that require immediate study. Manurial experiments have been carried on for years on the Marthur Farm and they give very interesting results of value.

*Cardamom.*—Large areas are grown in Hassan and to some extent in all areca gardens in the Malnads. Varietal studies have been conducted at Balehonnur. Fruiting branches, shape and number of fruits borne vary. Raising seedlings, selection of plants and the multiplication of selected ones by deviding the rhizomes will give much scope for improvement. Curing of fruits for colour and aroma on up-to-date methods are urgently needed for improving the marketing quality.

*Pepper.*—This crop is generally grown with areca in the Malnads. Its importance is slowly dwindling. New varieties of Balamcota and Kallanahally have been introduced from Taliparamba and they are thriving at Marthur. Rooted layerings and cuttings of the improved varieties are being widely distributed. In the Mysore Malnads pepper grows wild. At Agumbe in Shimoga, Kempanakote State Forest and Jog falls numerous wild forms are found. Near Balehonnur once a gaint form was secured. It is worthwhile making a search for more prolific types in the forest for cultivation.

*Plantain.*—Plantain is the most important garden crop. Several lakhs of rupees worth of fruits are being imported into Bangalore from South India. Out of about 19,000 acres grown in Mysore State nearly 8,000 acres are in Mysore District. Rasabale is our well known variety. The Salem varieties are spreading in the Hiriyur Taluk. They bear well and stand transportation. Those varieties are now being multiplied on the Irwin Canal Farm for general distribution. Better facilities for marketing and providing cheap money as crop loans are necessary to develop this industry.

*Mango.*—Nearly 18,000 acres are under this crop. Srinivaspur, Bangalore and Channapatna Taluks are important areas. The old gardens have failed and they are being cut down for fuel. New ones are not being planted. The famous Badami and Rasapuri varieties with attractive colour, good grain, size and flavour are fast disappearing. Reliable grafts are now not available and the trade in mango grafts is falling down. During the last four years experiments conducted at Peenya have shown that by judicious heavy pruning of trees the old gardens can again be rejuvenated. By cutting down the trees to about three feet from the ground and protecting the cut ends by a coating of tar and a thin layer of cement the main branches are forced to send out fresh

shoots and they revive the trees in two or three years and begin to bear well. This method seems to be a very profitable one for reviving old gardens.

A beginning has been made on the Hebbal Farm to make a collection of all the well known mango varieties. At present 25 varieties have been planted and many of them have begun to flower. It is proposed to collect types of fruits from all the well known areas of Mysore like Malavally, Nagar and Doddaballapur.

*Linseed*.—Small areas are sown with linseed in Mysore for seed. Seven improved strains were secured from Pusa and tested on the Irwin Canal Farm on the red soils with a few irrigations as a winter crop. Sowings were made in the middle of November and the crops were harvested in the middle of March. The yields were over 200 lbs. in all cases but No. 21 gave the highest yield of 564 lbs. of seed per acre. No. 68 gave 463 lbs. of seed. Other types tested were No. 10, No. 55, T. 12, T. 121 and T. 124. The crops are subject to heavy attack of mildew.

*Oats*.—Large quantities are imported into Mysore for feeding horses. Winter is the best time to grow it in Mysore. The vegetative growth is very good and good yields are obtained for fodder. The setting of the grain is very disappointing both at Hesaraghatta and on the Irwin Canal Farm. Four improved strains from Pusa were tested on the Irwin Canal Farm. If they are sown in September and harvested in January fair yields are obtained. B. S. No. 1 has given about 770 lbs. of grain and B. S. No. 2 gave about 605 lbs. of grain per acre. Hybrid J. and Hybrid C were also tested. For producing fodder for horses Oats will do very well here but it will be cheaper to get seeds from North India for the present.

*Barley*.—Over 25 varieties of barley were tested on the Hebbal Farm for the Breweries. The crop does not thrive here. A few strains were secured from Pusa and tested on the Irwin Canal Farm. All of them were failures. T. 21 was the only type which made some growth when sown in September. If we can secure a type that could be grown here there is some demand for it in the Indian Breweries.

*Tapioca*.—Usually two varieties are grown here in the gardens. One of them is the bitter Cassava. In Travancore Tapioca has become more or less a sort of

famine food. Each plant produces often over half a maund of starchy swollen roots. Dr. Coleman selected and sent six of the best varieties available in Java during his visit and they have been multiplied on the Hebbal Farm. All of them are thriving and have no bitter taste. Some of the varieties have produced nearly a maund of roots when the plants are a year old. When the cuttings are planted in rows one foot apart and a foot in the row tender roots like ordinary sweet potato can be obtained and they are very useful as a vegetable. They are easily cultivated as cuttings and stand droughts exceedingly well. Grown up plants can thrive without rain or irrigation for over 6 or 8 months. It is highly desirable to multiply them rapidly and distribute all over the State especially in the Kolar District and in the Malnads. As an insurance against famine it is hard to beat this crop. The following varieties are now available for distribution :—

A. Manji, A. Valenca. Md. Basiorao, Md. Tapicara, and Md. Haparica. All these have already been sent to Taliparamba on the West Coast for trial.

*Pineapple*.—Varieties of pineapple planted in the dry area on the Marthur Farm are thriving. A mulch of cane trash during summer months seems to be useful. Out of four varieties tested, Kew, Queen, West Indies and Mauritius the quality of Queen is attracting attention though the Kew variety produces heavy fruits. Recently varieties have been imported from Cochin and planted on the Irwin Canal Farm. Under irrigation and intensive cultivation Kew variety seems to be a very profitable crop.

*Ginger and Turmeric*.—Both the crops grow well on the Marthur Farm. It is quite possible to grow all the ginger requirements of the Medical Department. Several attempts were made to improve the quality of ginger prepared for the market. Much remains to be done in improving the curing methods.

*Medicinal Plants*.—The commercial variety of Senna introduced from Tinnavelly is thriving on the Irwin Canal Farm. Taraxacum, Fennel and Pyrethrum have done well at Bangalore. Rhubarb, Belladonna and Hyoseyamus made good growth at Bangalore. Ledgeriana variety of Cinchona seeds brought by Dr. Coleman from Java germinated well here and a large number of seedlings were raised on the Bababudan hills.

## GRASSES AND OTHER FODDERS.

*Legumes.*—Sand Lucerne was found to thrive here. They have long tap roots and tide over droughts. They deserve more attention in our grazing areas. Other varieties do well under irrigation and give several cuttings a year. Beersam makes a fair growth in the cold weather but as a field crop it is a failure. *Sesbania Egyptica* is a very useful legume for feeding cattle. Once it is established during the monsoon even on dry lands several cuttings could be had in a year. Velvet bean and Soy beans are useful if water for irrigation is available. Cowpea is very useful as a fodder either for feeding fresh green leaves or for making silage. Sann-hemp sown in the fag end of the season makes a tolerably good growth for fodder and it can be easily grown during the seasons of scarcity when other crops fail. Algaroba plants introduced by Dr. Kunhikannan have grown very well here and the sweet pods are relished by cattle. Kamara plants produce very good leaves fit for feeding cattle and they require to be multiplied in all the dry tracts where famines are frequent. Sisso leaves are also useful for making silage.

*Grasses.*—All the local grasses found in the vicinity of Hebbal have been collected and grown in lines to study their habit of growth, yielding capacity and suitability to various soils. A large number of them were found to be annuals. Some are perennials. One of the *Panicums* is very similar to Guinea grass but grows on dry soils without irrigation. Three or four *Ergrostis* are good as green feed. The rest are coarse and unfit for cattle. Many annuals like *Chloris barbata*, *Panicum Javanicum*, *E. Egyptica* and *Digitoria Marginata* are good for cattle and they grow as weeds in cultivated fields. *Hariyali* and *Panicum Indicum* thrive on wet soils. *Leersia* grows freely in the drains and wet channels. Kolakattai grass *P. cenchroides* from Erode grows fairly well but the quantity is low per unit area.

Among the imported grasses, a large number of varieties from Europe and America have failed. A few from Newzealand like Kikiyu also were not suited to our conditions. Natal grass has succeeded in dry lands. Napier grass of the thin type is thriving in dry soils. Napier grass of the thick type known also as elephant grass flourishes under irrigation. Johnson grass and Sudan

grass have not grown satisfactorily. Guatamala grass which is very much like maize and closely related to it does fairly well as a field crop on dry fields. The hard seed coat is said to bring on indigestion in cattle. Rhodes grass has come to stay as a good grass. It persists on dry soils but thrives well under irrigation. Guinea grass gives several cuttings per year under irrigation and is the cheapest grass for dairy purposes. Both Guinea grass and Rhodes grass require irrigation and heavy manuring along with irrigation and they do not stand salinity. Under such conditions the hardier Napier grass will do well.

~~The~~ Sun-flower has done exceedingly well as a fodder crop. Along with jola it has been used for preparing silage. The seed are very useful for feeding poultry and the oil has a good market. Maize is grown round about Bangalore for its cobs. Several varieties have been tested and discarded. The season of sowing has a great influence on the production of green matter. There are a large number of American long duration strains which are fit for fodder purposes and they may be profitably introduced and tested for securing desirable strains suitable for our seasons and soils.

*Seed Production and Distribution.*—Promising strains are taken out of the Breeding Plots when they have given encouraging results in at least three years and then tested on the Farms in plots of 1-20 to 1-10 acre for some years to study their average performance. In every case the strains are tested against a local standard variety and the experiments are conducted on three plots at least to make an allowance for variation in soil fertility. Strains that have done well in these rigorous tests are sent out to the districts for preliminary trials. There are mainly two agencies through which the testing of varieties is pushed forward. The members of the Mysore Agricultural and Experimental Union and influential cultivators do the testing for the Department under its supervision. Usually two or three strains which are likely to succeed are tested in each locality. The best of them, the one which satisfies the local requirement, is released for general distribution.

In the first instance the selected seed is sown on a private estate on one or two acres, cultivation, roguing, harvesting and threshing are done under the general supervision of the Department. Such farms are termed by the Department as "A" grade farms. If the seed

produced is good and it satisfies the purity, germination and vigour tests, it is certified fit for seed purposes. The grower is given a premium of 10 per cent for his trouble. Such farms for ragi are now scattered in many parts of the State and a few landlords who took a keen interest in the work have been awarded with the Public Service Medals by the Government in recognition of the good work done by them.

Seed from the "A" grade farms is distributed to several selected growers in the locality. At the time of flowering and harvest, the best fields are selected and the seed produced is taken over by the Department after necessary tests, for general distribution. These farms are termed as "B" grade farms. Thus in four years after leaving the Farm, the Pedigree seed has a chance of getting into the field of the cultivator. The general spread by private distribution begins usually from the fourth year. By the time a new strain is produced and it is released to the raiyat's field, a period of 8 to 10 years elapses and the various checks adopted in the tests and distribution ensures the release of only really good Pedigree seeds. Doubtful ones are eliminated during the process of multiplication. At present attention is being paid to Ragi only. Seed production on Paddy, Cotton and Groundnut will be taken up as soon as possible.

Mysore State was the first Province to organise a separate seed production section in the Department after the recommendations of the Royal Commission on Agriculture were published. A great demand for pure seeds of staple crops has been created in the State. The Co-operative Societies, Village Panchayets and the leading raiyats are helping wholeheartedly in the spreading of new varieties.

*Laboratory Work.*—There is a Botanical Laboratory and a large Breeding Cage at Bangalore. It is well equipped for giving help to the breeders. Critical Breeding Experiments and Cytological investigations are conducted here.

Early in 1913 Ragi was found to be a self-fertilised flower under dry land cultivation. This observation helped us to make a large number of plant selections in the fields and ultimately isolate H. 22, H. 2 and K. ragies. Methods were evolved to germinate Ragi pollen grain in moist chambers. By creating a dark moist chamber round the ragi flower it was found possible to induce the pollen



sacks to emerge out of the glumes without bursting within the glumes. This method has been further elaborated at Coimbatore and it seems to be useful in the breeding work on cereals with small flowers.

The groundnut plant has been studied in detail and methods of hybridization have been evolved. Several hundred hybrids have been raised and studied. A large number of the homozygous segregates are now under plot tests. Cytological investigations showed that Small Japan had 10 chromosomes haploid and the spreading Virginia had 20 chromosomes haploid.

A large collection of wild American cottons have been made and seeds of some of them have been distributed to other cotton workers in India. By soaking the seed and cracking the hard seed coat after the seed is swollen it has been found possible to easily germinate the wild cotton seeds. A method of germinating pollen grains of cotton on drops of castor oil in a moist chamber was found out. This will be useful in testing the vitality of pollen used in breeding work. Methods have been found to bud and graft cotton plants easily. It has now been possible to propagate original hybrids for observation along with the plants of succeeding generation. Further it has helped us to study the incidence of "Red Leaf" disease on different varieties of cotton by budding them all on one common stalk of a healthy tree cotton. The effect of stock and scion on one another has also been studied and interesting results have been obtained. Hybridization work on crossing the wild cottons of 13 chromosomes with the American cottons of 26 chromosomes have given very interesting results.

X-Ray work on Sugarcane is in progress in the Laboratory. Material treated here is sent out to the Farms for planting. Potatoes, groundnuts, paddies and cottons have also been treated with X-Ray. Ragi seeds from Government Farms, and from "A" and "B" grade Seed Farms and paddy, groundnut, jola and other seeds are tested in the Laboratory. Nearly 300 samples are studied every year. Two extra hands are usually employed in the season for two months to help the permanent staff.

Post-graduate students work here for sometime and many of them have found employment in various places in India. One of the staff is in charge of the teaching work at Hebbal. A Botanical Garden is being formed at Hebbal to help the students in their study of cultivated

crops and economic plants. The Section is often engaged in the preparation of exhibits for the Dasara "Industrial and Agricultural Exhibition" and other District shows. A scheme is now before the Government for enabling at least six research students to carry on important investigations on the staple crops of the State.

##### 5. AGRICULTURAL ENGINEERING SECTION.

This section was constituted in the year 1915 with the appointment of an Agricultural Engineer. After two years, a small staff of subordinates was provided and an Assistant Engineer was added to the section in 1929. The work of the section relates mainly to the critical study and field tests of imported and locally made implements and machinery of various kinds with a view to investigate the possibilities of adapting them for local conditions. In addition, this section looks after all the Civil and Mechanical Engineering work of the whole Department. The teaching of Agricultural Engineering in the Hebbal Agricultural School and the management of the Workshop on the Hebbal Farm have been assigned to the Assistant Engineer. The planning and construction of buildings on the Farms including the lay-out of roads and drains is carried out by the Agricultural Engineer.

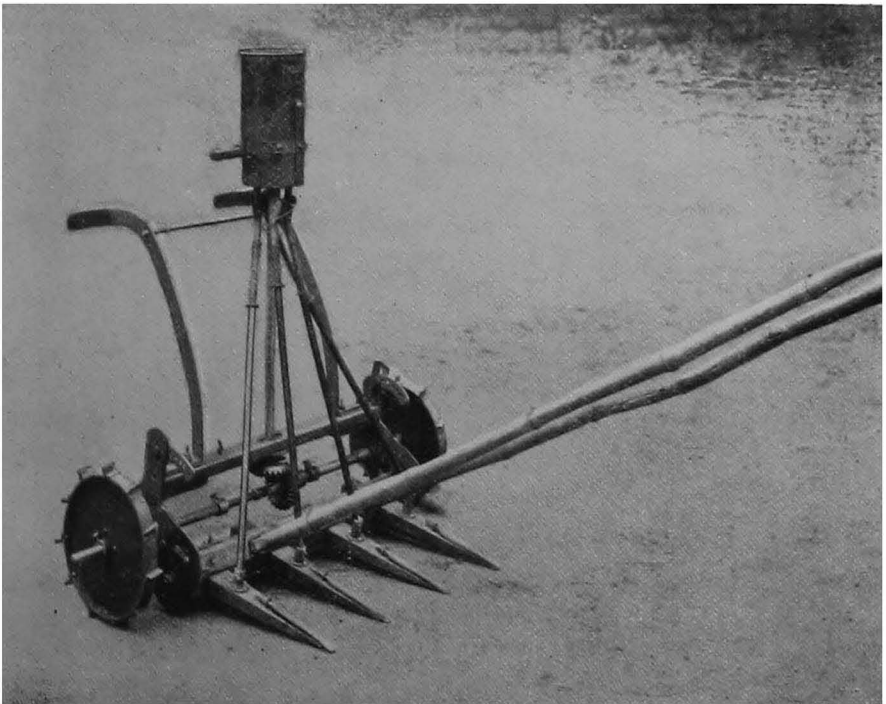
2. The installation of and attention to the pumping machines, sugarcane crushing machines and ginning machines on the various Farms has formed part of the work of this Section. Such large scale implements as the Department possesses, such as tractors and tractor ploughs, etc., are also in charge of this section.

3. In the midst of these duties, this section has paid attention to several important projects connected directly with Agricultural improvements. They are:—

(i) The design and execution of the "Mysore Plough" after various trials and alterations. The work was carried out in a small Workshop on the Farm, until the model was ready for production in bulk. The first consignment of a few hundred ploughs was got made at the well-known plough manufacturers, Seimens and Jeffris in England. They were sold locally and to Departments of Agriculture in Bombay, Bengal, United Provinces, Baroda and Travancore. The cost of the imported product being high, attempts were made to reduce it by encouraging its manufacture locally. Ploughs are now



A sight of ploughing.



Improved seed drill.

made at the Government Industrial Work Shop and sold for nearly half the original price.

(ii) After carrying on a series of trials with models for the design of an improved seed drill to replace the existing indigenous drills which though simple, and ingenious have still some drawbacks, an automatic drill has been brought out recently into successful operation. A few improved drills are under distribution to establish their advantage over the prevailing types.

(iii) A small suitable bagasse furnace has been evolved, as a result of much work done in collaboration with the Hebbal Farm Staff after designing more than one type of fuel saving furnace for jaggery boiling. The improved furnace is being built in large numbers through the efforts of this Section and the District Staff.

(iv) An areca drier has been designed in collaboration with the Mycological Section on the model of the imported iron drier after trying a number of types. It is a cheaper substitute and is recommended for the areca gardens of the Malnad.

(v) Cheap bee-keeping appliances have been designed and are made in required quantities for the Agricultural Section. Cheap spare parts of the Koleroga Sprayers are supplied from the Hebbal Work Shop which in addition, manufactures all the indigenous implements for the Department.

(vi) Large applications for tractor ploughing are received. With a view to help in bringing more land under the plough, a Fordson Tractor with a plough outfit is maintained and let out on hire.

The Agricultural Engineer not only attends to requests from raiyats for technical advice regarding the installation of pumps and engines, farm drainage and irrigation and survey of lands, but also arranges to carry out or supervise work that may be started as a result of the advice.

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## CHAPTER V.

## Research—(contd.)

## THE GOVERNMENT EXPERIMENTAL FARMS.

The Government Experimental Farms are seven in number—*viz.*, (a) The Hebbal Farm, (b) The Marthur Farm, (c) The Babbur Farm, (d) The Nagenhalli Paddy Breeding Station, (e) The Coffee Experimental Station at Balehonnur, (f) The Kar Ragi Breeding Station, Hunsur and (g) The Irwin Canal Farm, Mandya.

(a) *The Hebbal Farm.*

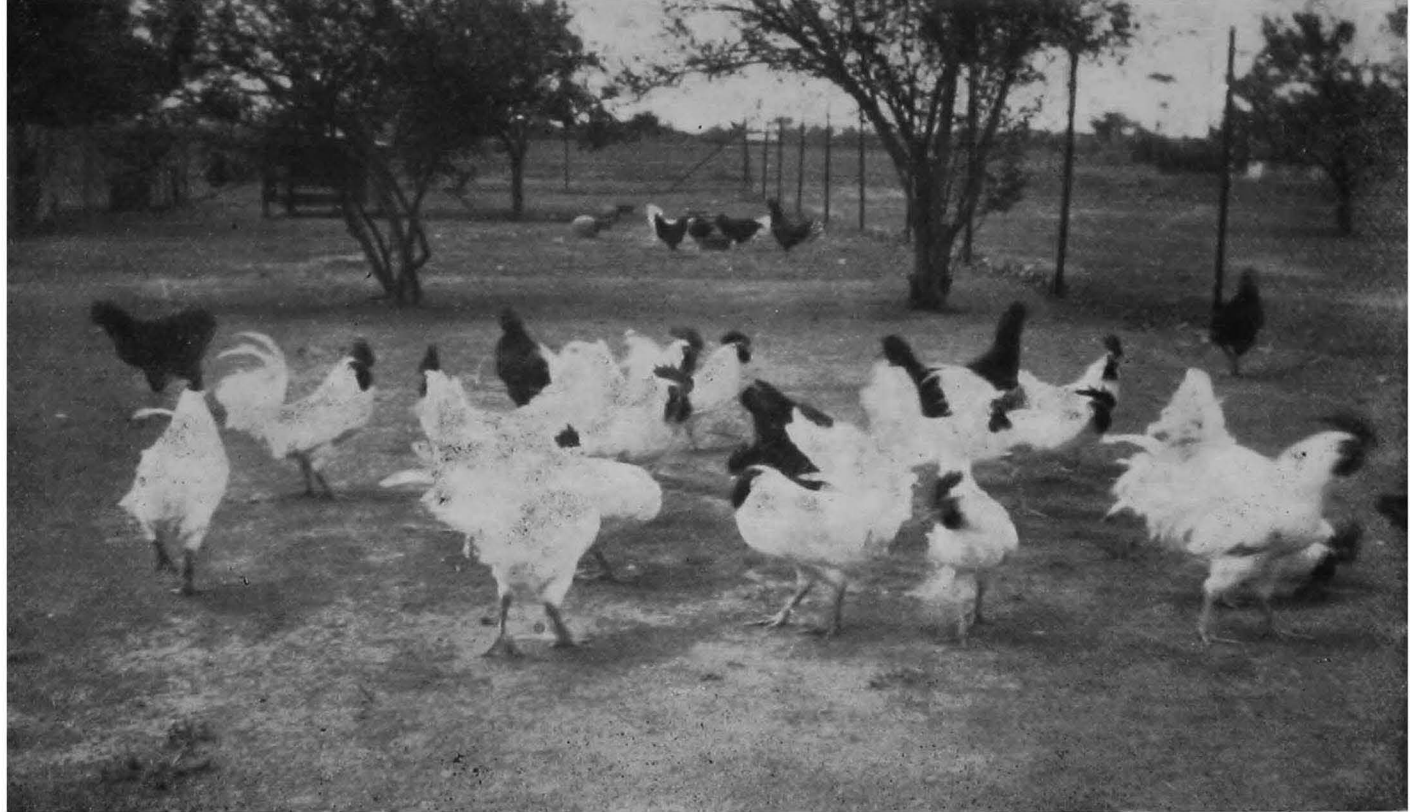
This is the oldest of the seven Farms and was opened in the year 1904. It is situated in the village of that name, about five miles from Bangalore. The tract is representative in a general way of the red soil areas which largely comprise the Bangalore, Tumkur and Kolar Districts. It comprises cultivated area of 20 acres of wet land and 60 acres of dry land. The wet land is commanded by an irrigation tank and is further protected by an irrigation well.

On the Farm is also situated the Agricultural School, with its adjuncts, the Hostel, the Veterinary Hospital and the Hebbal Dairy and Poultry Farm.

A small workshop which comprises the Agricultural Engineering Section and which also gives instruction in carpentry, smithy work and fitter's work to the students is also located on the farm. The bulk of the Farm buildings, and the general lay-out of the Farm were designed by Dr. A. Lehmann when he was Agricultural Chemist.

The experimental work on the Farm has related mainly to sugarcane and paddy among wet crops and to ragi, groundnut and castor among dry crops.

The experimental work of the Farm was preceded by a thorough scheme of standardising of the Experimental plots for a few years before they were utilised for the experiments, a feature seldom seen on any other farm in India.



Poultry on the Hebbal Farm.

The experiments on sugarcane related to—

- (1) time of planting,
- (2) maturity of cane,
- (3) varietal tests,
- (4) manurial tests and
- (5) spacing tests.

Moreover all the breeding work on cane of the department has been conducted on this Farm.

Work on paddy has likewise related to—

- (1) manurial tests,
- (2) varietal tests,
- (3) green manuring,
- (4) seed rate,
- (5) age of seedlings,
- (6) duty of water and
- (7) effect of ploughing after harvest.

Work on ragi has related to—

- (1) methods of sowing,
- (2) mixed and pure cropping,
- (3) green manure experiments,
- (4) tillage experiments,
- (5) varietal and
- (6) manurial experiments.

It was from the Hebbal Farm that the short season groundnuts (including H.g. 1, a chance hybrid, which are now grown on thousands of acres were first introduced into the State. In addition to these, several of the main season varieties of groundnuts for example, Sogatur Virginia, Mauritius, Carolina and Transvaal have been tested and much seed of the first two distributed.

A large variety of implements, ploughs of different kinds, and other tillage implements including the "Spalding deep tillage implement", seed drills, a potato digger for harvesting groundnuts, pumps and engines, threshing machines, reaping machine, etc., have been tried on the farm to determine their suitability to Mysore conditions. All the work in connection with the design and tests of the "Mysore" plough was conducted on the Hebbal Farm.

The Farm incidentally supplies some quantities of seeds of the selected varieties of the different crops, principally sugarcane, paddy and ragi. Larger supplies are

made from the other farms: Sugarcane from the Irwin Canal Farm, Paddy from the Paddy Breeding Station at Nagenhally and Kar Ragi from the Kar Ragi Breeding Station, Hunsur and Cotton from the Babbur Farm near Hiriur.

(b) *The Marthur Farm.*

The Marthur Farm is situated in the interior of the Malnad near Talaguppe in the Shimoga District not far from the famous Jog Falls. It was opened in the year 1914 with the object primarily of experimenting on "Koleroga" of the arecanut, but was later developed to include experiments on the cultivation of areca, paddy and sugarcane and other crops suited to the Malnad tract. It is 56 acres in extent and fairly typical of the Malnad areca and paddy area.

Work on the koleroga of the arecanut has related not only to the devising of the main remedy, *viz.*, the spraying with the Bordeaux mixture and the importation of a suitable spray pump, the Holder Sprayer which this Department was the first to get out but also to the different "Stickers" resin soda and casein, and groundnut oil and other oils, their preparation, time of application and so on. Extensive manurial experiments, *viz.*, the testing of the suitability of different kinds of green manure to this area of heavy rainfall, the use of artificial manures, the practice of growing and digging in green manure have been in progress. The results have shown that yields of arecanut per acre can be increased by 50 per cent by the application of a mixture of groundnut oil-cake and sulphate of ammonia and superphosphate and sulphate of potash. The growing of green manure between the rows of the areca palms, in preference or as an adjunct to the usual practice of bringing in leaves from the forest, the damage to which as a consequence has often been protested against, has been found to be very useful.

Experiments on sugarcane have related not only to the best varieties that could be introduced into this tract, but to the manuring and cultivation side of the question also. Of the varieties of sugarcane so far tried H.M. 553 has been found to be the most suitable for Malnad conditions and setts of this variety are being distributed. The begasse furnace constructed on the Farm has been much appreciated and has resulted in creating a demand for the construction of similar furnaces for jaggery making.



Paddy being the chief or the sole grain crop of the tract, a number of varieties suitable to the tract have been on trial. Six of these have been tried on a bulk scale and of these H. O. 529 and W. 3629 have given the best yields with regard to grain as well as straw. A good deal of demonstration work on the economic transplanting of paddy which has been largely and successfully popularised in the Malnad paddy areas was conducted on the Farm in the earlier years.

Pepper being one of the most important of Malnad crops, experimental work on this crop is carried on on the Farm. A large number of varieties gathered from different parts of both Mysore and Malabar have been tried for a number of years. Some of the varieties from Malabar have been giving decidedly higher yields than the local ones, and a large number of layerings and cuttings of the best among them are being distributed to cultivators in the neighbourhood.

For demonstration purposes, the Farm has also a silo. As in the wet season throughout the Malnad there is a luxuriant growth of grass which does not admit of being cut and dried into hay, the practice of Silage Making has been deemed a desirable one to introduce in the Malnad. On the Farm excellent silage has been made in ordinary pit silos. It is expected that the example of the Farm in this respect will be copied by the raiyats of the neighbourhood.

Attention is also paid on the Farm to the introduction and testing of varieties of certain minor crops such as ragi, chillies and groundnuts. Selection M. F. 1 of chillies has been giving very good yields and deserves to be introduced on a large scale in this tract.

Another minor crop that has done well on the Farm is Pineapple. Of the four varieties tried the variety "Queen" has done best. There is a great demand for this in the neighbourhood.

The Farm has also an orchard area, on which several kinds of fruit trees have been planted to test their suitability to the tract.

### (c) *The Babbur Farm.*

The Babbur Farm is situated in the Hiriyur Taluk of the Chitaldrug District, in the tract irrigated by the (Marikanive) Vani Vilas Sagara irrigation system. It is

also representative of the great black cotton soil country of that district on which the special crops grown are jola and cotton. The Farm is therefore intended to demonstrate the cultivation of sugarcane and other irrigated crops on a large scale as a measure of development of that area, and also to study problems relating to the cultivation and improvement of the typical black cotton soil crops, cotton and jola. The area is also one where alkali patches abound, the trouble having also been aggravated by the irrigation project.

The Farm comprises a total area of 210 acres, of which one hundred and thirty is irrigable while the remainder is all dry land.

The crops grown on the Farm are sugarcane, Cambodia, Mysore—American and other irrigated cottons and plantains on the wet area and Selection No. 69 and H. 190 cotton and jola on the dry area. Sugarcane has been grown only over an area of from 10 to 20 acres, the principal reason being the unsuitable nature of the soil, which is wanting in depth and is greatly in need of drainage. A thorough system of open drains has greatly improved the soils after several years of continued attention and this has served as an object lesson to the neighbourhood. Manurial and varietal tests on sugarcane are carried on, the former indicating the need for cattle or organic manures for these soils which could not be altogether replaced by artificials though the latter in conjunction therewith have given greatly increased yields.

The varieties H. M. 553, Babbur Striped, H. M. 608 and Co. 281 and Co. 290 having done very much better than the local canes Rasathali and Pattapatti, some of these are being largely grown on the Farm and also distributed in the locality. Of these, Co. 281 and Co. 290 have done very well.

The Farm owns a large power crushing plant and a battery of three open pan furnaces for boiling down the juice into jaggery. Wood fuel has altogether been dispensed with and the jaggery boiling charges greatly reduced thereby. The whole arrangement serves as a demonstration of large scale methods in the tract.

A large area was put under plantains more or less as a nurse crop to the young cocoanut plants of which a plantation has been raised. The cocoanut is becoming a popular crop in this locality, and this area on the Farm under cocoanuts has been put down to study manurial

cultivation and other problems relating to that crop. A large number of varieties of plantains were planted and the result showed that the most profitable variety to plant was the "Poovan" of Coimbatore, the so-called choice varieties not proving suitable at all or as good as this variety. Cambodia and Mysore—American cottons are grown as a bulk crop, from which the large seed supply for this tract is derived.

On the dry land, the most important work has been breeding work in regard to the local "sannhatti." As the result of this work, Selection No. 69 and H. 190 have been evolved, which are superior in length, colour and uniformity of staple and ginning percentage to the local variety and also yield well under dry conditions. Selection No. 69 variety has been distributed largely through the District Staff, the area in the year 1935-36 being about 13,000 acres.

Systematic selection and breeding work on jola has been going on during the last ten years with the result that unit strains of all the local varieties have been isolated and a selection from a promising variety from Hyderabad called Maldandi is being extended.

The Farm is also equipped with two double roller gins in which all the Farm cotton is ginned pure for seed purposes. A great deal of the raiyats' cotton is also brought to the Farm gins and the return by way of ginning charges amounts to a substantial sum in certain years.

The new variety of cigarette tobacco which is being grown on a large scale in Goribidnur, Whitefield and other areas at the instance of the Tobacco Company is being tried on this Farm also with a view to see if it is possible to introduce its cultivation in this tract.

Recently a cocoanut and fruit nursery has been started. Different varieties of cocoanuts, arecanut, pomegranates and lemons, etc., were obtained from different parts of the State and a nursery raised with a view to be able to meet the demand for the seedlings which was expected as a result of the policy of Government to encourage fruit growing by special *takkavi* loans under the Vani Vilas Sagara. The response from the people has not however been very encouraging.

Just in the same way as the other Government Farms, the sale of seeds of different kinds is a very large item of the work; 50 maunds of cotton seeds of the several improved varieties and varying quantities of paddy and

jola are being supplied annually, in addition to Sugarcane setts.

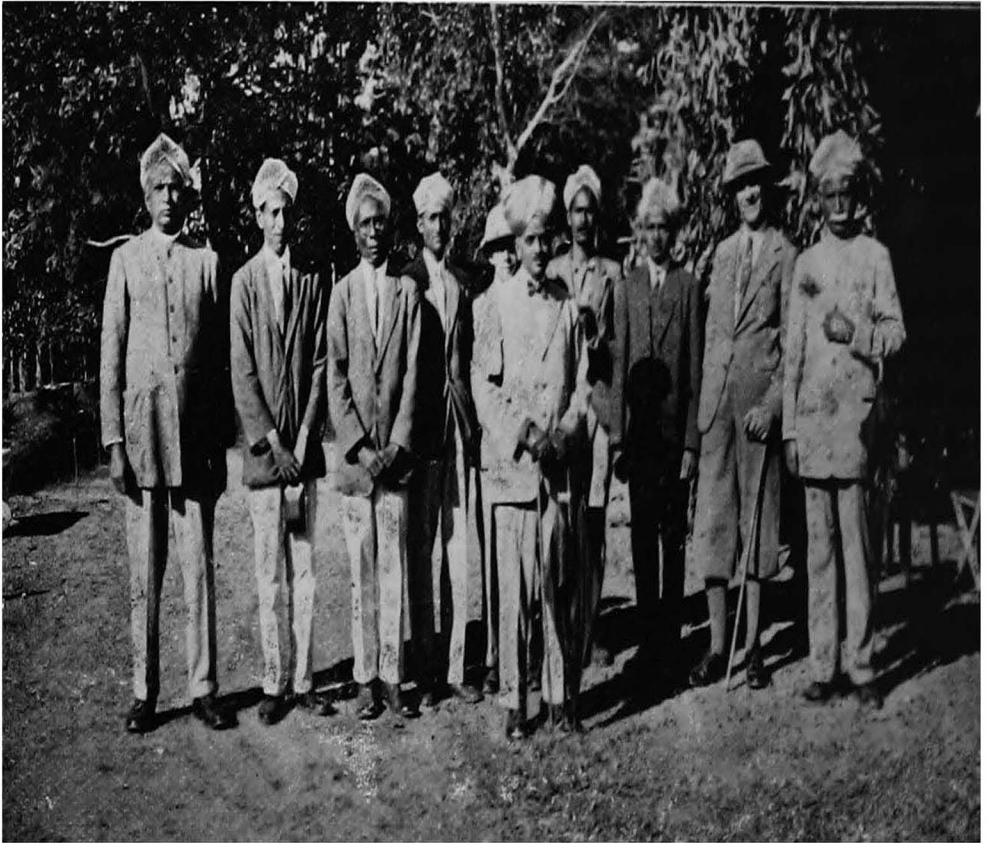
(d) *The Paddy Breeding Station.*—Nagenhally, situated at a distance of five miles from Mysore on the Mysore-Bangalore Road, was started in 1917 as a Sugarcane Farm with Paddy as an important subsidiary crop, but was later (1928) converted into a Paddy Breeding Station devoted exclusively for breeding new varieties and for the study of problems connected with Paddy.

Testing promising varieties of Sugarcane evolved on the Hebbal Farm as regards their suitability to the Mysore Channel area and multiplying such varieties and supplying their seed to the raiyats formed the bulk of the work on this Farm. Incidentally the Farm also carried out manurial tests on sugarcane and experiments on the cultivation methods—chiefly a rotation of sugarcane and groundnuts instead of sugarcane and paddy—and experiments on planting seasons and demonstration of jaggery boiling methods.

Until 1924-25 arrangements for giving the Farm a hot weather supply of irrigation water were not complete and consequently sugarcane was being grown under great difficulties, nevertheless about three lakhs of setts of cane of the H. M. 544 and other varieties were supplied to the raiyats during the few years it continued as a Sugarcane Farm. The Farm also milled sugarcane for the raiyats of the neighbourhood in its power mill for a small fee in order to popularise the idea of a co-operative ownership of a power mill and engine by the raiyats themselves.

The Farm devised a cultivating tool for bullock draught combining a bladed hoe with an earthing up arrangement for work between rows of cane, cotton or castor so that hoeing and earthing up may be combined in one operation. On the smaller terraces, which do not allow of the use of bullock drawn implements, the Planet Junior Hand Hoes were used for working between the rows of cane.

Work on paddy has related mainly to varietal tests and manurial experiments. A large number of selections have been isolated and tested on a large scale. Some of these given over for trial in the Districts have done very well. S. 246, S. 268, S. 363 and Maharaja Bhoga are some of the new varieties full of promise. G. E. B. 24 or Coimbatore Sanna as it is popularly called which is now grown on about 30,000 acres all over the State was first tested on this Farm.



Opening of the Coffee Experimental Station Laboratory by **His Highness**  
the Maharaja of Mysore.

The following are some of the manurial problems studied on the Farm :—

- (i) The use of superphosphate alone and in conjunction with the green manures usual in the tract ;
- (ii) The use of nitrogenous manures like sulphate of ammonia combined with supers ;
- (iii) The use of ammonium sulphate with bone-meal ;
- (iv) The use of oil cake with supers ;
- (v) The value of basic superphosphate as against ordinary superphosphate ;
- (vi) The value of "Ammophos" of the grade 20-20 in comparison with sulphate of ammonia and super ;
- (vii) The effect of varying proportions of nitrogen and phosphoric acid in the manure mixture ; and
- (viii) The value of lantana as a green manure as compared with sannhemp and wild indigo.

As a result a manure mixture for paddy consisting of sulphate of ammonia and superphosphate has been largely advised in the neighbourhood. Superphosphate alone does not give profitable yields without the addition of nitrogenous manure. "Ammophos" gives very good yields and if it can be supplied cheap would prove a popular manure; and lantana can be profitably utilised as a green manure for paddy.

It has also been observed that a basal dressing of green manure at a stipulated time before transplanting definitely improves both yield of grain and straw irrespective of the nature of the soil or the source of the irrigation water. It therefore appears that the influence of fertilizers, cakes and organic bulk manures like Compost are complementary and should be tested as addenda to a basal dressing of green manure, and experiments have been laid out on these lines for the coming years.

(e) *The Coffee Experimental Station* started in the year 1925 is situated near Balehonnur in the Kadur District in the heart of the Coffee region with an elevation of 2,700 feet and an annual average rainfall of nearly 100 inches. The soil is of varying character and represents average kinds generally met with in the Coffee areas of the State. The Station owes its inception to the success of the preliminary work on coffee conducted by the department both in the Laboratories at Bangalore and on private estates prior to 1925 and the

consequent offer of co-operation and support from the planting community for organising and conducting a Central Research Station for an all-round and intensive study of the several problems connected with coffee. Fifteen acres of bearing coffee, the generous gift of Mr. C. S. Crawford, a prominent planter of the locality formed the nucleus of the Farm which now extends over an area of over 300 acres. Eighty-two acres of this area is mature coffee 20 to 35 years old; 20 acres, three to eight years old and 15 acres, two to three years. There is besides, about 185 acres of jungle suitable for fresh planting. There is a well equipped Chemical and Biological Laboratory and a complete set of meteorological instruments on the Station.

The funds to run the Station are derived partly from the levy of a cess of 2 annas per acre on all estates above 15 acres in extent and a contribution by the Government of Mysore equal in amount to the total cess collection.

Another special feature connected with the work and administration of the Station is the close association of the planters with the Department. There is an Advisory Board consisting of five planters representing planting interests in Mysore and South India assisting the Director of Agriculture in the administration. Another point of contact between the departmental staff and the planters in the work of the Station is the Scientific Officer of the United Planters' Association of South India who is working on the Farm under the general control of the Director of Agriculture.

The main lines of work programmed to be conducted on the Station come under the following:—

- (i) Botanical,
- (ii) Chemical,
- (iii) Mycological,
- (iv) Entomological,
- and (v) Miscellaneous.

Under Botanical investigations plant selection and hybridization form the most important item of work. A large number of selected plants of Arabica are selfed and also fertilised under controlled conditions. Thousands of selfed and crossed seedlings are growing in the field and the most promising ones are being watched and studied.



**Cultivation of Pine Apple on Irwin Canal Farm.**



Among plant propagation methods that are being studied are (a) grafting, (b) budding and (c) growing of cuttings. Various kinds of stocks—Robusta, Liberica and Netrikonda hybrid—have been tried of which Robusta and Netrikonda appear to be promising.

The period for successful grafting, the kind of sucker (scion) to be used and the most efficient technique for grafting have all been studied and the results published in the Station Report for 1930-31. Raising coffee cuttings and budding have been tried. Budding seems to be a more successful and easier means of multiplying than growing cuttings. Large scale operations of these methods are under progress.

*Chemical.*—A comprehensive scheme of manuring has been laid out on about 50 acres of mature coffee. This includes trial of various forms of organic and inorganic manures both singly and in combination. Variation of plant food ratio and dosage experiments are also being tried.

The results of these and other chemical experiments are discussed in the work of the Chemical Section.

*Mycological.*—Mycological investigations comprise (a) scientific research of the causal organism of disease and (b) methods of disease control.

Leaf disease, black-rot, die-back and root-rot have all been studied. Experiments have been conducted on the composition and the strength of spray mixtures; the most suitable time for their application and efficacy of different kinds of spraying appliances. The results so far achieved are discussed under the work of the Mycological Section.

The Coffee Scientific Officer of the United Planters' Association of South India is also engaged in the study of Leaf Disease of Coffee. He has identified three strains of leaf disease spores attacking Coffee Arabica which behave differently to different strains of coffee. This knowledge will, it is expected, be useful in breeding resistant types of Arabica Coffee.

*Entomological.*—The Station is particularly fortunate in that the borer and green bug pests are not at all severe; opportunity being thus limited for study and experiment on such pests, the Entomologist has been obliged to carry on his experiments on private estates elsewhere. The trial of a tar emulsion as a wash on the coffee stems has proved effective against borer pest.

*Miscellaneous:—*

*Subsidiary Crops.*—Of the subsidiary crops, the study of cardamoms is the one taken up at present. Important varieties of pepper are also grown.

The important types of cardamom grown are (1) Valparai "Ceylon", (2) Mysore and (3) Malabar. The plants have just come to bearing and an attempt has been made to study the different characters such as habit of growth, vegetative characters, fruiting, etc., as a preliminary survey to facilitate definite programme of breeding work.

*Meteorological Station.*—The equipment includes the following instruments—Wet and Dry Bulb, Maximum and Minimum Thermometers, Standard Barometer, Anemometer, and Wind-vane. Recently a Sun Shine Recorder has been added. An Observer, qualified in Agricultural Meteorology, has been recently appointed to study the relationship between the incidence of coffee diseases and climatic conditions.

*Library.*—The Station maintains an up-to-date Library consisting of several important publications on Coffee.

(f) *Kar Ragi Breeding Station, Hunsur.*—(Twenty-eight miles from Mysore on the Mysore-Mercara road.) This was opened in 1928 for work connected with Kar Ragi and other crops of the Kar area. Plant selections and testing of varieties which had been commenced on a small scale even before the starting of the Breeding Station have been continued, and out of the many promising selections of ragi, one violet compact variety—H. K. 13—appears to be very promising. It is closely followed by a green compact type K. 1. Both of them give much heavier yields than the local Kar Ragi mixtures. Attempts are being made to introduce them into the general cultivation of the Kar tract.

Jola, Tobacco and Castor are some of the other crops that are being grown on this Farm and very interesting results have been obtained in regard to the latter two crops.

(g) *The Irwin Canal Farm.*—The largest among the Departmental Farms situated near Mandya on the Bangalore-Mysore Road was started in the year 1931 with the special object of working out the several problems connected with the development of the tract that was just being brought under irrigation by the Irwin Canal and its



**Zig zag method of irrigating cane on a slope.**



**Ridging with a mould board plough when the cane is 3 months old.**

branches. Soil conditions are typical of the whole tract except that grey soils are not represented. All the other types of soils—stoney, gravelly, sandy, loamy and clayey soils—are present in the farm area. It is a combined experimental, demonstration and seed farm.

The area of the Farm is nearly 650 acres of which about 500 acres are under irrigated farming. The principal crop grown is sugarcane about 200 acres coming under this crop every year.

As the irrigational system introduced into this tract is based on a rotation of crops—paddy, dry, and sugarcane—an area of 40 acres is devoted to this block system. Another kind of block system in which the low lying lands are under paddy permanently and the upper parts come under a rotation of sugarcane and dry crops only is also being tried on a corresponding area.

Experimental work on the Farm has included :—

- I. Trial of crops that could be grown in the Irwin Canal Area and the season suited for each.
- II. Manurial experiments with Sugarcane, Paddy Cotton, Groundnut and Tobacco.
- III. Experiments to study the duty of water for sugarcane and other crops.
- IV. Reclamation of alkaline soils by the use of molasses in different doses.
- V. Reclamation of water logged soils by underground drainage.
- VI. Methods of combating sugarcane borer pest.

Results of experiments under the charge of the several Scientific Sections are described in a previous chapter under the work of the sections concerned. What follows is a brief account of the general work that is being conducted in addition to the experiments referred to above.

Paddy, cotton, groundnut, tobacco and gingelly have all been tried and found to grow very well on the Farm and efforts are being made to extend the area under each of these with a view to produce pure seed for distribution among the raiyats of the tract.

From the results obtained so far it has been observed that two of these crops—Tobacco and Cotton are eminently suited to be grown as alternative crops to sugarcane as the maximum area that could be put under sugarcane

depends to a very great extent on the limited requirements of the Sugar Factory.

Thirty to forty acres of land on the Farm are, during the last two years, put under the new variety of tobacco—Harrison Special—that is being grown on extensive areas in different parts of the State for the Mysore Tobacco Company. The leaves are cured in a barn specially constructed on the Farm for this purpose. The crop compares very favourably—both in respect of quantity and quality—with that in any other part of the State and deserves to be popularised in the tract particularly in view of the advantage of the assured water supply it enjoys.

Two varieties of cotton—M. A. 2 and Co. 2—have also done very well and attempts have already been made to introduce these into general cultivation in Mandya and Maddur Taluks. A power gin has been put up on the Farm to handle all the cotton that may be grown in the neighbourhood so as to be able to supply pure seed for larger areas that are expected to come under this crop during the coming years.

Attempts have been made to demonstrate that it is possible to grow a crop like plantains by making use of water given according to the rotational system of irrigation during a period of three years. A portion of the Farm is laid out into a cocoanut garden. A small orchard has been started to study the possibility of growing citrus, pineapples, pomegranates and other fruits. Fodder grasses such as Rhodes grass, Guinea grass, Napier grass and Elephant grass and Lucerene are also being grown. All low-lying and water-logged portions have been planted with casuarina both with a view to dry out the land in course of time and also to solve the fuel problem in the tract. An area of nearly 20 acres is devoted to Botanical work to evolve new varieties of crops by selection as well as hybridization work with sugarcane occupying a great portion of this area.

In spite of the comparatively large area that is being handled, only such agricultural implements as are worked by bullock labour and are within the reach of the ordinary raiyats are in use on the Farm.

Almost from its inception, the Farm has exercised great influence in demonstrating modern methods of cane cultivation to the farmers in the neighbourhood and through them to the cultivators in the rest of the Irwin



A view of Plantain Garden on the Irwin Canal Farm.

Canal Tract and it may with confidence be expected that it will exercise a similar influence during the coming years with respect to the cultivation of many other crops that may have to be introduced in the interests of further development of the tract.

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## CHAPTER VI.

**Extension, Popularisation or District Work.**

**Staff and Equipment.**—The work of extension and popularisation of improvements in agriculture has been in the hands of Divisional Officers designated as Deputy, Senior Assistant or Assistant Directors in charge of one or more Districts assisted by a staff of Agricultural Inspectors and Fieldmen. The Inspectors' Ranges have ordinarily extended over two Taluks. The Inspector has under him two or three Fieldmen carrying out the actual field operations in the various items of demonstration work.

Each of the Agricultural Inspectors has an office and one or more Depots where seeds and implements and sometimes manures and sprayers and spraying chemicals recommended by the department are stocked for sale. Agricultural Inspectors are also supplied with a set of improved implements such as plough, cultivator, harrow, sugarcane mill, etc., for being taken out and worked on raiyats' fields as demonstrations.

As work developed and as trained men became available there has been a gradual increase in the strength of the entire District staff.

**Methods of Work.**—The popularisation of improvements is carried on in a variety of ways but the greatest importance is attached to the only efficient method, *viz.*, that of ocular demonstration. All improved implements are shown at work side by side with the local implements on the raiyats' own holdings. Sufficient interest is aroused and co-operation enlisted to induce respectable raiyats to carry out on a small scale one or other of the various recommendations of the department. It may be the trial of a new variety of crop, of a new manure or manure mixture, of a new method of seed selection, a new method of planting, of treatment against pests and diseases and so on. Such areas serve the purpose of demonstration plots for the neighbourhood carrying conviction not only to the actual cultivator concerned but also to his interested neighbours. The success of the staff is judged by the extent to which the raiyats'



confidence is enlisted and the number of such demonstration areas increased. From these as nuclei, the improvements spread and the district staff takes all possible means to give publicity, to supply the seeds or manures required, to supervise and advise, and to steadily widen the area of each improvement.

The name of every person who thus undertakes any of the recommendations is borne on the Clients' Registers of the Inspectors who are to watch the progress, to see that the methods are permanently adopted, to look into and attend to repairs or renewals of worn parts of implements, in fact to keep in frequent touch with such agriculturists. No opportunity is missed to address meetings or gatherings of raiyats, to hold ploughing and other demonstrations suitable to the seasons, and bring the recommendations to the notice of the people; at the various 'jatras' and cattle fairs, the larger weekly fairs, at Jamabandi gatherings and at the meetings of Co-operative Societies, the Agricultural Department is in evidence, lecturing, demonstrating and exhibiting.

For all the materials such as manures or seeds supplied for the demonstration areas, it should be said to the credit of the raiyat, he pays cash, so that these cost little or nothing to Government. It is only in very exceptional cases or with any special funds that may be provided by Local Bodies who may be anxious to speed up improvements in their tract that any of these articles are given free or at concession rates. The object of Government farms is thus secured more efficiently, more cheaply and to a very much wider circle of raiyats than may ever be possible by the opening of Government Demonstration Farms here and there in the country. The various lines of work along which the district staff reports progress from month to month will be seen from the diary heads prescribed which is given in the appendix.

The bulk of the work accomplished along the main recommendations may be summarized as below, the figures covering the 23 years beginning 1914 when this Section was constituted unless otherwise specified.

**Inspection of Estates, Advice and Clientele.**—The department has succeeded in inducing raiyats to resort freely to the department for advice regarding the improvement of estates. It can be claimed that there is no landholder of any importance whose land has not been inspected by the staff. It is a sign of the times that a number of

English educated landholders and others are beginning to look to the land for a career, are acquiring new land or taking up the cultivation of their own land into their hands and avail themselves of the advice of the department relating to land improvement, irrigation, drainage, cropping scheme, farm machinery, manuring, remedies for diseases, etc.

### Implements.

The demonstrations of improved implements are of course, too numerous to specify. The result has been the sale of the improved ploughs, cultivators, harrows and spare parts of ploughs in large numbers from year to year. The number of these implements sold in the State from year to year is given below.—

<i>Year.</i>	<i>Number of implements sold.</i>	<i>Year.</i>	<i>Number of implements sold.</i>
1910-1914	746	1926	1,800
1914	613	1927	1,035
1915	1,551	1928	1,774
1916	1,129	1929	2,719
1917	1,600	1930	3,556
1918	978	1931	714
1919	981	1932	1,249
1920	771	1933	1,987
1921	879	1934	1,960
1922	1,033	1935	890
1923	269	1936	643
1924	577	1937	826
1925	2,009		

The number of spare shares supplied amounts to about 43,000. This number of ploughs and shares represents only what has been sold through the departmental depots and does not include sales through private agencies.

As regards the type of ploughs sold, there is a great variety; the Kolar Mission plough is the most popular; in the black cotton soil districts a heavier plough is required and the Verity plough—a first class plough manufactured by Massey Harris Company of Canada—and a heavy plough manufactured by the Kirloskar Brothers of Satara are sold largely; in the Malnad and in the paddy tracts of the channel areas, smaller ploughs called the "Eureka" and the "Meston" both small, one-handed mouldboard ploughs are supplied.

The share renewal of the Kolar Mission plough which is now being sold largest is always an expensive charge; but local blacksmiths have been encouraged to weld new pieces to old shares and make a fair imitation of the share itself. The Government Central Industrial Workshop has also undertaken the manufacture of cheap shares. Kolar Mission ploughs and cultivators are also made and sold by more than one village blacksmith, the "frog" or foundation of the plough being cast and sold by foundrymen in Bangalore.

The "Mysore" Plough.—To get over the "share" problem, the department has tried several methods. The "slip point" share was imported and still enjoys some vogue. Later, the "Syracuse" plough which has a bar point arrangement was imported but was found unsuitable both on account of its weight and the material, *viz.*, cast iron, of which it was made which led to breakages. Later, a cross between the Kolar Mission and the Syracuse was attempted combining the bar point feature of the latter with the lightness of the Kolar Mission and the result is the "Mysore Plough." After several alterations as the result of trials by and suggestions from the members of the Agricultural and Experimental Union, it emerged in its present design, and was got out manufactured in England. The number sold during the past eleven years is 2340.

Cultivators.—Along with the improved plough, the "six shovel cultivator" is being popularised for working the land after the ploughing. Being only a local made implement, it is being copied widely by many villages, and is also made by the Government Central Industrial Workshop. The "cultivator" is being made use of not only to follow the plough but also for covering seed and for even the harvesting of groundnuts. There are a large number in use, but those sold through the depots is 3151.

Trials of and enquiries about large scale implements such as tractors, tractor ploughs and disc harrows have been attended to by the staff, but only a few large landholders own these outfits and use them successfully. These outfits are, however, the subject of frequent inquiries and correspondents are always put into touch with the few clients of the department who are using the outfits.

Threshing Machines.—A threshing outfit consisting of a small  $5\frac{1}{2}$  H. P. oil engine and a "Pennsylvania" threshing machine was demonstrated for the threshing of ragi

largely in the villages and was also worked for hire at about six annas per palla of ragi threshed. As even this small outfit is found too large for even the larger agriculturists and as co-operative ownership and use was too difficult to secure, the matter was not pushed further.

Meanwhile the stone threshing roller being found a great improvement over the old methods and suitable for individual ownership, that implement was taken up for the threshing of ragi and jola. The number of these has increased with astonishing rapidity and the demand has opened out a new occupation for the "woddars" at many of the quarries in the State. There is no threshing floor now, especially in the Eastern Districts, where it is not in use. In the Malnad, the roller is coming into use for the threshing of paddy also. The demonstration of a heavy implement like this and its supply for sale in waggon loads has been an arduous work for the District Staff.

**The Disc Harrow.**—The disc harrow is being recommended not only for its well known uses but also for stirring the soil after the ragi harvest, when the soil hardens generally and makes ploughing difficult. Experiments have established the great usefulness of this ploughing, and the discing with the disc harrow is recommended as an alternative. Each Agricultural Inspector's Depot keeps one such for being hired out. Only a few have been sold as the high cost is against its being bought by the average farmer.

**The "Nahan" Sugarcane Mill.**—More strongly built than the sugarcane mills in ordinary use, capable of an increased extraction of about 10 per cent, and singularly free from the annoying and frequent breakdowns incidental to the local mills, this "Nahan" mill manufactured by the Nahan Foundry, Punjab, was tested and recommended by the Agricultural Department. Through these 22 years a very large number of demonstrations have been held all over the State, as the Agricultural Inspectors are provided with a mill for demonstration purposes. As a result the number purchased by raiyats from year to year has steadily increased. At present the number in use in the State is not less than 1,000; it speaks volumes for the responsiveness of the Mysore raiyat to genuine improvements that this large number should have been sold notwithstanding the fact that these mills cost twice as much as the local mills. This type is now being manufac-

tured with materially improved features by Messrs. Madurai Mudaliar and Sons of Bangalore City. The whole demand which this supply is seeking to meet has been created by the work of the District Agricultural Staff.

### Manures.

**Cattle Manure.**—The improvement in the quality of cattle manure by better methods of collection and conservation, both by alterations in the construction of cattle stalls and in that of the manure pits, is one of the recommendations which the Department is incessantly urging. Model cattle stalls and manure pits exist on the Government Farms to which the attention of all visitors is drawn; and at the larger exhibitions similar stalls and pits are put up for demonstration. Although it has not been found possible for many to adopt these recommendations in their entirety owing to difficulties of a non-agricultural character, still a large number have adopted either the one or the other. The provision of water-tight floors with gutters in the stalls has been largely adopted, some of the large landholders having the floor stonepaved; only a few, however, have taken to the improved manure pit construction. The question is connected to a certain extent with the extension of the village sites.

**Green Manuring.**—The practice of growing green manure crops on wet lands and in garden lands for being ploughed in as manure being one of the cheapest ways of improving the soil, and as the result of a large series of experiments on the Hebbal Farm have shown that the sannhemp crop has been found the most suitable, this has formed an important item of district work. Where the difficulties due to stray cattle are serious, the green manure "*Crotalaria Striata*" has been recommended. In the areca gardens of the Malnad, Daincha has been found to be excellent crop for green manuring. In the cocoanut gardens of the Tiptur Taluk, sannhemp is being recommended and grown largely. The green manure seeds are stocked and sold from the Agricultural Inspectors' Depots. One of the results on the Hebbal Farm relates to the value and possibility of growing a green manure crop on dry lands prior to the main ragi crop itself for ploughing in as manure. It has not been found possible to induce raiyats to look upon this with favour, due no doubt, to the insufficient rainfall apprehended.

**Oil-Cakes.**—Among concentrated fertilizers, the first to be taken up in the earlier years of district work was oil-cake, especially for use for the sugarcane crop. At that time there were important sugarcane areas where the use of oil-cake was either unknown or was not in vogue. Further, even in places where it was known, custom prescribed only hongey and castor cakes and the groundnut oil-cake was new and therefore as usual tabooed. A strenuous campaign was therefore set on foot to introduce the use of these oil-cakes including the groundnut cake, which was generally becoming more and more plentiful, all over the State. The Department itself stocked the manure in huge quantities and sold it to the raiyats some times for cash and more often for credit. The usual indifference and unwillingness was slowly overcome, and at present in villages where not a maund could be sold even after months of persuasion, groundnut oil-cake itself is bought in hundreds of maunds. So thoroughly common has it become that the Department has completely ceased to stock and sell it at all, all the demand being met by manure dealers in different parts of the State. The quantity sold by the Department up to the year when we ceased to stock it was 3,616 tons. Further more, while we found it hard to persuade raiyats to manure a valuable crop like sugarcane with oil-cake, at present the raiyat readily takes it, if advised for dry crops like ragi. Oil mills of modern types driven by oil, steam or electric power have come into existence in Bangalore, Mysore and Davangere. Added to the output from the old bullock driven village mills, there is thus at the present time a very large supply to draw from.

**Sulphate of Ammonia.**—For the past twenty years or more the use of sulphate of ammonia in addition to the oil-cake manuring of the sugarcane has begun to be advised; the beginning was very moderate not only because it was new but also because it was very costly. More and more demonstration areas were put down, the sulphate of ammonia too became cheaper and with special aids such as the giving away of prizes in the shape of sulphate of ammonia instead of cash or medals at the Conferences, the use of the manure was extended. Once the effect of the manure was actually seen here and there in the various villages the demand rose by leaps and bounds.

At the present prices, sulphate of ammonia furnishes nitrogen in a cheaper form than the oil-cakes, and the use of the manure is being taken up for all kinds of crops. The use has so greatly been stimulated that the suppliers themselves have taken up the work of opening sale depots with their own staff and have appointed propagandists to work along lines suggested by the Department.

**Superphosphate, Bone-meal and other Fertilizers.**—The introduction of phosphatic manures in the districts arose first out of the necessity for supplying a suitable manure mixture for paddy for the Mysore channel tract, where manure was scarce and seldom applied though on account of the assured water-supply there was great scope for its profitable and liberal use. In the earlier trials bone-meal, and oil-cake mixtures were used, then supers and oil-cake and now the general mixture is that of supers and sulphate of ammonia. The question of the cost of the manure per acre being all important, other things being equal, this fact had to be kept in view and the ingredients chosen accordingly. Little by little the use has increased and extended to many paddy growing tracts of the State.

The raiyats having been thus generally accustomed to the use of artificial manure for sugarcane also, a mixture of both super and ammonium sulphate is advised and the advice has been almost universally adopted particularly in localities where irrigation facilities are assured. As the years go by the use of phosphatic manures for paddy and sugarcane and other crops is bound to become as general as the nitrogenous manures.

Although paddy and sugarcane are two main field crops that account for the bulk of the sale of these manures, other crops like tobacco, cocoanut, potato, chillies, onions and even ragi and groundnut are beginning to be manured likewise. The work is however, pursued with caution, and only results of small scale trials indicate the suitability or otherwise of different mixtures.

In fact nothing so strikingly proves the utility and need for a District Agricultural staff than the fact, that although prior to 1914 the Mysore raiyat was aware of the fact that these manures were being used largely on the coffee plantations, although huge quantities were imported into Mysore and bone-crushing factories too existed in the State both in Hunsur and Bangalore and although in the laboratories of the Department the most laborious analytical work was being done chiefly on artificial manures, little

or nothing of it was used for any of the field crops, the raiyat not wasting a thought on it as something good for his crops also.

### Cultivation Methods.

**Ploughing Dry Land after Harvest.**—The advantage of ploughing dry land soon after harvest an important practice in dry farming has been explained widely and also demonstrated. In spite of the difficulties of carrying it out in years of poor rainfall the practice is now followed in a great many villages, the increasingly large area under groundnut making the practice less difficult on account of the loosening of the soil after the harvesting of the groundnut.

**Seed Selection.**—The selection of seed on the field itself by the selection of the best earheads and later by the floating out of inferior grains by the salt water method, in the case of ragi and paddy has been widely adopted as the result of the easy nature of the method and the large number of demonstrations every year. Some of the larger raiyats have been induced to take special pains to ensure pure seed selected from first class earheads.

**Economic Transplanting of Paddy.**—One of the earliest recommendations has related to the economic transplantation of paddy especially in the malnad area where the practice has been to plant in bunches of even a hundred seedlings to the clump. Due to the persistent work of the District staff, this large number has been reduced to as few as about 5 or 6 and on thousands of acres the improvement has now been adopted. Even in the Maidan tracts the same work has been carried on in order to reduce the seed rate sufficiently low to bring the seedlings from 6 or 7 down to 2 and 3. In the first years of the campaign, special staff was told off for this work in the channel areas, demonstration plots were laid out in a large number of villages and the raiyats' transplantation coolies also trained and supervised. In this way a general reduction of the seed rate has been brought about throughout, although even a further reduction can take place without a reduction in the yield.

**Wider Planting of Sugarcane.**—Experiments on the Hebbal Farm conducted over many years having demonstrated the advantage of planting sugarcane in rows three feet apart or even four feet apart in preference to the raiyats' method of planting it 12 to 18 inches apart, the



practice was recommended for general adoption. There was great disinclination at the outset to widen the rows, but the example of many important clients of the Department who were induced to make a beginning had great effect. In the important cane growing Districts of Kolar, Bangalore and eastern Tumkur, and the extensive tract which has recently come under cane in the Mysore District the practice has become very general, many of the extra cautious raiyats feeling their way so to speak and increasing the distance gradually from year to year.

**Jaggery Boiling Methods.**—Improvements in the methods of jaggery boiling have occupied attention from the very beginning as a great deal of scientific work was being done both at Hebbal and in the laboratories on this subject as may be seen from the Report of the Agricultural Chemist. Better mills, ripe canes, clean handling of juice, the use of the litmus paper for judging sufficiency of lime, the use of metallic ladles for skimming, and above all a fuel saving furnace, all these are widely popularised.

Litmus paper books are stocked and supplied by the depots. Brix spindles to test the ripening of the cane are also kept for sale, metallic ladles have been sold in hundreds, and improvements also introduced in furnaces by the provision of fire bars and chimneys. The use of a double pan furnace to economize fuel has been demonstrated but it has not become general, being in use only in the estates of a few larger clients.

**Areca Drying.**—The drying of the arecanut and cardamoms has likewise been improved by the use of a special imported drying furnace and of a local imitation of that dryer with the use of local materials. In the Malnad, the staff has erected many such drying furnaces for raiyats and the great improvement in the quality of the produce especially when drying has to be done in the middle of the monsoon season, is being greatly appreciated.

**New Rotations.**—The changes in crop rotation that are being popularised as the result of work on the Hebbal Farm are (1) the rotation of ragi with groundnuts and (2) the rotation of sugarcane with dry or semi-irrigated crops like ragi, groundnut or garden crops. The former has become general over very large areas during the last few years, the work by the staff being reinforced in this regard by the rapid increase in the areas under groundnut crops.

**CROPS.**

The work of the District Staff in this section relates to the arranging for the large scale district tests of the varieties evolved and put out by the Farms as superior varieties, and then the extending of the area under these varieties and of similar work with regard to new crops altogether.

The results have been reviewed in great detail in Chapter IV under the work of the Botanical Section.

*Work in conjunction with Co-operative Societies*—The District Staff has also from the beginning been interesting the Co-operative Societies to take up the stocking and sale of agricultural implements, seeds and manures, and the members of the Societies to take up one or other of the recommendations of the Department. A number of societies have thus been induced to purchase and keep implements like improved ploughs and sugar-cane mills for hire and for demonstration and many societies have also invested substantial sums in the purchase of implements and manures for sale to members.

*Village panchayats*.—Likewise in recent years, depots for the sale of implements and manure have been opened by certain Village Panchayats. The District Staff are also in close co-operation with District Boards and have succeeded in persuading them to grant material financial assistance for the encouragement of work in their respective areas. The District Staff also assist in the work of the other sections of the Department bringing outbreak of cattle disease or plant diseases to the notice of the respective officers, and rendering all assistance required by the other sections in the District.

*Depot sales*.—The total transactions of the Agricultural Depots are steadily growing and amounted to about Rs. 21,212 in the year 1937-38 for all the Forty-three depots together. This does not include sales from the manure depots of the dealers themselves.

*Clientele*.—The number of clients of the Department who have been carrying some item or other of work along improved lines as recommended by the Department and with whom the staff is in touch is over a lakh which takes no note of the hundreds of raiyats who buy their manure or seed independently from dealers or from other fellow raiyats.

## CHAPTER VII.

**Agricultural Education.**

(a) Higher Grade.—*The Hebbal Agricultural School* giving a two years' course in agriculture was started in the year 1913, with provision for the training of about fifteen students per year. Instruction is imparted in English and is of the grade that may be compared to the Diploma Course in many of the Colleges of Agriculture in British India. It is a residential institution, and the bulk of the instruction, *i.e.*, agriculture both theory and practice, is in the Farm itself, while for instruction in the Sciences—Physics and Chemistry, Botany and Biology and for Veterinary instruction the students were in the first few years brought over to the Laboratories and the Veterinary Hospital in Bangalore. As the Institution expanded, all the instruction was transferred to the Farm itself where suitable buildings had been built. A Veterinary Hospital was also built on the Farm so that the school is now self-contained in all these respects. Provision for the imparting of instruction in Smithy, Carpentry and Fitter's work has also been made in the Farm Workshop. A Dairy was also started with a small herd of local cows and buffaloes and the necessary dairy appliances such as separators, improved churns, etc., for practical instruction in cream separation, butter making and milk testing.

The school was intended to pay special attention to the theory and practice of agriculture proper, keeping the scientific instruction at a minimum in order to attract and train the sons of agriculturists who may eventually go back to farm their own land. A high entrance qualification was also for the same purpose not insisted upon. Instruction is free; a number of scholarships are awarded in addition. Instruction is given in all the branches of agriculture for each of which a separate staff is provided. The higher scientific staff of the Department also take part in the work of teaching.

Under this two years' course scheme, altogether 73 students passed out and were awarded certificates.

In the year 1920 the courses were revised and the school reorganised into one giving a three years' course.

At the same time the entrance qualification was also raised to the S. S. L. C. standard. Instruction in the sciences was also, conformably to the scheme, made more detailed. The performance of all items of practical work on the Farm by the students has been insisted upon from the beginning in the practical classes and the varied work of the Farm affords very valuable training ground. Under the new scheme, 173 students have passed out and have been granted Diplomas.

Although the school has for its primary object the training of the rising generation of agriculturists to look to farming as a career and to attend to it with a knowledge of modern scientific agriculture and skill therein, the school has not been an exception, as far as the outlook of the students is concerned, to the schools and colleges of agriculture in other parts of the world which have set out with identical objects. A good number of men look to the Government Department of Agriculture for employment and probably the popularity of the school will be proportional to the prospects of employment under Government or other agencies. But though this is true of the Hebbal School quite as much as it is of such schools all the world over, it has still been possible to record that many among the passed men who possessed fairly large landed properties have refused to enter Government Service although they had very good chances of being taken into service. A few had to go back to the land because Government appointment could not be had. All these men, scattered over the various parts of the State, continue to be valuable and serviceable allies to the Department, each in his neighbourhood. The men who have joined the Department have nearly all of them justified themselves, being found intelligent and resourceful, energetic and tactful and fully entering into the spirit of the service required of them. No better testimony is needed to their qualities than the record of District Work given in the previous chapter.

(b) Lower Grade.—(i) *The Sree Krishnarajendra Vyavasaya Dharma Patashala or the Chikkanahally Vernacular Agricultural School* which gives a one year's course in Agriculture is situated in the Chikkanahally Village, Tumkur District, and was started in the year 1916. This institution owes its origin to the benefaction of the late Mr. Ugre Gowda, a wealthy land-holder and sowcar of that village. About six acres of dry land, a

good irrigation well and some wet land, a fine spacious stone building for the school and hostel, and a cash endowment of Rs. 17,000 were all given by this charitable donor for the purpose of the school. This school is also residential and the students receive scholarships from the endowment funds which are supplemented by Government. The instruction is both in the theory and practice of agriculture and for a one year's course, a great deal of ground is covered. The whole of the land being given over for students' work, practical instruction bulks large, students having to do all the work of the school farm including the tending of the bullocks, working the kapile, etc.

Practical instruction classes in carpentry and smithy, in rope and basket making and in leather-stitching are also arranged for; several agricultural implements required for daily use on the school farm such as sickles, axes, country harrows, cultivator etc., are all usually prepared by the students themselves. Government also pays for an excursion trip of the students to the larger farms of the Department. Veterinary instruction is imparted by the Veterinary Inspector of the Sira Taluk.

During the last 21 years of the existence of the school, the total number of boys trained is about 300 and of these about 75 are in the employment of the Department as Fieldmen under Agricultural Inspectors. The bulk of the remaining 225 have gone back to their land.

It may be added that the possession of land is insisted on in the case of every applicant to the school, so that we may have the assurance that admission to the school is not sought solely with a view to Government employment.

(ii) *The Sree Ramakrishna Krishishala* is situated at Ramakrishnapur, 18 miles from Bangalore on the Bangalore-Anekal road. It was started in the year 1929 and owes its existence to the generosity of Mr. G. Venkataramaniah, Pleader, Bangalore, who has given a whole village in addition to cash endowments for meeting the expenses of the School. Liberal contributions are also being made by the Bangalore District Board towards the maintenance of this institution. Excellent facilities are provided for the practical training of the students. In addition to the course of studies pertaining to the theory and practice of agriculture in common with the other Vernacular Agricultural schools in the State, arrangements

have been made in this institution to give some instruction in hand-spinning and weaving as well. Till recently there was accommodation for only 16 students every year. To meet the persistent increased demand for admission, arrangements were made at the commencement of the current year to accommodate twice this number. Thirty-two students were admitted into the school last July and it is expected that this strength will be kept up during the coming years.

All the students are boarded and lodged free, and no tuition fees are charged.

The total number of students that have passed out of this institution so far is one hundred and seven and out of these, only a small percentage have sought employment in the State Agricultural Department or under the Mysore Sugar Company and the Mysore Tobacco Company. The rest have all been engaged in managing their own lands; and from the reports obtained about some, they seem to be doing exceedingly well as practical agriculturists serving as models to their neighbours and co-operating with the Department in spreading improved methods in the interior of the State.

(iii) *The Agricultural School at Hassan* is managed by the Hassan District Board with an annual grant from the Government and with the technical assistance of the Department of Agriculture. This school was also started about the same time as the Ramakrishna Krishishala. Although the curriculum of studies has been the same as that of the Chikkanahally and Ramakrishnapur schools, want of adequate land and other facilities for practical work has been a great handicap for the proper development of this institution.

Eight batches of students totalling 102 in all have passed out of this school so far and as in the case of the other schools most of them (about 70) have gone back to farm their own lands.

**Agricultural Education in Conjunction with the Educational Department.**—A scheme of "Rural Science" instruction was sanctioned by Government, for the imparting of instruction in agriculture, mostly of a practical nature, in certain selected Rural Middle Schools. The necessary land, irrigation well and indoor equipment were sanctioned as well as an officer of the Agricultural Department, as itinerant instructor. Four schools were selected for the work, and the work was carried out for a couple of years.

A batch of teachers of the Education Department was also given a course of special training for this work on the Hebbal Farm. Before the scheme passed the experimental stage, the whole educational policy of the State was overhauled and this scheme was stopped pending the provision for a more satisfactory method of agricultural instruction in rural schools. In pursuance of this new scheme which has come into force since 1928-29 agriculture, sericulture and horticulture (according to the local conditions) is made a compulsory subject of study in certain Middle Schools in rural areas. There are at present 22 such schools, 18 giving instruction in agriculture and 4 in sericulture, with land and other equipment required for practical farm work which is all done by the students. The course extends over a period of three years and is in charge of teachers who have had training both in Agriculture and in Methods of Teaching. An officer deputed by the Agricultural Department working under the control of the Director of Public Instruction supervises and co-ordinates the work of all these schools.

**Short Courses.**— Short courses are occasionally organized and conducted on some of the Experimental Farms. These are intended for persons desiring to obtain instruction in specific subjects mostly of a practical nature and to suit their convenience, each course is made only of a week's duration or less. The instruction is, of course, in the Vernacular. The courses are as far as possible held at the time of the year when the particular farm operations which are the subject of the courses are in progress. Thus in the ploughing season, the course is on tillage and tillage methods, in the jaggery boiling season on sugarcane cultivation and jaggery boiling methods and so on. In the earlier years part of the travelling expenses of those who came used to be met by the Department.

Short courses on Bee-keeping have been held regularly every year during the last four years by the Entomologist in the Central Laboratories at Bangalore. The average attendance has been about 50 and among those that attended these courses were persons who had come all the way from parts of Bombay, Madras and Travancore.

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## CHAPTER VIII.

### Department of Sericulture.

#### EXTENT AND DISTRIBUTION OF THE INDUSTRY.

Mysore is admirably fitted by soil, climate and local conditions for silk production. The industry is at present practised over about a third of the area of the State, to the south of a line joining Chintamani, Sidlaghatta, Chikballapur, Kunigal, Mandya and Nanjangud (and is slowly spreading northwards). The sericulture of Kollegal Taluk (Madras Presidency) is a continuation and organic part of the Mysore system. There is practically no part of the State where climatic conditions do not admit of extension of the industry; the only limiting factor seems to be economic. During 1926-27, the total area under mulberry was about 50,000 acres, the value of silk produced amounted to about a crore of rupees, and the industry in its various branches supported about 200,000 families. Since that year there has been a gradual decrease in the area under mulberry and during 1935-36 it was only about 24,000 acres. Partly due to the shrinkage in the area under mulberry and partly due to fall in the price of silk, the value of silk produced has now gone down considerably.

Mysore has a distinct race of silk-worm which is polivoltine, and spins a greenish cocoon yielding a beautifully lustrous silk of excellent natural quality. The Mysore worm is hardy and highly resistant to disease, but is slow in arriving at maturity and a poor producer of silk in proportion to the food consumed as compared with univoltine and bivoltine races. It is however one of the best polivoltine worms in existence.

#### POSITION OF SERICULTURE IN MYSORE INDUSTRIES.

Sericulture has an important place in the agricultural economy of the State. It employs that part of the labour of the home which is prevented by custom or feebleness from participating in the more strenuous work of the field, and also that part of the time of the raiyat which is left unfilled by the operation of the seasons. The utilisation of factors which would otherwise go to waste is wholly a



gain, morally as well as materially, and one may claim for sericulture all that is claimed for spinning, with this addition, that it is more profitable, as it turns to account, certain differential advantages of climate and natural conditions.

#### NATURE OF THE INDUSTRY.

The great bulk of Mysore sericulture is subsidiary to agriculture. It is practised by small agriculturists, who, as a rule do not employ paid labour, nor devote exclusively to rearing either time or house room or other resources. They generally grow their own food, and depend on the returns from sericulture for clothing and condiments, and for the little extras which brighten their lives.

#### AVERAGE RETURNS FROM INDIVIDUAL UNDERTAKINGS.

The Mysore rearer has, on the average, half an acre of mulberry, with which he rears six crops of silk-worms in the year. He loses or used to lose about two of these crops owing to bad seed or inadequate knowledge and resources, but is able notwithstanding to make a net gain of about one hundred rupees a year. The average duration of a crop from start to finish is about six weeks. Apart from its undoubted material advantages, the industry necessitates a certain amount of co-operation and evokes a mental alertness which is more akin to industrial than agricultural pursuits. A sericultural village has generally an air of life and prosperity all its own.

#### HISTORY OF SERICULTURE IN MYSORE.

In spite of obvious advantages, the story of Mysore sericulture is one of vicissitude. In 1866 it had almost died out owing to disease or deterioration of silk-worms, and was temporarily restored by the importation of Japanese seed. The root causes of decay however remained untouched, and one or two bad seasons upset this lightly built restoration. But the vitality due to favourable natural conditions enabled the industry to start with a new lease of life about 1890. It is significant that in this revival the imported worm had disappeared, and the Mysore worm emerged triumphant. Once again the industry declined, till in 1914-15, it reached its lowest point,

with an acreage, under mulberry of not much over 25,000. As a result of vigorous State action, the decline has been arrested, and the growth natural to a healthy industry has been restored during the past twenty years.

#### STATE ACTION.

**Economic Conference, Agricultural Committee, Organisation of Sericultural Department.**—The efforts made to protect and develop sericulture are a measure of the growing recognition of its importance to the State. Not very long ago, the Education Department was entrusted with teaching sericulture through the agency of village schools—with no great success. The subject was then taken up by the Economic Conference, and a few trained men were sent out for work to sericultural taluks. Each step rendered the scope for advance more obvious. In 1913, Signor W. Mari, an Italian Expert, was appointed to organise sericulture, but was able to remain only for a year, during which time he started a small farm at Channapatna, and made a beginning in the manufacture and issue of cellular seed. After Signor Mari's departure, the work was continued and developed by the Agricultural Committee of the Economic Conference, which did much to popularise disease-free seed and improve the methods of rearing. The causes of the decline of the industry were investigated and remedies proposed. The Committee's labours at this critical period in the history of sericulture proved that the situation was not hopeless, and indicated the lines of useful action. In 1916 Signor Mari's services were engaged for a second time, and Mr. N. Rama Rao, an officer of the Mysore Civil Service, who was Secretary of the Agricultural Committee, was associated with him for sericultural work. Signor Mari was only able to draw up a scheme before failing health and the outbreak of the Great War compelled him to return to Italy. Mr. Rama Rao was then appointed Superintendent of Sericulture in addition to his duties as Secretary of the Agricultural Committee. In 1920 the work had developed sufficiently to necessitate the organisation of a Sericultural Department, and the transfer of the whole-time services of Mr. Rama Rao as Superintendent. The Department secured and utilised to advantage, the services of Mr. M. Yonemura, a highly qualified Japanese Expert, for scientific work, and of Miss E. Sato for reeling. Later on

it was possible to replace them by members of the departmental staff who returned from deputation with high technical training in Europe and Japan or had been able to specialise by association with the Expert in scientific work. Mr. H. S. Govinda Rao is now in charge of the Sericultural Department.

#### *Classification of work in the Department.*

The activities of the Department have been based on a close analysis of the structure and requirements of the industry. Investigation placed it beyond doubt that the instability of Mysore sericulture in the past was due to one or more of the following causes :—

- (i) Bad or insufficient seed,
- (ii) Faulty methods of rearing and reeling,
- (iii) Bad methods of purchase and sale—resulting in “sweating” at each stage.
- (iv) Want of economic stamina.

That this analysis is in the main correct, seems borne out by the success of the action based upon it. The work of the Department falls under the following heads :—

- Education.
- Expansion.
- Research work.
- Improvement of seed supply.
- Demonstration and advice-help in case of silk-worm diseases.
- Loans.
- Formation of Co-operative Societies.
- Establishment of filature and popularisation of Mysore Silk.
- Improvement of reeling machinery, and methods.
- Investigation of markets for silk.
- Production of high class silk fabrics.

#### *Organisation of the Department.*

The organisation of the Department for working out these objects is as follows :—

**Circles, Farms, Outposts.**—The sericultural parts of the State are divided into four circles, each provided with a

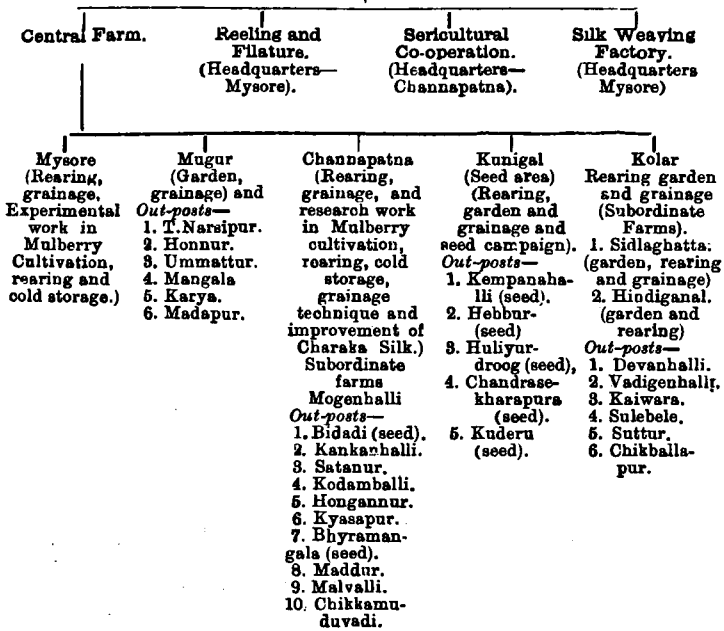
well-equipped Central Farm capable of attending to all the activities of the Department in the area allotted to it. These central farms are in the charge of officers called Senior Inspectors, most of whom have high academical and technical qualifications. Each central farm controls a number of subordinate farms, located at strategic points so as to command the sericultural area. There are altogether 30 such subordinate farms and outposts. Their function is to keep in close touch with the raiyats to secure them their requirements in the way of mulberry cuttings, silk worm seed, rearing and reeling appliances, and loans, and to advise and guide them when necessary, to procure for them assistance, such as disinfection, etc., in case of silk-worm epidemics, and to render them generally all possible assistance in making the rearings a success.

**Staff.**—The staff of the Department exclusive of clerical staff consists of two Assistant Superintendents, seven Senior Inspectors, two Technical Assistants for Reeling and Weaving, 25 Inspectors, 47 Operatives, one Mechanic and two Reeling Demonstrators.

**Special Branches—Filature and Reeling, Co-operation, New areas.**—The improvement of reeling, and the filature constitute a separate section under an officer entitled Superintendent of Reeling and Filature, with headquarters at Mysore; and the formation and care of Co-operative Societies is treated as a special branch of work, and has a Senior Inspector with head-quarters at Channapatna to look after it. The improvement of Charka reeled silk is attended to by the Assistant Superintendent of Sericulture at Channapatna. The following statement shows the organisation of the Sericultural Department, which is now attached as a separate unit to the Department of Industries and Commerce under the general control of the Director of Industries.

**HEAD OF THE ORGANISATION—SUPERINTENDENT OF  
SERICULTURE.**

(Headquarters—Mysore).



The work done by the Department under various heads of activities is summarised below :—

**Education.**

1924-25	...	10 students, Higher course.			
		10	"	Lower	"
		5	"	Short course in Mysore.	
		4	"	"	in Channapatna.
		6	"	"	in Hole- Narsipur.
1925-26	...	77	students including	22	in reeling.
1926-27	...	76	"	26	in reeling technique.
1927-28	...	83	"	33	"
1928-29	...	105	"	55	"
1929-30	...	145	"	80	"
1930-31	...	215	"	175	"
1931-32	...	85	"	55	"
1932-33	...	82	"	57	"
1933-34	...	60	"	40	"

In co-operation with the District Boards of Mysore, Hassan and Tumkur and the Education Department, Sericulture has been introduced as vocational and examination subject in four selected Middle Schools at Kuderu and Malvalli, Santigrama and Hebbur. One hundred and sixty-eight students had taken up sericulture in these schools in 1932-33 and 208 students in 1933-34.

#### SEED SUPPLY.

**Cellular Seed.**—The development of this section of work furnishes a measure of the growth of the Department in influence and usefulness. Twenty years ago, the rearers could, with difficulty, be persuaded to take 200 layings a year. In 1933-34, the Departmental grainages produced 22,88,000 layings and arranged through the selected rearers, the production of nearly 450 lakhs of seed cocoons raised with cellular seed ; and yet only a part of the demand was met. A feature of the present demand is the eagerness of the raiyats for the disease-free seed and the seed of the new races. These new races and hybrids, which are a result of experimental and breeding work conducted by the Department represent an increase in yield of nearly 40 per cent and a curtailment of the period of rearing by four to five days in its most expensive part.

Some idea of the value of this branch of the Department's work can be formed when it is said that whereas formerly two crops used to be lost out of every five owing to bad seed, failures from that cause are now comparatively infrequent in areas reached by Departmental seed organisation.

**Selected Seed Rearers.**—A word of explanation is necessary about selected seed rearers. Since cellular seed is expensive, and its supply is very limited, it is necessary to supplement the work of grainages—which turn out only cellular seed—by a carefully planned and controlled campaign of seed production with the co-operation of selected rearers in the recognised seed centres. The basis of selection is a good mulberry garden, a disinfestable rearing room, and skill and reputation on the part of the rearer. The selected seed-man has to bind himself to rear only cellular layings issued to him from the Government grainages, and to submit to supervision and control. He gets the cellular seed free of cost, his rearing room is

disinfected, and he is placed in touch with the great body of rearers requiring seed cocoons. We have now 540 seed rearers in the far-framed seed centres of Bidadi, Kunigal and Hebbur, capable of producing in the aggregate about 700 lakhs of seed cocoons. Special staff has been set apart for this work.

The following figures show the growth of the seed work of the Department.

Year	No. of disease free layings supplied		Number of seed cocoons supplied in lakhs
1924-25	...	390,168 (including	12,000 of new races). 70
1925-26	...	408,556	68,000 68
1926-27	...	512,664	165,000 cross breed layings. 75
1927-28	...	684,727	219,818 " 74
1928-29	...	813,132	325,778 " 186
1929-30	...	1,044,540	324,015 " 220
1930-31	...	1,290,804	297,332 " 350
1931-32	...	1,337,240	565,939 " 250
1932-33	...	1,682,836	740,278 " 400
1933-34	...	2,288,000	1,225,000 " 450

**Aided Grainages.**—With the object of supplementing the supply of disease-free seed issued from the Government Grainages, a system of aided grainages has been created, which offers a career to specially qualified men. For this purpose, candidates selected for intelligence and general knowledge of the industry, are put through a stringent course of grainage technique in a Government Grainage, which gives them a thorough grounding in all branches of work. Government have sanctioned liberal concessions for starting aided grainages which are under the supervision of the technical staff of the Sericultural Department. The first aided grainage was started in 1928 and there are now five aided grainages preparing and supplying cellular seed to the sericulturists in the State. The extent to which they command popular confidence is an indication of the care with which men are selected and trained for this responsibility and the efficiency of the control exercised over their work;

The following statement gives information regarding the number of these grainages and the amount of work turned out by them :—

<i>Year.</i>	<i>No. of aided grainages.</i>	<i>No. of layings supplied.</i>
1927-28	... 2	2,000
1928-29	... 5	3,12,000
1929-30	... 11	7,10,546
1930-31	... 13	12,78,575
1931-32	... 16	15,24,178
1932-33	... 16	16,43,565
1933-34	... 15	13,87,000

#### DEMONSTRATIONS, IMPROVEMENT IN REARING, TREATMENT OF SILK-WORM EPIDEMICS.

What with the improvement of the seed supply and what with the example and the educative influence of the farms, the Mysore raiyat, especially in the vicinity of the departmental institutions, now gets a yield which represents a substantial improvement over what he used to get in the past. Fifteen years ago 25 to 30 lbs. was considered a fair yield for a rearing with 100 layings; the present average is somewhere about 40 lbs. in areas influenced by new organisations. The record yield got anywhere was 92 lbs. for 100 layings of a F(1) race near Channapatna. The improvement consists in better spacing, a more suitable adaptation of food to stage of development, more efficient methods of cleaning, some attention to silk-worm hygiene, and greater care in mounting and harvesting. A very large number of demonstrations accompanied with lantern lectures are held every year at important jatras, festivals, or other large gatherings of people with the help of District Boards. Competitions are arranged between improved machinery and the old-time village appliances, and many a convert to rational sericulture has been secured.

#### LOANS.

As has already been stated, the small rearer has not much economic stamina, and is frequently in need of loans for short terms. He was formerly at the mercy of small money-lenders who practically squeezed him dry; and when, as frequently happened, the money-lender was also a buyer of cocoons, the rearer rapidly lost freedom of sale, and fell into a position of dependence. There are



two obvious remedies—State aid through takavi loans, and the organisation of co-operative credit. Real co-operation suited to the industry is of slow growth, and as will be stated later, a sound and promising beginning has been made. Government have sanctioned a scheme of sericultural loans also; in practice, these loans at present provide for long term credit for capital expenditure, while short term loans are as a rule left to co-operative and private credit. Formerly the administration of these loans was entrusted concurrently to local revenue officers and the Superintendent of Sericulture; revised rules of 1925 vest this responsibility solely in the Sericultural Department.

#### CO-OPERATION.

There is no doubt that sericulture offers an almost ideal field for co-operation and yet strangely enough, till 1926, there was not in existence a single Sericultural co-operative society. One had been started by the Co-operative Department some years ago at Sidlaghatta, but it failed. It was obvious that existing types of society would not do, and that the industry required a distinctive type, combining short-term credit with supply of seed and appliances, technical guidance, and aid in marketing. The work of such a society is sericulture first, and co-operation afterwards; and close and constant technical direction is essential. A type of society suited to Mysore sericulture was worked out. Government approved of the scheme, and sanctioned a special Senior Inspector for working it. They placed a sum of Rs. 2,800 with the Registrar of Co-operative Societies for being advanced to sericultural societies. Ten societies were formed during the year 1926-27 in the following villages, which were prepared for the development by careful propaganda.—

- |                   |                   |
|-------------------|-------------------|
| (1) Mangalwarpet, | (6) Sidlaghatta,  |
| (2) Malurpatna,   | (7) Thimmasandra, |
| (3) Chakkere,     | (8) Kudlur,       |
| (4) Mogenhalli,   | (9) Mugur,        |
| (5) Closepet,     | (10) Karohatti.   |

At the end of June 1934 there were 21 Sericultural Co-operative Societies in the State with about 500 members and a subscribed share capital of Rs. 2,500.

These Societies prepared and supplied 1,89,000 layings for the use of the members during the year 1933-34. The existing societies have been attending to the following items of work :—

1. Preparation and supply of disease-free seed.
2. Stocking of improved Chandrikes and appliances.
3. Disinfection of rearing rooms.
4. Joint preparation of Chowki.
5. Supervising of rearings and adoption of improved methods of rearings.
6. Short term loans to rearers.
7. Joint marketing of cocoons and silk.

#### FILATURE, VILLAGE AND DOMESTIC REELING.

A small filature of 12 basins of the French type was installed in Mysore in 1922. The object was to train labour, experiment in reeling technique, test the reeling quality of cocoons, and familiarise the silk world with Mysore sericulture. This filature started with exporting silk to France and England, and is now devoting itself to the manufacture of high grade silk capable of utilisation in Indian weaving. It is slowly educating the Indian demand, and preparing the way for grading up the quality of Mysore silk as a whole. A definite demand has been created in India for the high grade silk produced in the State. The filature has now been extended and is capable of producing on the average about 15,000 lbs. of raw silk every year.

**Village and Domestic Reeling.**—Filatures have undoubtedly an important part to play in raising the industry by giving a lead in the improvement of reeling, and by preparing the way for superior silk by advertisement and securing a demand; yet the country's silk as a whole can only be benefited by gradually improving the equipment and methods of the village reelers.

Experiments were conducted with various types of domestic basin; demonstrations were organised on a large scale, and constructive criticism was invited from all eligible quarters. The result of the investigation may be summarised as below :—

(1) It is essential to the development of Mysore sericulture and even to its stability, that the quality of the raw silk produced should be improved and made uniform, so as to extend the scope of its employment in manufacture.

(2) Conditions in Mysore make it imperative that this improvement must commence in the villages in close touch with the rearing industry ; and it cannot be imposed from outside by the establishment of filatures. The improvement of raw silk is dependent on the improvement of cocoons by the provision of good seed and employment of better rearing methods on the one hand, and the introduction of more efficient reeling machinery on the other. In Mysore, reeling cannot, without disaster, be dissociated from seed production and rearing.

(3) The reeling machinery should satisfy the following conditions :—

(a) It must possess all the essential working parts of the latest type of filature basin, which ensure proper size, strength and cohesion.

(b) It must be strong, simple in construction and capable of being attended to by the village smith with his ordinary resources.

(c) Its initial cost must be within the means of the average village family ; its working should demand no special skill or expense, and it should exact no requirements in the way of furniture.

(d) It should be portable, and should lend itself to gradual expansion by the addition of fresh units, securing fresh economies with each expansion.

(e) While not inferior in efficiency to the best foreign basin, it should compare favourably with the village charka in cheapness of operation and adaptability to rural conditions.

To satisfy these local conditions, a basin was designed by Mr. N. Rama Rao and patented under the name of the "Mysore Domestic Basin." This basin can be worked either singly or in combinations consisting of two or more. It is found by experience that five form the most advantageous combination, as they can be operated by a single turner. They have been successfully tested throughout the State, and have invariably elicited great interest and enthusiasm during demonstrations. Silk reeled with the Domestic Basin is nearly as good as filature silk, and fetches higher prices than silk produced with the village charka.

Vigorous propaganda work has been and is being conducted by the Sericultural Department to improve the quality of silk and waste produced in the State. Government have sanctioned the sale of Mysore Domestic Basins

to people at reduced rates, the cost being recovered either in small annual instalments or in small monthly instalments. To train the workers, reeling classes are being attached to each domestic basin installation. The services of the Mechanic of the Department are made available, free of cost, to all the domestic basin owners and spare parts are kept ready for sale in the Departmental stores. The silk reeled in private domestic basin installations is tested in the Government Filature and test certificates are being issued free of cost.

The concessions granted by Government and the great demand for high grade Mysore silk have induced a large number of people to instal and work these basins. There were only four sets of five basins working at the end of June 1927 but the number rose to 24 sets by the end of June 1932. The Domestic Basin installations are capable of producing about 40,000 lbs. of high grade silk every year. With a view to improve the quality of charka silk, re-reeling and twisting classes have been started in various silk producing centres.

**Silk Weaving.**—The high grade raw silk produced in Mysore was being utilised for producing Sarees, Dhoties, etc., in India along with the Charka reeled silk. To find wider uses for the high grade silk produced in Mysore, a Silk Weaving Factory was started by Government early in 1931. This Factory is equipped with the most up-to-date appliances for Weaving, Dyeing and Finishing Silk Fabrics and is the first of its kind in India. Very high grade fabrics such as Georgette, Crepe-de-chine Satin and Crepe Satin which were not being produced in India prior to the starting of this Factory are being produced now utilising pure Mysore Silk. The fabrics produced in this Factory are very superior in quality and are pure dyed, as such find a sale in India in spite of the slightly higher prices. The utilisation of high grade Mysore raw silk to produce marketable silk fabrics has created an outlet for the cocoons of the sericulturists during the period of heavy depression and abnormal competition from foreign raw silk. The starting and working of this factory has fully demonstrated that with the raw material available in India, highest grade silk fabrics can be produced in India with Indian labour and has paved the way for the starting of such Silk Weaving Factories in other parts of India.

## EXPERIMENTS.

Important experiments in silk worm breeding and mulberry cultivation are being conducted in the Central Farms at Mysore and Channapatna, covering practically the whole field of sericulture. In breeding, the main objects kept in view have been selective improvement of the Mysore race of silk worms, fixation of new races, determination of the extent to which hybrid seed could be profitably issued for producing reeling cocoons, rearing and acclimatisation of pure foreign race for stock in the preparation of hybrid seed.

Besides the progress made towards the objective, the experiments have been fruitful in results of great scientific interest. They were only made possible by a free and successful employment for the first time in India of the artificial treatment of hibernating eggs so as to make them hatch like multivoltines.

The following experiments are being conducted in the Sericultural Farms :—

1. Manurial experiments on mulberry.
2. Improvement of Mysore mulberry by grafting and budding.
3. Comparative study of the cost of cultivation and yield from bush and tree mulberry.
4. Propagation of foreign varieties of mulberry.
5. Propagation of Mysore mulberry by means of seedlings.
6. Comparative study of the cost of cultivation and yield from the several methods of planting mulberry in vogue in various parts of the State.
7. Isolation of male and female varieties of Mysore mulberry.
8. Eradication of Mildew which attacks mulberry plants.
9. Experiments to determine the best time of the day for harvesting mulberry leaves.
10. Rearing of foreign races of silk worms and their crosses with Mysore race to study their behaviour during the several seasons.
11. Minimising the incidence of pebrine.
12. Comparative merits of bush and tree mulberry leaf for feeding worms of different ages.
13. Improvement of Mysore race by selection.
14. Experiments in voltinism.
15. Retardation of emergence of moths.
16. Retarding the hatching of Mysore layings.
17. Experiments on the utility of seed cocoons of various localities in the State to verify scientifically, the popular notion that seed cocoons of a particular locality are alone suitable for certain rearing areas.

18. Experiments to test whether double cocoon production is a genetal character.
19. Genetical work to evolve new races of silk worms.
20. Production of silk from double cocoons.
21. Experiments in reeling with a view to cut down cost of production by improving storing, stifling and cooking methods of cocoons.

#### SUMMARY.

The chief measures for which the Department has been responsible are :—

1. Organisation of Government Grainages.
2. Organisation of Aided Grainages.
3. System of selected rearers of seed cocoons.
4. Organisation of supply of mulberry cuttings to aid expansion.
5. Organisation of practical instruction to rearers and reelers.
6. Provision of sericultural loans.
7. Concession for introducing sericulture in new areas and among the depressed classes.
8. Establishment of filature.
9. Designing new types of basin to suit Mysore conditions.
10. Organisation of Sericultural Co-operative Societies.
11. Evolving new races and breeds of silk worm.
12. Securing co-operation and assistance from Local Boards.
13. Investigation of Indian Markets.
14. Concessions for the formation of mulberry topes.
15. Introduction of sericultural instruction in the Middle Schools in co-operation with the Education Department.
16. Organisation of the Mysore Silk Association.
17. Installation of a demonstration plant for producing high grade fabrics from Mysore Silk.
18. Establishment of cold storage plants in the Central Farms.

## CHAPTER IX.

**The Civil Veterinary Department.**

The beginning towards the formation of the Civil Veterinary Department for the State was made in 1905 when the Veterinary Officer attached to the Imperial Service Regiment, was appointed Inspector of Cattle Diseases in Mysore under the official control of (Dr. Sreenivasa Rao) the then Director of Public Health.

In December 1906, Government sanctioned the opening of a Veterinary Hospital at Bangalore on the recommendation of the Revenue Commissioner, and placed the Inspector of Cattle Diseases in charge of it under the control of the Revenue Commissioner.

A scheme for the organisation of the Civil Veterinary Department was sanctioned on 4th September 1907 in which provision was made for the appointment of two Superintendents, five Veterinary Inspectors and thirty-four Assistant Veterinary Inspectors, to be increased gradually as experience was gained and as funds permitted. As a first instalment, three Hospitals and four Dispensaries were ordered to be opened during 1907-08 with an Assistant Veterinary Inspector in charge of each of them, an additional Assistant Inspector being also appointed for the Bangalore Hospital to enable the Inspector of Cattle Diseases to tour out more freely.

The designation of "Inspector of Cattle Diseases" was changed to "Superintendent" of the Civil Veterinary Department from 1st July 1911.

The development of the Department was at first very slow, and even at the end of 1914, the strength of the Veterinary Department (excluding clerical, subordinate and menial establishments) consisted of one Superintendent, eight Assistant Veterinary Inspectors for the eight Veterinary Institutions and two extra temporary Assistant Veterinary Inspectors.

Owing to the great demand from all the districts for the opening of more dispensaries, four new dispensaries were opened each year for three years commencing from 1916-17. For four years thereafter there was no progress in this direction and three institutions were opened in 1923-24, four in 1924-25 and five in 1925-26. Thus there

were in January 1926 thirty-two Veterinary Institutions spread all over the State. The same policy of gradual expansion has been pursued by Government during the last twelve years by sanctioning the opening of three to four new dispensaries every year, preference being given in locating these institutions to places which supported their demand for them by offers of co-operation and help.

Reorganisation of the Department—As occasion demanded, the Department was reorganised and the strength of the establishment according to the last reorganisation of the Department in 1928 excluding clerical, subordinate and menial staff is as under:—

- (i) A Superintendent,
- (ii) Six Assistant Superintendents, and
- (iii) Eighty-five Veterinary Inspectors.

It is hoped that the strength of the Veterinary Inspectors will be further increased during the coming years as the demand for dispensaries is persistently on the increase.

Direction.—The department was under the control of the Revenue Commissioner till September 1920, when it was transferred to the control of the Director of Agriculture in Mysore.

Recruitment.—The officers of the department are recruited from persons holding diplomas from any of the recognized Government Veterinary Colleges in India.

Mobile Corps.—In 1915, Government sanctioned a Mobile corps. In February 1918 orders were passed increasing the number of these Inspectors to eight who would be deputed for work, according to necessity in any part of the State, under the orders of the Superintendent.

Campaign against Contagious Diseases.—The most common diseases prevailing in the State are Rinderpest, Black-quarter, Anthrax, Hemorrhagic Septicæmia and Foot and Mouth diseases. Preventive inoculations against several of these diseases have proved very successful. Mortality under Rinderpest, one of the worst cattle scourges in India which was as high as 34,228 in 1925-26 was practically nil in 1935-36. The Royal Commission on Agriculture during its visit more than ten years back noted the progress of Serum Simultaneous inoculations in Mysore with appreciation and commended it as an example for British Indian Provinces and other Indian States to follow. During the last ten years 8,89,352 head of cattle have been permanently protected by the Serum



Simultaneous method and the recently developed Goat Virus method. Campaigns against other diseases have also been equally successful.

**Treatment of Cattle.**—Treatment of cattle in the State is free. But at the Veterinary Hospitals at Bangalore and Mysore, a fee of four annas for a horse, two annas for a pony and one anna for a dog per day is charged for treatment exclusive of feeding and grooming which the owner of the animal has to arrange for.

**Castrations.**—In order to prevent deterioration and to improve the breed of cattle, vigorous steps are being taken to have all deformed and stunted bulls castrated by an improved method, in addition to encouraging Village Panchayats to keep good breeding bulls for the benefit of all the cattle in their respective areas and organising their supply through the Live-Stock Section of the Department.

**Reporting of Out-breaks of Cattle Diseases and Cattle Mortality.**—Thanks to the co-operation of the Revenue Department, there has been considerable improvement in the reporting of cattle diseases and the submission of cattle mortality statements. This has been made part of the duties of Village Officers and printed forms are supplied to ensure uniformity in the manner of reporting. As soon as any contagious disease breaks out in a village, the Village Headman or Patel reports immediately to the nearest Veterinary Inspector sending copies of his reports to the Amildar of the taluk and the Assistant Veterinary Superintendent of the Division. The Veterinary Inspector attends to the out-break and carries out inoculations in all cases of inoculable diseases and renders such other aid as may be found necessary.

Cattle mortality statements are submitted by the Patels every month to the Taluk Office where the figures are consolidated and sent to the Superintendent, Civil Veterinary Department. Half-yearly statements of mortality are sent by taluk officers to Deputy Commissioners who consolidate the figures for their respective districts and send them on to the Superintendent, Civil Veterinary Department through the Director of Agriculture. The Superintendent submits the consolidated half-yearly statements for the entire State to Government through the Director of Agriculture. Intelligence with regard to the prevalence of contagious diseases is exchanged between the State and the neighbouring British Indian Provinces.

**Supplies of Biologicals.**—Until 1927 the entire supplies of Biologicals for the control of Rinderpest, Hæmorrhagic Septicæmia, Anthrax and Black-quarter were being obtained from the Imperial Institute of Veterinary Research Muktesar. All these are now being made more expeditiously by the Mysore Serum Institute which is rendering further service to the Department by the valuable researches it is conducting on problems connected with diseases of cattle and poultry.

A detailed account of the work of the Serum Institute will be found in a separate chapter.

**Lectures and Demonstrations.**—Advantage is taken by the Department of the numerous cattle shows, taluk conferences and other public gatherings to deliver lectures to the people on suppression of contagious diseases, improvement of live-stock and other matters pertaining to the Department and on the necessity and advantages of resorting to Veterinary Institutions in time of need and of reporting out-breaks of cattle diseases at their onset.

Even when there are no out-breaks of any epidemic disease, Veterinary Inspectors in charge of Hospitals and Dispensaries go out on a systematic tour for 10 to 15 days in a month, on propagandist work, visiting village after village in their respective jurisdictions and giving any professional aid that may be necessary.

Leaflets in Kanarese are prepared by the Veterinary Inspectors on cattle diseases and allied subjects and distributed freely among cattle owners during their itineration. They carry a medicine chest containing the more common medicines and instruments for treating sick animals on tour.

**Future Programme.**—Treatment of diseases, protective inoculations against epidemics, castration of scrub animals and propaganda regarding care and improvement of cattle will all be continued. The fact that Rinderpest and other common epidemics have, to a very marked extent, been brought under control by a persistent and vigorous campaign during the last ten years particularly will, it is hoped, enable the Department to devote greater attention during the coming years to other obscure diseases which are causing considerable loss to cattle owners all over the State and diseases of sheep and poultry will also be attended to. Further efforts will be made to spread the activities of the Department wider still, particularly in the Malnad.



**Cattle Breeding Station, Ajjampur.**



**Amrit Mahal Bulls.**

In order to give an idea of the nature and extent of work carried out by the Department every year and the development which has taken place during the last ten years, the following comparative statement of its activities during the years 1925-26 and 1935-36 is appended :—

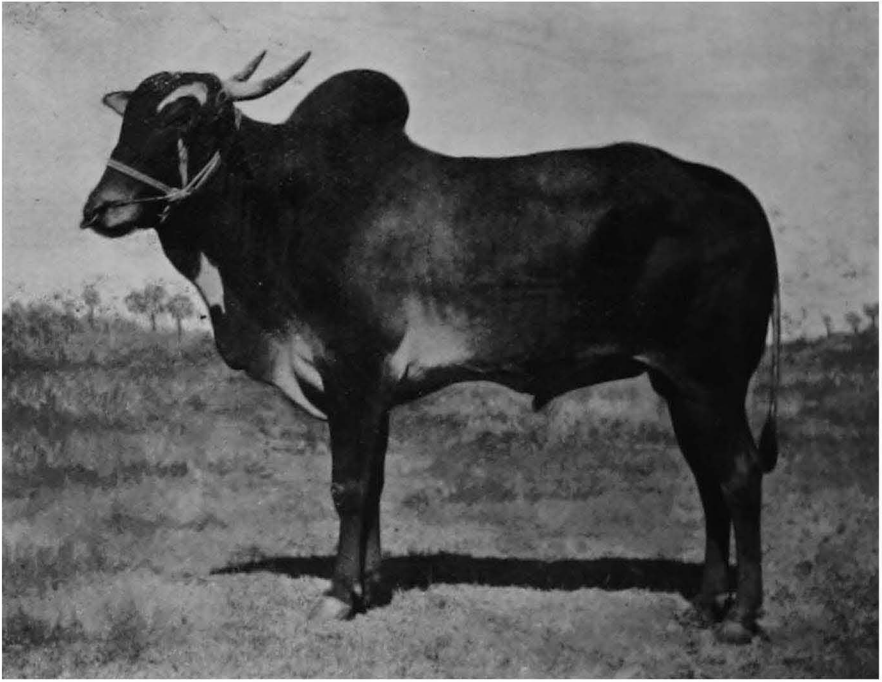
Sl. No.	Particulars	Number	
		1925-26	1935-36
1	Number of fresh cases admitted to the Institutions.	56,115	2,50,226
2	Total of daily attendance for the year.	1,26,909	4,72,112
3	Number of castrations performed in the Institutions.	2,578	26,571
4	Number of other operations performed in the Institutions.	4,109	19,121
5	Number of cases treated on tour.	14,362	52,845
6	Number of castrations performed on tour.	17,126	41,061
7	Number of other operations performed on tour.	797	1,241
8	Number of inoculations performed against rinderpest by— S. S. Method ...	39,912	} 39,815
	S. A. Method ...	66,630	
9	Number of inoculations performed against Anthrax.	3,898	19,992
10	Number of inoculations performed against Haem Sept.	1,617	30,356
11	Number of inoculations performed against Black-quarter.	24,556	89,095
12	Number of vaccinations against sheep-pox.	1,030	41,115

## CHAPTER X.

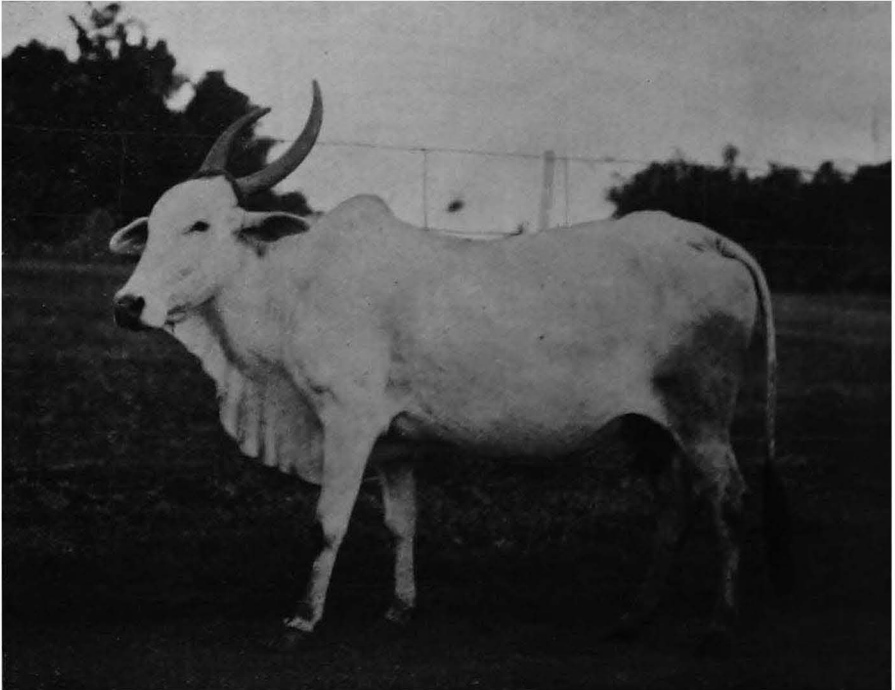
**The Live-Stock and Amrut Mahal Department.**

The Live-Stock Section was organised as a branch of the Department of Agriculture in January 1920 with Mr. W. Davison, B.S.A., as Live-Stock Expert. Attempts to improve the cattle and sheep of the State had been made, off and on, even prior to the inception of the Department of Agriculture, but sustained and systematic work became possible only with the starting of a separate section with the necessary equipment and staff. In the interests of economy and in view of the different conditions required for the different items of work connected with an all-round improvement of the Live-Stock of the State, the work has, from the beginning, been conducted at several different centres :—The Hebbal Dairy, the Rayanakere Dairy Farm and the Gottigere Sheep Farm, which was shifted later on to Yellachihalli, that had been started at different times and for different purposes long before the organisation of this section. The Cattle Breeding Station, Ajjampur and its sub-stations, the Poultry Farms at Hebbal, Ajjampur and Nagenahally, and the semi-official body, the Kolar Sheep Breeders' Association, were started later as the work of the section developed.

When Mr. Davison resigned his appointment in June 1925, the office of Live-Stock Expert was abolished and the Live-Stock Section excluding the Rayanakere Dairy Farm and the Amrut Mahal Department was under the charge of Lieutenant A. A. Monteiro, who was appointed Officer in Charge. Later on in 1928, Lieutenant Monteiro, who was at the time Superintendent of the Amrut Mahal Department, was deputed to Edinburgh to undergo training in Animal Genetics and Live-Stock Breeding. He returned in September 1930. In 1931, with a view to provide for the supervision and control of breeding and to ensure that all operations in connection with the improvement of Live-Stock are carried on satisfactorily, the Live-Stock Section and the Amrut Mahal Department were constituted into one charge, the appointment of Amrut Mahal Superintendent abolished, and the appointment of Live-Stock Expert revived, and Lieutenant Monteiro was appointed Live-Stock Expert.



**Mysore Bull.**



**Mysore Cow.**

The following is a summary of the work of the Department.

### Cattle.

The most important item of work that is being attempted by this Department is the improvement of the cattle population of the State which constitute one of the main assets of the Mysore raiyat, and play a very important part in local agriculture. Although Mysore has, from a very early period, enjoyed a just renown for its superior breed of cattle—the Amrut Mahal and the Hallikar breeds—those owned by the average raiyats, the Nadudana or the village cattle, are generally of an inferior type. This has been due mainly to the following among other causes:—

(i) The presence of large numbers of defective and inferior bulls left uncastrated.

(ii) The common practice of driving all the village cattle, male and female, together for grazing and the consequent indiscriminate breeding; and

(iii) The absence of breeding bulls of the right type, and the unwillingness or inability of the raiyat to avail himself of the services of such as are present.

Various attempts have been made to remedy these defects. As a means of awakening an interest in the improvement of draught cattle, maintenance of breeding bulls in Veterinary Institutions and Agricultural Farms for public service was adopted and some of these were even sent out on a definite itinerary to enlarge the territory of demonstration. The progress made by this system could not be easily measured; it could only be gauged very roughly by the number of services given and by any tendency there might have been towards an increased demand for good breeding bulls by private owners. With regard to stationary bulls it was found that a large percentage of cows covered were the property of the townspeople which could not therefore be regarded as furthering the improvement of the agricultural stock. The touring system, which was intended more for the purpose of arousing an interest in the matter of maintaining good sires in villages than to make any appreciable effect on the stock of the country, did not work satisfactorily, as the bulls had often to be withdrawn from the villages on account of fodder difficulties, prevalence of contagious

diseases and other causes. This system was therefore abandoned and arrangements made instead to send them out to selected villages allowing them to wander at large in village herds from which all the scrubs were castrated. The better quality of calves born in the villages created an appreciable effect in the minds of raiyats as regards the importance of a good sire. This system was in operation for about a year and was stopped as soon as a Cattle Breeding Station was started in 1929.

With a view to overcoming the tendency of the raiyats to sell their breeding bulls at the first good offer and to encourage the steady maintenance of useful bulls both for private purposes and for the benefit of the public, subventions on certain conditions regarding the maintenance of the bulls and facilities to make them available for use to the public were granted to some of the raiyats who were prepared to take advantage of the scheme. This scheme was also discontinued after establishing the Cattle Breeding Station.

As the policy of Government since 1921 has been to reduce the Amrut Mahal Cattle, in view of the growing mechanisation of the Military Transport, the question of cattle improvement was tackled seriously by establishing a Cattle Breeding Station at Ajjampur, so that the usefulness of the Department may mainly consist in meeting the demands of the agricultural population of the State. The work was started by selecting the best available cows from the semi-wild herds for the foundation stock. The present strength of the stock is about 1,000. An important function of the Cattle Breeding Station is the keeping of a record of milk production of the cows used for breeding with a view to gradually weeding out poor milkers so that the distribution of bulls which are the progeny of high yielders might lead to a gradual improvement of milk yield in the State. All the males that are fit to be used as breeding bulls are supplied to Village Panchayets and private agriculturists at a price fixed by Government and bullocks are sold to the public. More than a hundred bulls were supplied to the Village Panchayets during the last official year. Castration of scrub bulls in such villages is systematically being attended to by the Civil Veterinary staff.

With a view to encouraging the breeding of the famous Amrut Mahal cattle through private agencies in different centres and thus develop this most important





Merino Ram



Group of cross bred lambs in Sabbanahally Village flock.

industry, a scheme was devised in 1932, under which cattle breeders could be induced to take up the cows and young calves and carry on breeding themselves. Under this Aided Cattle Breeding Scheme, there are 9 private organisations maintaining about 1,000 cattle. The work is being carried on in close conjunction with and under the supervision of the Department.

### Dairy Cattle.

Several observations are being made for the last ten years to test the milk yielding qualities of the indigenous breeds at the Palace Dairy, Rayanakere and on the Cattle Breeding Station, Ajjampur, by a system of milk recording. Appreciable progress in the selection of good milkers from among the indigenous breeds has been effected by the local suppliers of milk to the Bangalore City. The question of encouraging the maintenance of good milkers in the cities and in rural areas and of organising the supply of pure milk to important urban areas of the State is under the consideration of Government.

Courses in Live-Stock and Dairying are given in the Agricultural School at Hebbal, where a small Dairy is maintained for instructional purposes.

### Sheep Husbandry.

The work on sheep that is being carried out is (1) improvement of the local type of sheep, (2) cross-breeding experiments with Merinos, and (3) extension and demonstration.

(1) This is being done on the Yellachihally Sheep Farm, where the policy adopted is to effect an improvement in the progeny of the foundation stock from the standpoint of hardiness, resistance to disease and the quality of the fleece, so that suitable types of ewes with definite characteristics are always available for cross breeding experiments, and rams are available to the public to improve the local flocks.

(2) Cross breeding work is being done at Ajjampur and Hebbal. The cross-bred progeny are graded according to the quality of the fleece and other points of conformation.

(3) *Extension and Demonstration.*—This is being attempted by educating the raiyats to adopt improved methods. The supply of a few white ewes and two half

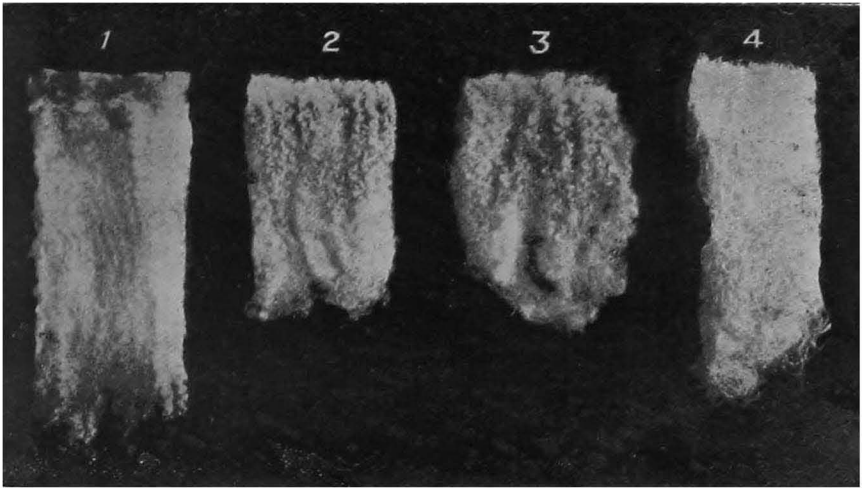
bred rams to three applicants as foundation stock for breeding purpose and demonstrations of improved method of clipping and dipping undertaken during the early years of the work of the Section created a great demand for extension of this work in the Kolar District and as a result the Kolar Sheep Breeders' Association was organised in the year 1923. The present strength of the Association is about 200. The strength of the flock under the control of the Association is 7,000, of which 2,000 are white and 625 are progeny derived by mating merino hybrids with the local ewes. Several of the flocks of mixed colour are headed by pure white rams of the local breed which are supplied to them from the Government Farm at Yellachihally, with a view to eliminate colour.

Remarkable improvement has been achieved by some of the members who have taken keen interest in improved methods of sheep husbandry. By the introduction of cross bred rams, rigorous selection and severe culling, improvement in quality as well as in quantity of wool has been effected. The best of such flocks is owned by Mr. Lakshman Reddy of Sabbanahally. The wool produced by his flock is free from kemp, dense and fine with a close, regular crimp. His flock yields  $2\frac{1}{2}$  times the clip a similar flock of local sheep would. The price he gets for his wool is 12 annas a pound as compared to 6 annas for pure white wool of the local breed. As hybrids effect an immediate increase in quantity as well as improvement in the quality of wool, the line of work to be adopted in future would be to issue hybrid rams to local flocks only in the first instance, the resulting ewe progeny being bred to selected improved rams of higher grade from the Government Farms. The best hybrid ewes in the flocks will be bred to merino rams, by lending them for the season, whenever they could be spared.

Machine shearing and dipping have gained wide popularity in the Kolar District. Some of the Panchayets have constructed their own dipping tanks.

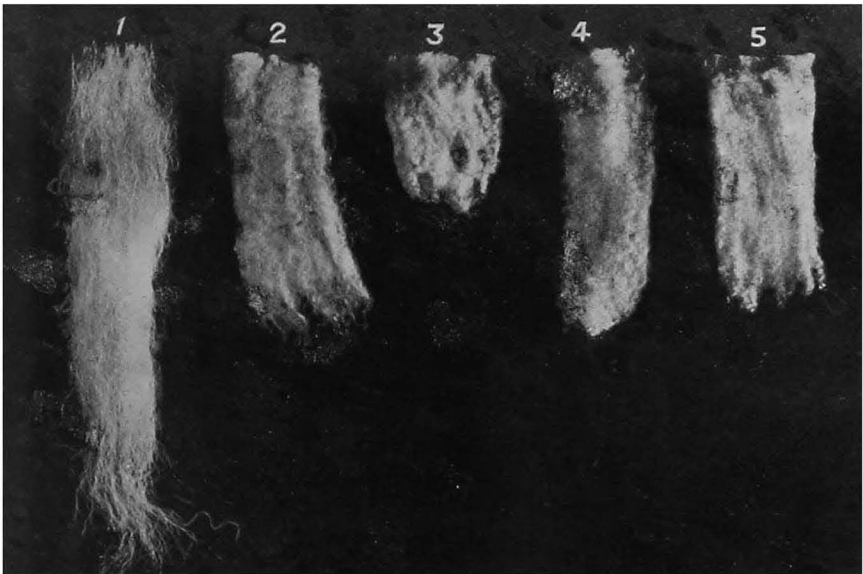
Large quantities of wool are collected, graded and sold on a co-operative basis through the Association. The members thereby realise more money for their wool than by exchanging the wool of 50 sheep clipped by a local shearer for a blanket as would otherwise be done.

As wool furnishes raw material for one of the greatest manufacturing industries and is an important product of



Samples of wool.

1 Merino 2 3 4, variations in improved village flock at Sabbanahally.



Wool.—No. (1) local;  
(2) half bred;  
(3) quarter bred;

(4) double half bred;  
(5) Merino.

the animal husbandry branch of agriculture, it would make a substantial addition to the agricultural income of the State, if sheep rearers could only realise the importance of putting the industry on a fairly good basis.

### **Poultry.**

Improvement of poultry is another promising item of work recently started. The work is being carried on at Hebbal and at Ajjampur and on the Nagenhally Farm. White Leg-horns, Rhode Island Reds and Black Minorcas are bred at Hebbal, Rhode Island Reds at Nagenhally and White Leg-horns at Ajjampur. The White Leg-horns are very hardy and prolific egg producers. A good hen will normally consume about 5 annas worth of food per month and lays on an average 15 eggs which weigh 2 ounces each or more. A country hen lays on an average 45 to 60 eggs per year and the weight of the egg is about  $1\frac{1}{4}$  to  $1\frac{1}{2}$  ounces. The Rhode Island Reds are one of the best "general purpose" breeds. They lay about 12 big sized eggs per month. The best performance from a White Leg-horn hen on the Farm has been 234 eggs in a year. With a view to encourage cross-breeding with the local poultry, Cockerels are distributed to Village Panchayets. Eggs for hatching are also sold to Village Panchayets at concession rates.

Courses in Poultry Farming are given at the Hebbal Farm by Mr. L. B. Losey of the Seventh Day Adventist Institute at Krishnarajapuram.

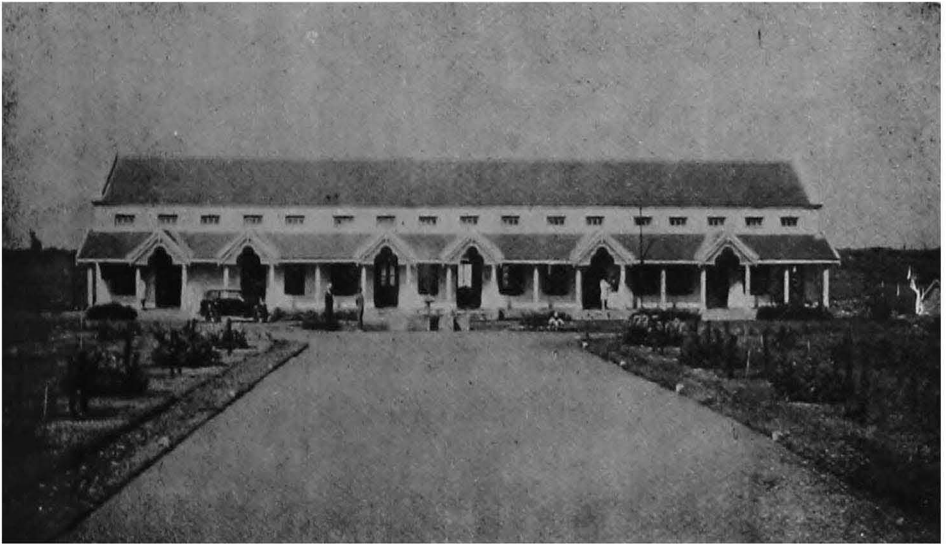
A small booklet has been published to serve as a guide to people interested in the subject and distributed free.

## CHAPTER XI.

**The Mysore Serum Institute.**

Almost from the inception of the Mysore Civil Veterinary Department in the year 1905, efforts were being made to control Rinderpest among cattle, the commonest and, at the same time, one of the most fatal of epizootics which was, year after year, causing considerable loss to the raiyat population in the State. For a long time one of the principal means adopted for this purpose was, what was known as, the "Serum alone" method of inoculation which was however found to confer on the animals inoculated only a very temporary immunity. This method had therefore to be replaced, in course of time, by the more effective one of "Sero-Virus Simultaneous" inoculations whose effects were known to be more lasting. To carry on these inoculations on an extensive scale very large quantities of Anti-Rinderpest Serum and fresh Bovine Virus were required. As Rinderpest Virus usually loses its potency during the transit over long distances there was some difficulty in getting potent Virus from the Imperial Institute of Veterinary Research—Muktesar, wherefrom all the Veterinary Biologicals required for use in the State, were being obtained previously. A "Virus Depot" was therefore started as an experimental measure in December 1925 for preparing Rinderpest Virus and supplying it fresh to the local Civil Veterinary Department as and when required for its campaign of Sero-Virus inoculations. The Depot was located in the out-houses of the Chief Commandant's Office in the High Grounds, Bangalore, and placed under the charge of Major R. W. Simpson, Superintendent of the Civil Veterinary Department.

The production of Virus in this Depot having proved successful, Government were pleased to sanction, in the year 1927, the preparation of Anti-Rinderpest Serum also as an experimental measure. The "Virus Depot" was thus converted into a "Serum Institute" and Dr. P. Parthasarathy, who was the Superintendent of the Vaccine Institute, was appointed as the Officer-in-charge of this new Institution. The Serum prepared here was found to be quite as good as that obtained from Muktesar and



The Government Serum Institute, Bangalore.

also very much cheaper. The success that attended the work of the Institute during these early years resulted in Government providing increased facilities for further work on a more efficient and much larger scale. The construction of the present block of buildings, specially designed and equipped for the work, was sanctioned in the latter part of 1929, and the buildings were actually occupied for work in March 1932. It was about this time that Dr. P. Parthasarathy was transferred as Health Officer to the Bangalore City Municipality and Mr. S. D. Achar who was till then Assistant Superintendent was appointed Superintendent of the Institute.

The facilities for work thus afforded in the new buildings were made full use of by the staff and more biological products, such as Anti Black-quarter Serum, Anti Hæmorrhagic Septicæmia Serum, Hæmorrhagic Septicæmia Vaccine, Black quarter Filtrate, Sheep-pox vaccine, Anti Anthrax Serum, etc., the preparation of some of which had been just started in the old buildings were begun to be manufactured in large quantities and very soon even these new products gained recognition both in the State and in other parts of India.

This Institute was made permanent with effect from April 1st, 1933.

During the four years and seven months that have elapsed since the Institute was made permanent, the work has gone on on the same general lines as in the past, but paying greater attention to Experiment and Research, both with a view to improve the technique of the manufacture of the several products which the Institute has already placed on the market and also to find out the possibility of preparing new products of scientific or of economic interest. The business aspect of the Institute's work has not been lost sight of either, inasmuch as the Institute has been able to issue since its inception in the year 1927, a total quantity of about twelve and a half million unit doses of various biologicals, the quantity supplied to places outside the State alone being over two million doses bringing in a revenue of about Rs. 3,00,000 to the State within the last six years.

An item of Research which has yielded results of great practical value to the raiyats of the State, particularly of the Maidan, is that connected with the use of fixed "Goat Rinderpest Virus" for inoculations against Rinderpest in place of "Sero-Virus Simultaneous"



inoculations. Extensive trials on the relative merits of the two methods started in the year 1932, both in the laboratory and in the field and conducted in several parts of the State and on several batches of Government Amrit Mahal cattle established the fact that "Goat Virus alone" could be safely used in the case of Maidan cattle for protection against Rinderpest in preference to the "Siro-Virus Simultaneous" method. The Mysore Civil Veterinary Department has been carrying on these "Goat Virus alone" inoculations for the past over three years with great success. The importance of the discovery lies in the fact that the "Goat Virus alone" method costs only about four annas per head as against rupee one per head by the "Siro-Virus Simultaneous" method of inoculation. Besides, it is less cumbersome than the latter requiring only a single injection.

The organisation of a special Research Section under a highly qualified Veterinary Research Officer in 1935-36 has added considerably to the prestige and efficiency of the Institute.

Four new products, *viz.*, Vaccines against (1) Rabies in dogs and other animals, (2) Anthrax in sheep and cattle, (3) Strangles in horses, and (4) Chicken-pox in poultry have been prepared and tested in the Research Laboratory with very satisfactory results. It is proposed to issue them all in due course for wider trials in the field.

More recently funds have been allotted for research on prophylactic methods for diseases affecting poultry in the State. The work is being carried on and a wider scheme for Poultry diseases research work in our State is under the consideration of the Imperial Council of Agricultural Research.

A scheme for the investigation of Johne's disease among cattle sanctioned and subsidised by the Imperial Council of Agricultural Research is being worked out by an Assistant Superintendent of the Scientific Section. Both these items of research will, it is believed, yield results of great practical value.

The lists of biological products the Institute has already placed on the market, the different places in India which are now obtaining their supplies from this Institute and the statement of expenditure and receipts given at the end of the chapter will, it is hoped, give some idea of the volume and variety of the work of the Institute and the All India reputation it has gained as a useful scientific Institution of great economic value.

Sl. No.	Biological products prepared at the Institute	Different places in India which are obtaining their supplies from this Institute	Statement of Expenditure and Receipts of the Institute from 1927-28 to 1936-37.				
			Year	Expenditure	Receipts	Remarks	
				Rs. a. p.	Rs. a. p.		
1	Anti Rinderpest Serum ...	Agre, Allahabad, Baroda, Bhavnagar, Bhopal, Cochin, Coorg, Colambo, Hyderabad, Jodhpur, Kolhapur, Indore, Morvi State, Pudukkottai, Pondicherry, Pullamcottah, Rangoon, Savanur, Sawanthawadi, Sangli, Trivandrum, Ujjain.	1927-28	59,237 14 6	8,847 8 0	Cost of products supplied to C. V. D. (Mysore) not included	
2	Anti Blackquarter Serum ...		1928-29	1,54,543 4 4	47,332 12 0	Do do	
3	Anti Haemorrhagic Septicæmia Serum.		1929-30	1,46,885 1 10	16,270 11 0	Do do	
4	Anti Anthrax Serum ...		1930-31	1,49,879 4 8	30,868 5 0	Do do	
5	Haemorrhagic Septicæmia Vaccine.		1931-32	1,04,939 0 0	60,098 8 0	Do but cost of products supplied to C. V. D. at the approved rates work out to Rs. 1,19,985-8-4.	
6	Blackquarter Filtrate ...		1932-33	92,173 0 0	63,363 11 0	Do but cost of products supplied to C. V. D. at the approved rates work out to Rs. 1,14,322-9-6.	
7	Blackquarter Bacterin ...		...	...	...		
8	Sheep-pox Vaccine ...		1933-34	83,407 1 2	1,27,299 0 0 (including the cost of products supplied to C. V. D. Mysore).	Cost of products supplied to C. V. D. (Mysore) alone works out to Rs. 74,058-13-4.	
9	Rinderpest Bovine Virus ...		1934-35	70,600 0 0	94,188 5 9		
10	Rinderpest Goat Virus ...		...	...	...	Cost of products supplied to C. V. D. (Mysore) alone works out to Rs. 48,169-5-0.	
11	Fowl Cholera Serum ...		} 1st July 1935 to end of April 1936.				
12	Fowl Cholera Vaccine ...				58,124 0 1	55,623 2 0	Cost of products supplied to C. V. D. (Mysore) alone works out to Rs. 28,227-6-0.

## CHAPTER XII.

**The Department of Horticulture.**

The Government Gardens Department is one of the oldest Departments and was the nucleus of all Agri-Horticultural work in the State. The sphere of activities of this Department, as it now stands, extends over Economic, Scientific and General Horticulture, besides Botanical work. In recent years, scientific and economic work has been largely developed apart from the improvement and maintenance of the various gardens and parks—as many as 37 in Bangalore and 35 in Mysore—which are all artistically laid out and in addition to the planting of ornamental and economic plants of both indigenous and exotic varieties for trial and observation. The development of the Department on its present lines dates from 1908 and the following paragraphs deal with it.

**Economic Work.**

The work of Fruit culture is carried on in the Central Fruit Nursery in the Government Botanical Gardens and the Experimental Orchard at Krishnarajasagara. The centre of work in vegetable culture is the Horticultural Farm in Bangalore and Jeevanrayankatte in Mysore. Introduction, acclimatization and propagation of economic and garden plants are done in the Lal-Bagh Nursery.

The ideal climatic conditions favourable for general fruit culture are:—

Freedom from extremes of high and low temperature, an abundance of sunshine, summer atmosphere with low percentage of humidity. These conditions exist in many parts of the *maidan* districts where fruit plants like apples, peaches, grape vines, mangoes, guavas, pomegranates, and figs grow well. In the *malnad* districts where there is heavy rainfall and humidity, citrus fruits, bananas and pine-apples grow well.

A fruit survey of the State was conducted in the year 1914-15 at the request of the Agricultural Committee of the Mysore Economic Conference and a detailed report was published suggesting, among other measures, the opening of an Experimental Orchard, a Fruit Nursery and a

Horticultural School and the appointment of Horticultural Inspectors for extending and improving fruit industry and other items of Horticultural Development in the State. The school was opened and Horticultural Inspectors appointed, but later the school had to be closed and the number of Inspectors reduced on account of financial stringency.

### Apples.

In 1897 an outbreak of American Blight or Woolly Aphis caused considerable loss to apple growers and many varieties which were under trial were wiped out by this pest. The Department revived the cultivation of apples since 1914 by the importation of new varieties, grafted on disease resisting stock from Australia. The temperate climate, the elevation, sweet water supply and a long dry period in the fruiting season at Bangalore help in the formation of sugar in fruits and the apples produced in Bangalore District are of excellent quality. One variety which has found much favour with the local fruit gardeners is the "Rome Beauty." It is a prolific bearer and its fruits have attractive colour and size and have keeping quality. More than a lakh of plants of this variety are imported and supplied to orchardists. There are 97 varieties of apples which are under trial and a few of them have fruited now. It is too early to say which of them would be suitable for our conditions. Experiments are also under way to find out suitable stock which would increase the life of apple plantations. In this connection, five kinds of vegetatively propagated vigorous stock of apples were imported from East Malling Research Station for trial and a number of varieties of apples are grafted on them.

**Citrus fruits.**—More than fifty varieties of citrus fruits consisting of oranges, grapefruit, lemon, lime, etc., were imported from Australia to be tried by the Department and then plants supplied to Fruit growers. The varieties Joppa, Washington Naval, Late Valenica, Marsh's Seedless Grapefruits, etc., are quite suitable for local cultivation. Besides these, the cultivation of indigenous citrus varieties is also in progress. Pomelo from Devanhalli in Bangalore District, Oranges from Coorg and Yammedoddi in Kadur District and limes from Seringapatam and Bangalore are famous and genuine plants are propagated and supplied to Village Panchayet gardens for planting.

**Grape Vine.**—At present, this fruit, a black variety, is grown round about Bangalore in small patches aggregating 50 acres in extent. The plants produce fruits slightly acid in taste but they are resistant to pests and diseases. A series of experiments are laid out to improve this variety by adopting different methods of training, changing the season of pruning, by irradiation methods and by hybridization. Besides there are about fifteen varieties, some imported from Australia and some from Poona, under cultivation. All of them are promising. The imported varieties are susceptible to Mildew which can however be kept under control by spraying with Bordeaux Mixture.

**Mangoes.**—Rasapuri, Badami and Mulgoa are the favourite fruits of Mysore. Particular areas in certain districts are well-known for superior quality of mangoes, for example, Seringapatam for Badami, Tumkur and Bangalore for Rasapuri fruits. Sundershaw and Neelum are also grown on large areas in the State; they are late varieties found in the market in July and August. Large plantations of Neelum are to be found in Kolar District. Besides these a number of varieties from Alipur, Darbhanga and from Southern India, are also grown in the Palace Gardens. Some varieties like Black Andrews, Imam Pasand, etc., from Vizianagaram are worth introduction and steps are taken in this direction. There are nearly 24 distinct varieties in the Daria Dowlat Bagh and Gumbaz Gardens in Seringapatam though some are inferior. The total area under mangoes in the State is more than 19,000 acres.

**Figs.**—Very good varieties of figs are grown in Ganjam, Seringapatam Taluk. The gardens there have now deteriorated considerably on account of scarcity of water and the poverty of the people. The question of improving the old orchards and starting new ones is engaging the attention of the Department. Provision for adequate water supply has been made by pumping water from the river Cauvery. Bangalore also grows excellent figs. A number of varieties of figs are got from Australia, Poona and other places and are under trial.

**Plantains.**—There are more than thirty varieties grown in the Horticultural Farm, Bangalore, and in the Krishna-rajasaagra Orchard. These varieties are from Mysore, Trichur, Bassein and other places. The Nanjangud Rasabale, Rajabale from Bangalore, Pachabale grown in

Hassan District and Karibale grown in Malnad areas are all good. Attempts are being made to increase the area under these varieties. About 18,000 acres are under the cultivation of this crop in the State.

**Pomegranates.**—Varieties of Pomegranates from Jaranahally in Bangalore Taluk, from Chintamani in Kolar District and Madhugiri in Tumkur District are noted. Large number of plants are grown in the Central Fruit Nursery in Lal-Bagh for sale to the public and also to the Village Panchayet gardens. Besides these varieties a number of other varieties from Poona, Bassein and Australia are under trial. The seedless variety from Bassein has fruited and is propagated for sale as it is good, though the size is slightly small.

**Guava.**—This fruit plant thrives very well all over the State. The Pear shaped variety from Bangalore and a variety from Allahabad are largely cultivated. Seedlings are raised and supplied to the Orchardists. A variety known as "seedless" from Bassein which was introduced has fruited. The fruits are seedless and very sweet, though smaller in size than the other two varieties.

### **Pine Apple.**

There are six varieties under trial in the Central Fruit Nursery. Of these, the variety "Queen" has been found to have the finest flavour. Great impetus is given to popularize this variety by supplying suckers to orchardists. Pine apple grows very well in Malnad areas without much care though they are slightly inferior in flavour to those grown in Maidan tracts. The other variety, which grows to considerable size is "Smooth Cayenne." It is a good variety for canning purposes.

**Pappayas.**—Seven varieties of Pappaya were tried on the Horticultural Farm, Bangalore, out of which Honey Dew, Mammoth Java and Singapore proved the best. Besides these the local variety is under cultivation. There has been great demand for the seeds of these varieties.

### **Jak.**

This fruit tree which attains huge size is grown all over the State. There are some with red flesh and some with yellow flesh. In some cases it will be hard and crisp and very sweet. Some of the fruits grown in Hole-Narsipur

Taluk of Hassan District and in Tumkur District are very sweet and are worth propagating.

**Sapodilla.**—Sapodilla thrives very well in the Mysore State and the area under it is increasing year after year. The plants are received from Calcutta for planting purposes. There are two main types in this variety one with oblong fruits and the other with round fruits. In both cases the fruits grow to good size under proper cultivation.

### Miscellaneous Fruits.

**Blackberry.**—Out of the several varieties introduced from Australia in the previous years, the variety Lawton has fruited.

**Strawberry.**—Melba, Royal Sovereign and Illiawara, Sun Beam and Wilson's Pride were imported from Australia and grown in the Fruit Nursery. Melba is found to be the best of all the varieties.

**Raspberry.**—Some varieties got from Paris are under trial in the Fruit Nursery.

**Litchi.**—A few plants received from Saharanpore are being grown. The fruits contain a big seed and a thin layer of kernel.

**Butter Fruit.**—This fruit has not yet been taken up in general cultivation and attempts are being made for popularising it by supplying grafts and seedling plants. The fruit is very rich in proteids and fat.

Fruits such as Mangosteen, Durian, Apricot, Walnut and Pears were tried and found not to succeed as they require a higher elevation.

Besides the above kinds of fruits such as Loquots, Rose apple, Komrac, Brazilian Cherry and Anona varieties, Breadfruit, Plums etc., are under trial.

### Fruit Preservation.

Methods of preservation of fruits in the form of slices, jams, jellies, juices and marmalades are demonstrated at the Lal-Bagh with a simple apparatus—Fowler's Fruit Bottling Outfit—to impress on the minds of fruit growers how wastage of fruit in certain seasons could be prevented. This may develop into a cottage industry in course of time as some of the orchardists are now preserving fruits for their home consumption.

### Fruit Research Scheme.

A scheme for opening a Fruit Research Station in the State with a grant from the Imperial Council of Agricultural Research has just been sanctioned. The scheme contemplates an extent of 45 acres being taken up, 25 acres of which come under apples and 20 acres under miscellaneous fruits including pine apples. The total cost of the scheme is about Rs. 46,200. The site for the Research Station has been selected in the Jodi village Aivarakhandapur in close proximity to Hessarghatta Reservoir in Bangalore Taluk. Work will commence very shortly. The Research Station when it begins to work will, it is expected, play a very important part in the development of fruit cultivation not only in the State, but in the whole of India.

### Vegetable Culture.

The centre of work in vegetable cultivation is the Horticultural Farm near the Lal-Bagh and Jeevanrayankatte Farm in Mysore. The Horticultural Farm depends for its water supply chiefly on the city sewage which runs through the Farm. There is a large barn for drying and keeping the farm produce. The Farm is doing very useful work in the cultivation of improved kinds of temperate and tropical vegetables, fodders and other economic plants along with indigenous varieties.

Among the new vegetables mention may be made of the following:—

**Sweet Corns.**—Black Mexican, The Landreth, Money Maker, Howling Mob, Golden Bantam, Kendal's Giant, Delicious, Bantam Evergreen, the Burpees Branching, Golden Giant and Sweet Orange.

**Maize.**—Golden Beauty, Hickory King and Golden Dent.

**Pop Corn.**—White Rice Pop, White Pearl Pop and Golden Queen.

**Artichoke.**—Jerusalem, Green Globe and Early Purple Globe.

**Asparagus.**—Palmetto.

**Beans.**—(Yellow-podded vars.)—Bountiful, Improved Golden Wax, Golden Butter Wax, (Green-podded vars)—In-exhaustible and Canadian Wonder, Lima Beans and Velvet Beans.



**Beetroot.**—Egyptian Early yellow Turnip, Egyptian Extra Early, Long Black Red, Egyptian Dark Red Turnip rooted, French Travise extra, Early and Cooper's Sunset.

**Brinjal.**—Burpee's Black Beauty, Very Long White, Giant of Benares and Long Green.

**Lady's Finger.**—White Velvet, American Dwarf Green.

**Cabbage.**—Bloomsdale, Large Late Flat Dutch, Bloomsdale Large Late Drumhead, Premium Large Late Drumhead, Savoy Perfection Drumhead, Large Red Drumhead Surehead, Golden Acre, Sugarloaf, London Market, All Head Early, Quintal, Earliest Large Solid Drumhead, World Beater, Burpee's Copenhagen Market.

**Cauliflower.**—Early London, Early Snowball and Large White Cape.

**Carrot.**—Long Ornage, Half Long Scarlet Chanenay, Half Long Nantes, Early Short Horn, Horn Exhibition.

**Celery.**—Golden Self-branching and white Plum.

**Capsicum.**—Ruby King, Ruby Giant, Bull Nose, Chinese Giant, Sunny Brook, Golden Queen, Sweet Spanish and Pimento.

**Knol-Khol.**—Early White Vienna, Early Purple Vienna, Erfurt Earliest Forcing, Green Earliest Forcing, Green Earliest Erfurt, Purple Early Smooth, Erfurt Purple Large Green.

**Leek.**—American Flag, Large Flag or London, Musselburg.

**Lettuce.**—Hanson, Cabbage New York Improved, Drumhead, Naples, Egg Small Solid, Cos Perfection.

**Peas.**—Little Marvel, The Pilot, First and Best and American Wonder.

**Pumpkin.**—Golden Oblong, King of the Mammoth, Cheese White Luxury, Large Red and White.

**Parseley.**—Curled and Glory of Erfurt.

**Onion.**—Cooper's Prize Taker, Cooper's Market Gardner, Yellow Globe, The Queen and Paris Silver skinned.

**Radish.**—White Icicle, Scarlet Globe Round White, Golden Globe, Turnip Scarlet, Long Scarlet, Turnip Yellow, Berlin Blood Red Forcing, No plus ultra, Violet Giant, Chinese Rose Winter, Crimson Giant Rose, Turnip Scarlet Gem, and Long Rose White Tipped.

**Turnip.**—Early Red Top Flat, Early White Dutch, Golden Ball or Orange Jelly and Beck's Improved Snowball.

**Tomato.**—Tangerine, Ponderosa Cooper's Monarch, Peach Blow, The Peach Landreth's Ten Ton, Golden

Queen, Burpee's Matchless, The Landreth Pear Shaped Red, Perfection, Marglobe, Mikado Prize-Taker, Dwarf Giant, Landreth Red Rock, Bloomsdale, Carter's Epicure and Carter's Fruit.

Melon Favourite and Green Maize is an important crop for food as well as for fodder and is grown in rotation with potatoes and other garden crops. Out of the varieties introduced in recent years Golden Beauty, Golden Dent and Hickory King are recommended for fodder purposes as these are very heavy yielders. The sugar corns were found to be better for table purposes than Golden Beauty Maize.

The Pop corns are newly introduced and they are useful for popping purpose.

Out of the varieties of Tomatoes the Tangerine, Carter's Fruit, Bloomsdale, Matchless, Marglobe, Ponderosa, Landreth's Red Rock and Cooper's Monarch have been found good for table and find ready market.

Asparagus which is not commonly cultivated is grown on the Farm for demonstration purposes.

The New Zealand Spinach is cultivated successfully for its succulent Leaf.

### Floriculture.

A great deal of work is done in the introduction of plants of Horticultural and Botanical interest such as creepers, shrubs, trees, Aquatics, Palms, Ornamental and Florists' plants suitable for tropical and sub-tropical climates in addition to temperate plants.

Bulbous plants.—Dahlias (150 vars.) Gladiolus (100 vars.) Cannas (100 vars.) Begonias and Gloxinias, etc.

Cacti and Succulents.—Species of Cereus, Mamilaria, Echina cactus Echeveria, Aloe, Gasteria Bryophyllum, etc.

Orchid collection.—Indian and Burma orchids.

### Palms and Ornamental plants.

Species of Areca, Sabal, Pritchardia, Thrinnax Arenga, Latamia, Livistonia, etc.

Species of Anthurium, Caladium, Dracaena Alocacias, etc.

Species of Ferns Adiantum Asplenium Nephrolepsis, Nephrodium Polypodium, etc.

Roses.—More than 200 varieties of Roses.

Chrysanthemums.—Hundred varieties.

**Annuals.**—Asters, Pinks, Phlox, Verbenas, Antirrhinums, Zinnias Gerbera, etc.,

The above named plants are propagated and the acclimatized seeds, bulbs and plants are sold.

### Other Economic plants.

The following are some of the chief economic plants cultivated in the Botanical Gardens and in the Horticultural Farm.

**Rhodes Grass** (*Chloris virgata*).—The grass is liked by all kinds of stock and it forms good hay. About 500 acres are now under cultivation round about Bangalore. Twenty-three acres are now under this crop at the Horticultural Farm. Under good cultivation 12 cuttings weighing over 30 tons per annum could be got.

The other fodders grown in the Government Farm are :—

**Guinea Grass** (*Panicum maximum*), **Elephant grass** (*Pennisetum glaucum*), **Napier Grass** (*Pennisetum purpurens*), **Phalaris** *bulbosa*, **Paspalum dilatatum**, **Wimmera Rye grass**, **Grimm and Hunter River Lucerene**, **Hubam Clover**, **Guatamala grass**, **Stylosanthes Sundiaca** (*WildLucerene*) and **Medicago-diversifolia**.

**Napier Grass.**—This grass grows to a height of 8' to 12' and gives an yield of 80 to 100 tons per acre in 8 to 12 cuttings. Cattle eat it with relish and the stalk has to be chopped to 1' before feeding to avoid wastage.

**Hubam Clover** was imported from America. It gives an yield of 12,000 lbs. of fodder in two months. This fodder crop enriches the soil with organic matter and is useful for Apiculturists, as bees are very fond of these flowers.

**The Grium Lucerene.**—Is found to give the heaviest yield of all the varieties introduced.

### **Indigofera glandulosa** (Befri).

This is useful as a famine food and grows commonly as a weed in dry sandy tracts of the Daccan and Gujerath. Large quantities of seed were distributed in the districts. In its wild state it is only a foot high and produces one-seeded pods but under cultivation it attains 2 to 3 feet in height and gives double the yield and produces two-seeded pods. Chemical analysis shows that the nutritive value

of Befri in its protein contents is over three times that of wheat and also the energy value of carbohydrates is equal to that of wheat.

*Helianthes annus* (*Giant Russian Sunflower*).—This is an important fodder and oil yielding crop in Russia. It yields at the rate of 5,440 lbs. of seed per acre. Every year 3 to 5 acres are grown under this crop in the Horticultural Farm for seed, as there is a great demand for it, since this crop has become very popular for silage.

**Camphor.**—This is a very important economic plant. The oil and camphor contents were estimated and it was found that in this climate the percentages of oil and camphor were more than that in Dehra Dun. Since 1908 more than 5,000 seedlings have been supplied to various agencies.

**Sisal hemp.**—(*Agave rigida* var. *Sisalana*) produces a valuable fibre, chiefly used in Binder Twine Industry. It is a suitable plant for dry tracts. Detailed experiments were conducted in the extraction of fibre and it was found that this can be grown on a commercial scale profitably. Several lakhs of bulbils were propagated at Lal-Bagh and the Horticultural Farm and distributed to the public.

**Pencil Cedar** (*Juniperus procera*).—This is one of the valuable timbers used in the pencil industry. Several thousands of plants were supplied to various agencies including the Forest Department.

*Hedychium densiflorum*, *H. ellipticum*, *H. gardenianum* were introduced from Darjeeling. The stems are used in paper pulp.

**Soya Beans.**—Burmese, Kachin and Javanian varieties were introduced and seeds are collected for distribution. The Javanian variety is a bush and flourishes very well here. It flowers earlier than Kachin which is a creeper and late in flowering. Soya bean products such as Soya Coffee, biscuits and milk were prepared and exhibited.

*Aleurites fordii* (Tung oil of China) yields oil which is largely used for the manufacture of varnish, etc.

**Fibre yielding plants.**—Manilla Hemp (*Musa textilis*), Mauritius Hemp (*Furcraea gigantea*) and Ramie or Rhea fibre (*Boehmeria nivea*).

**Rubber yielding plants.**—Ceara rubber (*Manihot glaziovii*) Para rubber (*Manihot dichotoma*, Madagaskar rubber (*Cryptostegia madagacarensis*) West African rubber (*Funtumia elastica*) and Guayale rubber (*parthenium argentatum*).

Oil yielding plants.—(Oil palm *Elaeis guineensis*) Indian Beech Sunflower (*Helianthus annuus*) Cajeput (*Melaleuca leucadendron*) Worm wood (*Artemisia absinthium*) and Chalmugra (*Taraktogenus kurzii*) *Gynocardia odorata* Eucalyptus varieties: *E. robusta*, *E. equinoides* *E. resenifora* *E. crebra*, *E. globulus*, *E. pilularis*.

Perfume yielding plants.—*Geranium* (*Pelargonium capitatum*) Rose (*Rosadamascena*) Cassia (*Cassia farnesiana*) Cananga (*Cananga odorata*) Lemon grass (*Cymbopogon citratus*) Rosemary (*Rosemarinus-officinalis*, *Careway* (*Carum carvi*) and *Davana*.

Rosin and Gum yielding plants.—*Styrax balsam*, the Locust tree (*Hymenaca courbaril*) *Carcinia* (*Garcinia hanhuryi*) Indian copal (*Vateria indica*) and *Gumarabic* (*Acacia arabica*).

Dye and Tan.—(*Indigofera tinctoria*) Logwood (*hæmatoxylon campechianum*. Saffron (*Crocus sativus*) *Dividivi* (*Cæsalpinia coriaria*) Iron wood (*Sideroxylon inerme*) and *Catechu* (*Arech catechu*) *Cæsalpineia spinosa*, *Acacca dealbata*.

Green manure plants.—*Crotalaria oocarpa* *C. veletonii*, *C. spectabilis*.

Timber plants.—*Tectonia grandis* *Swistenia* Mahogany *Dalbergia latifolia*, *Terminalia arjuna*, *Cedrela tuma*.

Medicinal plants.—*Digitalis purpurea* *Foeniculum vulgaras*, *Gentiana lutea* *Hyocyamus niger*, *Taraxicum officinale* *Valariana Officinale*, *Glycyrrhiza glabra*, *Rhuburb*, *Aristolochia elegens*, *Cincohna succirubra*, *C. Officinalis* *C. Ledgeriana* and *C. robusta*.

### Economic Development Work in Rural areas.

Seedlings of mango, guava, pomegranates, pine apple, lime, lemon, Rose apple, Loquat raised in Fruit Nursery from seeds of selected fruits of the superior quality true to variety are distributed to the orchardists to ensure the spread of only reliable stock of plants throughout Mysore.

Similarly vegetable seeds are raised in special plots and seeds true to variety are distributed.

The Department renders help to the Village Panchayets, District Boards, Municipalities in the selection of good land for starting fruit, vegetable and flower gardens, in obtaining advice regarding the supply of suitable plants for the respective localities and in obtaining technical

advice in pruning, manuring, cultivation methods and Plant Pest Control.

Help is given to the planting of avenue plants, maintenance of parks and gardens, Panchayath orchards and Nurseries, and Backyard planting of fruits and vegetables.

Lectures on the cultivation of fruits, vegetables, flowers and other economic plants and Nursery work are delivered in rural areas for the benefit of Patels Shanbhogs and Revenue Inspectors on the occasion of Rural Scout campings.

### **Exhibitions.**

The Department takes part in the All India Dasara Agricultural and Industrial Exhibition, shows interesting and instructive exhibits connected with Horticultural work and distributes seeds of economic plants and vegetables explaining the cultural methods.

### **Short course classes.**

Short course classes are arranged to train students in Practical Horticulture in the Government Botanical Gardens and the Horticultural Farm. Many students come from within and outside the State for undergoing training.

### **The Mysore Fruit Growers' Association.**

In order to voice the difficulties of Fruit Growers and to solve the problems connected with fruit culture and to find a suitable market to good fruits, the Mysore Fruit Growers' Association is formed. This Department in collaboration with the Department of Industries and Commerce in Mysore is collecting certain data in connection with the working of the Association.

### **The Mysore Horticultural Society.**

The Mysore Horticultural Society is another organisation meant for the promotion of Horticultural activities in the State and it is becoming an important means of spreading horticultural knowledge. The Horticultural Society has maintained its prosperous condition with the help and co-operation of this Department. The arrangement of the Half-yearly Horticultural Shows and the

Garden and Mali Competitions held annually have been responsible for the improvement of the standard of exhibits in the gardens year after year thereby improving the horticultural knowledge.

The total membership is now 232. There are three classes of membership, Fellows paying a subscription of Rs. 18, Members paying Rs. 12, and Associates paying Rs. 6 per annum.

The following are the chief privileges of the members :—

- (1) Free supply of plants and seeds to the full amount of the subscriptions paid by them.
- (2) The use of the Lal-bagh Library.
- (3) Sending seeds and plants for trial at the Lal-bagh.
- (4) Assistance from the Society in procuring seeds or plants from abroad.
- (5) Free admission into the Half-yearly Horticultural Shows.

The Society is managed by a Council consisting of a Chairman, a Secretary and a Treasurer and eighteen members. The Superintendent of Government Gardens is the Secretary of the Society.

The chief activities of the Society are—(1) The holding of Half-yearly Horticultural Shows, (2) Holding of Annual Garden Competitions, and (3) Helping the members of the Society in Horticultural matters in all possible ways.

#### **Horticultural Shows.**

The Half-yearly Horticultural Shows are held in the first week of February and August in the Glass House in Lal-bagh.

The Government Horticultural Farm puts up a large stall containing excellent exhibits of many kinds of vegetables artistically arranged in both the shows. This serves to create interest in the public in new and improved varieties of vegetables.

A Scientific Section is run by the Department. Important economic plants are shown with their products with short notes about the method of preparation. Tools, seeds, manures and entomological drawings are also exhibited. The domestic Fruit Preservation outfit and preserved fruits, such as mangoes, pine apples, limes,

tomatoes, grapes, etc., are shown. Pamphlets on the preservation of fruits are distributed.

### Garden Competition.

The Annual Garden Competition is held in August every year. Considerable improvements are noticed both in the lay-out and upkeep of the gardens and the owners of gardens take great pains in maintaining their gardens in excellent condition. A similar Garden Competition is held in Mysore during the Dasara Season annually.

The first Mali Competition was held on 29th August 1935.

*Scientific Work.*—Scientific work is being conducted in the Government Botanical Gardens in the following sections:—

**The Bureau of Economic Botany.**—Started in 1911. Reference slips and typed extracts of various economic plants and horticultural crops are taken from the various journals received here and filed in the ledger cabinet boxes. About 200 subjects are arranged in alphabetical order. Information is filed in three separate divisions in each cabinet, *viz.*, (1) Cultural, (2) Botanical, and (3) Commercial. Similarly a case has also been prepared for plant diseases and there are 44 subjects in this case. This arrangement was started here for the first time in India.

**The Herbarium.**—Originally contained a collection of about 1,000 specimens and recently it has been very much improved by the addition of specimens collected in the garden and elsewhere locally and also specimens received from other Botanical Institutions as donations. The present number of specimens is 3,500.

A carpological collection has been recently opened.

Technical information on various subjects has been collected and noted in registers. These contain notes on flowering and fruiting periods of creepers and shrubs and trees. The General Book consists of names of plants grouped together in the garden. The Pot Garden Register contains information on the seasonal flowers so that a continual show may be had in the garden. A statement of seasons for sowing seeds has been made.

The collection of *Botanical Drawings* consists of 1384 excellent coloured sheets mostly of local plants, flowers, fruits and plant diseases. There are also a number of photographs of economic plants grown here.



**The Library.**—has been much enlarged during recent years by the addition of standard works of Botany, Horticulture and other subjects. There are 396 books and 460 volumes of journals. Most of the journals are received in exchange for departmental reports and publications while some are subscribed for.

**The Fumigator**—was built as early as 1912. All the incoming and outgoing plants are fumigated with hydrocyanic acid gas. This was the first of its kind in India.

**A Seed Testing Room.**—was opened in 1912. Germination tests are carried out on tiles specially made for the purpose.

**The Seed Depot.**—was started in 1908 with the object of importing new plants and seeds from other Botanical Institutions in exchange for seeds and plants collected here. This is also the centre from which improved varieties of seeds and plants are distributed to the public. Seeds and plants are also sold here. Technical advice on horticultural matters is freely given not only to those in the State but in many cases to enquirers outside the State.

#### **Publications.**

Leaflets on Insecticides and Fungicides, Fruits, Vegetables and fodder cultivation, Preservation of fruits and lists of seeds and plants for sale, Exchange lists, etc., are published.

**Activated Composts.**—They are being prepared and tried using cow-dung solution and night soil solution as starters. Experiments in the preparation of composts conducted in the various gardens in charge of this Department have proved successful. Composts are prepared out of dried mixture of leaves of Mango, Honeysuckle, Java fig and Bamboo and Honeysuckle flowers. Their analysis shows that they are in no way inferior to Farm-yard manure in their composition, the percentage of Nitrogen in them varying from 0.78 to 1.33. The great advantage is that in this method good manure becomes available in a short time.

#### **Distillation of Essential Oils.**

A number of essential oil yielding plants are under cultivation in the garden and out of these scented Geranium, Lemon, Eucalyptus, Citriodora and E. Pillicifolia were distilled.

### **General Horticulture.**

There are four large Parks and sixty Minor Gardens in Bangalore, Mysore, Seringapatam, Karapur and the famous Terrace Gardens at Krishnarajasagara maintained by this Department.

### **Government Botanical Gardens, Bangalore.**

The centre of work of the Horticultural Department has been from the beginning the Government Botanical Gardens popularly known as Lal-Bagh in Bangalore. The important sections of the gardens are—Economic Garden, Rose Garden, Statue Garden, Terrace Garden, Succulent Border, Pot Garden, Japanese Garden. The Palm house Orchid house, Fernery and In-door and Out-door Nurseries. Among other purposes served by this garden are experimental cultivation, introduction, acclimatisation and propagation of new plants, training of gardeners and exchange of new specimens of plants with various botanical and horticultural institutions in the world. Two half-yearly Horticultural Shows are held under the auspices of the Mysore Horticultural Society, which is very closely associated with the Government Botanical Gardens in the large Glass House.

### **Cubbon Park.**

The park is named after the late Sir Mark Cubbon who was the Chief Commissioner of Mysore. It covers an area of 300 acres. Within the park are situated in different parts the old and the new Public Offices. The Seshadri Memorial Hall and the Government Museum. The Statues of Queen Victoria, King Edward the VII, Sir Mark Cubbon and His Highness the late Sree Chamaraja Wodiyar Bahadur with ornamental gardens around them. The general landscape effect is greatly improved by planting shrubberies and clipped and other ornamental plants. The low railings bordering the expansive lawns and foot-paths add beauty to the park. The main roads in the park have been tarred. A Fairy Fountain was constructed in front of the Statue of His Highness the late Sree Chamarajendra Wodiyar Bahadur out of the munificent donation of Rs. 5,000 given by Her Highness the Maharani of Bhajang. The Fountain is both worked and lit up by Electricity and the central jets rise to a height

of 25'. It is a great attraction to the visitors during nights when the electric bulbs of different hues are switched on.

Besides this there are 32 minor gardens attached to the important Government Buildings, Offices and Hospitals. The gardens in front of the Victoria Hospital, Vani Vilas Hospital and the Bull Temple are really a source of pleasure to the public.

### Gardens in the Mysore City.

The City of Mysore is known as the Garden City of India, a name which it richly deserves. Gardening has assumed great importance in the city. It follows the street builders with trees, turns the little squares and circles into gardens, simple but beautiful, drops down fountains here and there embellished by Statues and margins the roads with flower beds. It brings the public pure air and aims directly and effectively at the recreation and benefit of the people.

There are broad roads bordered by trees of different kinds, providing shades of beauty with their blooms. The flowering trees are an attraction in some of the avenues and of these Goldmohurs which flower during the month of April and May look as if they are robed in flaming gold and scarlet.

To flower and tree lovers the Curzon Park, Hardinge Circle and Nishath Bagh are of great interest. The avenue of Colvillea cernosa trees planted along the Albert Victor Road is most striking when their orange coloured flowers burst out in the months of August, September and October. One is reminded of a glorious Sunset.

Gateways and trellices are covered with lovely creepers of all kinds and flower beds blaze with cannas. Other kinds of bedding plants are seen in the various gardens.

There are two seasons when Mysore is most charming. These are the Birthday and Dasara seasons when the flower beds are in full bloom, shrubs flowering and lawns green and pleasant.

There are as many as 23 gardens and four public parks in the city maintained by the Gardens Department. The important parks that are maintained by the Gardens Department are the Gordon Park and Curzon Park.

Gordon Park is laid out with large open spaces with flower gardens round the District Offices and the Gordon Statue.

Curzon Park is laid out in four blocks divided by the Albert Victor Road and the Statue Square. In the middle is the Marble Statue of His Highness the late Sree Chamarajendra Wodiyar Bahadur under a canopy glittering with gold. The Memorial Fountain surrounded by red cannas and illuminated with flood lights during nights is a very attractive sight.

The Hardinge Circle has a diameter of 120 yards and is laid out beautifully. This has six gates and has a background of shrubberies. There are six *Spathodea* trees in the Circle and the space between the gates is covered by the lawns. There is a beautiful fairy fountain in the Centre.

There are gardens in the Guests' Quarters, Official Residential buildings, Hospitals, Educational Institutions and Public Offices. Government House and Lalitha Mahal Gardens are most beautiful.

#### Gardens in Seringapatam.

*Daria-Dowlat Bagh.*—This is the garden in which there is Tippu Sultan's Summer Palace. *Dar-i-Dowlath* means "The Gate of Wealth" or "The Gate of Kingdom". This garden was originally planted with varieties of mangoes. It was afterwards laid out with flower beds, shrubberies, shade gardens, pergolas, etc., on the western style and now the garden is a combination of the East and the West. The open grounds, which were originally paddy fields, were laid out and planted with cocoanuts and plantains. The garden is frequently used by the public for picnic parties. All the distinguished persons who go to Mysore invariably pay a visit to this place. The sacred river Cauvery flowing by the garden adds great beauty to the Bagh.

#### Gumbaz.

A garden is laid out round the Gumbaz wherein the Tombs of Hyder and Tippu Sultan and their relatives are built. This is largely used by mussalmans for picnics. This was originally a tope of mangoes planted during the time of Tippu Sultan; there are now 24 varieties, few of them being good. The borders of this garden are full of guavas. After this garden was handed over to this Department in 1924 a Drive Road was formed round the garden. Useless and ugly trees were removed and distant

views were opened out. Many new kinds of trees and ornamental shrubs were planted.

Not far from this garden (about five furlongs) is the Sangam where the western and northern branches of the Cauvery meet. Visitors who go to the Gumbaz Garden can drive through its eastern gate to the Sangam. The road leading to this place is maintained by the Gardens Department.

### **Krishnarajasagara Gardens.**

Brindavana (South Bank).--The famous Terrace Gardens of Mysore known as Brindavana are situated behind the Krishnarajasagara Dam across the River Cauvery. The work of laying of this garden was started by the Gardens Department in 1927. The garden extends over an area of twenty acres and it is laid out in three terraces and ends in a horse shoe shape. It is sixty feet below the top of the Dam. Half way down the slope there is a pavilion from which a foot-path runs on the slope to meet the paths on the sides. A view of the whole garden can be had from this pavilion. This garden is walled in by trees and shrubs of different kinds on the eastern and western sides and on northern and southern sides by groups of flowering and shady trees. An underground channel leads water from the lake and drops it to a depth of forty feet under the pavilion. This water runs in the central masonry channel and feeds the fountains which are in it as well as in the wings on its either sides. The fountain in the middle of the channels shoots water straight up in a single jet and those in the side channels in various directions producing different effects some like an arch, some like a dome, while the largest fountains at the end of the wings shoot water to a height of about 40' in huge masses. These fountains are arranged to be illuminated with flood lights during nights on Saturdays and Sundays when visitors pour in to see this famous garden.

Adjacent to the Terrace Gardens on the eastern side are an Orange Grove and a Plant Nursery wherein all kinds of ornamental, shady and economic plants are propagated.

Brindavan (North Bank).--This is laid out on a smaller scale than the garden on the South Bank, it is 2½ acres in extent. The surroundings of this are planted with shady trees.

*Experimental Orchard.*—This orchard was laid out in 1931 and is fifty acres in extent. Out of this, twenty acres are fenced and are planted with Australian fruit plants. Plantains and Papayas planted to afford shade and protection from wind to the citrus kinds are now yielding.

Adjacent to these on the western side is a miscellaneous fruit plot which contains fruit plants such as Plum, Peach, Nectrine, Breadfruit and Butterfruit. On the eastern side of the Orchard is a Mango Garden, 25 acres in extent planted with Raspuri, Badami and Malgoa varieties. At the northern end of the Bank beyond the Irwin Canal a group of 500 hongey trees are planted.

#### **Karapur Gardens.**

The garden is laid out in the midst of a forest where there is a shooting camp. It is at the 42nd mile from Mysore on the Mysore-Mannantoddy Road and is sixty acres in extent. The River Kapini flows on the northern side of this garden. The banks of this river are covered with thick vegetation and impart a charming view.

#### **Nandi Hill Station.**

Close to Bangalore (35 miles and connected with it by a Light Railway) is the Nandi Hill Station which has a salubrious climate all the year round. In the hottest months of the year April and May when the Thermometer ranges from 76° to 90° in Bangalore, it registers in Nandidroog between 64° and 65° in the early morning and to 77° in the hottest part of the day. The climate is consequently superior to that of the Shevroy Hills and very nearly equal to that of Coonoor in the Nilgiris. With the co-operation of the Director General of Indian Observatories in May last, the Government of Mysore sanctioned the opening of a new Meteorological Station on the Hills, for keeping an accurate record of the weather conditions prevailing at the Hill Station for the information of the public. With its fortifications, the ruins of which may still be seen, it was a formidable stronghold in the 18th century and was captured by the British Army under Lord Cornwallis in 1791. There is a temple of Iswara at the top and also a tank of spring water called Amruthasarovara or Lake of Nectar noted for its crystal purity and health giving properties. Sir Mark

Cubbon and other British Officers built fine bungalows on the Hills for summer residence. Nandi Hill now serves the purpose of popular summer resort with fine furnished bungalows provided with electric lights and having excellent catering arrangements—vegetarian as well as non-vegetarian.

A few of the amenities available and the recent improvements effected for the convenience and comfort of the public who may resort to the Hill Station for residence during the coming summer season are mentioned below:—

The construction of a motorable road to the top of the Hill has just been completed and will be available for use shortly. Motor sheds are available for parking the cars on payment of prescribed rent.

All the five bungalows on the top of the Hill, *vis.*, Oaklands (Cunningham Bungalow), Cubbon House, Glentilt, Brown Lodge and Sankey Rooms have been fitted with electric lights and water taps. The seasonal rate for the occupation of these Bungalows have now been considerably reduced. During the off season, the rates will be half of the seasonal rates. Concession rates will be allowed in Brown Lodge and Sankey Rooms to *bona fide* students in charge of responsible teachers. Available vessels, etc., will be supplied free of cost on previous notice to parties making their own arrangements for cooking.

Rickshaws and Chairs for ascending the Hill can be had on payment of the prescribed hire by previous arrangement with the Hill Staff.

There is a well equipped Dispensary and a Free Reading Room and Library.

A well laid out Tennis Court and a Badminton Court are maintained for the recreation of the visitors.

Nandi Hill is connected with Nandi Railway Station by Telephone which the public may make use of on payment of charges to be ascertained either at the Railway Station or at the Hill. Telegrams received at Nandi Railway Station for visitors on the Nandi Hills will be transmitted to the Nandi Hill Station to the addressee by telephone free of charge.

A large collection of economic plants which thrive at a higher altitude such as Pencil Cedar (*Juniperus procera*) Eucalyptus vars, The Camphors (*Cinnamomum camphora*) fruit plants and medicinal herbs are planted.

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## CHAPTER XIII.

## AGRICULTURAL CO-OPERATION.

The Mysore Co-operative Societies Regulation was first introduced in 1905 and has since been amended a number of times, the latest amendment having been in the year 1935. In the whole State there were 1,862 Societies working at the end of June 1937. Of these, 1,417 societies belong to the Agricultural class who form nearly 80 per cent of the population. They had a total membership of 62,229 and collected a total Working Capital of Rs. 55,00,845. Credit forms the backbone of the movement and the societies for promoting objects other than credit form a small minority being only 80. The reasons for this small progress in the development of non-credit agricultural co-operation are not far to seek. It is much easier among the rural people, who are for the most part backward and illiterate, to start societies for credit than for production and distribution, which involve much technical skill, knowledge, experience, etc.

As in the British Indian Provinces non-credit work is combined with credit in many of the societies. The members being the same even if different societies are organized in rural parts it is found to be of greater advantage to combine several functions in one and the same society, maintaining different accounts for different branches. Especially in villages, advantages are immense in combining credit and non-credit work in one and the same institution on account of the limited sphere in every respect and the difficulty of finding suitable workers of diverse kinds. A beginning is made in respect of supply of agricultural requirements, such as, good seeds, ploughs, manures, sugarcane mills, pans, etc., to the raiyats and there are some rural credit societies now doing this kind of non-credit work, besides the regular Agricultural Supply Societies. The number of societies of the latter type in June 1937 was 22 with a membership of 624 and a paid up share capital of Rs. 12,912, a deposit of Rs. 1,345 and a total working capital of Rs. 74,826.

The special advantages accruing to the agriculturists from these supply societies are numerous. The aim of both the Agricultural and Co-operative Departments is



identical, being essentially economic in their activities. The chief requirements of a raiyat, besides cheap credit, are good seeds, implements, manure, etc. The Agricultural Department has carried on various experiments and found the best kinds of ragi, paddy, sugarcane, potatoe and cotton seeds which are most suitable for the Mysore soil and its climate, and has been doing demonstration work on a very extensive scale to popularize their use. The Department has also improved and manufactured a plough best fitted for all kinds of soils in the State. The difficulty in obtaining reliable seeds at the right time is overcome to a large extent. Unless the people make use of the help of the specialists of the Agricultural Department for their requirements and take advantage of their advice and help they will find it difficult to adjust their business to the changing conditions of rainfall, price etc. The raiyats are too conservative to change their methods and habits of work all at once. They obtain seeds for sowing from the grain dealers without caring for their quality, because it is the only supply to which they are used and which is readily available. They have now begun to feel that the Co-operative Societies are intended for providing facile credit to them and appreciate their help in time of their need. In order to bring about a change in their methods and popularise the good results of the Agricultural Department, Rural Credit Societies have been coming gradually forward to undertake the supply of seeds, ploughs manure, etc., recommended by the Department as being most useful and profitable to the raiyats, and make them readily available to their members at the proper seasons.

Next in importance in non-credit agricultural co-operation, are sale societies, *i.e.*, societies for the sale of produce grown by the members in profitable markets. The aim of these is primarily to get rid of the middle men who are responsible for the low price obtained by the producers in the sale of their produce. Large differences between the bazaar rates and the rates realised actually by the producers are apparent, and the figure is usually high, as near as 50 to 60 per cent. The difficulties are aggravated often when the cultivator is in debt to the middleman, and is forced to sell his articles through him at prices dictated by him. Human nature being what it is the middleman naturally fixes a low price for the produce, as he takes the risk of waiting for a chance to sell it to his own advantage,

and thus the cultivator gets very much less than what is rightly due to him.

The above difficulty can be overcome by the organization of Co-operative Societies for the sale of agricultural produce. Such societies can collect the produce of the members and sell it at the best prices, in the open market, instead of through middlemen. For doing all this work, honest and energetic workers well acquainted with the conditions of trade variations and market fluctuations are necessary. In all villages, it is not easy to get such efficient men as workers. For the present, the existing credit societies having the best available men among their directorate can undertake to help the members in this respect, though first attempts prove uphill work for want of sufficient experience. A small beginning has been made in regard to the sale of areca and cardamom. There are at present two societies for the sale of areca and two for cardamom in Shimoga and Kadur Districts. The Maradihally Co-operative Society in the Chitaldroog District has a branch for the sale of cotton as an adjunct to its credit business. All these institutions have been doing very useful work.

Investigations have been completed for the organization of some half a dozen societies for the sale of areca on somewhat different lines with a Central Warehouse and Marketing Agency at Shimoga and the Scheme is expected to materialise in the near future.

Some of the Paddy growers in the Mysore District have organised themselves into a Society for stocking, milling and selling paddy. Societies for the sale of copra are also under contemplation.

The Co-operative Department is in correspondence with the Department of Industries and Commerce for organizing Co-operative Societies for the promotion of suitable Cottage Industries in villages with a view to supplement the income of agriculturists.

Co-operative Grain Banks have not however been a success.

The association of Co-operation with agricultural improvements may assume different forms. In one place the society may perform the functions of an Agricultural Association, in another Agricultural Associations may have a separate existence but may work in union with the co-operative movement. It may safely be said that, by the united efforts of the Agricultural and Co-operative

Departments, the Agricultural Department devoting its sole attention to experiments and demonstrations and the Co-operative Department undertaking the entire Agricultural Depot work, *viz.*, the sale of implements, seed and manure, the economic uplift of the people is bound to take place in the near future.

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## CHAPTER XIV.

**Publications and the Agricultural Press.**

Realising that only a very small section of the people can be reached through the printed page in a country like Mysore, where literacy among the raiyat classes is at a very low level and where even those who can read seldom resort to instruction from a book, the Department has not embarked upon that method of reaching the raiyats to any large extent. As explained already, efforts have been concentrated on ocular demonstrations on the raiyats' holdings. Nevertheless, the printed page has by no means been neglected, as will be seen from the list of publications issued by the Department from its inception, given in the appendix. The more salient features of this particular line of work, may however, be briefly indicated here to show the nature of the methods followed.

The use of green manure, the growing of Cambodia cotton, methods of collecting and conserving cattle manure, showing the right way and the wrong way, the kumblihula pest and combative measures against it, the keeping of good breeding bulls and stallions—these have formed the subjects of coloured and striking posters which have done duty at scores of villages.

The Vernacular Newspapers in the State have been utilised for the publication of information, at different times, on subjects suitable to the season of the year. A large variety of subjects has been covered in this manner and articles were prepared and supplied simultaneously to all the newspapers.

The next step is the Vernacular leaflet illustrated wherever necessary and distributed at conferences and jattras or from the Depots of the Agricultural Inspectors. These are of more permanent interest and copies are always available and reprinted when the supply is exhausted.

The Agricultural Calendar is a yearly publication. The ordinary panchanga or almanac form is maintained but it is made the vehicle for a large mass of useful information on matters of agricultural improvement, principally relating to some of the recommendations of the Department. The monthly notes giving brief

suggestions to attend to in regard to the improved methods, month by month, is a particularly useful feature. During the 23 years that the Calendar has now been running, the total number of articles published is more than ten times that number. The price list of the implements and other materials stocked in the Depots for sale is also published in the Calendar. The Calendar is published in English and in Kanarese and sold at a nominal price.

The Journals of the Agricultural and Experimental Union—English and Kannada are utilised for publishing results of scientific work that is being conducted in the Laboratories and Experimental Farms of the Department and those of field trials conducted by the Members of the Union. The Kannada journal is specially meant for disseminating useful information on all agricultural and allied matters among the non-English knowing rural population of the State. The Revenue and the Education Departments help to popularise this Journal by recommending its purchase by Village Panchayets and Middle Schools.

The scientific publications and bulletins of the Department are issued when a project or line of experimental work pursued on a definite subject may have sufficiently advanced to admit of conclusions being drawn and recommendations made, or may be deemed fit for publication for other reasons.

### **Publicity and Exhibitions.**

The Mysore Dasara Agricultural and Industrial Exhibition is held as an annual event in connection with the Dasara celebrations and the session of the Representative Assembly in Mysore City. The exhibition is of a very elaborate character and the Agricultural Department of the State organises every year, a most striking and instructive display of all aspects of agricultural work. Each section is made as comprehensive as possible, with a view to imparting knowledge mostly through visual instruction methods. A Demonstration Farm is attached to the Exhibition, on which plots have been laid out for manurial and varietal demonstration purposes and crops grown. A large variety of crops which the Department desires to bring to the notice of the people are grown and displayed in situ.

Daily demonstrations of agricultural implements actually at work, spraying of insecticides, milk analysis, cream separation and butter making and jaggery boiling, exhibitions of lantern-slides and moving pictures and other fixtures are arranged, and altogether, the Exhibition is made to furnish as big a feast of knowledge as the resources and enterprise of the staff can afford. The Sericultural Department has a separate pavilion for itself, for demonstrations and exhibits illustrating the sericultural industry of the State and the improvements suggested.

For a number of years Conferences used to be held annually at District and Taluk Headquarters to review the District and Taluk activities in economic development; in conjunction with these conferences agricultural exhibitions and demonstrations were held, some of which were organised like the Dasara Exhibition itself in miniature.

Displays entitled "All about Sugar-cane" "All about Ragi", "Cocoanut Show", "Potato Show" "Groundnut Show" etc., have been also arranged though not at regular intervals either as harvest festivals or on special occasions and in select centres.

The Cocoanut show was arranged at Tiptur, the heart of the cocoanut tract and its chief trading centre. Every aspect of the co-coanut palm with its multitude of uses formed the subject of display. The object was to bring before the cocoanut planters of this Taluk in the most striking manner possible, the various uses to which the cocoanut tree and its products could be put. The coir trade of Cochin and Travancore had also been largely represented, as also the cocoanuts from Ceylon.

The other harvest festivals were also arranged at appropriate centres; and on all these occasions, all matters relating to improvements in the crop husbandry of these crops were made the subject of strikingly instructive displays. Soils suited, varieties to be grown, implements for ploughing, ridging, weeding, harvesting grading methods, manures, bye products etc., were all illustrated and explained.

These special shows are easier to organise and more striking in their effect and deserve to be repeated at shorter intervals than it has been done in the past.

Field days arranged at appropriate seasons on some of the Experimental Farms in connection with the Annual Meetings of the Agricultural and Experimental Union have also served to bring the agriculturists of the State

in touch with the problems that are being tackled and the results achieved so far in respect of the several crops that are being studied at these Stations.

The Department of Agriculture has two competent artists on its staff whose services are fully made use of in the preparation of the charts, coloured posters and illustrative matter for the various publications as already described. In addition, Magic Lantern Slides on a wide variety of subjects both of the class room lecture order as well as of the village audience standard are prepared regularly and stocked for being made use of at these periodical shows and conferences.

These periodical shows are frequently organised by the Department, as part of its visual instruction methods of imparting information to the raiyats and spreading a knowledge of improved agriculture.

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## CHAPTER XV.

**Summary and Conclusions.**

The foregoing chapters will, it is believed, have amply made clear the peculiar agricultural features of the Mysore State, its great advantages in soil and climate the great variety of commercial crops already grown, from coffee and cardamoms and pepper the money crops of the mountainous zone of terrential rains called the Malnad, through sugarcane and mulberry the premier money crops of the State, down to the cocoanut, cotton, groundnuts and tobacco of the plains and likewise the great volume and variety of its food grains, pulses and oil-seeds. Mention has also been made of its celebrated breeds of oxen and its sheep, constituting the cattle wealth of the State.

The scope for and the main lines along which the improvement of this agricultural wealth of the State can be effected have been indicated. The bringing under cultivation of the vast areas still remaining to be developed by methods such as would enable the raiyat to own and form a much larger holding than he does at present has been urged and the question of the introduction of improved implements and the question of putting large areas under plantations of perennial crops like coffee and tea in the Malnad and cocoanuts, tamarind, soapnuts, hongey and other valuable plantation crops in the Maidan have both been gone into. The great and all important question of increasing the production and the money value thereof, on the vast areas already under cultivation, by the extension and improvement of irrigation, by the use of concentrated and other fertilizers on a very much larger scale than at present, by the growing of higher yielding varieties and by the displacement of part at least of the old crops by more profitable money crops and by an intensive campaign against the numerous pests and diseases of the cultivated crops has been dealt with. The increasing of the profits of cultivation by cheaper and better cultural methods, by greater attention to the preparation of produce for market, and lastly by the safeguarding to the raiyat a larger share of the fruits of his labour by the prevention of exploitation by the money



lender and the trader, through the agency of the co-operative movement has also been discussed in broad outline. The question of the improvement in and the prevention of loss by mortality of the cattle and sheep and goats and other live-stock of the State, has been dealt with, emphasising its importance as a subsidiary source of income to the raiyat. Particular stress has been laid on the importance and the improvement of the Silk Industry of the State and also of the importance of the cultivation of fruits, flowers and vegetables as subsidiary occupations of substantial money value. The nature and extent of State action and of the Departments thereof studying and actively engaged in bringing about improvements have been described and the nature of the results achieved and the programme of the various Sections of the Departments gone into in detail.

It is true that something by way of the introduction of a new crop or variety has been attempted now and again in the past, but it has little more than mere historical interest. Direct State action implying the new role of Government as an active agent in the introduction of improvements into the agricultural methods can be said to have been inaugurated only about 40 years ago. From very humble beginnings, it has been shown that the State Department of Agriculture has grown slowly but steadily. The agency for the spread of agricultural improvements among the actual raiyats in the villages may be said to have been brought into existence only about 23 years ago, with the constitution of the District Staff, the Scientific sections through their work in the Laboratory and on the Experimental Farms having accumulated sufficient material by way of specific recommendations to be taken out to the Districts in the meanwhile. The combination of agencies such as, the Civil Veterinary Department, and the Amrith Mahal Department, and the starting of the Live-stock Section and the Serum Institute putting them all under the control of the Director of Agriculture with a view to greater economy and efficiency may be said to have been complete only as late as the year 1925.

It is needless to further refer to the work accomplished during the years except to indicate the money value of these improvements. Twenty three thousand and odd improved tillage implements and the huge number of threshing rollers, improved sugarcane mills, irrigation pumps worked by oil engines and electric power and other

improved appliances would account for Rs. 17 lakhs. The improved varieties of ragi, sugarcane and cotton, the cigarette variety of tobacco introduced into large areas with the starting of the Mysore Tobacco Company, short season groundnuts and paddy would account for Rs. 40 lakhs. The artificial manures and oil-cakes would likewise be credited with Rs. 30 lakhs and the saving due to remedial measures against pests and diseases for Rs. 30 lakhs. These then would amount in the aggregate to a sum of Rs. 117 lakhs. Then there is the campaign against rinderpest and other epidemics may account for saving cattle of the value of about 20 lakhs making up roughly a total money value of about of 1,37,00,000 rupees. There are again the improvements brought about by the work of the Sericultural Department, which should be credited with a large and substantial amount.

The budget of the Agricultural Department for the year 1937-38 is Rs. 7,62,200 which is divided between the main divisions as under.

		<i>Net Expenditure.</i>
		Rs.
Direction	...	59,800
Chemical Section	... }	76,300
Entomological Section	... }	
Mycological Section	... }	
Botanical Section	...	
Agricultural Engineering	...	13,600
Farms	...	42,200
Implement Depot	...	1,800
Agricultural Education	...	24,900
Demonstration and District Staff	...	1,56,300
Live Stock Section	... }	76,000
Amruthmahal Department	... }	
Civil Veterinary Department	...	2,65,000
Serum Institute	...	3,000
Miscellaneous	...	43,300

If we put this expenditure side by side with the figure given for the money value of the improvements relating to the current year, *viz.*, 1,37,00,000 rupees, it will be seen how substantial is the return that is being obtained for the expenditure.

It is possible to contend as sometimes it is contended that all the above mentioned return does not imply any direct additional receipts into the Government Treasuries. It can only be pointed out in reply that the material prosperity of the raiyat is the foundation of the prosperity of

the State and an increase in the one corresponds to an increase in the other. It is well to realise what is perhaps too obvious that every ton of increased produce means not only more food to the raiyat, more money in his hands to purchase and pay, and thereby keep going the multitude of occupations depending on the raiyat, means increased profits to the merchants, and to the carrying trade of the country whether by rail or road, means more raw produce to the factories here or abroad, and above all means a happy and more contented raiyat. If the material welfare of the raiyat is the main concern of the State, and the raising of his standard of life and of the condition of the Mysore village to the level of the urban conditions of the State and in the fullness of time to the level of the urban life of England or America, it can be accomplished only by increasing the raiyat's profits of farming and helping him to accomplish it for himself. That the money required for this purpose for the whole State can ever come out of the coffers of the State is almost impossible to contemplate.

What has been accomplished so far, substantial as it is, is little compared with what can be and what has to be accomplished. Any material increase in the pace at which such a result can be secured can be chiefly through a large expansion of the staff of the Agricultural Department and a liberal allotment of money for the development of the work on the various lines indicated in the foregoing pages. This subject of increased staff and funds may appear too monotonous and insistent. It cannot be too well emphasized that the staff and the bulk of the work accomplished stand in direct relation of cause and effect in a large measure, especially where speeding up the work is required without leaving progress entirely to the effect of time. An instance is worth quoting to illustrate this point. Take the subject of artificial manures. Prior to the year 1914, it was not as if these were not known at all in the country. The Coffee Planters were importing them in large quantities; there were large bone-crushing mills in Hunsur and Bangalore; there were at least half a dozen large European Firms engaged in the trade. In the Laboratory of the Department of Agriculture itself years of work were principally upon the analysis of fertilizers. And yet as far as the raiyat was concerned, little or nothing was being taken by him. Compare this picture with the state of affairs subsequent to 1914 when the sale

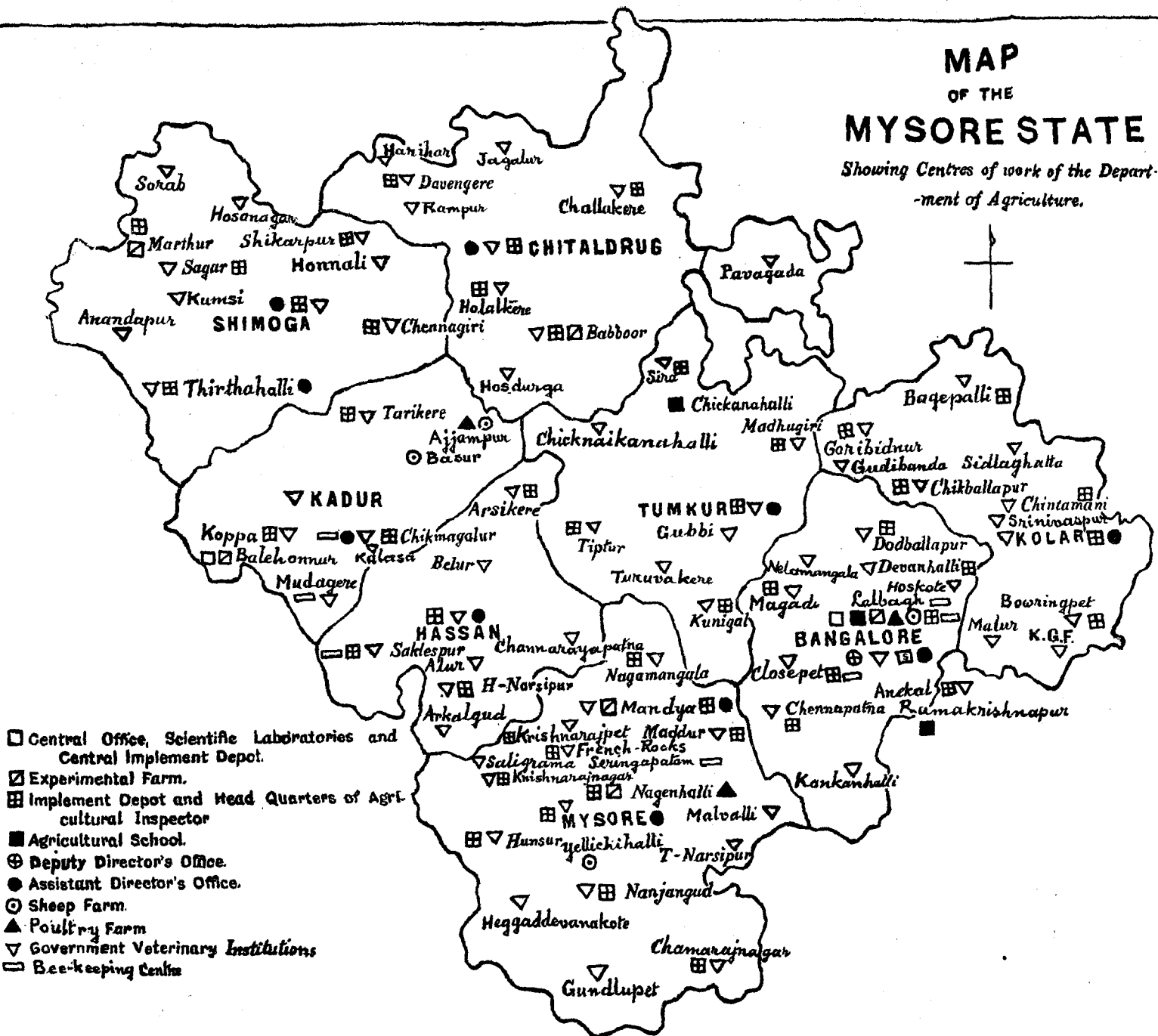
of oil-cakes and artificial manures to raiyats runs into nearly 3,000 tons. The change is nothing short of a revolution due solely to the work of the Department out in the Districts. The desirability and urgency of the development of the work and agency of the agricultural and allied departments has not only to be adequately realised, but translated into action if the end in view has to be accomplished within a reasonable period of time.

This survey cannot be concluded more appropriately than with the following quotation from the Opening Address delivered by His Highness the Maharaja of Mysore at the Meeting of the Board of Agriculture of India which met in Bangalore in January 1924, as it is impossible to sum up the situation more accurately. His Highness said, "Gentlemen, when we look at the field that is open before you, when we consider the needs of Indian Agriculture, we must all of us be struck by the immensity of the task that lies ahead. The immense distance which lies between Indian Agriculture as it is and Indian Agriculture as it should be, calls for the most strenuous efforts you can put forward and for the most loyal support and recognition of your work on the part of Local Self Governments."

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# MAP OF THE MYSORE STATE

Showing Centres of work of the Department of Agriculture.



- Central Office, Scientific Laboratories and Central Implement Depot.
- ▣ Experimental Farm.
- ▤ Implement Depot and Head Quarters of Agricultural Inspector
- Agricultural School.
- ⊕ Deputy Director's Office.
- Assistant Director's Office.
- ⊙ Sheep Farm.
- ▲ Poultry Farm
- ▽ Government Veterinary Institutions
- ▭ Bee-keeping Centre

## APPENDIX II.

DEPARTMENT OF AGRICULTURE IN MYSORE,  
BANGALORE.

## STAFF.

## DIRECTION.

Messrs.—

- T. G. Rama Iyer, B.A., Director of Agriculture.  
 Venkata Rao K. Badami, L.Ag., Ph.D. (Cantab.), Deputy Director.  
 B. Sankara Rao Badami, M.A., Headquarter Assistant.  
 N. Venkataramaiah, B.Sc., Manager.

*Publication and Library.*

- Mr. N. Venkatasubbaiya, F.B.H.S., Agricultural Inspector in charge of  
 Kannada Publications, Secretary, Agricultural and Experimental  
 Union and Officer in charge, Library.

*Statistician.*

- Mr. A. Ananthapadmanabha Rao, B.A., Department of Agriculture.

## CHEMICAL SECTION.

Messrs.—

- K. Bhima Rao, B.A., Agricultural Chemist.  
 B. T. Narayanan, B.A., Ph.D., D.I.C., Bio-Chemist.  
 M. Subbaiya, B.A., Assistant Chemist.  
 D. Hanumanthiah, B.A., B.Ag., Assistant Chemist.  
 B. Dasappa, B.A., B.Ag., Ph.D., (O.O.D., Assistant Director, Bangalore).  
 N. G. Chokkanna, M.Sc., Ph.D., Offg. Assistant Chemist.  
 S. Ramaswamy Sastry, Analyst (O. O. D., Mysore City Municipality).  
 G. P. Krishnaiyengar, B.Sc., Analyst.  
 B. Bhimasena Rao, B.Sc., Analyst (Offg.).  
 K. R. Anantaramiah, B.A., Analyst (Offg.).  
 K. Lakshminarayana Bhatta, B.Sc., Assistant Chemist, Fish Poisons Scheme.

## MYCOLOGICAL SECTION.

Messrs.—

- M. J. Narasimhan, B.A., Mycologist.  
 S. V. Venkatarayan, B.A., Senior Assistant Mycologist.  
 D. Gundu Rao, B.Sc., Junior Assistant Mycologist (Tirthahalli Circle).  
 N. S. Venkatakrishniah, B.Sc., Junior Assistant Mycologist.

*Artists.*

Messrs.—

- M. Ranganaikalu Naidu, Senior Artist. (On leave Preparatory to retirement.)  
S. Shadagopa Mudaliar, Assistant Artist.

## ENTOMOLOGICAL SECTION.

Messrs.—

- T. V. Subramaniam, Dip. in Agri., Entomologist.  
B. Krishnamurthy, B.Sc., Senior Assistant Entomologist.  
D. Seshagiri Rao, B.Sc., Junior Assistant Entomologist (Mandya).  
H. A. Abdur Rubb, B.Sc., Junior Assistant Entomologist, Chikmagalur.  
M. Puttarudriah, B.Sc. (Hons.), Junior Assistant Entomologist (Fish Poison Scheme).  
S. V. Vasudevan, M.Sc., Junior Assistant Entomologist (Offg.).

## BOTANICAL SECTION.

Messrs.—

- Venkata Rao K. Badami, L.Ag., Ph.D. (Cantab.), Deputy Director and Principal, Hebbal Agricultural School.  
M. Narayana Reddi, B.Sc. (Edin.), Vice-Principal, Agricultural School, Hebbal.  
V. N. Ranganatha Rao, L.Ag., Senior Assistant Botanist, Assistant Director, Chitaldrug.  
S. V. Sarma, Junior Assistant Botanist, Assistant Director, Mysore.  
K. Gopala Iyengar, M.Sc., Junior Assistant Botanist.  
T. Srinivasa Murthi, M.Sc., Junior Assistant Botanist (In charge Babbur Farm).  
K. Subba Rao, B.Sc., Agricultural Inspector, I/C Kar Ragi Breeding Station, Hunsur.  
A. Krishnaswami Iyengar, L.Ag., Agricultural Inspector, Paddy Breeding Station, Nagenahalli.  
N. Ramanna, B.Ag., Agricultural Inspector, Hebbal.  
R. S. Iyengar, B.Ag., Agricultural Inspector, Hebbal Agricultural School.  
P. Jacob, Agricultural Inspector, Hebbal.

*Imperial Research Council Sugarcane Scheme.*

Messrs.—

- B. Venkoba Rao, B.Sc., Senior Assistant Botanist.  
M. L. Subbanna, B.Sc. (Hons.), Junior Assistant Botanist.  
G. Srinivasa Iyengar, M.Sc., Junior Assistant Botanist, Mysore Doddahatti Scheme.  
S. G. Narasimbachar, M.Sc., Field Assistant, Mysore Doddahatti Scheme.

## EXPERIMENTAL SECTION.

Messrs.—

- Gundappa S. Kurpad, B.A., Senior Assistant Director, Kolar Circle.  
K. H. Srinivasan, M.A., B.Sc. (Edin.), Senior Assistant Director, Chikmagalur.  
C. Ellappa Chetty, L.Ag., Assistant Director, Tumkur.  
V. N. Ranganatha Rao, L. Ag. Chitaldrug.  
S. H. Bennur, L.Ag. (O. O. D., Mysore Sugar Company).  
B, Dasappa, B.A., B.Ag., Ph.D., Assistant Director, Bangalore.

## Messrs.—

C. V. Ramiiah, Assistant Director (O. O. D., Mysore Tobacco Co.)  
 K. Krishna Murthy, Assistant Director, Mandya.  
 S. V. Sharma, Assistant Director, Mysore.  
 H. Venkoba Rao, Hassan.  
 K. A. Krishnan, Shimoga.

## AGRICULTURAL INSPECTORS ON DISTRICT WORK.

## Messrs.—

C. V. Krishna Rao, Agricultural Inspector, Channapatna.		
B. Srinivasiengar, L.Ag.,	do	Davangere.
D. Balakrishna Rao,	do	Mysore.
T. J. Narasoji Rao,	do	Magadi.
B. R. Gopala Rao,	do	Devanhally (on leave.)
Bapu Shama Rao, L.Ag.,	do	Kolar.
C. Ramaiah, L.Ag.,	do	Closepet R. W. C.
S. Rangaswamy	do	Education Department.
M. Krishnamurthy,	do	Challakere.
G. S. Rangaswamy Iyengar, L.Ag., Agricultural Inspector, Hassan.		
T. C. Thimmaiah, L.Ag.,	do	Saklespur.
K. Basavaraj Urs, L.Ag.,	do	O.O.D., Hessarghatta.
Grass Farm (Military Department).		
S. V. Haridas, L.Ag., Agricultural Inspector, Sagar.		
B. Narasimha Murthy Rao,	do	Tumkur.
H. Venkataramaniah,	do	Chamarajnagar.
M. B. Ranganatha Rao, L.Ag.,	do	Hole-Narsipur
K. Chayapathy,	do	Tiptur.
M. S. Ramachandra Rao, L.Ag.,	do	Chikmagalur.
K. Ramaiyer,	do	Goribidnur.
K. Narayanachar,	do	Marthur Farm.
M. V. Suryanarayan Rao,	do	Nanjangud.
K. V. Ramaswamy,	do	Bowringpet.
P. Kalingappa, L.Ag.,	do	Irwin Canal Farm.
N. Sreenivasa Murthy,	do	Tarikere.
D. Srikantaiah,	do	Chitaldrug.
N. C. Madan Gopal,	do	Holalkere.
K. A. Krishnan,	do	O. O. D., Assistant Director, Shimoga.
D. R. Shivaramaiah, L.Ag.,	do	Arsikere.
H. Venkoba Rao	do	O. O. D., as Assistant Director, Hassan.
K. Ramachandra Iyer,	do	Chintamani.
G. Sundararaja Iyengar,	do	Mandya.
C. J. Madhwaraj,	do	O. O. D., Industries and Com- merce Department.
C. M. Mallappa	do	Shikarpur.
D. C. Rayalu, L.Ag.,	do	Dodballapur.
H. G. Hanumiah Setty,	do	Mysore Sugar Company.
H. M. Subbiah, L.Ag.,	do	do
K. Nagesha Rao, L.Ag.,	do	do
H. Seshagiri Prabhu, L.Ag.,	do	do
H. Shaikaranarayana,	do	S. K. V. D. Patasala.
M. Vasudevamurthy,	do	Koppa.



## Messrs.—

K. N. Krishna Prasad, Agricultural Inspector,	R. K. Sala.
M. Padmanabhasetty,	do      Channagiri.
H. Padmanabha Rao,	do      Kunigal.
C. Venkatachalaiah,	do      Bagepalli.
V. S. Ponnurangum,	do      S. K. V. D. Patasala, in charge of Sira Range.
Syed Naziruddin	do      Shimoga.
M. Abid Hussein	do      Krishnaraj Nagar.
G. P. Visweswariah	do      Krishnarajpet.
D. Venkataramanayya	do      French-Rocks.
K. Anantharaja Urs	do      Tirthahalli.
V. M. Gangiah	do      Devanhalli.

## ENGINEERING SECTION.

## Messrs.—

M. G. Singarachar, B.A., A.C.E., A.M.I.E., Agricultural Engineer.  
S. Venkatasubbaiya, B.E. (Mech.), A.M.I.E., Assistant Engineer.

## AGRICULTURAL SCHOOL, HEBBAL.

## Messrs.—

Venkata Rao K. Badami, L.Ag., Ph.D. (Cantab.), Principal.  
K. M. Guru Raja Rao, L.Ag., Vice-Principal, O. O. D., Bhopal State Service.  
M. Narayana Reddi, B.Sc. (Edin.), Vice-Principal.  
N. Ramanna, B.Ag., Agricultural Inspector.

## AGRICULTURAL SCHOOL, CHIKKENAHALLY.

## Messrs.—

H. Shankaranarayana, L.Ag.  
V. S. Ponnurangum, L.Ag., in charge Sira Range.

## AGRICULTURAL SCHOOL, RAMAKRISHNAPUR.

## Messrs.—

A. Venkataramiah, Anekal Range.  
K. N. Krishna Prasad, Head Master.

## HEBBAL FARM.

## Messrs.—

M. Narayana Reddi, B.Sc. (Edin.), in charge of Hebbal Farm.  
Arcot Devaraj, B.Ag., Farm Manager.  
R. S. Iyengar, B.Ag., Agricultural Inspector.  
A. M. Bawkar, B.Sc.

## BABBUR FARM.

## BOTANY SECTION.

## Messrs.—

V. N. Ranganatha Rao, L.Ag., Senior Assistant Botanist (O. O. D., Assistant Director).  
T. Srinivasa Murthy, B.Sc., Farm Manager.  
C. Puttiah, Agricultural Inspector.  
H. N. Subbarayasetty, L.Ag.

## MARTHUR FARM.

Mr. K. Narayanachar, Manager.

## BALEHONNUR COFFEE EXPERIMENTAL STATION.

Messrs.—

Y. R. Narayana Rao, L.Ag., Manager.  
G. N. Kale Gowda, Assistant Manager.  
R. L. Narasimhaswamy, M.Sc., Plant Breeding Inspector.

## NAGENHALLI PADDY BREEDING STATION.

Messrs.—

S. V. Sarma, Junior Assistant Botanist (O. O. D., Assistant Director, Mysore).  
A. Krishnaswamy Iyengar, L.Ag., Agricultural Inspector.

## HUNSUR KAR RAGI BREEDING STATION.

Messrs.—

K. Subba Rao, B.Sc., Agricultural Inspector in charge.  
R. G. Sivappa, Agricultural Inspector.

## IRWIN CANAL FARM.

Messrs.—

T. Krishnaswamy, Superintendent.  
C. B. Krishnamurthy, Agricultural Inspector.  
P. Kalingappa, do  
D. P. Lakshminarasimhayya, B.A., Agricultural Inspector (Botanical Section).

## LIVE STOCK SECTION.

Lt. A. A. Monteiro, G.B.V.C., Live Stock Expert.

Messrs.—

B. Lakshmiipathi, G.B.V.C., Assistant to the Live Stock Expert and in charge of Marketing Survey Work.  
McIsaac, B.Sc. (Hons.), Ph.D., Manager, Cattle Breeding Station, Ajjampur.  
M. Siddaiya, L.Ag., Assistant Manager.  
M. Krishna Sastry, B.A., I.D.D., Manager, Cattle Breeding Sub-Station, Basur.  
J. Aswathanarayana Rao, L.Ag., Agricultural Inspector, Yelachihalli Sheep Farm.  
S. K. Venkata Rao, Agricultural Inspector, Kolar Sheep Breeders' Association.  
S. B. Vasudeva Rao, L.V.P., Veterinary Inspector, Hebbal.  
R. Ramaswamy, Veterinary Inspector, Poultry Farm, Hebbal.  
B. Chandrasekhar, Veterinary Inspector, Sheep Work, Ajjampur.

## DAROGAS.

Messrs.—

S. P. Seshagiri Rao, G.B.V.C., Hassan Range.  
N. D. Venkatakrishnayya, Holalkere Range.

## KAVAL RANGERS.

Messrs.—

Mohamed Fazlur Rahiman Sheriff (attached to Office of the L.S.E.).  
S. R. Gundappa, Hunsur.  
Abdul Latiff, Arsikere.

## CIVIL VETERINARY DEPARTMENT.

Messrs.—

- 1 K. Krishniengar, G.B.V.C., Superintendent, Civil Veterinary Department.
- 2 B. V. Venkatachar, G.M.V.C., Assistant Superintendent, Mysore.
- 3 Subedar T. V. Manickyaraj, G.B.V.C., do Tumkur.
- 4 N. Krishnaiengar, G.B.V.C., do Bangalore.
- 5 N. R. Srinivasa Iyengar, G.B.V.C., do Shimoga.
- 6 K. Ranganatha Rao, G.B.V.C., do Scientific Section.
- 7 Dr. P. M. Narayanaswami Naidu, B.Sc., L. V. P., Sc.D. (Germany),  
F.F.A.S. (France), Veterinary Research Officer, Serum Institute.
- 8 S. R. Bapu, G.B.V.C., V. O. Forest Department.
- 9 C. V. Govinda Rao, G.B.V.C., Office Assistant to Superintendent, C. V. D.

## VETERINARY INSPECTORS.

Messrs.—

- 1 S. R. Bapu, G.B.V.C., O. O. D., Forest Department.
- 2 C. V. Govinda Rao, G.B.V.C., Office Asst., C. V. D. Superintendent.
- 3 G. Subramanya Iyer, G.B.V.C., Sidlaghatta.
- 4 L. V. Shallam Iyengar, G.B.V.C., T-Narsipur.
- 5 C. Narayaniengar, G.B.V.C., (on leave).
- 6 N. Krishna Murthy, G.B.V.C., Chintamani.
- 7 M. R. Kenchैया, G.B.V.C., Hassan.
- 8 T. Chendu, G.B.V.C., Mysore Serum Institute.
- 9 M. Ramaswami Naidu, G.B.V.C., Madhugiri.
- 10 T. V. Venkatachalam, G.B.V.C., Hiriyyur.
- 11 C. S. Prabhakar, G.B.V.C., Davangere.
- 12 H. B. Kulkarni, G.B.V.C., Tumkur.
- 13 P. K. Shama Rao, G.B.V.C., Chitaldrug.
- 14 C. Nanjundiah, G.M.V.C., Tiptur.
- 15 B. Sheik Peer, G.M.V.C., Mysore Serum Institute.
- 16 T. Aswatha Sastry, G.B.V.C., Dodballapur.
- 17 G. V. Ramaiya, G.B.V.C., Mysore.
- 18 G. Narayana Murthy, G.B.V.C., Serum Institute.
- 19 K. Sreekantaiya, G.B.V.C., Bangalore.
- 20 V. Jagannath, G.B.V.C., O. O. D., Mysore Lancers.
- 21 S. Kalyanasundaram, G.M.V.C., Closepet.
- 22 M. Subba Rao, G.M.V.C., Kolar.
- 23 B. Venkatesaiah, G.B.V.C., Arsikere.
- 24 B. Somasundaram Pillay, G.B.V.C., Pavagada (on leave).
- 25 M. Sreekantaiya, G.B.V.C., Bagepalli.
- 26 Syed Nuruddin, G.M.V.C., (O. O. D., Palace Stables).
- 27 K. Krishna Murthy, G.M.V.C., Chikballapur.
- 28 N. Narayana Rao, G.M.V.C., Hole-Narsipur.
- 29 P. C. Adikalani, G.M.V.C., Krishnarajnagar.
- 30 Kuppaswamy Mudaliar, G.M.V.C., Mysore Serum Institute.
- 31 R. M. Purushotham Naidu, G.B.V.C., do
- 32 K. R. Ramachandra Rao, G.M.V.C., Rampur (on leave).
- 33 K. S. Gopala Rao, G.M.V.C., Tirthahalli.
- 34 H. N. Doraswamiyengar, G.M.V.C., Channapatna.
- 35 N. Seshagiri Rao, G.M.V.C., Malvalli.
- 36 K. J. Subramanyam, G.M.V.C., Mandya.
- 37 S. G. K. Iyengar, G.B.V.C., Mobile Corps (on leave).

## Messrs.—

- 38 S. M. Pantambekar, G.M.V.C., French-Rocks.
- 39 Syed Masum, G.M.V.C., Pavagada.
- 40 Syed Yusuff, G.P.V.C., Malur.
- 41 S. M. Abdul Hakim, G.P.V.C., Shikarpur.
- 42 G. Zachariah, G.B.V.C., Kolar Gold Fields.
- 43 D. N. Vasudeva Mudaliar, G.M.V.C., Maddur.
- 44 S. Parthasarathy, G.M.V.C., Anekal.
- 45 G. N. Srikantiah, G.M.V.C., O. O. D., Foreign Service, Jodhpur.
- 46 S. Ramakrishna, G.B.V.C., Arkalgud.
- 47 L. Gurunathan, G.M.V.C., Chiknaikanhalli.
- 48 J. P. Wesley, G.B.V.C., Gubbi.
- 49 H. Bandiah, G.B.V.C., Turvekere.
- 50 R. Shadagoparamanujam, G.M.V.C., Magadi.
- 51 P. K. Nair, G.B.V.C. Hoskote.
- 52 P. K. Kurian, G.M.V.C., Chamarajnagar.
- 53 Abid Hussain Khan, G.B.V.C., Sorab.
- 54 M. M. Kulakarni, G.B.V.C., Harihar.
- 55 H. Khader Khan, G.M.V.C., Hunsur (on leave).
- 56 T. Krishna Rao, G.M.V.C., Gundlupet.
- 57 M. V. Srinivasa Rao, G.M.V.C., Bangalore.
- 58 S. V. R. Swamy, G.M.V.C., Kadur.
- 59 Mahomed Davood, L.V.P., Kunigal Stud Farm.
- 60 J. Muniappa, L.V.P., Bowringpet.
- 61 G. K. Mahomed Ibrahim, L.V.P., Mudgere.
- 62 K. N. Subba Rao, B.A., L.V.P., Chikmagalur.
- 63 M. Bhima Rau, G.M.V.C., Kunigal.
- 64 J. D. Sampathkumaran, L.V.P., Rayanakere Dairy Farm.
- 65 M. G. Shekharan, L.V.P., Serum Institute.
- 66 K. S. Krishnappa, G.M.V.C., Devanhalli.
- 67 B. L. Subramanyam, G.M.V.C., Sira.
- 68 A. N. Venkatanarayana Sarma, G.M.V.C., Challakere.
- 69 K. K. Murthy, G.B.V.C., Channagiri.
- 70 N. M. Krishna, G.B.V.C., Gudibanda.
- 71 C. Puttaswamy, L.V.P., Saklespur.
- 72 K. S. Sri Ram, B.A., B.Sc., L.V.P., Jagalur.
- 73 M. Abdul Rahimon, L.V.P., Koppa.
- 74 B. Krishna Singh, L.V.P., Nagamangala.
- 75 S. B. Vasudeva Rao, L.V.P., O. O. D., Hebbal.
- 76 C. T. Tirumalai Swamy Modaliar, B.A., G.M.V.C., Belur.
- 77 D. Ramaiah Setty, L.V.P., Tarikere.
- 78 H. S. Ramaswamy, G.B.V.C., Shimoga.
- 79 H. R. Bhashyam, G.M.V.C., Goribidnur.
- 80 P. T. Krishnappa, L.V.P., Honnali.
- 81 P. N. Mukundu, B.A., G.M.V.C., Holalkere.
- 82 C. V. Govindaiya, L.V.P., Hosdurga.
- 83 L. Rama Rao, G.B.V.C., Kankanhalli.
- 84 Mohamed Hussain, L.V.P., Sagar.
- 85 B. C. Nanjundaiah, L.V.P., Forest Department.
- 86 H. Abdul Rahiman, L.V.P., Kalasa.
- 87 A. M. Jambulingam, G.M.V.C., Hosnagara.
- 88 M. Appaiah, G.M.V.C., Heggaddevankote.
- 89 Syed Habibulla, G.M.V.C., Saligrama.
- 90 D. S. Eswarappa, L.V.P., Nanjangud.

## Messrs.—

- 91 M. K. Veerendra, O. O. D., Palace Stables.  
 92 D. C. Mahadeviah, L.V.P., Kumsi.  
 93 K. Srinivasa Murthy, B.Sc., L.V.P., Johnes Disease Investigation.  
 94 B. R. Seshachar, G.B.V.C., Under Marketing Officer.  
 95 K. Malliah, G.V.Sc., Anandapuram.  
 96 P. G. Rajagopal, G.V.Sc., Channarayapatna.  
 97 D. Narasimha Murthy Rao, B.A., G.V.Sc., Krishnarajpet.  
 97 R. Ramaswamy, G.V.Sc., O. O. D., Hebbal, Bangalore.  
 98 B. Chandrashekar, G.V.Sc., Mobile Corps, Ajjampur.  
 99 G. Krishne Urs, G.B.V.C., P.G. (Edin.), Mysore.  
 100 A. V. Srinivasa Rao, G.V.Sc., Rampur.  
 101 D. Rudrayya, G.V.Sc., Hunsur.  
 102 A. H. Potgris, L.V.P., Poultry Disease Investigation Scheme.  
 103 B. S. Srinivasamurthy, B.A., G.M.V.C., Mobile Corps.  
 104 A. Sundaramurthy, G.V.Sc., M.C., Nelamangala.  
 105 K. N. Gopala Iyengar, G.B.V.C., M.C.  
 106 N. V. Doraswamy, G.V.Sc., M.C.

## MYSORE SERUM INSTITUTE.

- Mr. S. D. Achar, G.B.V.C., P.G. (Punjab), Superintendent.  
 „ P. U. Nayar, G.B.V.C., Bacteriological Assistant.  
 „ K. Ranganatha Rao, G.M.V.C., Assistant Superintendent, Scientific section.  
 Dr. P. M. Narayanaswami Naidu, B.Sc., (L.V.P., Sc.D. (Germany), F.F.A.S. (France), Veterinary Research Officer.  
 Mr. T. Chandu, G.B.V.C., Veterinary Inspector, Serum Section.  
 „ B. Sheik Peer, G.M.V.C., Veterinary Inspector, Virus Section.  
 „ V. S. Kuppuswamy Mudaliar, G.M.V.C., Veterinary Inspector, Blackquarter Section.  
 „ R. M. Purushotham, G.B.V.C., Veterinary Inspector, Laboratory Section.  
 „ G. N. Srikantiah, G.M.V.C., Veterinary Inspector, Services lent to Jodhpur State.  
 „ M. G. Sekharan, L.V.P., Veterinary Inspector, Research Section.  
 „ G. Narayanamurthy, G.B.V.C., Veterinary Inspector, Laboratory and Sterilising Section.  
 „ K. Srinivasamurthy, B.Sc., L.V.P., Veterinary Inspector, Johnes Disease Investigation Scheme, subsidised by the Imperial Council of Agricultural Research.
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## APPENDIX III.

MONTHLY REPORT OF WORK DONE BY THE AGRICULTURAL  
INSPECTOR.

Range.....		For.....	193
1. Number of days on tour	...	...	...
2. Number of villages selected for intensive work in the Range	...	...	...
3. Number of villages visited	...	...	...
4. Number of ploughing demonstrations held	...	...	...
5. Total number of demonstration plots in raiyats' fields	...	...	...
6. Number of plots inspected out of 5 above	...	...	...
7. Number of demonstrations held in—			
(a) Transplantation	...	...	...
(b) Selection of ear-heads for seed	...	...	...
(c) Improved methods of cultivation	...	...	...
8. Implements sold—			
Ploughs	...	...	...
Plough shares	...	...	...
Cultivators	...	...	...
Sugarcane mills sold to—			
(a) Individuals	...	...	...
(b) Co-operative Societies	...	...	...
9. Supply of improved seeds—		Kind.	Quantity.
Ragi	...	...	...
Paddy	...	...	...
Sugarcane	...	...	...
Groundnut	...	...	...
Cotton	...	...	...
Gingelly	...	...	...
Jola	...	...	...
Sunnhemp	...	...	...
Others, if any	...	...	...
10. Sprayers and chemicals supplied	...		
11. Brief remarks about insect pests, plant or cattle diseases and seasonal condition	...	...	...

## APPENDIX IV.

PUBLICATIONS OF THE DEPARTMENT OF AGRICULTURE  
IN MYSORE, BANGALORE.

## ANNUAL REPORTS.

Annual Report of the Agricultural Chemist		1899-00
Do	do	1900-01
Do	do	1901-02
Do	do	1902-03
Do	do	1903-04
Do	do	1904-05
Do	do	1905-06
Do	do	1906-07
Do	do	1907-08
Do	do	1908-09
Do	do	1909-10
Annual Report of the Agricultural Department		1910-11
Do	do	1911-12
Do	do	1912-13
Do	do	1913-14
Do	do	1914-15
Do	do	1915-16
Do	do	1916-17
Do	do	1917-18
Do	do	1918-19
Do	do	1919-20
Do	do	1920-21
Do	do	1921-22
Do	do	1922-23
Do	do	1923-24
Do	do	1924-25
Do	do	1925-26
Do	do	1926-27
Do	do	1927-28
Do	do	1928-29
Do	do	1929-30 to 1930-31
Do	do	1931-32
		1932-33 to 1936-37

## THE MYSORE AGRICULTURAL CALENDARS.

English Calendars for the years 1915 to 1928	
Do	for the year 1929 to 1931
Do	1934 to 1938
Kannada Calendars for the years 1915 to 1928	
Do	for the year 1929
Do	do 1930
Do	do 1931
Do	do 1934 to 1938

## THE MYSORE HEBBAL AGRICULTURAL SCHOOL CALENDARS.

Calendars for the years 1917-18 to 1926-27 (out of print).  
 1927-28 to 1928-29 do  
 1929-30 do

## BULLETINS.

## GENERAL SERIES.

	Rs. a. p.
1. Green Manuring in Mysore (English and Kannada)	0 8 0
2. Experiments on Paddy Cultivation (English and Kannada)	0 8 0
3. Report on Agricultural Education ...	0 8 0
4. Report on an agricultural tour in Europe, America and Japan during 1912-13.	0 8 0
5. Short Report of the Mysore Agricultural Department (English and Kannada).	
6. Coffee: Its Cultivation and Manuring in South India (English and Kannada). Copies available.	0 2 0
7. A Note on the Milk Supply of Bangalore, in English only ...	0 4 0
8. Prospectus of the Chikkanahalli Agricultural School	
9. Methods of Butter-making, local and improved. (Kannada, available).	0 4 0
10. The Cultivation of the Areca Palm in Mysore (English and Kannada).	0 8 0
11. The Cultivation of Ragi in Mysore (English and Kannada) ...	1 0 0
12. Agriculture in Mysore (English only). ...	1 0 0
13. Improvement of the Coffee Industry in Mysore (English only)...	0 4 0
14. Agricultural Research and Demonstration in the Dutch East Indies (English only).	0 4 0
15. Improvement of Coffee in the Dutch East Indies (Eng. only)	1 0 0
16. Report on the Coffee Berry Borer, <i>Stephanodores Hempei</i> , (English only).	1 0 0
17. Notes on Sugarcane cultivation in Java (English only). ...	1 0 0
18. Development of the Sugar Industry in Mysore (English only)	0 8 0
19. Sugarcane cultivation on the Irwin Canal Farm ...	0 8 0

## CHEMICAL SERIES.

- |   |       |
|---|-------|
| 1. Some Manurial Earths of Mysore ( <i>boodi mannu</i> ) (English and Kannada). (Out of print). | 0 2 0 |
|---|-------|

## MYCOLOGICAL SERIES.

- |  |       |
|--|-------|
| 1. Ring Disease of Potatoes. Out of Print .. ...                                 | 0 8 0 |
| 2. Diseases of the Areca Palm. I. Koleroga, English and Kannada. (Out of print). | 2 0 0 |
| 3. Spike Disease of Sandal (English) ... ..                                      | 1 0 0 |
| 4. Proceedings of the Conference on the Spike Disease of Sandal.                 | 0 8 0 |
| 5. Black Rot or Koleroga of Coffee in Mysore (English) ...                       | 0 8 0 |



## ENTOMOLOGICAL SERIES.

	Rs.	a.	p.
1. The Rice Grasshopper in English and Kannada. ...	1	0	0
2. The Jola or Deccan Grasshopper in English and Kannada ...	1	0	0
3. Kamblihulas attacking crops in Mysore. ...	0	8	0
4. Some Scale Insect Pests of Coffee (English) ...	1	0	0
5. Ground Beetles attacking crops in Mysore ...	0	4	0
6. Pulse Beetles ...	0	4	0
7. The Function of the Prothoracic Plate in Mylabrid (Bruchid) Larvæ (A study in adaptation) in English only.	0	8	0
8. The Large Citrus Borer of South India (English) ...	0	8	0
9. The Potato Epilachna Beetle Epilachna [Viginti-Octo-Punctata (Fabr)].	0	4	0
10. Bee-keeping—A Subsidiary occupation for the Raiyats ...	0	8	0
11. The Coffee Stem Borer. (English) ...	0	8	0
12. Bee-keeping for beginners (Bull. No. 10 Revised) ...	0	10	0
13. Annual Report of the Coffee Scientific Officer 1933-34 ...	0	4	0
14. Do 1934-35 ...	0	4	0
15. Do 1935-36 ...	0	4	0
16. Factors affecting Spray Success in the Control of Coffee Leaf Disease (Hemilea vastatrix B. and Br.)	0	8	0
17. Annual Report of the Coffee Scientific Officer 1936-37	0	4	0
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