CHAPTER II.

AGRICULTURE.

I. General.

Results achieved. Features of cultivation. Area under cultivation.

THE area under cultivation in the State is roughly 6 million acres which is about 35·2 per cent of the total area of the State and 72 per cent of the area classed as fit for cultivation. The accompanying table shows the progress that has taken place during the past eighteen years in the extension.

Years	Area under cultivation (actually cropped) Acres	Years	Area under cultivation (actually cropped) Acres
1905-09 ...	5,799,850	1920-21 ...	6,261,325
1910-14 ...	6,188,113	1921-22 ...	6,369,379
1915-19 ...	6,368,367	1922-23 ...	6,461,009
1919-20 ...	6,198,407		

Forms of cultivation—Dry.

The cultivated lands themselves fall into three main classes, the dry, wet and garden. Dry lands are those on which cultivation depends solely upon the rainfall; the bulk of the area under cultivation in the State amounting to about 85 per cent of the total cultivated area is under dry cultivation. It forms therefore the main source of food supply in the State.

Ragi and Jola are the main food grains raised on these lands, the former being the staple food of the majority of the population. In addition to these, several minor food grains and a wide variety of both food and commercial crops such as pulses, oil seeds, cotton, etc., are raised also as dry crops. Information regarding the extent and distribution of rainfall on which alone the success of dry

land cultivation solely depends will be found in Part I, Chapter III (*Meteorology*) and under "Climate and Rainfall" in this Chapter as well.

Wet cultivation.

On the wet lands are raised crops which require irrigation, that is, a steady and copious watering throughout the period of the growth.

The sources of irrigation are:—

(1) Tanks either solely rain-fed, or fed by channels taken from rivers;

(2) Rivers from which water is taken for irrigation by the construction of dams or anicuts across them at convenient places and leading them through channels for irrigation on lands lower down the course of the river;

(3) Channels tapping underground flow, common in the river beds and the spring or "thalparge" areas in the eastern districts of Tumkur and Kolar; and

(4) Wells: in the Districts of Chitaldrug, Tumkur, Kolar and Bangalore, irrigation wells are common; large wells with permanent stone rivetment and capable of irrigating from three to five acres are seen mostly in the taluks of poor rainfall in these districts, that is, in Molkalmuru, Challakere, Pavagada and Sira. Small wells excavated in the firm laterite soils and capable of irrigating up to an acre form a common feature of the taluks of Hoskote, Malur, Chikballapur and Sidlaghatta. Large wells can also be seen constructed below the different tanks more or less as a supplementary source depending mostly on the percolation water of the tanks. The wet or irrigated areas form the most valuable lands, the value depending practically upon the degree to which irrigation water is assured. Those under the river channels command naturally the highest price, as a failure of crops due to lack of water is almost unknown. The lands under the rain-fed tanks vary greatly in value according to the capacity of the tanks and the nature of the rainfall in the catchment. Though the bulk of the irrigated area in the State is under tank irrigation and the aggregate amount of money spent upon them must run to a huge figure, their value is not as great as it might be. The tanks in the western parts of the State or the *Malnād* are very

small, being situated at the head of steep and narrow valleys and therefore requiring to be filled more than once before the crops of the season may be grown to maturity. The small tanks of which there is a very large number suffer from the same cause in addition to neglect in many cases as the annual upkeep is part of the functions of the village communities which in recent times have lost that cohesion and sense of joint responsibility characteristic of them in times gone by. The large tanks command extensive stretches of irrigable land and they form a striking feature of the landscape everywhere, especially in the Kolar District. They are magnificent works and form the main source of the wealth and prosperity of the tracts where they exist. Being however only rain-fed, the vicissitudes of the season affect these tanks also. In spite of the drawbacks inseparable from these sources of irrigation, very valuable crops are raised under them, both as annual crops and as perennial plantations or gardens. The crops usually raised as wet crops in these areas are mainly paddy and sugar-cane; perennial plantation crops are also raised, reference to which is made under "Bagayat" or garden crops.

Garden or Bagayat.

Under well irrigation are raised a wide variety of crops including food crops like ragi, paddy, jola; and economic crops like sugar-cane, turmeric, chillies, onions, tobacco, garlic, potatoes, mulberry and so on. In the eastern taluks where the rainfall is too precarious for raising crops of any kind, the food crops noted above invariably form part of the rotation, so as to afford food for the raiyat and fodder for his cattle. The commercial crops raised furnish the ready money required for the raiyat for his expense and may be considered to yield a good money return for the raiyat's expenditure of capital and labour.

Bagayat Crops.

These and the plantation crops such as areca-nut and cocoanut are classed as crops raised under "garden" or "bagayat" cultivation. The principal 'bagayat' crops, *viz.*, areca-nut and cocoanut are of course perennial and they mostly occupy that portion of the wet lands below tanks immediately adjoining the tank bunds. These

areas are in many cases further protected by substantial irrigation wells. In the Malnād, where these gardens are numerous and important, they occupy the long winding narrow valleys; during the monsoons, there is an over-abundance of water and in other seasons, they depend upon the natural moisture supplemented by the small tanks or *kattes* situated at the head of the valley. In the taluks of Maddagiri and Koratagere with their abundance of sub-soil water, the gardens depend upon wells and the river channels tapping underground supplies, referred to above. The greatest care is bestowed upon these gardens and heavy expenditure is incurred in keeping them in first class condition.

Kushki bagayat.

One also comes across a system called *Kushki Bagayat*, *i.e.*, literally "dry garden." This term is applied to the raising of cocoanut plantations on dry lands, on which during the rains heavy flooding is possible; they depend on neither tanks nor wells. These plantations are found extensively in the eastern part of the Hassan and Kadur districts and in the taluks of Tiptur and Chiknayakanhalli of the Tumkur District. They occupy the broad and shallow valleys which drain this part of the country. By repeated ploughings, the soils are kept in excellent condition, for absorbing and retaining the rain water; while the trees themselves are planted very wide apart to further economise the drain upon the soil moisture. It is also common, especially where the breadth of the valleys is not very great, to see low earthen embankments put across them and provided with an overflow weir, in order to impound the rain water for some considerable time in the plantations.

Plantation crops.

Among plantation crops coming in a class by themselves are:—

(1) Coffee; (2) Mango; and (3) Casuarina.

A full list of the crops of the State under the headings *wet*, *dry* and *garden* and *fruits* and *vegetables* is given in Part I, Chapter IV (Botany); but as may be seen from the accounts of the cultivation methods, this distinction is not strictly followed, as many of the crops classed as "dry" are quite often grown under irrigation and should be classed "wet."

Soil—Red loams, coffee soils, Malnād soils.

The prevailing type of soils in the State is a red loam fairly deep and uniform in character. The depth of the soil in most parts of the State is very remarkable, as a uniform and fairly homogeneous structure can be noticed to a depth of ten and even up to twenty feet. The nature of this loam is altered to different degrees firstly by the variation in the quantity of ferruginous earth present, on account of which these soils vary in colour from light red to deep brown and chocolate; secondly, by the admixture of gravels of different grades of coarseness and composition, and thirdly, by a large admixture of clay either red and highly ferruginous, or light coloured and yellowish. In the eastern districts of Bangalore and Kolar, some of the best types of the deep loam can be seen; both the rolling plains of the cultivated country side as well as the ridges and hollows are composed of this type. Valley sides and bottoms throughout the State may also be said to be composed of this type of soil. The same soil interspersed largely with ferruginous and laterite gravel abounds in the taluks of Hoskote, Sidlaghatta, Malur and Devanhalli where beds of laterite and ochre are met with. On the ridges, both high and moderately high, in nearly all the districts, the soils are highly gravelly; in the Mysore District especially, both in the Cauvery valley and elsewhere, the ridges are exceedingly so. In the Malnād, the cultivated valleys are predominantly clayey; the laterite hills are subject to excessive wash and in many places unweathered clay is

readily exposed. The coffee soils in the State which are situated on hill slopes and valleys are also mostly of the highly ferruginous type; they are also inclined to be clayey; they are further enriched by heavy mulches of organic matter resulting from the shedding of the leaves of the shade trees.

Black cotton soils.

The next important type of soil, but by no means comparable in extent with the first and predominant type, is the black cotton soil of which extensive areas are met with in the Districts of Chitaldrug, Mysore, Kadur and Shimoga. Except in the Mysore District, these are only of a moderate depth of about three or four feet.

River alluvia.

River alluvia of good quality are not very abundant; it is only in the Kolar District and in Eastern Chitaldrug and Tumkur that it is of some importance, *i.e.*, along the banks of the North Pennār and its tributaries and likewise along the Tungabhadra and its tributaries. In the important Cauvery valley where one would expect good stretches of such soil, it is very inconsiderable, the soils on both sides being highly gravelly. Rich clay soils form a feature of all the wet lands under the numerous tanks. Careful cultivation, manuring and frequent addition of good soil continued through generations have greatly improved what were naturally fertile soils in these situations. This type of familiar rich soil exists here and there throughout the State, but extensive areas are to be found only in the districts of Shimoga, Chitaldrug, Kadur and Mysore.

Alkaline soils.

Alkali lands of all degrees of alkalinity both in dry situations and in low lying flats forming boggy marshes are also to be found. The Mandya and Chamarajnagar taluks of the Mysore District, the Hiriyur taluk of the Chitaldrug District are notable areas; alkali land in both

the areas are cultivated by reclaiming them by the usual methods of improvement known to raiyats; considerable limestone and salts of soda such as the carbonate and chloride and even nitre are obtained from these soils; some of them, however, possess a natural vegetation, which consists of coarse grasses and of groves of date and babool. Even the wet lands under many tanks are mildly alkaline, but with close attention to drainage, they are kept in good condition.

Chemical composition of typical soils.

The chemical composition of some of the types of the soils is given in the table annexed.

Constituent	Red loam	Black cotton soil	Dark rich clay	Coffee estate soil
Nitrogen	·04	·039	0·4	·18
Moisture and loss on ignition ...	8·00	16·00	20·00	15·00
Insoluble residue	90·00	64·00	54·00	53·00
Iron and Alumina Fe_2O_3, Al_2O_3	6·50	16·00	22·00	29·00
Phosphoric acid, P_2O_5 ...	·02	·07	·09	·10
Lime CaO	·12	3·80	1·80	·50
Magnesia Mg O	...	1·90	1·40	...
Potash K_2O	·15	·50	·50	·17

It will be noticed that all the soils must be generally classed as poor and that even the soils of the coffee estates are not any different in this respect. Poor in nitrogen and phosphoric acid, moderately well supplied in potash, the predominant type is rich in iron and deficient in lime; the black cotton soils differ only as regards their lime content which is generally sufficient and sometimes abundant.

Soil types and distribution of crops.

As regards the crops grown on the different classes of soils, although with a fair season they are all capable of being put under any crop desired, still under ordinary conditions, considerable differentiation is well established and followed in practice. The red soils are the typical

ragi soils of the State, on which ragi is the principal cereal crop, and *save*, *navane*, *haraka* and *jola* the subordinate cereal crops; *avare* and *togari* are the principal pulses; niger and gingelly on the best soils and castor on the gravelly types, and ground-nut on the lighter types are the chief oil seeds. On the deep and well worked and mellow types, chillies, tobacco and Dharwar-American cotton are the economic crops. These are all grown as dry crops. On the black cotton soils, *jola* takes the place of ragi as the chief cereal crop, while *sajje*, *navane* and *wheat* are subordinate cereals; *togari*, Bengal gram, green gram, black gram and cowpea are the common pulses; safflower and linseed and groundnut are grown as oil seeds; while cotton, mulberry, tobacco, chillies, onions and coriander form the chief economic crops. In addition to the distinctive crops on these two types of soils, there are also other interesting and peculiar differences that could be noticed as in the different implements used and the methods of husbandry adopted. Reference will, however, be made to these under implements and crops.

Size of holdings.

The size of the average holding in Mysore is roughly about 6 acres. The appended table, however, gives a classified list of the number of holdings of different sizes :—

Number and extent of holdings in the State, 1923-24

		Number	Extent
			Acres
Below 1 acre	...	109,755	101,365
Between 1 and 5 acres	...	473,941	1,241,014
„ 5 „ 10 „	...	261,326	1,829,524
„ 10 „ 50 „	...	160,312	2,974,176
„ 50 „ 100 „	...	19,350	1,042,174
„ 100 „ 500 „	...	2,804	516,242
Above 500 acres	...	108	99,117

Scattered fields and holdings.

As elsewhere in India, the fields constituting individual holdings are situated in strips and seldom in a single block. In villages where there are irrigation tanks and therefore "wet" lands to cultivate, it is inevitable that a man's wet land holding lies in a different place from his dry land fields; but even in holdings consisting solely of wet lands or solely of dry lands, the fields of a holding do not lie in a single compact block. Again the cultivated fields are situated at a considerable distance from the farmer's house, sometimes as much as a mile which renders it necessary for the farmer, his cattle and men to walk this distance to and fro every day during the crop season, carrying and carting implements, manure and produce.

Malnād holdings.

In the western part of the State, *i.e.*, the *Malnād*, the farmer's home practically adjoins or lies within his garden and lands, where the farmer has his farmstead and his permanent servants have their cottages; villages here are made up of a number of such homesteads which, though isolated in this manner, are still within earshot of each other.

Maidan holdings and farm houses.

In the Maidan districts also, there has been, during recent years, a tendency for the farmer to live on his land. Due in the first instance to the desire to quit the village and live far from infection when plague first broke out, the advantage which incidentally resulted to the fields themselves by this step has induced the raiyats to make these temporary sheds into permanent structures. Especially has this been the case where raiyats have had some lands under well irrigation. Much as there is to be said in favour of this system of the farmer dwelling on the land he farms, it is not allowed by the State and the revenue law penalises such change of abode somewhat heavily.

Field fences for dry land.

The fields are not as a general rule fenced; their small areas and scattered nature, of course, preclude such

fencing, even were the raiyats inclined to do so. The cart-tracts leading into the village through the fields are generally fenced off on both sides permanently and constitute " leafy lanes ; " during the cultivation season, the road margins of dry crops and sugar-cane fields are similarly fenced to keep off cattle. Moreover, in the district of Mysore, especially in the taluks of T.-Narsipur, Chamrajnagar, Gundlupet and Nanjangud, fields are generally fenced permanently with quick hedges of *Euphorbia tirucalli*, prickly pear, aloe and other hedge plants.

Field fences for garden land.

In the Chitaldrug District, especially in the eastern taluks, where there is much well cultivation, the fields are fenced by substantial quick hedges. Likewise also are the *bagayat* lands throughout the State. Unenclosed fields are, however, the general rule and once the year's crop is off the ground, the village cattle are free to roam about where they will, both on the dry and wet land.

Size of dry land fields in red soil and black cotton soil tracts.

The size of the dry land fields, though small as a rule, is in many cases remarkably large. This is especially the case with the black cotton soil fields of the Chitaldrug District where fields, a furlong and more in length, are very common. Fields measuring up to ten to fifteen acres may be seen. On the red soil types such large fields are not common ; but fields three or four acres in extent can be met with. In both cases, where there may be steep slopes or the chance of flooding, laborious terracing and arrangements for letting out surplus water may be seen. It is also usual, especially in the Mysore and Bangalore Districts, to have the fields divided from each other by uncultivated margins which may appear unnecessarily wide, for they may be fifteen to thirty feet wide ; these provide a certain amount of grazing in the crop season, and also afford ample roadway to manure and produce carts.

Size of wet land fields.

The wet land fields are very small indeed. In the Cauvery valley, in the channel tracts, the paddy flats are laid into very small fields of about 1-10 to 1-20 of an acre each and extensively terraced. The channels run along the breast of a series of ridges, and the irrigable area lies below the channel extending right down to the bottom of the valley. This has rendered extensive terracing necessary and the plots are made small to obviate the need for any expensive levelling of the ground. Under tanks, the fields are not so small but even there the peculiar conditions of paddy cultivation necessitate small flat fields.

Climate and season.

In the Chapter on *Meteorology* above referred to appears a full account of the rainfall and its distribution throughout the year in the different parts of the State. It may be pointed out here that the western parts of the State comprised by the Districts of Kadur, Hassan and Shimoga, roughly westward of a line drawn from Shikarpur to Arkalgud and passing through Kumsi, Yedahalli and Chikmagalur is the region of the heaviest rainfall exceeding 60 inches per year. The south-west monsoon commences much earlier and throughout its course, the rains are incessant and torrential. In the western parts of the Mysore District also, the rains of the year commence early, and on the whole this region is favoured more by the south-west than by the north-east monsoon. The central and eastern portions of the State enjoy the benefit of both monsoons; a belt passing through the extreme north-eastern taluks of Harihar, Jagalur, Challakere, Hiriyur, Sira, Pavagada and Bagepalli constitutes a region of poor rainfall, averaging about 20″ and under. Throughout the *Maidan* districts of the eastern half of the State, the north-east monsoon rains are the heavy tank filling rains, and the wet cultivation in the months of December up to March and April following depends entirely upon these rains.

Cultivation seasons : Kar, Hain, Hingar.

The cultivation season is really comprised within the period of the two monsoons for the bulk of the crops in the State. The weather, however, is at no time of the year so cold as to preclude growth altogether and, provided there is a supply of water for irrigation, crops can be raised all the year round. As a matter of fact, under well cultivation and under the larger tanks, land will be found to be under some crop or other throughout the year. In general practice, however, the following well marked seasons are observed :—

The *kar* or early *mungar* season which is the earliest, beginning in the month of April and May.

(2) The *hain* season or *mungar* beginning in July ;

(3) The *hingar* commencing in September and October.

These terms relate to the dry crops. The *kar* crops are raised systematically in the western districts; these are followed in the same year with *hingar* crops or by a fallow during which the fields are ploughed. The *hain* crops are the rule in the rest of the State, and form the only crop of the season as they are harvested too late for growing a *hingar* crop. The *hingar* crops may either follow a *mungar* or *kar* crop, or be the only crop of the year.

Kārthik and Vaisak seasons.

In the case of paddy lands, the seasons are called *Kārthik* and *Vaishākh*, the former being the monsoon crop, *i.e.*, being sown from July onwards and harvested by December; and the latter sown from December onwards and harvested in April and May.

Nakshatra rainfall.

The agricultural year which begins roughly in April is divided into 27 rainfall periods called after the lunar asterisms, each roughly of a fortnight's duration; each such asterism is further divided into four quarters each called a *Pāda*. The names of these asterisms and the

English months corresponding to them roughly are given below :—

Nakshatra or Lunar asterism		*English month*
Asvini	...	April 14—27.
Bharani	...	April 28—May 10.
Krittike	...	May 11—May 24.
Rōhini	...	May 25—June 7.
Mrigasira	...	June 8—June 21.
Āridra ...	...	June 22—July 5.
Punarvasu	...	July 6—July 20.
Pushya	...	July 21—August 2.
Āshlēsha	...	August 3—August 15.
Makha	...	August 16—August 30.
Pūrvapalguna	...	August 31—September 11
Uttarapalguna	...	September 12—September 28.
Hasta ...	...	September 29—October 11.
Chitra ...	...	October 12—October 24.
Swati ...	...	October 25—November 5.
Visākha	...	November 6—November 19.
Anūrādha	...	November 20—December 2.
Jēshta ...	...	December 3—December 16.
Mula ...	...	December 17—December 29.
Pūrvāshāda	...	December 30—January 10.
Uttarāshāda	...	January 11—January 23.
Shrāvana	...	January 24—February 5.
Dhanishta	...	February 6—February 18.
Satabhisha	...	February 19—March 3.
Pūrvabhadra	...	March 4—March 17.
Uttarabhadra	...	March 18—March 31.
Rēvati ...	...	April 1—April 13.

Agricultural proverbs.

The various agricultural operations in their sequence are fixed in relation to these asterisms and their *pādas*, and the weather conditions during these periods also enable the raiyat roughly to forecast the condition of the weather and the effect on the crops in the succeeding periods. The various important feasts which really mark astronomical events of the year are also associated with distinctive agricultural operations. The experience

of centuries finds crystallized expression in various agricultural proverbs and sayings in regard to each of these asterism feasts, which afford considerable guidance to the farmer. The following proverbs selected out of a large number will serve as a sample :—

1. Uttara pūrva sasyani
Apara sasyani Rēvathi
Sarvam nasyanthi Asvini
Bharani sarva sasyani.

The rains at Uttari, Rēvathi and Bharani promise plenty. Rains at Asvini forebode scarcity.

2. Mikka ellv Mishkirili chellu.

Finish your gingelly sowing by the rains of Mrugashira.

3. Aridra malege, agiruva ukkege bithibidu.

By the rains of Āridra finish your sowings, let no ploughed land remain unsown.

4. Odiolaginādu hindē, hidi olaginādu mundē.

The seed from the basket comes up slower than the seed from the handful. (To show the necessity for sowing promptly with the season.)

5. Bede bandaga belili chellu.

If the season is right, sow even the hedge rows.

6. (1) Harastharasthondu gada
(2) Thadaranandanadondu gada
(3) Nanda kandanadondu gada
(4) Gouri Nandanadondu gada.

Arida, Makha, Pubba and Uttari are the rains suitable for all sowings.

7. Hasthe male beeladdidare hethathai hittikkodilla.

If rains of Hastha fail, even the mother will refuse to feed her child.

8. Uthara pothe, ethara gampa.

If Uttara fails, bring back your basket. (No grain to harvest).

9. Bale bagadu haku
Thengu theli haku.

Plant your plantains deep and your cocoanuts shallow.

10. Maralu bhumige
Kshuthitha mruthige
Ere nambido, Dhore nambido.

The sandy soil is a hungry soil, the black cotton soil gives like a king.

Implements and other appliances.

The implements and other agricultural appliances in use in the State are numerous and are of great interest, contrary to the belief that is often expressed by superficial observers that the plough is about the only implement of the Indian farmer. On the other hand, there is hardly a single agricultural operation of any importance which has not its appropriate implement. Next to their number and variety are their charasteristics which constitute at once their merits and defects. Their chief characteristic is their simplicity, for the best of them are mere arrangements of rough hewn wood, bamboo and strings. They are cheap to make out of materials all available locally in the village and market towns close by, capable of being readily and cheaply repaired by the raiyat himself or by the village carpenter and blacksmith. Many of them are nevertheless very efficient and show much ingenuity. They are all small scale implements, that is to say, are suited for individual ownership and to holdings of a few acres, being adapted for use either by manual power, and in the case of bullock implements, just suited for a pair of bullocks such as may be kept by the smallest raiyat. They are primitive in the sense that nothing beyond the simplest mechanical principle is involved in their construction and that they are adapted to a condition of society whose wants were few and easily satisfied, when therefore the land could support a much smaller population than it can in these times when conditions have

greatly changed. Many of them, therefore, could be advantageously improved or replaced by better types. This is a branch of work which is being keenly pushed forward by the State Department of Agriculture.

A description of most of the local implements and appliances is given below. Several special operations and the tools needed in connection therewith which are of equal interest are left out here but will be found under the particular crops to which they relate.

Implements of tillage.

The plough is of course the most important implement of tillage; there is, however, quite a variety of ploughs, which are in use in the different parts of the State suited to different conditions. They are all nevertheless made of one uniform type, that is to say, the working part which breaks the soil is a log of hard wood shaped so as to have a V-shaped cross section and tapering from the heel to the point which is reinforced with a flat iron point; they are all single handled so that the ploughman holds and presses the plough at this handle with his left hand, while the right hand is free to drive his bullocks; the beam is so fixed in the plough bottoms that the angle it makes with the latter can be widened or narrowed by driving a small wooden wedge or chip below or above the joint; by this means, the plough is adjusted to the size of the bullocks and depth of working. While this is the general type, the variations arise firstly, from differences in the size of the plough and secondly, the difference in the shape of the plough bottom and consequent differences in the attachment of the beam and handle to the plough. In sizes, three kinds may be distinguished :—

The general purpose plough.

The general purpose plough used for all the dry land soils other than the black cotton soil. This is the commonest type and is intermediate in size between—

The paddy soil plough.

The paddy soil plough, which is a very light plough used to plough paddy land in puddle (very good examples can be seen round Maddur) ; and

The black cotton soil plough.

The black cotton soil plough used in the black cotton soil tracts which is the heaviest of the ordinary ploughs, and is worked with a pair of good heavy bullocks and sometimes, when it is specially weighted, with two such pairs.

Special Malnād paddy land plough.

In addition, there are other special types like the *Malnād* paddy land plough, good specimens of which can be seen in the Shimoga *Malnād* taluks, which is shaped with a cross section like an inverted V and further scooped hollow, so that it resembles a miniature ridging plough. It is even lighter than the wet land plough abovenamed.

The heavy black cotton soil plough.

The heavy black cotton soil plough used for very deep ploughing in the hot weather so as to destroy "hariali" grass (*Cynodon dactylon*) and requiring the use of four or five pairs of bullocks. Such ploughing is done only once in three or four years on the same piece of land. This has been almost abandoned in favour of large iron ploughs, of different types and by different makers. Messrs. Massey and Co. of Madras make a single mouldboard type for this purpose and Messrs. Kirloskar Brothers of Satāra make a heavy turnwrest type for the same purpose and both are in use in the black cotton soil areas of the Chitaldrug District and parts of the Shimoga and Kadur Districts.

Shape of plough bottoms.

The plough bottoms again differ according as they are bent up at the heel end or not. The ploughs of the Chitaldrug District have the most conspicuous bend or elbow and this plough can work deeper than others.

The ploughs in the southern taluks of Mysore have no such bend at all and lie practically their whole length flat in the ground when they work. The intermediate types are common throughout the State.

Improved ploughs.

Reference has been made to the possibilities of improvement in the type of ploughs used ; the chief improvement lies in the introduction of the mouldboard plough which ploughs a rectangular furrow unlike the local ploughs which plough a V-shaped furrow. This latter fact renders it very uneconomical, for one has to do several ploughings with it before the land can all be stirred up once, an operation which a mouldboard plough can do in one ploughing, resembling in its action the ordinary spade which is a familiar enough tool to the raiyat. It will be interesting to speculate how the Mysore raiyat, shrewd and ingenious in many respects, has failed to exhibit these qualities in the construction of the plough, his most important implement. Be that as it may, it has opened out a great scope of usefulness to the State Department of Agriculture which has very successfully popularised more than one type of the mouldboard plough. Of these, several thousands are in use in the State and there is a keen and increasing demand for such ploughs. The number in use in 1919-20 was returned as 6,400. The favourite type among these ploughs is one which goes by the name of the " Kolar Mission " plough. It is really the American one-horse plough made in the United States of America ; only the plough bottom is imported and the light flat iron standard, wooden beam and flat iron handles are made and fitted together by the American Mission Institute at Kolar from whom the State Department purchases these ploughs. Though the Department has from the very outset set its seal of approval and been chiefly instrumental in the popularisation of this plough, much credit is due to the Rev. W. H. Hollister,

American Missionary and Superintendent of the Kolar Mission Institute, who started making these ploughs and continues to closely co-operate with the Department in this matter. Three other types of the mouldboard ploughs also deserve mention. Two of these are one-handled and resemble the country plough in this respect. Of these, one called "Eureka" is a product of the Kolar Mission; another called "Meston" is made by Messrs. Burn and Co., of Calcutta. The third is a comparatively heavy plough, being an American general purpose plough, called "Verity" and manufactured by the Massey Harris Co., of Toronto, Canada. The Kolar Mission plough has been copied by a number of local blacksmiths in the Bangalore District, who also sell a fair number of these annually. These blacksmiths also make and mend shares for this plough.

The Bar Share plough.

Popular as these ploughs are, they are not without drawbacks serious even in the country of their origin, but decidedly so in a poor country like Mysore. Keenly alive to this matter, the Department has been striving to make improvements and what is known as the "Bar Share" type of plough made locally is the result. The chief object of the improvement is to fit the plough with a type of share that will do away with the necessity for its frequent renewal and the expense which such renewal means. The bar share fitted to a plough of the material and workmanship of the popular Kolar Mission plough is what is being aimed at.

Cultivators' harrows: and rollers, the *kunte*.

The *Kunte* is a cultivating tool with four flat blades of iron tines or teeth passing through a horizontal log of wood which forms the frame. A couple of light wooden beams and a handle, both fitted to the frame complete the implement. It is used immediately after ploughing and is to be seen principally in the Bangalore and Kolar Districts.

The *Dodkunte* is a cultivating tool of a different type altogether. The type is, however, a great favourite with the Mysore raiyat and is very properly so as it is very efficient. This may be described as a bladed harrow; a heavy iron blade about two feet long and three inches broad is the working part; a heavy log of wood to which are attached the handle and the pole for the yoke forms the frame. It is about three feet in length and is provided with a couple of pegs or standards each about nine inches long and fixed one at each end of the frame both pointing forwards and downwards; to their free ends is attached the blade, so that the whole arrangement resembles a rectangular frame, of which the four sides are the blade, the two standards and the heavy log; as it moves along the ground, its long blade cuts through the clods, or through the surface soil according as it is used on ploughed or unploughed land, the half-broken clods pass over the blade and below the long beam which rides over and effectively breaks them up. The ploughman sometimes stands upon the log or weights it with stones to still further increase its effect. The implement is used only on the black cotton soils, and so is practically unknown outside these tracts.

The *Dodkunte*.

The *Bōlukunte* is a much lighter type of the same implement having a longer and narrower blade and a lighter frame. This also is used only in the black cotton soil tracts; it is used at a much later stage when the field has been brought into fair tilth, so as to break small clods, smoothen inequalities of the surface and also break the surface crust.

The *Bōlukunte*.

The *haluves* or harrows are of both heavy and light types. They all consist of a body with is a thick piece of wood about five feet long and six inches square and of a number of teeth fixed to it in one line. The teeth are of

Haluves or harrows.

iron in the harrows used on the wet lands under wells in the Eastern districts; or they are made of stout wooden pegs as used in all the districts in paddy fields; or they are of light bamboo, which are used in smoothening the seedbed of ragi in all dry lands and to break a surface crust.

The *Danti* or hand harrow.

A curious harrow for manual power is the small bamboo harrow called *danti* which is used in paddy fields in the Kolar District; this type of harrow has a long handle fitted with a flat cross bar at the end against which the workman presses his breast and pushes the harrow forward something in the manner of the old fashioned breast plough used in England.

Brush harrows.

A brush harrow called *Yelave* or *Yetta* is made of thick brushwood tied together and weighted. It is dragged over ragi fields soon after sowing in order to cover the seed. It is used in all the Eastern districts.

Clod crushers and levelling boards.

Clod crushers or levelling boards called *mara* are also used; they are either a heavy wooden plank or a rough log when used on dry land fields. In the wet land fields of the *Malnād*, they are made of wood in the shape of a long trough, trapezoidal or semi-cylindrical in the section, and dragged over the soft mud of the paddy field with the open face downwards; another plank leveller used in these parts is the *ṇolimara* which is also a narrow plank of wood drawn not flat but end on. All these are made about 4 to 5 feet in length, and are provided with holes for passing the ropes through for dragging. They are always worked with bullocks.

The *moodala*.

The *moodala* is a three tined hoe used in the Shimoga and the other western districts, the tines being pointed wooden pegs reinforced with an iron point. It is used

to make furrows for sowing ragi in the special method of sowing ragi mixed with manure prevalent in those parts.

Seed drills.

The seed drills in use are also admirably simple implements; they are all of one general type. They consist of a hopper, seed tubes and furrow opening tines. The hopper is made of a hard black wood, in the shape of a double cup joined base to base like a peg measure, the construction in the middle being not so great. Holes are drilled in the hopper from the funnel-like bottom of the upper half towards the periphery of the lower half so that the holes are situated in a circle close to the rim of the bottom of the hopper. The seed holes are three, six or twelve in number. The seed tubes are of bamboo and connect up with the holes in the hopper above and with holes on a long wooden beam below, which carries the furrow opening tines. The whole arrangement is rigidly fastened by means of ropes; the tines are sometimes hollow in which case they open the furrows and pass the seeds through. There is a tendency to irregular sowing with this type as the tines frequently choke with earth. In another type, the tines are solid and merely make the furrow in which the seeds drop either through holes in the beams to which the seed tubes are attached or through a hole cut in the furrow opening tine itself high enough to clear the soil. The drills in Bangalore and Kolar are twelve-tined, the tines being 4″ apart. In Maddur and Channapatna, they are six-tined about 6″ apart. In parts of Tumkur and Chitaldrug, they are four and three tined.

***Sadde* and mixed crop sowing.**

Another sowing arrangement is a *sadde* which is a kind of one tined drill; it has a hopper fixed to a long seed tube; the *sadde* is usually tied behind a plough, or behind the cotton sowing *Kuriges* for the sowing of large seeds like *avare*, *togare*, paddy, cotton and so on. The

various mixed or *akkadi* crops are always sown through the *sadde* which for this purpose is tied behind the *kurige*.

Interculturing implements, *Chippu kuntes*, *Yede kuntes*.

Interculturing implements called *Kuntes* and *yede kuntes* are also made in many patterns. The *chippu kuntes* are hoes with two to four flat bladed cultivating teeth; the *yede kuntes* have two tines, which are shaped like an L with their feet pointing towards each other so that they really look like a miniature bladed harrow. Bladed harrows of the *Dodkunte* type but much smaller are made in different sizes to suit the width of the crop rows; the one used for cotton and called *hatti* or cotton *kunte* is about 18" in breadth, similar ones are made for *haraka*, chillies and other dry crops principally in the Chitaldrug District. They are very efficient in their work both in breaking the surface crust and in thoroughly destroying the weeds in their track. Some of the *yede kuntes* are used in sets of two and even three, all of them hitched to only one yoke with one man to work each of the *kuntes*; ordinarily, however, they are used singly.

Monekuntes.

In certain taluks of Mysore such as Chamrajnagar, Gunlupet and Nanjangud, can be seen hoes called *Monekuntes*; in these, the two tines converge and end in a common blade of iron; they are used in pairs being held close together by the workman who is able to drive the bullocks as well.

All the hoes except the *hatti*, *haraka* and other *kuntes* of that special kind are about 10 to 12" in length and very light.

Hand hoes and weeding hooks.

Hand hoes and weeding hooks are of many patterns; the *ujari* and *vorvari* are little blades with suitable handles which are worked with the blades pointing forwards, *i.e.*, away from the workman; the *Kai guddali*,

used mostly in garden cultivation, and the *kale holu*, used in the Mysore District, are little hatchet-shaped implements the former with a long narrow blade and the latter with a short axe-like blade; they are adapted for working like a digging tool, *i.e.*, with their blade pointing towards the workman.

Harvesting, threshing and cleaning appliances.

The harvesting tool is only the sickle; threshing is done by the time honoured methods of beating with sticks in the manner of flails and of trampling out the grain under the feet of oxen. Within the last ten years however, in the districts of Chitaldrug, Kolar and Bangalore notably, a stone roller is used for this purpose. This is about 2′-6″ long and about 1′-9″ in diameter and fitted with an axle and a frame work to attach a seat for the driver and a yoke pole for the oxen. This roller is drawn over the sheaves round and round and the grain is threshed out. Though used at first for the threshing of *jola*, it is now used throughout for ragi as well; the Mysore District, though a *Jola* growing district, has not yet taken to the method, a curious instance of the slow pace at which improvements travel.

Appliances for winnowing, cleaning, gathering grains, carrying straw, etc., are also very simple and homely, though not without interest. The winnowing tray, a slow basket called *Mora*, having a rim only on three sides, is very cleverly handled, and can be used at once for the winnowing of chaff and dust, for separating grains of different grades and for cleaning the grain from earth, fine gravel, etc., with a deftness appropriate to each operation. Wicker or bamboo sieves, both large and small, are also used to sift grain, the larger resemble a child's cradle and are used by rocking to and fro. Metal sieves are slowly coming into use. The hand rake of bamboo and large slings or string baskets for carrying straw are other applicances seen on the threshing floor.

Farm carts: General purpose carts, solid wheel carts.

Of the farm cart can be seen many interesting types. They are all of the two-wheeled type and nowhere are four-wheeled ones made, though it is not uncommon to have more than one pair of bullocks hitched to a cart when the load requires it. The general type of farm cart has ordinary wheels, *i.e.*, with spokes and felloes. They are of medium height, constructed of sound timber, well braced, and generally have a substantial well made appearance. In T.-Narsipur, Chamrajnagar, Gundlupet and that neighbourhood, the carts have low solid wheels; these are so low in fact that they are eminently suited to the rough uneven ground of the countryside, for there is practically no risk of the cart being tilted out of balance. The receptacle for holding produce or manure and other material in the cart is a bamboo crib made either large or small according to the size of the cart; or more often the receptacle is made with wooden or hurdle sides.

***Sappe Gadi*: sleds.**

In Chitaldrug and Shimoga can be seen carts of a special type which are fitted together only at harvest time; these, called *Sappe gādi* (cart for *Jola* stalks), have a pair of massive solid wheels with an iron tyre three or four inches in thickness; a couple of wooden brackets (being the remains of an old wooden plough) fixed over the axle tree enables a frame to be put on so that the load may clear the wheels. Laden with a huge load of *Jola* stalks placed crosswise in the cart and fastened down tight with leathern ropes, they are being drawn by two or more pairs of heavy bullocks; this is a curious relic of the spacious times when iron and leather were cheap and articles were made to last for an age; for the wheels and ropes of many of these raiyats are really generations old. At the other extreme can be seen also little sleds made by mounting the heavy timber of a *Dodda kunte* over a couple of old plough bottoms fitted sledwise; on these manure baskets, fodder, thorns for

hedges and other odds and ends are drawn along mostly by hand. These can be seen in the Maddagiri, Sira and other eastern taluks. Wheel barrows are nowhere seen; the sleds and low solid wheel carts described above which are practically sleds are their equivalent; small loads are carried in headloads in baskets.

Water lifts.

Appliances for the baling of water for irrigation are of two kinds, *i.e.*, those suited (1) for manual power, (2) for bullock power.

The *picota*.

The first one is the familiar *picota*, which is a long lever mounted on a central vertical fulcrum; one end of the lever is suitably weighted and the other end carries the water bucket tied to a long bamboo. The weight at the rear end is heavy enough to be of help to the man to raise the full bucket and is at the same time not too heavy when the empty bucket is lowered. In order to further assist the man at the bucket, ropes are also tied on one or both sides of the central pivot at which a second man pulls now the one and now the other as the bucket is raised and lowered. In wells of very low lift, the lever is fairly broad, with steps cut on it, along which men can walk up and down. The buckets hold only about three gallons and even then the work is hard. The wells of the Kolar and Bangalore Districts are mostly *picota* wells.

The *kapile*.

The *Kapile* lift is of the second class and is adapted for bullock power. The bucket is lowered and raised by the bullocks walking up and down a steep ramp, pulling the bucket by means of a rope passing over an elevated pulley. The bucket is made out of leather and is circular in shape with a wide and long leathern hose stitched on to the bottom of the bucket. As the bucket enters the water, both bucket and hose fill; they are pulled up by

two ropes, one tied to the mouth of the bucket and the other to the tail end of the hose in such a manner that the hose bends like a U and bucket and hose come up full; when the arrangement comes to the top, the hose or tail rope is pulled and the hose straightens out emptying itself and the bucket with great ease. The buckets hold from 30 to 50 gallons, and either one pair or two or three pairs of bullocks are used; one pair raising the full bucket walks smartly down the steep incline, at the bottom of which it is released to walk up along a less steep incline by the side and take its place again at the yoke for the next downward journey. Two pairs are, however, usual each taking its turn alternately and the driver himself walking up holding on to the rope when the bucket is lowered.

Improved *kapiles.*

All the large irrigation wells are provided with the *Kapile;* the work is however so hard, and *kapile* fittings especially leather has become so expensive that improvements are welcomed, and keenly examined as to their merits. A few stray instances may here and there be seen of other types claimed to be improvements; for example, the Noria or the Persian wheel type; the *kapile* type adapted to a circular motion of the bullocks on the level along a circular track, in which the bucket rope winds and unwinds round a large wooden drum; the "Stoney" patent lift with its additional improvement in the type of bucket used; all these have been tried but none has taken on as they lack the many-sided merits of the *kapile.*

Engines and pumps.

It has been somewhat different with the pumping outfits being popularised by the Sate Department of Industries. The increasing cost of bullocks and their keep, and the heavy and tiresome work at the *kapile* wearing out both man and beast form a strong argument in favour

of their displacement by some mechanical power, provided the new appliance is not very costly in initial outlay or in the working charges. Engine-driven pumps have had some chance therefore with the larger farmers who could afford the cost and in places where the supply of water is satisfactory. Several outfits both large and small have within the last ten years been installed in the State. At Shimoga and Harihar, the pumping is from the river while in other parts it is from wells. The largest number within a small area is on the banks of the Jayamangali river in the Maddagiri and Koratagere taluks. As during the great War, not only machinery of all kinds but also Kerosine and crude oil rose abnormally in price and for many months the latter could not be had at any price, the movement received a serious check. Electrically driven pumps are being installed at Kankanhalli along the banks of the Arkāvati river in the area lying close to the switch house on the main electric transmission line. This scheme which is pushed forward by the State Department of Electric Engineering is full of promise though the area of its application is limited. It must be observed that the larger farmers of the State have shown very commendable enterprise in this matter demonstrating that they are by no means indifferent to even costly improvements.

The Farmstead.

This section may be closed with a description of the farmstead. It has already been mentioned that with the exception of the *Malnād* garden owners, few raiyats live out on their land. They live together in compact little villages whose size and lay out and the disposition of the houses therein have been decided principally by considerations of safety. The requirements of a real farm house are impossible of being satisfied under these conditions. The raiyat further increases his own individual safety by constructing a house not only approximating to the type

of a strong box, but also one that by its outward appearance could never tempt the cupidity of the robber or the tyrant. This stronghold is shared in common by the raiyat and all his belongings including his cattle. The general type of house is made up of a suite of apartments for the family and a row of stalls for the cattle. These stalls may run along only one side of the house in which case it is generally the front, or along two or three sides. The stalls open into the interior, that is, they possess no walls on the side facing the dwelling rooms, from which they are separated by an open yard. The stalls are occupied by the farmers' horned cattle; a portion is shut off by hurdles for sheep. The ploughs, cultivators, hoes and other implements are housed generally in a kind of attic in the stall above the cattle, or when the stalls are flat roofed, are stowed in a corner of the house.

Cattle stall.

The stalls also serve for the washing and bathing for the family and for all the household work other than the cooking. The grain bins when the grain is not stored in underground pits (see under Ragi) are also constructed in this portion of the house. The houses in the districts of Bangalore, Kolar, Tumkur and Chitaldrug are usually flat roofed, and in many cases even the portion which would correspond to a yard is covered in. The front door, a window sometimes and an opening in the roof at the kitchen to allow the smoke to escape are the only ways through which air and light can circulate. In the western taluks of Bangalore, throughout Mysore and the other western districts, the houses are seldom overcrowded in this manner, there being both open yards and detached cattle stalls. Many of the rich *patels* and land-lords have their cattle in a separate farm house altogether. The houses in these districts are also provided with a narrow veranda in front.

Manger and feeding arrangements.

The manger for the cattle usually runs along the wall or along the middle of the stalls. The mangers are often only a framework of wood or bamboo; sometimes they are built of mud. Mangers composed of long wooden troughs mounted on an earthen platform or wooden frame work may also be occasionally seen. In the latter case, the dry fodder, *viz.*, jola stalks, is put into the troughs and water is run in, in which the fodder soaks and becomes soft. Water for the cattle is provided in large earthenware pots sunk in convenient intervals along the manger or in one common spot; but being all the time under the eye of the raiyat or his womenfolk, the cattle never lack attention.

System of manure removal.

The floor of the stalls is only damped earth, rarely paved; no bedding is provided; and the urine merely soaks into the ground, or collects in a depression in the stall. In the Bangalore and Kolar districts, however, a little of the cattle dung is put out to dry every day and in the evening is strewn on the floor of the stalls as a bedding for the animals. The stalls are cleaned out every morning. In the Malnād, however, the cattle are housed in what may be called box stalls, a litter of green leaves is provided every evening and the manure is allowed to accumulate under the feet of the cattle; the manure is removed only when the level rises inconveniently high; sometimes the clearing takes place at frequent intervals, which is a mercy to the cattle. Excellent manure is the result, but the cattle are tormented by a plague of flies by day while the wet and sodden manure on which they lie at night, by no means tends to their comfort.

Grain store.

Ragi is stored underground in pits called *hagēvus*. These are excavated in front of the houses, or in front of the temple or other large open space in the village or in the raiyat's field outside the village altogether.

The system is in vogue only in villages where the soil is such that there will be no fear of water percolating into the pits. They are in shape like a large pot, the body being very large and the neck very narrow. They are made of all sizes depending upon the extent of a man's holding; the largest will hold from 200 to 300 pallas of ragi. The neck usually about 2 to 3 feet in depth is just large enough for a man to get down through. Before filling the ragi, the pit is cleaned and swept clean, the bottom and sides are lined with some straw and chaff and ragi, well dried, is filled in. The mouth of the pit is covered with a stone slab and then with earth. If the soil is quite dry and hard, ragi is said to keep well in these receptacles for many years; but considerable grain in the outer portions, *i.e.*, the top and sides goes bad even in the best of situations; should however water for any reason have got in, the ragi ferments so badly that it emits a most offensive stench. Ptomaines are said to develop under such conditions, fatal to people who may happen to use it as food.

Masonry and other above-ground bins.

Jola is also likewise preserved in pits of the same kind but is not kept more than a year. Where these underground bins are not excavated, the grains are kept in bags, or in large earthenware or wicker bins; occasionally in the large houses of families of consequence may be seen large soil-like masonry bins for storing grains. Paddy is stored in large rectangular masonry or wooden bins of the size of an ordinary room; mostly these bins are located above ground and have a draw-hole at the base made to open and shut by a rather clever device, through which grain is taken out when wanted.

Seed preservation methods.

Grain and pulses meant for seed are thoroughly dried in the sun, cleaned and winnowed and screened and then preserved in special receptacles called *Moodes*; these are

either cylindrical in shape made out of paddy straw or flat and pot shaped and made of straw twist; in these, grains are preserved as such and pulses are preserved with some ashes, chillies and chaff. In the Mysore District *moodes* of the first type can be seen, while in Chitaldrug and Shimoga, the second type can be seen.

It is said that grain is not stored to the same extent as it used to be many years ago—a result due to the modern facilities for extensive trade and quick and safe transport; this is probably true but the different types of store houses are by no means curiosities and are largely in use everywhere in the State.

Manures: Farmyard manure.

The excreta of oxen and sheep form the chief if not the sole manure used in the State. Raiyats generally keep more cattle than they can properly feed and look after, principally with the object of increasing their manure supply. The quality of the manure so made is exceedingly poor on account of the meagre and innutritious feed which most of these animals get and of the careless manner in which the manure itself is collected and preserved. The pasture lands attached to the villages are not only shrinking in area owing to the extension of cultivation but are in a hopeless state of neglect; they are naturally situated on the high lying parts of the village, as the more fertile areas are taken up for cultivation; they are cut up by gullies and streamlets along which such soil as exists is washed down yearly during the rains; they are overgrown with jungle vegetation, and being the common land of the village, it is nobody's business to bestow any attention in improving the pasture lands. While in the rainy season some grazing is available, in the dry months they are absolutely bare of grass. Concentrated feed for cattle is out of the question, the raiyat being too poor to afford it for any except his best or working cattle. The result naturally is a manure of

very poor quality. Further, as we have already noticed in the raiyats' method of housing his cattle, the urine is practically all wasted; the Malnād where owing to the use of green litter the manure is of good quality and the Maidān taluks where dry cow-dung is used as litter are exceptions. After the manure is removed from the stalls, be it every day as is done in the Maidān districts or periodically as is done in the Malnād, the manure is kept in open pits outside the village principally along the margin of the village approach. In these pits the manure lies exposed to the weather, drying in the sun, and being leached in the rains till it is carted to the fields at the commencement of the cultivating season. In some of the taluks of Mysore, Bangalore and Tumkur, it is usual to cart earth either from the dry tank beds or good red earth from the fields to the manure pits where the manure is covered by a thick layer of this earth. When the pits have to be emptied, this earth is well mixed with the manure and then carted.

Sheep manure, sheep folding.

The excreta of sheep and goats are highly esteemed as manure and are much sought after. The ordinary raiyat is a mere arable farmer, and he either keeps no sheep at all or only a small number. Herds are kept by a special class of agriculturists called *Gollars* or graziers at whose farms considerable manure accumulates, and is often sold to farmers round about. The *Gollar* farmers are generally reputed to be very successful farmers, mostly on account of the large quantities of sheep manure they are able to use on their lands. The taluks of Mandya, Malvalli and Nagamangala in Mysore, the whole of the Chitaldrug District, the taluks of Sira, Chiknayaikanhalli and Gubbi in Tumkur, and the eastern half of Kolar are the sheep raising tracts of the State. The larger arable farmers in these tracts also keep herds which are usually in the charge of graziers and roam about in the jungle during

the cultivating season and come to the village after harvest. They are then folded on the fields, where the green stubble affords some pasturage. In these tracts it is very common for farmers to hire herds of sheep to be folded on their fields; the consideration is partly the stubble which in the case of fields of cotton is considerable, but more often is a money payment, the sheep grazing where they can in the day and being folded on the raiyat's field at night; to fold a 1,000 sheep for a night the raiyat usually pays Rs. 5. In these districts land ploughed up for sugar-cane or meant for grain and other crops under well cultivation is heavily manured in this manner.

Other bulky manure.

Of the excreta of birds, a noteworthy manure is that of bats collected from caves, abandoned temples or ancient trees and similar haunts of bats. It is esteemed to be a very good manure and is used when it can be got by the growers of water-melons in the bed of the Tungabhadra in the Harihar Taluk.

Night soil.

Round Bangalore and Mysore, the use of human excreta as manure is in great vogue. The ragi fields of the villages adjoining the Bangalore City and Military Station are heavily manured with night soil; the Municipality systematically auctions the right to collect the manure and every morning the City refuse is carted away by raiyats to whom contractors sublet the right. The paddy fields and sugar-cane fields round Mysore and Seringapatam likewise are manured with the same material from the Mysore City.

Sewage.

Sewage also is utilized for its manurial value by the market gardeners of Bangalore.

Tank silt.

The silt from tank beds is another favourite form of enriching cultivated fields; as the dry season when the

silt could be had coincides with the slack season of the raiyats, this source is seldom neglected, especially when the cultivated lands are inclined to be sandy and the raiyat feels he could improve them by carting silt.

Sudhi mannu.

The earth from old village sites is also utilized in the same manner. This is a light ashy coloured earth excavated from these sites and contains mixed with it potsherds, bits of bone, kankar, etc., and goes by the name of *sudhi mannu* or ashy earth. It is much used in certain villages of the Dodballapur taluk and elsewhere also wherever such earth is found, as the raiyat knows its value. Some samples analysed showed they were rich in lime and phosphoric acid, evidently due to the decomposed bones in the earth.

Ashes.

Ashes of all kinds are freely used as manure and in fact constitute the sole manure supplying potash.

Lime.

Lime is nowhere used as a manure though it occurs more or less extensively throughout the State. It may in fact be said to be the one local product of importance whose manurial value is not known to the raiyat.

Green manure : *Honge tops.*

The other important source of manure is green manure. Green manures are used largely and almost solely for paddy lands when they are cultivated in puddle. This practice takes the form either of cutting and carting leaves and twigs from elsewhere to be ploughed into the field or of growing a green manure crop in the field itself to be ploughed into it as manure. The first one is the more general practice. The leaves most esteemed for this purpose are those of the honge tree (*Pongaima glabra*). This is the one tree which is regularly and extensively planted for the sake of its use as manure for paddy land. Practically all tank bunds, *i.e.*, the unrivetted

side facing the fields are planted with *honge* trees, where they serve a double function, their roots helping to bind the earthwork and their leaves being used as manure. Likewise the natural water courses which are the feeder channels to the tanks and the shallow portion of the catchment are also planted where they also extend by natural agencies; here too they serve the additional function of acting as silt traps. In the Sira and Maddagiri taluks of Tumkur, and in Hiriyur, Challakere and Molakalmuru of the Chitaldrug District can be seen regular plantations of these trees, planted by raiyats on their dry land holdings from which leaves are cut and used on their wet lands or sold to others. They are also planted as avenue trees. In Kolar and Tumkur there is also much natural growth of this tree in the fertile sandy valleys where underground moisture abounds. High prices are paid for the leaves and raiyats go long distances to cut and cart them. In Sira it is usual to apply from 100 to 300 headloads per acre, about 25 headloads going to a cartload. Such manuring will cost from Rs. 12 to Rs. 36 an acre. Trees in these tracts are severely pollarded every season, but in the moist situation where they grow, fresh growth is free and rapid.

Other leaves used.

In addition to the leaves of the *honge* tree, other leaves are also used, but in a very minor degree and especially in the Mysore District; these are tangadi (*Cassia auriculata*); yekka (*Calotropis gigantes*) said to cure alkalinity and neem (*Melia azadirachta*).

Paddy land and growing green manure crops.

The practice of growing a green manure crop for being ploughed in is confined almost entirely to the Mysore District. The paddy fields are ploughed up soon after harvest as soon as the field is in a fit condition for ploughing; and in the first rains (Bharani) towards the middle of April a mixture of sunn hemp, horse-gram, cow

pea, green gram and black gram is sown; by about the month of July, the pulses are ready to pick and a more or less fair crop is harvested according as the rains have been good or not. It is then partly fed of by bullocks and the remainder is ploughed in into the puddled field. If the green crop is sown late and does not mature by the time water is let into the channels and the fields are to be puddled, it is ploughed in without waiting for it to mature a crop. In recent years through the efforts of the State Department of Agriculture the practice has been copied in the other districts as well, and every year the Department sells large quantities of sunn hemp seed for being sown as a green manure crop not only in paddy fields but also in the cocoanut and areca gardens. As the fields are nowhere enclosed, it is essential that all the raiyats owning land under a tank should grow the crop, otherwise the enterprising pioneer is greatly handicapped; for the green manure has to grow at a time when the country side is dreary and not a green blade is seen anywhere; and single handed he will have to guard the green crop against the village cattle which is practically impossible.

Insufficiency of manure supply.

These exhaust the natural or farm made manures of the raiyat. Even with the best efforts of the raiyats, there is not enough cattle manure to go round; but his wasteful methods make the situation worse. Added to this is the custom of using dried cow-dung as fuel. This practice is universal in the country, and the quantity of useful manure which is burnt away in this manner should be very great in the aggregate. In the neighbourhood of the cities of Bangalore and Mysore, particularly the latter, the demand for this fuel is very great and the villages round about are depleted of this material; the same is the case in the black cotton soil tracts of Chitaldrug where fuel is very scarce and the deficiency has to be

made up by this special kind, which in this tract is collected and preserved carefully and a supply put in for use during the rainy season. The opening of Sandalwood Oil Factories in Mysore and Bangalore and a large number of cotton gins and presses in Davangere has certainly made fuel which was scarce and dear enough, much more so in these places. In the extensive cotton growing tract round Harihar and Davangere, it will be no uncommon sight to see even *jola* stalks which are meant for fodder, being used as fuel, the scarcity being so great. There seems, however, to be no way out of the situation which would put an end to this custom and set free all the cattle manure for its legitimate use.

Commercial Manures: oil-cakes.

Among commercial or purchased manures used in the State, the most important are the oil-cakes. The use of oil-cakes is, however, confined to the sugar-cane cultivators of the Bangalore and Kolar Districts. As the country produces a variety of oil seeds and as oil-cakes constitute the cheapest nitrogenous fertilizers, the State Department of Agriculture has been making great efforts to popularise its use throughout the State. A very large quantity is sold through the agency of the Department and through private merchants. For sometime, the oil-cakes were also being sold by the Department to raiyats on a twelve to fourteen months' credit so that the purchase money was paid back after the sugar-cane crop was harvested and milled.

Oil-cakes produced locally.

The oil-cakes in use at the present time are those of *honge*, castor, and the ground-nut. Until about fifteen years ago, with the sugar-cane growers of these two districts, the favourite and practically the only kind of oil-cake purchased used to be the oil-cake of *honge*. The seeds of this tree are gathered and milled in the ordinary local wooden or stone mills or *gānas* of the village

oil-monger and the cake which comes out in large heavy lumps is sold to the raiyats. Castor, though grown largely and also used for the expression of the oil locally, is treated somewhat differently for this purpose. The local method of obtaining the oil is to grind down the seed, mix the pulp with water and boil the mixture; the oil cells rupture and the oil rises to the top whence it is ladled out. The refuse, after the oil is removed, is therefore obtained in the form of a semi-liquid mass, and not being in a fit condition for commercial handling is usually thrown away in the manure heap. A fair amount is also milled in the stone *gānas* like other oil seeds but with the introduction of screw presses in the Bangalore City, about fifteen years ago, castor oil-cake began to come into the market largely and has been available to the raiyats. It must be said to be quite as popular as the *honge* oil-cake. During the last 5 or 6 years, ground-nut is being milled largely in the State and the oil-cake is becoming available for use. This cake is being popularised very largely by the State Department; there was some prejudice against its use by raiyats, but this has now been overcome and its use is steadily increasing. The new Anderson Oil Expellers installed in Bangalore produce cake in the form of thin flakes which are very easy of powdering and this forms therefore an additional recommendation in favour of this cake. Due chiefly to the cheap and convenient electric power available in Bangalore, several small mills of the rotary type have also come into existence, further increasing the supply of oil-cakes of all kinds. Neem cake can be made in large quantities, for in many parts of the State neem trees have been largely planted as avenue trees; but except in the Mysore District, little is made, and even there, it is made only in small quantities in the houses of the raiyats.

Outside sources.

On the coffee estates in the State, considerable

purchased manures, both oil cakes and the artificials referred to below, are used. In fact, for the latter kind of manures outside of these estates, there has been little or no demand. The manure works at Hunsur and Bangalore supply powdered oil-cakes of different kinds to these estates, while from the West Coast, Coimbatore and the Manure Works at Ranipet near Madras, large quantities are also imported.

Method of using oil-cakes.

The raiyat seldom goes to the trouble and expense of powdering the cake he uses. The heavy lumps, in which form the country *gānas* turn out the cake, are hard to grind to powder, and the raiyat merely chops it up into small lumps about the size of one's fist; when sugarcane rows have to be earthed up, he places one or two such pieces under each clump of cane where they are covered with the earth thrown up. It is also common to soak the cakes over night in water in a pit situated at the head of the water channel in the cane field; the cake crumbles down and mixes with the water into a sloppy mess, in which condition it is taken out in potsful and let into the furrows.

Bone meal.

Bonemeal comes next in importance, but except on the Coffee Estates is used only to a very limited extent. Bone crushing mills exist both in Bangalore and in Hunsur, from which the supply is derived.

Artificial or chemical manures.

The State Department of Agriculture has been demonstrating the value of Sulphate of Ammonia, of Superphosphates and other chemical fertilisers. Special mixed manures suitable for paddy lands, cocoa-nut gardens, potatoes and such special crops are also made by the Department and sold to raiyats. The paddy lands in Yedatore Taluk in Mysore, Hole-Narsipur in Hassan and in the Hoskote Taluk in Bangalore are noteworthy areas where these manures are used for paddy; the

cocoa-nut manure mixture is being taken up in the Tiptur Taluk of Tumkur. There are unmistakable signs that the raiyat is beginning to appreciate the value of these new fertilizers; even the prejudice on religious grounds against handling bone meal which exists among the high caste cultivators is slowly wearing down; the high price of produce of all kinds is also acting as a stimulus. If fertilizers could be made locally and their cost lessened, large quantities would be taken up for use. Oil mills are increasing in number and a notable one is a plant being erected in Tumkur for the extraction of oil by the use of benzene. Under the Krishnarajasagara Dam, it is proposed to start the manufacture of calcium cynamide by the aid of electricity; provision has already been made for the installation of plant for generating electricity at the dam. The manufacture of steel at the large State Iron Works at Bhadravati, in the Shimoga District, will no doubt bring into existence a number of by-product plants for the production of basic slag and of ammonium sulphate. As manures constitute far and away the most important means of increasing production, these activities are full of promise to the improvement of Agriculture in the State.

Forms of Tenancy.

Under the overlordship of the State, the land is held under different kinds of tenures in all of which the landholder pays a fixed money rent to the State which absolves him from all further obligations, and confers on him full proprietary rights in the land. An account of these different tenures appears elsewhere. We shall deal here with the various methods by which the actual landholder himself gets his land cultivated, *i.e.*, whether he farms it himself or lets it out to tenants, and if so, the conditions under which he lets it out.

In the old days when the village communities were practically agricultural corporations, things seem to have

been so arranged that each farmer had a share in the dry, wet and garden lands of the village. Conditions have, however, vastly changed and the ownership of land has changed hands bringing into existence a large class of absentee landlords and of resident landlords who have taken to other occupations more lucrative than agriculture.

Dry land farming.

Broadly speaking, it may be said that all the dry lands are farmed by the owners themselves. Their number is obviously the largest in the State and they also constitute the small holders. The cultivation of ragi, which is the main crop on these lands, has to be looked upon as the means of the people's food supply and not as an undertaking of any commercial value, *i.e.*, as a venture in which one can invest capital with the hope of earning a fair return on it. Taking a good season with a bad one, the ordinary dry land cultivation is not such that if every item of the raiyat's labour on the crop, from the preparation of the land to the marketing of the produce, is valued at market rates for manual and bullock labour, any respectable margin of profit can be expected. It, however, provides food for the raiyat and fodder for his cattle and where the area farmed is not very small, furnishes a modest competence which, combined with his innate desire to cling to his land and his village and to the profession to which he is born, is enough incentive to keep him on the land. Much capital is not required and with a little co-operation from his neighbours at the busy season, he is just able to carry on. Such raiyats possess little or no reserve and money borrowed for marriages and other domestic celebrations is seldom capable of being paid back by an actual money payment.

Gardens and plantations.

Similarly, the most lucrative form of agriculture such as gardens and plantations, are also owner farmed; areca-

nut gardens, cocoanut gardens, and coffee plantations are farmed by the proprietors themselves. When the properties are small, the owners themselves work; in the case of the larger properties, paid labour is employed. Much capital is, however, required as the expenses of digging, watering, etc., are heavy and the garden owners also belong to a better class of people whose standards of living are somewhat higher and their domestic expenses greater. Though they own very valuable properties, it is stated that a large number of them are heavily indebted.

Wet land cultivation

Paddy and sugar-cane lands are almost invariably let. They are for one thing generally in the hands of people who do not belong to the farming class, or who though they may belong to this class have given up farming, being either too well-to-do or having other and more lucrative occupations. Being very valuable lands, they are the most favourite form of investment, and are so costly that they are seldom within the means of the ordinary farmer. The extensive paddy lands in the Cauvery valley in the Hole-Narsipur, Yedatore, Mysore, Seringapatam and T.-Narsipur Taluks are to a large extent owned by the absentee landlords and are keenly sought after, on account of the certainty of the paddy crop and therefore of a fair return on the money with the best of security.

Lands in *Jōdi* villages.

In the *Jōdi* villages, the dry lands are let out to tenants who as long as they pay their assessment enjoy all but proprietary rights; the wet lands are kept by the *Jōdidār* himself and are invariably let out by him to his own dry land tenants in the first instance, and to other villages if necessary.

Fixed produce rent on paddy land.

The rent in such leases is always in the shape of produce; it is either fixed as a share of the produce

which varies a great deal according to circumstances, or a definite quantity of the produce. The latter, called *Gutta*, is the simplest form next to a money rent. It is the one resorted to always by absentee landlords, and is commonest in the paddy tract of the Cauvery channels. The landlord does not trouble himself about the treatment the soil receives; he never supervises or dictates, as a matter of fact, it is not uncommon to find landlords who may not even have seen their fields. The lessee delivers the stipulated quantity of paddy at harvest, and oftentimes is trusted sufficiently to sell it himself and remit the money to the landlord. Leases usually run for a period of three years at a time; longer periods are not uncommon but shorter periods are rare. The *Gutta* varies from one *khandaga* (a *khandaga* of 180 seers) of paddy up to five *khandagas* which may be said to be practically the maximum. When the lands are very fertile and competition is very great, it may go up to seven *khandagas* of paddy. The straw is all taken by the tenant and so is any pulse crop which he may grow as a catch crop. This rent will work out to be almost a half share of the gross produce; the landlord pays the land assessment, and other Government dues such as road cess, out of his share and the tenant pays all the expenses of cultivation. This rent should be taken to be very fair, all things considered. A resident farmer can, and many do actually, obtain considerably more out of their land farming it themselves; as a matter of fact, many lessees sublet the lands for a higher rent and earn the difference as their profit chiefly because they are local residents able to exercise considerable judgment in choosing tenants and supervising the cultivation; but a man whose business is not agriculture and who therefore looks upon his paddy land purely as an investment readily foregoes any such possible enhanced rent in view of other conveniences. The raiyats too further protect

themselves against unreasonable enhancement by refusing to take up such land altogether.

Produce sharing on paddy lands.

In the other system where the rent is fixed as a share of the produce, with regard to paddy lands under tank irrigation whether in Government or in *Jōdi* villages, the half share system is almost universal. Land let out in this manner suffers greatly from neglect; and as an investment such land should be deemed poor, unless one farms it himself. The tenant looks upon this paddy land more as a certain source of fodder for his cattle than as a source of grain. His energies are all directed to his own dry lands in the first instance and the paddy land is taken up last; little or no manure is used, and only such attention is paid as can be spared from his all important dry land farming. The scope for increased production with better attention is comparatively great in these areas.

Produce sharing on sugar-cane land.

In the case of sugar-cane, the land is let generally on the condition that the landlord provides the seed and the oil-cake manure; the raiyat undertakes the complete cultivation; the milling charges are borne equally and the produce is also shared equally. This is the commonest form. Sometimes the produce is divided in the proportion of 2/3rds to the tenant and 1/3rd to the landlord, the landlord's liability being the same as in the first case in places where competition for sugar-cane land is not great. In certain parts of Kolar, it is also usual for the tenant to give one boiling in six to the landlord, the latter paying nothing more than the assessment. This is only a kind of *gutta* adapted to sugar-cane cultivation.

Produce sharing on areca gardens.

In the case of the areca-nut gardens of the *Malnād*, longer leases are common; the *gutta* is fixed at so much per 100 bearing trees and will generally work out as

1/3rd of the gross produce; leases run for ten years and longer; and strict conditions regarding the carrying out of the customary digging, manuring, etc., yearly are specified in the leases. The expenses are reckoned to amount to 1/3rd of the gross produce and the remaining 1/3rd becomes the share of the tenant.

Labour and wages: permanent labour.

For labour on the farm, both permanent and casual labour are employed. Permanent labour is generally such that the labourer is bound to work for the employer for a period of many years if not for his life time. In the olden days, in the *Malnād* especially, the system of serfs attached to the land existed. Though absolute serfdom has long ago been abolished and the labourer is free to hire his services to whomsoever he chooses, still by a kind of mutual agreement, the labourer and his family reside permanently in the farmer's land, the farmer finding everything for the labourer, his food, clothing, and ready money for petty luxuries, and also incurring the expenses of the marriage and other domestic events of his labourer. All this is counted as an advance against the labourer to be reckoned up should he show any inclination to quit, but he seldom drives the employer to this necessity.

Wages.

Elsewhere a money advance is always paid with or without interest according to the necessitous circumstance of the labourer; he lives with the farmer who furnishes him with food and once a year a blanket, a pair of slippers, and a cloth in addition. In addition, a money payment of Rs. 2 to 4 per month is also paid. Rs. 24 to Rs. 50 a year with the—"*Unda oota thundu Cambali*"—food to eat and a *Kambli* for clothing used to be a common wage for the permanent labourer.

Difficulty of securing labour.

These systems, however, depend for their permanence upon the ignorance of the labourer: conditions are

rapidly changing and the procuring of permanent agricultural labour is becoming a serious problem. An advance of money has always to be paid in addition to a monthly wage to secure permanent labour, the advance to be paid back if the labourer wished to leave; but the farmer has no remedy except by suing in a Civil Court if the labourer runs away. Landlords try to get over the difficulty by raising the labourer to the rank of tenant, themselves playing the roll of the capitalist and advancing him money to purchase bullocks and other farm stock and paying the expenses of the first year.

Casual labour.

Casual labour is generally available in the villages as the women turn out for the lighter class of operations like weeding, transplanting, harvesting, cotton picking and so on. Bullock labour is rarely hired out and the man who depends upon such can never get it when wanted.

Wages for special operations.

Payments are made usually in money and range from 3 annas to 5 annas per head. In many villages the labourer also gets a meal in addition to this wage. Transplanting paddy in the Mysore District is done at contract rates, Rs. 5 being paid for transplanting a *khandaga* of land, *i.e.*, about 3 acres. This is generally divided between 25 women coolies, for whom it forms a day's work. The picking of cotton and the harvesting of ground-nut are paid for as a share of the quantities harvested, 1/6th in the case of cotton and 1/3rd or even ½ in the case of ground-nuts. The harvesting of paddy is paid for in kind, the wage at present being 8 *seers* of paddy per head. In the *Malnad* and for the Coffee estates, casual labour is got from the West Coast for the gathering of the areca-nut; the men hire themselves out in groups, each group being under a headman. Payment is made in the shape partly of rice and provisions, and partly of money. Each

person is allowed a *seer* of rice and annas 3 per day and about an anna worth of condiments. These rates which used to rule for many years have risen 50 to 100 per cent within the last year or two.

The milling of sugar-cane is usually done by the raiyats themselves all clubbing together, the jaggory boiling man and the man who feeds the furnace alone being paid. But in parts of Mysore, in Kunigal, and in the Channarayapatna taluk, groups of professional people go round and do the milling on contract; they take with them their own mill, pans, and also two or more pairs of buffaloes. The charge which is paid by contract will work out at 4 annas a maund of jaggory made. These men in many cases purchase the standing cane as a speculation.

Ayams and wages for village servants.

The raiyats also pay *āyam* or a small levy in grain, straw and pulses to the village servants and artisans among whom the Nirganti, who regulates and distributes the water from the tank, the village blacksmith and carpenter, who repair the plough and the few simple implements such as *Kunte* and sickles. Likewise the village chuckler (cobbler) gets one half of the skins of the carcasses of the village in return for the supply of whip thongs, a pair of slippers to the raiyat and repairs to the *Kapile* bucket. Many of these customs are fast disappearing, and both the raiyats and the *āyamgars* are prone to exchange these obligations to each other for independence.

II. Dry Crops.

Ragi (*Eleusine coracana*)

Ragi is the most extensively grown crop in the State. It is the staple food grain of the bulk of the people. It occupies an area of nearly 2,740,000 acres, which is roughly over 1/3rd of the total area under cultivation in

the State. The following table gives the area in the different districts during the year 1923-24 :—

Bangalore	...	445,706	Hassan	...	261,806
Kolar	...	279,572	Shimoga	...	114,483
Tumkur	...	329,927	Kadur	...	93,127
Mysore	...	510,841	Chitaldrug	...	137,693

In the Chitaldrug District, in the Eastern part of the Shimoga District and the black cotton soil tracts of Mysore its place is taken by the jola as the main food crop; likewise in the *Malnād* tracts where rainfall is too heavy to admit of dry cultivation, it gives place to paddy.

It is grown both as a dry crop and also under irrigation, but the latter though by itself may be taken to be considerable in extent is nevertheless almost nothing by comparison. The cultivation of irrigated ragi is confined to certain taluks of Bangalore, Kolar, Chitaldrug and Tumkur and is then grown mostly under well irrigation.

Being sown so extensively, it is raised on practically all kinds of soils. The deep red fertile loam which forms the predominent type in the State is the most favourite soil. The best yields can be obtained on the rich black cotton soils but these soils are usually under jola, there being a tendency for the ragi to grow rank on such soils.

On good soils, well manured and with good rainfall very heavy yields are secured; but even with a poor rainfall, it makes a moderate growth and will give a fair yield; it is further so hardy and drought-resisting that even under very unfavourable conditions it will struggle on. The crop is remarkably free from fungus or insect attacks. The grain too is unsurpassed for keeping qualities; stories are told of ragi being kept for as many as forty years; it is also free from the pests common to stored grains in the country.

Rotation.

Except in the Mysore District, where it is grown as an irrigated crop in the taluks referred to already,

there is practically no rotation of crops followed in the case of ragi. Ragi follows ragi year after year in the same field. It may, however, be noted that where a raiyat's holding is extensive and a variety of crops can, therefore, be grown, a certain rough kind of rotation is adopted so that the raised year after year on one and the same field. There is also the curious practice in vogue throughout, of growing a mixed or subsidiary crop of avare (*Dolichos lablab*) along with the ragi, by having one row of this crop for every 12 rows or less of ragi. It is possible that this interposition of a leguminous crop neutralises in some degree the evil effects of a succession of ragi crops on the same soil which would otherwise follow.

Dry land ragi rotation.

The exceptions referred to above are, however, interesting and are given in detail :—

A. Dry land Rotations.

(*a*) 1st year	...	Gingelli, jola for fodder, Savé or baragu.	Followed by horse-gram in the same year. Savé and baragu may also take the place of horse-gram if they were not already grown as first crop.
2nd year	...	Ragi.	
(*b*) 1st year	...	Castor, or chillies (dry land) rarely ground-nut, jola or haraka.	
2nd year	...	Ragi.	
(*c*) 1st year	...	Horse-gram as preparatory crop on rough land.	
2nd year	...	Ragi.	

These three may be said to be followed in the districts of Bangalore, Kolar and Tumkur, the double crop rotation *(a)* being more or less confined to Bangalore.

In the Mysore District, especially in the taluks west and south of Mysore, the rotations are these :—

(*a*) 1st year	...	Kar-ragi or jola followed by fallow but ploughed up between rows of subsidiary or akkadi crop.
2nd year	...	Kar-ragi or jola followed by ploughing between rows of subsidiary crop and sowing of hutchellu or hurali in this space.
3rd year	...	Hain ragi or if hain ragi sowing is not in vogue, transplanted ragi.

(*b*) 1st year ... Kar-ragi (sown pure) followed by fallow but ploughing deep.
2nd year ... Tobacco or kar-ragi.
(*c*) 1st year ... Kar-ragi (sown pure) followed by hurali or hutchellu.
2nd year ... Hain ragi.
(*d*) In the black cotton soils of Hunsur.
1st year ... Kar-ragi followed by coriander or Bengal-gram.
2nd year ... Gingelli followed by coriander or Bengal-gram.
1st year ... Kar-ragi followed by fallow but ploughed.
2nd year ... Tobacco.
(*e*) In the black cotton soils of chararajnagar, Nanjangud and T.-Narsipur.
1st year ... Jola in kar, followed by cotton sown in the same year.
2nd year ... Cotton continued, followed by black-gram or cow-pea or Bengal-gram.
3rd year ... Hain ragi.

B. Rotation for Irrigated Ragi.

Irrigated ragi is grown (1) in tracts where owing to poor rainfall, ragi could not be sown as a dry crop, this being the case in the extreme east such as in parts of Sira, Maddagiri and Pavagada, in the Tumkur District, and in most taluks of the Kolar District and (2) in small-holders' fields under well cultivation, where work in intensive cultivation leaves them little time to attend to dry land ragi growing, this being the case in Hoskote, Devanhalli, Chikballapur, Sidlaghatta and Malur Taluks.

In the former, the crops raised are only food-crops except under the large tanks in the Kolar District where sugar-cane is also grown. The rotations are as follows :—

(*a*) First year ... Early mungar, a kind of kar ragi called yenegar ragi which grows quickly and hain ragi on part of the fields.
Second year ... *i.e.*, in Vaisākhe either paddy or bilijola according to the amount of water in the well which will depend on the plentifulness or otherwise of the previous north-east monsoon.
(*b*) First year ... Sugar-cane if north-east monsoon was good.
Second year ... Irrigated ragi.

In the latter, *i.e.*, on small holdings, a variety of crops is grown, ragi being always one of the crops whatever the others may be and this being managed by growing one or other of two kinds of ragi, *viz.*, gidda ragi which

is a three months' crop, and hain or rainy season which is a four months' crop.

The rotation is arranged in the following way :—

In the middle of December, the *Besike* crop is put in. This may be gidda ragi, *Besike* potatoes or onions or garlic. This is followed by one or other of the following crops:—Rainy season potatoes, hain ragi, chillies or chrysanthemum, taking care that the same crop is not repeated twice. In the case of the last two crops, *viz.*, chillies and chrysanthemum, there will be only one crop in the year, thus :—

First year ... *Besike* crop, say *gidda* ragi followed by chillies or chrysanthemum up to middle of second year.
Second year ... Hain ragi or reiny season potatoes.

Varieties.

Two types are distinguished as *Kar* and *Hain* ragi, the former which matures about a month earlier than the latter and is sown principally in the Western half of the ragi area of the State, where it is sown in the month of May; the latter is the more important variety and is sown throughout the central and eastern parts of the State and is sown in July. Several varieties are also distinguished each having fairly distinct characteristics. They fall into two groups according as the glumes are green or tinged with violet; in both these groups, varieties with open earheads, closed earheads and branching spikes can be distinguished by local names and their characteristics are given below :—

1. *Hullubile*, green open spikes.
2. *Madayangiri*, violet open spikes.
3. *Gudubile*, green closed spikes.
4. *Giddaragi*, violet closed spikes.
5. *Hasarkambi*, green open spikes.
6. *Doddaragi*, green open spikes.
7. *Kareegidda*, violet closed spikes.
8. *Jenumudde*, green open spikes.
9. *Majjige*, green open and with white grain.
10. *Jadesangha*, violet branched spikes.
11. *Rudrijade*, green branched spikes.

In various parts of the State, these go by other names also, names more or less descriptive of the appearance of the earheads. No. 2 also goes by the name of *Konankombu* (Sira, Maddagiri); the green open variety of this type goes by the name of *Balepatte*, (Hassan and Channapatna); the open types by the name of *Chowlaga* (Hunsur); and *Makhalhidike* (Tumkur). Trials at the Hebbal Experimental Farm have shown that the open types give heavier yields of grain than the closed ones.

Preparation of the soil.

In the *Kar* ragi tracts, land intended for ragi is ploughed soon after the previous crop is harvested, *i.e.*, in the month of September and October; the ploughing is repeated with the early rains of the succeeding year, *i.e.*, in the months of April and May, and sowing follows next. Throughout the main ragi area, however, the ploughing begins only in the month of May with the beginning of the rains. The ploughing is repeated several times according to the frequency of the rains and the time at the disposal of the raiyat; the ploughing is followed by working the *kunte* in Bangalore and the Kolar Districts, and by the *Dod-kunte* in Chitaldrug and Shimoga; the weeds and stubble are collected and burnt; and manure either carted already before the ploughing is begun or later, generally at 10 cart loads an acre is spread and the land is again ploughed once or worked with the *kunte*. Levelling implements and clod crushers already described are used as they may be needed and a final harrowing is given prior to sowing.

Sowing methods.

Sowing is either broadcast or in drills. In the former case, the grain at the rate of 10 to 15 seers per acre is sown and covered by working the light wooden harrow; if the seed bed should be somewhat dry and the soil likely to blow, in parts of the Mysore, Tumkur and Hassan Districts, Nagamangala, French-Rocks, Kunigal

and Channarayapatna, a herd of sheep is driven round and round over the field; after this operation, furrows are opened by the plough at intervals of about two yards throughout the field in which avare *(Dolichos lablab)* the principal mixed crop is sown by hand and covered with the foot.

Drills are used as a rule throughout Bangalore, Kolar, parts of Tumkur, Chitaldrug, Kadur and Shimoga. The drill of the Bangalore and Kolar Districts is of the 12 tined pattern; elsewhere four tined and six tined drills are used; behind the drill the sadde is attached (*Vide* description under implements), through which the avare is sown. After sowing, the land is worked with a brush harrow.

In Shimoga, ragi is sown mixed with manure; for this purpose, shallow furrows are drawn with a three tined hoe (called the Moodala, *vide* description) and in these the whole is then covered by a harrowing.

Transplanting dry land ragi.

In parts of Chitaldrug, in Hassan and Kadur and to some small extent elsewhere, ragi is also transplanted on the dry land; for this purpose, the land is well prepared and manured, and shallow furrows are drawn by one of the different kinds of hoes or by the stout tined harrows; often the land is worked both lengthwise and crosswise; the seedlings are then planted at the corners of the squares; the seedlings for this purpose are obtained from the thinnings of broadcast or drill sown fields. In such transplanted fields, no mixed crop of avare is grown.

Interculturing, harvesting and threshing.

From the fourteenth day onwards, interculturing begins and is continued about three times at intervals; as the sowing in every case is very thick, severe thinning is necessary and the hoes effect this thoroughly; about three are usually thinned out; the hoeings also bring the crop into lines where the ragi was sown broadcast; they also pull

out weeds and break up the surface crust. Hand weeding follows once more or sometimes twice and then the crop needs no attention till harvest; where the ragi comes up very luxuriant, it is usual, especially in Bangalore, to lightly graze it down. From 4 to 4½ months after sowing, the crop is ready for harvest; the crop is cut down by the sickle, the unbound sheaves lie on the ground for three days, and then are put up in field stacks; in the case of *Kar* ragi, there are generally rains at the time of the harvest, and harvesting and stacking have to be done very quick and the field stack or heaps turned over taking advantage of dry spells. The field stacks are removed to near the threshing floor where they are put up into skilfully constructed stacks till the threshing time, *i.e.*, about February. About two months after the harvest of the ragi, the mixed crop is ready and is gathered, the threshing floors are meanwhile prepared by cleaning a circular space, loosening the surface lightly, watering it and trampling it well under the feet of bullocks or by means of stone rollers; the floor is well plastered over with cowdung paste, figures of the raiyats' implements, such as ploughs, drills, hoes and carts, are drawn over the surface amidst much reverent exultation, and the floor allowed to dry. From the middle of January onwards, as the weather warms up, threshing is taken up, and conducted either by beating out the grain, or more generally by trampling it under the feet of bullocks; also in recent years, especially in the Eastern Districts, by the use of a stone roller. The grain is then winnowed and cleaned, heaped up when the threshing is all finished, and the heap is worshipped by the raiyat and his family. It is seldom measured, as it is considered inauspicious, but carted home to be stored or sold.

Yields.

The yields of ragi vary greatly; the best yields are in the *kar* ragi areas where 600 to 700 seers per acre are

obtained. Yields however up to 800 or 900 can be obtained on dry land well manured and when the rains are favourable. The average yield for the State can be taken to be 250 or 300 seers per acre. Irrigated ragi gives as much as 1,200 to 1,400 seers per acre. The straw of ragi is considered the best among the cereal straws of the State; the straw of irrigated ragi is very coarse and woody; as a matter of fact, the straw is not harvested at all but is left in the field to be grazed down; in this case, only the earheads are gathered to be dried and threshed. For use, ragi is ground into a fine meal in the household stone mills; cooked into a kind of pudding is the commonest form in which it is eaten; it is made into a kind of unleavened bread, and also eaten as a gruel. (*vide* Volume I, Chapter IX).

Total annual production.

The production of ragi in the State per year may be taken to be 600,000 tons roughly; there is a considerable export, but hardly any import.

Improvements in ragi cultivation.

Improvements in the methods of ragi cultivation which are being popularised by the State Department of Agriculture as the result of trials, extended over a number of years on the Hebbal Experimental Farm, consist of the following:—

(1) The use of the improved plough and the six-shovel cultivator for the preparation of the ground so that a larger area may be covered and the ploughing made thorough;

(2) the rotation of ragi with ground-nuts;

(3) the sowing of ragi in drills in preference to broadcasting;

(4) the ploughing of the land immediately after harvest in view of the beneficial action of the operation on the succeeding crop;

(5) the growing of a green manure crop of some legume to be sown in the first rains of April and ploughed in in mid-July, the sowing of the ragi to follow about a fortnight after;

(6) the growing of the better yielding varieties, such as H22 and other strains, isolated and tested on the Farm and multiplied on the holdings of selected raiyats;

(7) the selection of large earheads for seed in the field itself and later the selection of the heavy seed for sowing; and

(8) the use of the labour saving threshing appliances such as the stone roller and the threshing machine.

Along most of these lines considerable progress has been made.

Jola (*Sorghum vulgare*).

Next to ragi, *jola* is the most important dry land food crop. The area under this crop in 1923-24 was 601,845 acres. On the black cotton soils, it generally takes the place of ragi as the main food crop; in the Mysore District, it is grown extensively in other soils also; in Maddagiri, Koratagere, Goribidnur and Sira, it is raised as an irrigated crop during the summer months from January onwards. The Districts of Chitaldrug and Mysore are, however, the most important jola tracts, the eastern taluks of Shimoga and Kadur coming next. In these tracts, it is the staple food of the people.

Varieties.

As in the case of ragi, a large number of varieties are grown in the State. The most important group are the varieties sown as the main south-west monsoon crop; in Mysore, these are sown very early and sometimes as early as the middle of March but usually before the second week of April; and in the Chitaldrug District the sowings are late, continuing into May and June. The second group belong to the later monsoon and raised in the months of October onwards. Both these groups are grown for grain and for fodder; another type is grown solely for the sake of the green fodder; very little being allowed to seed.

Jola varietides are stinguished by the shape, size and colour of the earheads; these are either compact, or loose

to varying degrees; the glumes are either dark or white; and the grain is white, yellow or red. The type grown in the *hingar* season is principally the white jola, both compact and loose earhead types, and those with white grains but with white and dark glumes. The latter are also raised as irrigated crops, principally in Sira, Maddagiri and Goribidnur Taluks. In years when the north-east monsoon fails and the large tanks are empty, in these taluks, it is grown in the tank beds on the rich silt of which the crop grows luxuriantly.

Cultivation method.

The preparation of the field for jola does not differ materially from that for ragi, except that a very elaborate tilth is not attempted as in the case of ragi; for the same reason jola can be seen grown even on the rough land on which ragi is not usually thought of. In the black cotton soils, a shallow tilth is aimed at, the land is generally worked with the *doddakunte* instead of the plough and manured. In the Mysore District as the sowings are very early, jola is sown even on lands only imperfectly prepared, the subsequent interculturing being deemed sufficient to make up for imperfect preparatory cultivation. Sowings are generally either in drills or in plough furrows; in the Chitaldrug and Shimoga and adjoining black cotton soil areas, drill sowing is general. The drills used have from 3 to 6 tines with bowls made suitable to the size of the seed; and the tines are about 9 inches apart. Jola mixed with cattle manure and sown by hand in plough furrows is the custom here. Covering the seed is by the *bolukunte* in the case of the drill sown jola; where sown in plough furrows, seed is covered by ploughing an additional furrow. Like ragi, in the case of jola also, except in the case of *besike* jola or irrigated jola, a mixed or akkadi crop is sown, togare being the one generally grown for this purpose. In Chitaldrug, however, it is usual to raise a great variety of

such crops principally for the household needs of the raiyat, *viz.*, avare, togari, menthya, alsande and pundi. After the crop comes up, in Mysore it is usual to give one ploughing close to each row of jola, which serves to earth up the rows and to collect such water as the rains bring close to the roots of the plants. In the other districts, the *yede* kuntes already described are used to intercultivate and weed twice before the rows close up. During the earlier stages, *i.e.*, before the heads begin to appear, the field is guarded against cattle as the young jola brings on bloating and often death in cattle grazing on it; when the heads appear and until harvest, a perpetual watch has to be kept against birds which levy a heavy toll. Tall perches are erected in the fields from which the raiyats keep up a great din to scare away birds. In Mysore, trees grown in the hedge row or planted occasionally in the field itself for this purpose are often trained with a flat head so as to form a permanent perch. In 4 to 4½ months the crop is ready to harvest; the plants are cut close to the ground and stacked in the field temporarily. It is also usual especially in Chitaldrug to harvest the earheads separately. These are stored in a large temporary field bin made of the stalks themselves.

Threshing and stacking.

Threshing is done by trampling out the grain under the feet of cattle; except in Mysore, this has been replaced by the method of threshing under the stone threshing roller; on some of the larger threshing floors in these tracts, two or three rollers may be seen worked simultaneously one behind the other on the same heap. The grain is preserved in underground receptacles or *hagēvus* as the ragi, while grain intended for seed is preserved in the *moodes* already described. The stalks form the most important dry fodder in these tracts and is put up in large substantial stacks; some of these are so large that the handing up of the sheaves is

along tall ladders or by means of a kind of see-saw hoist. This is a clever and simple contrivance and worthy of description. A tall post is fixed by the side of the stack, about half a way down its height is slung loosely a long cross pole which can be worked see-saw fashion; to one end of this cross pole the sheaf to be raised is hooked on, a man pulls at the other end by which the sheaf end is raised to the top of the stack; the sheaf can be also slung around to wherever it may be wanted on the stack, by the man moving the power end of the sea-saw suitably. After the stacks are built, they are well thatched over with the dry stalks of the togari plants.

Yields and Pests

The yield of grain will generally range from 400 to 700 *seers*; irrigated jola will yield up to 1,000 *seers*. Jola is eaten either by grinding into flour out of which unleavened bread is made, or is broken and cooked like rice. Jola is, unlike ragi, subject to pests and diseases; the young crop is preyed upon by the *kambali hulu*, hairy caterpillar, *(Amsacta albistriga)* which is a serious pest; these grubs hatch out about the same time as the jola is sown and soon become so numerous and active that whole fields are often wiped out, necessitating a re-sowing altogether. The jola grasshopper is an occasional visitor; about ten years ago there was a serious outbreak in Honnali and Shimoga but in subsequent years, the pest has not appeared. The jola fly is another enemy; in the Mysore District, it becomes serious in some years; the young earheads are the portions attacked, the juice being sucked and no grain forming at all. Another serious pest is the *Kadike* or smut, which is prevalent more in the Chitaldrug tract than elsewhere. Stored in bags or above ground bins, jola is subject to weevil attacks which, in serious cases, besides preying upon the grain, will render such as is left absolutely unfit for food. The Department of Agriculture has all these pests well in hand and timely

measures are taken by the District staff to combat them.

Navane (*Setaria italica*).

Navane is another important dry land grain crop. It is grown extensively in the Mysore and Chitaldrug Districts. In the latter district, it is grown practically only on the black cotton soil. In Mysore, it is grown on red soils also. Except the varieties known as garden *navane* which are grown either as irrigated crops or in the moist situations, navane is seldom grown by itself. In Chitaldrug on the black cotton soil, it is grown as a mixed crop with the local cotton which is on this account often referred to as *navane hatti.* The two crops are sown at the same time, five to seven rows of navane alternating with one of cotton. Navane is harvested in three months after which the rows are ploughed up or harrowed which helps the cotton to shoot up. Elsewhere it is grown as a mixed crop along with ragi. There are a large number of varieties which fall into two types, one having a thin low compact earhead and the other a thick heavy and very much larger earhead which bends down by its weight. In both these types, there are white, yellow, dark and orange yellow coloured grains. The heavier type is the one often grown under irrigation. In Mysore, it is sown about the month of May along with early *kar* ragi. In Chitaldrug, it is sown in the month of September in rows 9 inches apart. Cultivation is given as for other dry crops; in three months, the crop matures; it is harvested like ragi. The grain is threshed straight away; the straw is not considered as of much value. Navane is eaten cooked like rice. An average yield when grown as a mixed crop may be taken as 600 lbs. per acre.

Sajje (Bajri, Kumbu) (*Pennisetum*) *typhoideum*.

Sajje is the next most extensively grown dry land grain. It is grown extensively in the Chitaldrug, Mysore and Kolar Districts. It is grown both as a pure crop and

as a mixed crop sown along with ragi. The varieties differ in size, colour of the ear-heads and in the presence or absence of awns. Though many varieties may be distinguished among the crop as generally grown, a variety with a thin greenish ear-head and the thick awned pinkish variety called *mullu sajje* are the ones gown mainly.

It is grown on the cotton soil much in the same way as jola; it is also usual to grow it on red loam and even gravelly soils especially in the Kolar District; in this district, it can be seen grown under irrigation in wet lands.

Cultivation methods.

It is grown as a principal crop like jola in which case a mixed crop of some kind is also sown; or the sajje itself may be sown as a mixed crop in ragi; the sowing season is the main Mungar; land is prepared as for jola or ragi, and the grain is sown mixed with manure in plough furrows through a *Sadde* or through one of the ordinary seed drills, giving rows 1 foot or 18″ apart, the seed rate being 6 lbs. per acre. The crop is intercultured and thinned out as for other dry crops. If there are heavy showers at flowering time, the pollen is washed away and seeds do not set properly. Harvest commences in October; the plants are cut like jola and stacked; at threshing time the ear-heads are cut off and threshed. About 900 lbs. of grain is a good yield. The grain is eaten cooked like rice.

Sāve (*Panicum miliare*).

Sāve is another minor grain grown to some extent in the districts of Mysore, Chitaldrug, Tumkur and Kolar. It is grown both as a pure crop and as a mixed crop, along with ragi; when grown alone, it is sown mostly on the poorer sandy soils; when, however, owing to the failure of the seasonal rainfalls ragi cannot be sown, *sāve* is sown on the better class soils also. Two varieties are

recognized, a tall heavily bearing variety called *Hire-sāve* and a dwarf variety called *kiri-sāve*. Varieties differing in colour of grain such as white, dark and yellow are also to be seen in both the types. The taller variety is the one which is chosen for sowing on the better class soils and also for sowing as a mixed crop with ragi. The dwarf variety is sown on the poorer class of soils.

The grain is generally sown after the end of the main Mungar rain and before the beginning of the Hingar, that is to say about the end of August. The grain ripens in three months and is harvested and threshed in the same way as the other grains. From good soils about three to four *pallas* of grain can be expected.

The straw is esteemed good fodder; the grain is eaten boiled whole like rice and ground into flour for making cakes.

Baragu (*Panicum miliaceum*).

Baragu is another inferior millet grown to an insignificant extent; as it is the earliest to mature among cereal grains, it is sown mostly by the poorer class of raiyats who wish to have some grain before the main crop of ragi is harvested. It is sown both as a Mungar as well as Hingar crop. It ripens in 2½ months, when it is pulled out and threshed. The crop is very small in height and with a very poor vegetation growth. The straw is therefore insignificant.

Hāraka (*Paspalum scrobiculatum*).

Hāraka is grown extensively in the districts of Bangalore, Tumkur and Kolar. It is about the hardiest amongst the dry land cereals, and will struggle on even in the most trying season and yield a small crop. It is sown only on the rough and poor varieties of soils and on the fields situated far away from the villages. As a matter of fact, it is only with a view to get some grain crop on the poorer lands and even when the season may be unfavourable that it is sown. The land is given very

little preparatory tillage; the grain is sown, either broadcast or in rows, about the middle of June before the main ragi sowing commences.

It receives little or no attention except one hoeing with the *kunte*. It takes 6 to 7 months to ripen. The grain is exceedingly coarse; it is pounded to remove the thick shiny husk and ground into flour for eating. The straw is insignificant and also not reckoned good fodder.

Wheat. (*Triticum sativum*).

Wheat is grown to a very small extent only in the black cotton soil tracts of the State, *viz.*, Chitaldrug, Shimoga, Kadur, Mysore and Tumkur, the total area under the crop being between 5,000 to 5,500 acres annually. During the year 1922-23, the total area under this crop was 5,765 acres the extent of cultivation having fallen to 2508 during the year 1923-24. In the Tumkur and Chitaldrug Districts, it is grown on other soils alsoc hiefly under irrigation. On the black cotton soil lands, it is grown as a dry crop. Two varieties are grown. *Triticum monococum* and *Triticum spelta*. The usual sowing season is in the *Hingar* or North-East Monsoon. It is sown in plough furrows, or sown broadcast; when grown under irrigation, it is sown usually as a Vaisāk crop, that is, sown in the month of January. In both the cases, the crop is well attended to; weeding by bullock hoes and also hand weeding being given.

In three months the crop ripens and is harvested; in the case of the spelta wheat, the grain is beaten by sticks to separate the seed. The crop is much subject to rust; sometimes whole fields may be attacked and the crop ruined.

Pulses: Avare (*Dolichoos lablab*) or Ballar.

Avare is one of the important articles of food of the Mysore raiyat. Every raiyat raises at least enough for his domestic needs. The crop is never raised pure but is grown as a mixed crop with ragi. Sown along with ragi, it

comes to maturity only about the end of January; but from December onwards the green pods are picked and sold as a vegetable. The crop is harvested when the pods are quite dry; it is threshed by beating the pods when quite dry with sticks. The haulms form excellent grazing and are to a considerable extent gathered and stacked. A great part, however, is grazed down in the field itself.

A number of varieties exist, the differences arising from the colour of the seed coat and the shape of the pulse, *i.e.*, whether rounded or oval; the colours are purple, cream colour and white. There is also a variety which matures very much earlier than the field varieties. The seeds of this as well as of the other pulses are subject to weevil pest and are difficult to keep sound. Specially made straw *moodes*, are used in which the quantity meant for seed is preserved; ashes, chillies and some of the chaff are put in along with the seed in the belief that they keep away insects. The pulse is usually sold split and the seed coat removed.

Togare or Tuver (*Cajnus indicus*).

Considered as a human food *Togare* or *Tuver* is the most important among the pulses of the State. The total area under *togare* in the State in 1923-24 was 153,903 acres. It is grown on all kinds of soils. Soils not deficient in lime are said to yield the best quality. Quality consists in the readiness with which the pulse softens on boiling. It is grown as a mixed crop both with ragi and with jola; as in the case of *avare*, this crop also comes to maturity long after the ragi or jola is harvested; that is about the middle of January. When mature, the plants are cut at the base and are brought to the thershing floor and stacked. The pulse is threshed out by piling the crop in a thick layer on the threshing floor and beating out with a stick. In Chitaldrug, the stone roller used for threshing jola and ragi is used for this purpose.

The empty pods and chaff are used as fodder and the dry plants used as fuel, and to a small extent for making cart hurdles and for thatching jola stacks.

The pulse is split and husked for consumption, by inducing incipient sprouting and then drying and splitting in a grinding mill. The germination is brought about by mixing the pulse with wet red earth and piling it loose; the pile is opened and heaped twice over in the course of a day; the sprouts then become slightly visible, and the pulse is then dried in the sun, freed from the adhering earth and then passed through the splitting stone mills.

A garden variety which grows into a tall and highly branching bush is often planted round sugar-cane fields and in gardens. This bears longer and larger pods in great abundance which are picked for use as a green vegetable.

Bengal-gram (*Cicer arietinum*).

Bengal-gram, called *kadale* or *chenna*, is another pulse grown extensively. The total area in the State under the crop in 1923-24 was 56,904 acres. It is grown almost exclusively on the black cotton soils, on the wet black clays, and on the beds of tanks when these dry up. Mysore and Chitaldrug are the districts where notable areas are grown with this crop. Unlike *avare* and *togare*, this pulse is always grown pure, that is by itself. It is a cold weather crop and is sown late in the North-east Monsoon, *i.e.*, from October onwards up to December. On the black cotton soil, it follows cotton, or any the minor crops like coriander. In many cases, it is the only crop raised on the land in the year. This happens on the wet lands when no *Kārthik* crop is raised and when the tanks do not receive enough water for a *Vaisāk* crop. Four varieties which are distinguished by the colour of the seed, *viz.*, black, dark brown, white and yellow exist but are grown indiscriminately; the variety with the dark brown colour is the one which is grown to the largest

extent. Except when grown as the single crop of the year, the soil is not worked up to a fine tilth; seed is sown in plough furrows and is also broadcasted. Little attention is paid to interculture; the crop comes to maturity in about three months; the heavy dews of the cold months of December, January and February are said to be greatly beneficial to the crop.

Considerable quantities of the crop are sold when it is only partially ripe to be eaten green or cooked as a vegetable. When dead-ripe, the plants are pulled out and the pulse beaten out on the threshing floor.

The pulse is eaten in various ways, fried, whole and salted, parched and split, cooked with a variety of dishes or ground into flour and made into a number of sweetmeats. It is fed to cattle, often softened by soaking in water; it is seldom fed to horses in this State, though in other parts of India this is one of its chief uses.

Horse-gram (*Dolichos biflorus*).

Horse-gram is the most extensively grown pulse of the State; about 800,000 to 900,000 acres being put down every year; about a third of this acreage is contributed by the Mysore District. During the year 1922-23, the total area under this crop was 714,698 acres. It is grown either as the sole crop of the year or following a *Mungar* crop of Jola, or gingelly. It is grown nearly always as a pure crop but in the Mysore District *hutchellu* comes as a mixed crop with it, and in Hassan and in parts of Tumkur, it is grown under castor as a mixed crop. On all rough new land, it is raised as a preparatory crop for a year or two by which time the land comes into a fit condition for growing ragi. Most of the surplus lands of the raiyat which he cannot prepare sufficiently well in time for the ragi crop is also put under horse gram. In years when the *Mungār* rains fail and even grains like *sāve* cannot be put in also for a like reason, the land is sown to horse gram in the North-east Monsoon, if the soil

is red, and to Bengal gram or wheat or other black cotton soil crops on the black cotton soils. In normal years, on the good red soils, horse gram is grown extensively as a second crop after jola or *kar* ragi in the Mysore District; in the other districts following gingelly, fodder jola or hutchellu, or other minor early crop of the South-west Monsoon. Black seeded and brown seeded varieties exist; but the brown variety is the one grown most extensively.

Sowing is generally by broadcasting; the field is then ploughed up to cover the seed; but sowing in plough furrows with a view to interculturing is also common, especially in Hassan and in parts of the adjoining Districts of Mysore and Tumkur. The sowing time is in the months of September and October. Except in these areas, horse gram receives no attention after sowing. When the crop grows rank, it is lightly grazed down. A large quantity of green material, both stalks and pods, is removed as green feed to cattle and sheep. The crop is ready for harvest in 3½ months, and is pulled out and stacked. Threshing is under the stone roller, but beating out by sticks and trampling out under the feet of oxen are more common. About two *pallas* per acre may be taken as the average yield. Both the husks, chaff and the straw are fed to cattle. Horse gram is chiefly used as the main concentrated feed of the working cattle of the State. Its use as human food is comparatively insignificant. As the State grows a very large area, there is a considerable export trade in horse gram.

Other pulses.

Blackgram or *Uddu* (*Phaseolus mungo*), green gram or *hesaru* (*Phaseolus radiatus*), cowpea or *alsandi* (*Vigna catjang*). Black gram is grown as an early monsoon crop on the black cotton soils; also to some extent on wet lands as a catch crop preceding the main paddy crop. It is further put in occasionally as one of the mixed crops with jola where often several kinds of seed are sown mixed

togther. Two varieties exist, a small seeded one and a large seeded one, the latter being rather larger than a pepper corn. Sowing is in the months of April and May; little is done by way of manuring and weeding; the crop is harvested in from three to four months, after which the stubble is ploughed in for paddy on the wet lands, or is followed by wheat, coriander or *bili* jola on the black cotton soil. The larger seeded variety is sown in the main season in August.

Green gram is also raised in a similar manner on the same class of soils; it is, however, grown on the red soils also and on the wet lands to a much larger extent than black gram; *alsandi* or cowpea is grown largely on the black cotton soils as a pure crop and also as a mixture. It is common on the red soils also especially in the eastern taluks of Mysore where it is grown as a mixed crop in rows with ragi. Two varieties are grown, one with a large seed and luxuriant leaf growth and the other small seeded and less bushy.

Both green gram and black gram are also raised as catch crops on wet lands.

These pulses are used principally as human food and for this purpose are prepared in a number of ways. To a small extent they form part of the concentrated ration of milch cows and buffaloes for which purpose they are ground up into a mash with other ingredients like cotton seeds.

Oil-seeds.

The total area under oil-seeds of all kinds in the State amounted to 475,613 acres in 1923-24. The oil seeds grown are:—

(1) Gingelly or Sesamum;
(2) Hutchellu or Niger;
(3) Castor;
(4) Ground-nut; and to a small extent
(5) Safflower; and
(6) Linseed.

Other oil-seeds produced largely in the State consist of honge (*Pongamia glabra*), hippe (*Bassia latifolia*) and neem (*melia azadirachta*), but as these are not agricultural crops they are not noticed here further.

Gingelly (*Sesamum indicum*).

Gingelly is one of the important crops sown early in the South-West Monsoon. The total area under gingelly in 1922-23 was 76,914 acres. About $\frac{1}{6}$ of the total area under oil-seeds is generally under gingelly; the area of early rainfall, *viz.*, the south-west taluks of Mysore grow the largest acreage. It is sown largely on the red loams and on the soils inclined to be sandy, as a dry crop. As a semi-irrigated crop it is raised on the paddy lands in the Cauvery valley, and under tanks on clay soils also, where it is taken as a catch crop in the same way as the different kinds of pulses described above. Gingelly is usually followed by another crop in the same year, horse gram or jola or a minor millet in the dry lands and paddy on the wet lands. Gingelly is said to be an exhausting crop and is popularly believed to be prejudicial to the succeeding grain crop.

Cultivation methods.

The dry land fields intended for gingelly are ploughed and prepared well as usual; the land has to be in readiness for the crop quite early in the season; lands which are ploughed in the early April showers of the year or which were ploughed after harvest the previous season, provided there were suitable rains, are usually taken up.

There are two varieties, one black seeded and the other white seeded, the former being the variety generally cultivated.

The seed being very small in size is mixed with earth, ashes or mouldy ragi from *hagevus* and then is sown either broadcast or in drills. The fields are hoed with the *kunte* after the plants grow up and are also hand weeded. The crop is ready for harvest in three months. The plants are then pulled out and taken to the threshing floor; threshing

is exceedingly simple, the bundles are shaken upside down so that such of the capsules as have opened in the field itself shed the seeds; the bundles are stacked for a few days when all the capsules dry and open; they are then shaken and also beaten to get out all the seed; as brought from the threshing floor, the seeds are mixed with a lot of earth and gravel and require much winnowing and screening out.

Yield. An acre would yield about 200 *seers* of seed, but the crop is somewhat delicate and uncertain.

How used. The seed is used principally for the extraction of the oil which is the most important among the edible oils used by the people. With the poor classes it really takes the place of butter or ghee. The oil-cake is a highly priced cattle food and is largely fed to milk cows and buffaloes. The seed to some extent also enters into the preparation of various dishes.

The stalk and chaff are merely used as fuel.

Hutchellu or Niger (*Guizotia abyssinica*). *Hutchellu* or Niger is also an extensively grown oil-seed throughout the State. Unlike gingelly, it is not grown usually as a pure crop but mostly as a subordinate crop mixed with ragi if sown in the main season or with horse gram if sown later. About the month of November, it is a most conspicuous crop in the dry fields in many parts of the State, where the rows of the crop are picked out in the showy yellow flowers with which it is covered. Even though the akkadi rows may not be entirely devoted to this crop, it is always part of the mixture of seeds used for this purpose, and there will consequently be a fair percentage of this crop along with the avare, fodder jola or other akkadi crop. When sown with ragi as a mixed crop, it is sown about the end of June; if as in parts of the Mysore District it is sown after *kar* ragi, or *Mungar* jola,

it is sown by itself or along with horse gram in the month of September. It is also said to stand a certain amount of waterlogging in the dry lands. When in flower, the crop furnishes along with a lot of other green material, excellent green feed for cattle and sheep; for this purpose a considerable portion is cut.

The crop matures in three to four months; the plants are then cut down at the base and are stacked. They are spread out to dry and the seeds are beaten out and winnowed out of the chaff.

Castor or Haralu (*Ricinus communis*).

Castor is the most extensively grown oil seed in the State, the acreage amounting to more than 1-3rd of the whole area under oil-seeds. The total area under this crop during 1922-23 and 1923-24 was 111,726 and 116,982 acres respectively. It is grown throughout the State and mostly the red and ash coloured soils are put under the crop; but rough soils are also taken up specially where holdings are large, and the comparatively intensively ragi cultivation is not possible on the whole area. The crop is of the main crop type, and occupies the ground throughout the cropping season. It is almost always grown by itself, the growing of a crop of horse gram under it between the castor rows being to some extent in vogue in Hassan.

Cultivation methods.

The better lands are given thorough preparation by repeated ploughing and working with *kuntes* and a good seed bed is prepared. Plough furrows are then made both lengthwise and crosswise at a distance of about four feet, and at the intersection of the furrows a little cattle manure is put in and two seeds are planted. This practice is followed in the districts of Tumkur, Chitaldrug and Kolar; elsewhere it is common to make only the longitudinal furrows at a distance of 3 to 4 feet and plant the seeds fairly closely at about a foot from each other. The sowing is in the month of June. There are several varieties, but

only two are grown as annual field crops; one of these has a reddish stem, while the other has a greenish stem, a bluish white bloom covering the stem in both the cases. The seeds of these are medium sized. There is a larger seeded variety and a very small seeded variety, which grow as perennials in gardens and backyards and in the margin of sugar-cane fields. The latter is esteemed best for the extraction of oil for medicinal purposes. There is also a large red ornamental variety which grows very tall and in which the inflorescence is strikingly red in colour.

After the plants come up, the large spaces between the rows are worked with the plough so that the rows are earthed up, a furrow being made close to the row, and the interspaces well weeded. The rows themselves are also handweeded, and thinned out. In Chitaldrug and the adjoining districts, the bladed *kuntes* are worked both lengthwise and crosswise, the regular check board like planting making this easy. This hoeing is repeated twice till the fields are absolutely clean.

In three months the plants begin to flower and fruit and from December onwards the fruit bunches are picked and the picking is continued as the bunches keep ripening; by about February the picking ceases; the fruits are spread out in the sun and well beaten out to separate the hard husk from the seed.

Castor pests.

The standing crop in its earlier stages is subject to the attacks of the castor semi-looper called *Kondli Hula* (Achoea Janata, Dr.) This causes considerable damage, and cases where the plants are completely defoliated are not uncommon. A good shower of rain mitigates the injury. Spraying with lead arsenite is recommended and spraying outfits and solutions are supplied by the Agricultural Department. Methods of prevention by cheaper methods are also advised in special leaflets published by the Department.

The seeds are used for the extraction of the oil which finds use as a medicine, as unguent, and as lamp oil; in recent years the use of kerosine for lamps has reduced the use of castor oil for this purpose which used to be one of its chief uses. The seeds are largely exported. Local mills also handle it to some extent. Further information will be found under manures and oils cakes.

Ground-nuts (*Arachis hypogoea*).

The ground-nut as a field crop finds no mention in that exhaustive account of the Agriculture of Mysore recorded in Buchanan's *Journey from Madras*, nor is it referred to in the last edition of this *Gazetteer*; and yet the crop is grown on an area of over 100,000 acres at the present time. It is an instance of a crop which, though comparatively a new introduction to the State, has yet been taken up to an extent which is truly remarkable.

The bulk of the cultivation is in the Districts of Bangalore, Tumkur and Kolar but it is rapidly extending into the other districts, notably the south-eastern taluks of Mysore. Were it not that the crop is subject to the ravages of wild pigs and jackals, its cultivation would have extended more rapidly and into most of the other parts of the State as well.

The cultivation is principally as a dry land crop; in the Goribidnur Taluk and its neighbourhood, it is grown on the wet lands also under more or less semi-irrigated conditions. It is cultivated only in the better class soils, the light red, and ashy coloured loams inclined to be sandy as well as on the stiffer loams. It is at present grown only as the main crop of the year, but earlier maturing varieties called Spanish and small Japan have been introduced by the Department of Agriculture, and these are grown as the early monsoon crop to be followed by jola or an inferior millet.

Varieties.

The long established variety has a much spreading habit, takes about five months to mature, and bears thin long

pods with three or four seeds in the pod. This is esteemed to be sweeter and is a great favourite with the people for eating purposes. The variety is confined to Bangalore largely and it is probably in the Bangalore District it was introduced first. The variety which is rapidly extending and is grown now most is called Bādāmi or *Sime Kayi* is also a spreading long season variety but with a thicker shorter pod with only two seeds in the pod. This is reckoned to have a higher oil content though not as nice to eat as the local variety. In addition to these are other varieties introduced by the Department of Agriculture, the same Japan and Spanish referred to already, which are erect in their habit of growth and also mature in 3½ months and Mauritius and Virginia which are trailing long duration varieties with large pods.

Cultivation methods.

The land intended for the crop receives a good preparatory tillage in the early monsoon rains; sowing is in July for the long season variety and May for the early maturing variety. Seeds are sown in plough furrows about one foot apart and about 4″ in the rows from each other. After the plants come up, the rows are worked with a *kunte*; this may be repeated in the case of the erect varieties. In the case of the spreading variety, the crop will have to be thoroughly hand weeded. In from 3½ to 5½ months according to the variety the crop matures, the leaves become yellowish and begin to dry. During the later stages of the crop, for about a month or two, the crop has to be guarded against the ravages of crows by day and of pigs and jackals by night. Digging out the pods is laborious; in the case of the early erect varieties, the operation is less difficult as there may be rains at the time rendering the ground soft; also as the pods all form immediately round the base of the plant in a bunch. With the long duration varieties, the harvest time usually coincides with the cessation of the rains for the year and

the ground becomes very hard. About one-third of the crop will have to be paid as wages for digging. If the ground is not very hard, it is usual to plough the land in order to help the pickers to gather the pods more readily. The pods are dried well before they are sold or sent to market for sale; the haulms are fed to cattle if the crop is harvested in time, otherwise they are left in the field as they become too dry to be fed when harvesting is delayed.

Yields.

The later maturing varieties yield more than the early varieties. About 500 lbs. of the latter and 800 lbs. of the former may be taken as average yields per acre.

Under irrigation they may be expected to yield twice or thrice these quantities. With the exception of the comparatively small quantity used as food in the State, the large annual production is exported; the country oil mills and the Anderson Oil Expellers also take up some for milling in the State. The oil-cake is rapidly becoming known as a cattle food and as a valuable manure due to the endeavours of the Agricultural Department which has been popularising it against the initial prejudices of the raiyat.

Safflower and Linseed.

Safflower and linseed are grown to a very small extent, principally for the individual needs of the raiyat. They are grown as mixed crop along with wheat in the black cotton soils, in the Mysore and Chitaldrug Districts. The Safflower is generally grown all round the margin of the field as its spiny leaves prevent the inroads of cattle into the fields of cotton, jola or wheat. Safflower of two varieties., *i.e.*, a large seeded and a small seeded variety, are grown; both, however, are grown for their seeds which find use solely as an article of food. It is not grown in sufficient quantities for the expression of oil.

Fibre crops.

The fibre crops raised as annual crops in the State are:—

(1) Cotton;
(2) Sanabu or Sann hemp; and
(3) Poondi or Bimlipatam Jute.

The raiyats' requirements for ropes and striking and all forms of cordage are also met from the following fibres:—

(4) aloe and
(5) coir or the fibre of cocoa-nut husks, and
(6) from the tender leaves of the Date palm.

Cotton (*Gossypium*).

The cultivation of cotton is confined to the Chitaldrug and parts of the Tumkur, Shimoga, Kadur and Mysore Districts. Until recently, it used to be grown only on the black cotton soils in the State as the indigenous variety cannot be raised successfully on any other soil; but with the introduction of the American Upland variety, called Dharwar-American, which can be grown on the red soils as well, practically all kinds of soils are put down to the crop. The annual area under the crop has steadily increased, reaching about 100,000 acres. In 1923-24, the total area under this crop was 88,283 acres as against 147,280 acres in 1919-20, 125,125 in 1918-19, 56,669 in 1921-22 and 83,120 acres in 1922-23. On the black cotton soils of the T.-Narsipur and Chamrajnagar Taluks, cotton is beginning to be displaced by dry land mulberry as the price of silk has been very encouraging.

Varieties.

The varieties grown are two indigenous types of *Gossypium herbaceum*, both called Sannahatti; *viz.*, (1) grown in the Mysore District which is the Nadam cotton of Coimbatore, (2) grown in Chitaldrug called the Chitaldrug Sanhatti; and two types of *Gossypium hirsutum* the American Upland Cotton, *viz.*, (1) the Dharwar-American and (2) the Cambodia Cotton. The last has been only a recent introduction being about eight or nine years under cultivation in the State. The first two types differ in many

respects from the second two types; the former have a tall habit of growth, the branches growing mostly upwards giving the plants a tall and spindly appearance, the stem and leaves are green throughout, while the flowers are deep yellow with an "eye" or dark spot inside at the base of the petals; the fruits are smaller, the cotton gives a smaller percentage of lint, and the yield per acre is also low. In the latter type, the branches grow more horizontally giving the plants a thick bushy appearance, the stems and the midribs of the leaves are reddish in colour, the leaves and fruits larger, the flowers cream coloured and with no "eye;" they mature earlier, give a better yield and the percentage of lint is higher. The type is, however, not so hardy and is subject to disease notably a reddening of the leaves followed by the shedding of leaves and bolls.

Rotation.

Cotton is grown either pure by itself or as a subordinate crop. From December onwards the green pods are picked and sold as a vegetable. The crop is harvested when the pods are quite dry; it is threshed by beating the pods when quite dry with sticks. The haulms form excellent grazing and are to a considerable extent gathered and stacked. A great part, however, is grazed down in the field itself.

On the black cotton soils, cotton is always rotated with jola; in the Mysore cotton tract, cotton is taken only once in three or four years on the same land, jola, wheat, pulses like cowpeas, Bengal gram, Black gram, etc., being grown in the other years. On the red soils where Doddahatti (Dharwar-American) is grown, the cotton may follow jola or ragi, according to the fancy of the raiyat.

Cultivation of local cotton.

The preparation of the black cotton soil for cotton or other crops has been described under "Soils" and also under "Implements." The land is ploughed with the first heavy rains in the months of May and June; the

heavy Doddakunte is worked several times, the jola stubble is completely cleared, the field is manured with cattle manure and worked with the light kuntes. In about August, cotton is sown; for this purpose, the seed is prepared by being rubbed up with wet earth and cow-dung which makes the fluff adhere to the seed; sowing is generally through a two tined drill, a saddle being tied behind each tine. Seed is covered with light kuntes. After the cotton is well above ground, interculturing is given thrice at frequent intervals with the special hatti kunte. If the weather is too wet for these weedings and the interculturing is omitted, the crop receives a serious set back.

For three months from February onwards pickings go on, usually three in number, as the bolls are in different degrees of ripeness and do not therefore open at the same time. Round Harihar, Davangere and Chitaldrug where good crops may be seen, yields up to 30 *maunds* of seed cotton per acre are reported; but about 12 *maunds* may be taken as a fair average.

Cultivation of Dharwar-American cotton.

In the case of the Dharwar-American cotton, the sowings are much earlier; the red soils admit of ploughing even with ordinary showers unlike the black cotton soils. The land is prepared as for any other dry crop and the cotton is sown through saddes in the month of May or early June. The field is also set out chessboard fashion by working a plough or a cotton drill (without the sadde) lengthwise and crosswise, and the seed is sown at the intersections much in the same way as castor. Interculture and weeding are as already described. The pickings finish by the end of the year.

Cultivation of Cambodia cotton.

Cambodia cotton is grown under irrigation in Hiriyur and Challakere, and as a dry crop in Chamarajnagar; yields up to 40 *maunds* of seed cotton per acre are obtained,

provided the plants do not become diseased. But both the varieties are subject to the attacks of the stem borer and of the red leaf disease. The bolls are also attacked by the boll worm which also cuts down the yield considerably.

Through the depôts maintained by the Department of Agriculture, seed of good quality is supplied in large quantities to raiyats; trials of cotton varieties with a view to isolate superior types and later multiply the same for general distribution are conducted on the Government Farm at Babboor in the Hiriyur Taluk.

Sann hemp (*Crotolaria juncea*).

This is grown for the sake of fibre only to a very limited extent. Its cultivation for this purpose is confined practically to certain parts of the Bangalore and Tumkur districts, chiefly the taluks of Dodballapur, Gubbi and Sira. The crop is sold to the "Gōnigars" who spin and weave the fibre into the coarse tent cloths which are made use of for bags, curtains, awnings and so forth. The Sanabu for this purpose is grown both on paddy lands as a semi-irrigated crop and on the red soils of dry fields as a rain fed crop. It is sown in the Mungar rains on lands roughly prepared by broadcasting the seed and ploughing to cover them. Seed is sown very thick to supress branching. Little further attention is paid; with a favourable rainfall, the crop grows luxuriantly reaching a height of about ten feet. The plants are allowed to set and ripen seed before being cut down though it is believed that for the best fibre the plants should be cut before the seeds set. The raiyats, however, leave them till the seeds are ripe and then cut down the plants; the seeds are beaten out and the stalks are sold to the "Gōnigars" who prepare the fibre by retting the stalk in water which helps the fibrous bark to peel off.

The seeds are purchased largely for being sown in paddy fields for growing the sann hemp crop as a green manure (see under green manures).

Poondi (*Hibiscus cannabinus*).

Poondi is also a minor crop. It is sown along with ragi as a mixed crop, and even then only a few rows just enough for the needs of the individual raiyats. The plants are allowed to grow till they flower and seed, then cut down for retting. On a small scale they are grown throughout the eastern districts.

Aloe (*Agave americana*).

The other fibres, *viz.*, aloe and cocoa-nut furnish the bulk of the cordage requirements. Aloe is the *Agave americana*, also called "railway aloe," as it has been planted on both sides of the railway lines in the country. Though raiyats do not raise any aloe plantations, stil the aloe has become a favourite hedge plant with the raiyat which gives him also the fibre he needs. The aloe supplies the bulk of the raiyat's needs in the way of ropes for carts, *kapiles*, bullocks, etc.

Another important source is referred to under cocoa-nut. The tender leaves of the date palm furnish excellent material for ropes. In Sira, Challakere and the eastern dry taluks, thick *kapile* ropes are made out of these leaves, by splitting them into narrow strips almost as thin as fibre and plaiting them into thick strands.

Tobacco (*Nicotiana tabacum*).

Tobacco is raised as an important field crop in the Hunsur and Yedatore Taluks of Mysore and in the adjoining taluks of the Hassan District and in the Chitaldrug District. In these tracts, it is mainly raised as a dry crop; but in certain taluks of Chitaldrug, Tumkur and Kolar, it is an important money crop raised under well irrigation. Elsewhere, practically throughout the State, the crop is also raised in small patches by most raiyats for their own individual needs. The land under tobacco cultivation during the years 1922-23 and 1923-24 was 23,521 and 26,289 acres respectively.

Dry land tobacco.

Dry land tobacco is raised both on the black cotton and on the red soils; the latter, however, constitute the bulk of

the area. The red soils preferred are fairly light or medium in character, with a considerable admixture of fine gravel. The cultivation of dry land tobacco is carried out with great care and thoroughness. Though it is a crop which occupies the ground only for about 3½ to 4 months, yet it forms the sole and only crop of the year on the land, as the land is under preparation for the greater part of the year.

Varieties.

Two varieties are raised, one broad-leaved and the other with long narrow leaves. In the Mysore District, the former is extensively grown while in the other parts both varieties can be seen. Each variety is, however, grown by itself and mixtures are seldom met with.

Cultivation.

For dry land tobacco, the land is ploughed and reploughed with every rain from the earliest onwards; the thorough drying of the ploughed lands in the hot months is considered very beneficial; the *kuntes* are worked more than once, sheep are folded on the land and manure also applied at the rate of about 30 cartloads to the acre; heavy manuring is more usual with the irrigated crop than with dry land crop. The soil is thoroughly cleared of weeds and reduced to a fine tilth. Plough furrows are drawn at regular intervals of three feet both lengthwise and crosswise. These operations finish by about the end of September and the planting is done immediately after. For this purpose, seedlings are raised separately in the raiyat's back garden or other suitable place, where the seeds are sown in July so that seedlings of about 45 days old may be ready for transplanting. This takes place during the early north-east monsoon rains; the plants carefully removed from the nurseries are inserted two or three in each of the little holes prepared for them in the field; a small twig is planted by the side of each seedling to shade

it; if there be no rains at the time, some amount of hand watering is also done, for which water is carted to the fields. After the plants take root, from about the 20th day the *kunte* or plough is set going both across and along in the interspaces for clean and thorough interculture. When the plants have put out from ten to twelve good leaves, further vegetative growth is checked by pinching off the tops. All side shoots which begin to arise as the result of this operation are gone over and removed as they appear. The leaves begin to yellow in about four months from planting, when they are either harvested by the raiyat himself if he chooses to curve the leaves, or sold as standing crop to men who make a profession of buying and curing the leaves. The crop is sold at so much per 1,000 plants; usually about 4,000 go to an acre, as the plants are not planted exactly one yard square.

Curing methods.

In curing, two methods are common; the plants are cut whole at the base and allowed to lie in the fields for three days, they are then split along the length into two halves, and these are strung on a line in the open till they become more brown than yellow. They are then taken to a shed or to the raiyat's house where they are first cut into short lengths (two leaves each) piled in heaps of thirty to dry; after three days the piles are divided into two and dried, then again into two after three days; when thoroughly dry, the leaves are all piled together neatly covered over and weighted. The next day the pile is opened and rebuilt, changing the position of the leaves in the heap so that they may sweat uniformly. This is repeated on three or four occasions at intervals of a few days; the heap is not allowed to heat up too much, a little water is sprinkled, and the heap opened up for rebuilding whenever it is felt to become too hot. This process goes on till the curing is complete and no more heat develops. The leaves are then sorted and tied up into compact round bundles for the market.

In another method followed in the Hunsur Taluk, the plants are cut whole and are dried in the field without splitting the stems and are strung out to dry under shade for about a month ; then they are piled up and cured as in the first method.

Irrigated tobacco.

In the case of the irrigated crop, the land is heavily manured, and the crop is succeeded by irrigated ragi or paddy in the same year. Irrigation is given regularly and copiously and all the weeding is done by hand. The method of curing is the same as for the dry land crop. The dry land crop, especially in the black cotton soils, gives a fair ratoon and even the red soils, if there should be a suitable rain, give a small second crop which is gathered and cured for the raiyats' household use. The tobacco stems are also sold to poor people ; powdered up with the refuse, the leaf stalk, etc., it forms a low grade chewing tobacco. The tobacco grown in the country is used principally for chewing purposes and for the making of snuff; in fact, the dry land tobacco of Bettadpur (Hunsur Taluk) and that neighbourhood is greatly fancied for this purpose and very high prices are consequently paid for well cured lots. A large quantity is exported to Madras for the snuff makers.

Tobacco pests.

Tobacco is not without its crop pests; plant lice are very troublesome and if rains are not favourable, do much damage, checking the growth and disfiguring the leaves. Orobanche, a vegetable root parasite on the tobacco, is also common though the damage is not great.

Chillies (*Capsicum frutescens*). Dry land chillies.

Like tobacco, chillies form an important crop grown both on dry lands and under well irrigation. It is a most important and indispensable article of the dietary of the people and practically every raiyat grows a small patch of it for household needs. The area under this crop in

1923-24 was 59,393 acres. In parts of the Chitaldrug, and Hassan Districts, it is grown on large areas on the dry land. Both the red soils and the black cotton soils are put down to the crop; the latter gives the better yield. The cultivation is as thorough and careful as for dry land tobacco, ploughing several times, working with kuntes and so on, producing an excellent, fine and deep tilth. The variety grown is principally a long, thin, stringy variety, which is a heavy yielder and is yet quite hardy. It is also exceedingly pungent, which is all in its favour. In Mysore, a thicker and shorter variety is grown. Fancy varieties are grown in gardens, notably round Seringapatam. Seedlings are raised in small nurseries in the backyards or gardens, for which they are sown in the month of June and are kept watered regularly. Seedlings fit to transplant are ready in about a month or five weeks and transplanting is done about the same time as sowing ragi in mid-July or early in August. For transplanting, in the Chitaldrug District, plough furrows are drawn lengthwise and crosswise at intervals of 18″ and the intersections are manured with a little cattle manure and one or two seedlings are planted in each hole. After the plants take root, interculturing with special *kuntes* is done twice so as to remove the weeds and to earth up the rows. At one of the hoeings, some manure is also given to the plants. In three months green chillies can be picked but the field crop is not gathered green. It is allowed to yellow and ripen. The crop continues to bear even till February, though the bulk of the pickings finish by the end of December.

Irrigated chillies.

In the Goribidnur Taluk of Kolar and in all the well-irrigated tracts of the north-eastern part of the State, excellent chilly crops are grown under irrigation. The crop is heavily manured with sheep folding and cattle manure, while it is prepared and after the first hoeing, oil cake is applied as manure at the rate of about 30 *maunds*

an acre. Yields up to a 100 maunds of dry chillies are said to be produced but 30 maunds may be taken to be an average for chillies under irrigation, while 15 maunds may be taken as the yield for dry land chillies. The total land under chilly cultivation during 1922-23 was 59,038 acres.

III. Wet Crops.

Rice (*Oryza sativa*).

Rice is the most important wet land crop of the State. The annual acreage under it varies round 700,000 acres. Being almost a semi-aquatic crop, it requires an abundance of water supplied either by a high rainfall or by artificial irrigation. The acreage is largest therefore in the districts where such facilities exist. The total paddy area was distributed in 1923-24 as under :—

	Acres.		Acres.
Bangalore ...	40,131	Hassan	105,572
Kolar	18,827	Shimoga... ...	204,211
Tumkur	27,198	Kadur	94,406
Mysore	130,921	Chitaldrug ...	25,693

The total for the State is 707,509 acres. In the western districts of the State, it is grown to a great extent with the help of the torrential rains of the south-west monsoon. In the Hassan and Mysore Districts, in the valleys of the Cauvery and its tributaries, it is grown largely under canal irrigation. In the eastern districts, the large rain-fed tanks supply the irrigation water; while in the extreme east and north-east it is grown under well irrigation. In parts of Chitaldrug District and in the taluks of Channapatna, Malvalli and Mandya, quite a large area is under what is called "dry land" paddy; in these areas all low lying places, hollows, and pockets of sandy soil, which collect and retain rain water, are put under this variety.

Soils on which grown.

There is no kind of soil on which paddy is not grown in the State; under most of the tanks, the soils are either clayey or decidedly inclined to be such; in the Cauvery valleys, the fields are highly gravelly and the soil thin; at

the tail end of most achkats, alkali patches can be seen on which paddy is grown; on the laterite soils may be some exceedingly fine mud and inclined to be boggy. In fact, the incessant yearly use of water on the different types of soils produces several variations which are not ordinarily seen on dry land soils. Once water can be had, paddy is invariably put in, whatever the soil condition may be. The best crops are obtained where there is an abundance of water and the soil is a clayey one with ample drainage.

Varieties.

The kinds of paddy grown in the State are numerous. One hundred named specimens can be seen in the Museum collection in Bangalore. There is no doubt there may be more. Many of these are, however, merely nominal varieties as one and the same kind of paddy is known by different names in different parts of the country. The commonest way in which such duplication arises is the fact that paddies are called after the names of the places from which they may have come into any particular village, and with every such migration, there is the chance for a new name. But even allowing for all such doubtful or nominal varieties, the number of varieties in the State is truly remarkable. They differ in the colour and fineness of the grain, in the period of growth, in the adaptability to different conditions of water supply, in their yielding capacities and so on.

The following are some of the chief varieties of the State:—

(*a*) *Maidān varieties*:—

(1) Dodda Byra, grown under "punije" methods, a coarse long duration variety,

(2) Bolu Mallige, a medium quality general in Tumkur and parts of Bangalore and Mysore,

(3) Maralkanti, a coarse paddy general in Tumkur,

(4) Kembuti Sanna,

(5) Patsōmnahalli Sanna,

(6) Bile Sanna,

(7) Saklāti Sanna, all main season fine varieties common in the Cauvery channel tract,

(8) Kaddi Sanna, a medium quality main season paddy in the same tract,

(9) Hālubbalu, a short season (4 months) paddy of medium quality, very general in Tumkur and Chitaldrug, fit both for the Kārthik and the Vaisāke seasons,

(10) Kapile Sanna, a short season fine variety, superior to Hālubbalu and grown largely in the Goribidnur, Maddagiri and Koratagere taluks, and

(11) Chintamani Sanna, a main season superior paddy, general in Kolar and parts of Bangalore.

(*b*) *Malnād varieties* :—

(1) Dabbinsāle, a main season variety with thick white rice,

(2) Sidsale, and

(3) Shimoga Sanna, both medium quality white rice of the main season,

(4) Jeddu,

(5) Hegge, and

(6) Jolaga, very coarse varieties of the Malnād, giving red rice and used considerably for making parched rice (Kudapal akki).

Cropping seasons.

In most *Maidān* parts, two crops of paddy are grown in a year, the *Kārthike* or rainy season crop and the *Vaisāke* or the hot weather crop.

Rotation.

The commonest rotation is that of paddy with sugar-cane. Occasionally, white jola and fodder jola are grown on paddy land; especially when it appears likely that the water-supply will not be sufficient for a paddy crop. In this case, the jola is grown from February to June under irrigation, while the paddy is grown as a *Mungar* crop from May to August. Paddy land is also at times planted with plantains for about three years. Transplanted ragi is grown as a summer as well as rain crop in rotation with paddy. In some parts, garden crops such as tobacco,

chillies, brinjals, turmeric, garlic and onions, are at times grown in rotation with paddy on soils that do not become waterlogged.

In localities where rice is sown early in May, Bengal gram, black gram, green gram, and fenugreek are raised in the autumn and winter months. Under the Marikanave tank, every description of dry and garden crop is raised in rotation with paddy.

Preparation of rice fields.

Rice is grown in embanked fields. Level or nearly level beds are necessary, because rain or irrigation water must be impounded and kept at a height which should vary as the crop grows. Small sized fields are the rule in the highly terraced lands under the Cauvery channels while under the tanks in Kolar and Tumkur Districts larger fields are possible and are general.

Rice is cultivated in different ways, *viz* :—

(1) the seed is sown dry much in the same way as a dry crop and either broadcast or in drills;

(2) the field is puddled and the seeds previously sprouted are sown broadcast;

(3) the field is puddled and then seedlings raised separately are transplanted into the fields.

The various methods are described below.

"Puniji" cultivation.

The "Puniji" or "dry" cultivation of paddy called also "Barabatta" is done mostly in the districts of Bangalore and Kolar for the *Kārthike* or the rainy season of paddy under tanks. The variety usually grown in this way is the "Dodda Baira." The cultivation is as follows:— The land is ploughed twice or thrice in the early rains till about June; when the ground is moist after a rain, with moisture enough for a seed bed, the seed grain is sown broadcast and harrowed in with the wooden "halube." The crops receive no attention for two months, when irrigation is commenced. After the first flooding the

"halube" is again drawn over the standing crop in the soft mud, the field is then handweeded, and the flooding is continued as in the case of the ordinary paddy cultivation till harvest.

Puddle cultivation.

The sowing of sprouted seed in puddled land called "Mole" (sprout) cultivation is followed very extensively under the larger tanks in all the districts, more especially in the case of the *Vaisāke* or summer paddy, that is, the one which is sown about December and harvested about April. The method of cultivation is as follows:— The field is watered and the soil is softened and then ploughed in puddle. The ploughing is repeated four or five days till the stubble of the old crop rots well and the soil is thoroughly stirred up. The excess water is then drained. Leaves and twigs are spread on the field uniformly and then trampled in; sprouted seed—prepared as described below—is then sown broadcast; the seed sinks in the soft mud and the next day the field is drained thoroughly. For two weeks water is let in carefully for a few hours and drained, till the crop is well established. It is then irrigated copiously; after a month, harrowing is done both by the hand "harrow" and the bullock harrow; this being repeated both crosswise and diagonally. Hand weeding follows and the crop requires no further attention except copious irrigation till harvest.

The sprouting of the seed required for this as well as for raising seedlings for transplanting is effected by soaking the seed tied up in a bag or in straw twist for a night in water; the bag is then taken out and the contents heaped in a cool place covered up with straw and leaves; the heap is kept moist for two days, after which the sprouts begin to appear. In some places it is usual to mix the leaves of "Tumbe" (*Phomis esculenta*) with the paddy in the heaps.

Drill sown paddy.

In the semi-malnād tracts, the system of sowing dry seed paddy (*i.e.*, not sprouted) in drills in the moist (*i.e.*, not puddled) soil somewhat in the manner of the "Puniji" cultivation already described is common. For this purpose, the land is prepared as if for dry cultivation, *i.e.*, frequent ploughings and breaking the clods by working the "Koradu" and the "Heg Kunte"; manure is spread and the seed is sown through four-tined drills and covered with the "Koradu" or "bolukunte." The field is kept moist but no water is impounded, though rains are frequent. After the crop shows above ground, the "yedekunte" is used between the rows repeatedly, to remove the weeds which spring up in great profusion, and after the "yedekunte," "the koradu" is used to smoothen the field. The "yedekunte" is also made to straddle the rows at the final hoeing so as to remove weeds close to the rows; water is impounded at the third month after sowing, the "yedekunte" is used once again, this time being worked in the puddle, the "koradu" or the *noli mara*, both being smoothening planks, are made to follow the "yedekunte"; the bruising of the crops by these implements being said to help the crop to tiller; the field is also levelled thereby. More handweeding follows, and the crop thereafter receives no further attention. After harvest, the grain remains unthreshed for a considerable time in these tracts, and is taken up at leisure any time within a month.

Transplanted paddy.

The method of growing paddy by transplanting seedlings is prevalent largely throughout the State, more largely, however, in the Maidān districts than in the Malnād. This practice has apparently displaced the other methods in many parts of the country, as a comparison of the present practices in these parts with those described by Dr. Buchanan will show. This method of cultivation as carried out in the channel tracts of Mysore is as follows:—The paddy land is ploughed soon after the

harvest of the paddy as early as the condition of the soil will permit it; in the month of April or earlier, provided there is rain, green manure crops are sown. In June, water is let into the fields and the green manure crop is trampled in. The crop rots for a week, when the field is ploughed once again, the bunds are trimmed, and the puddle is levelled. Into this puddle seedlings abount 30 days to 45 days old are transplanted in bunches containing from 4 to 15 plants, at intervals of about a span. Water is let in scantily till the yellow of the transplanted seedlings changes into a deep green, after which the field is kept continuously irrigated till about 10 days prior to harvesting when the water is stopped. The crop is harvested and threshed straightway.

The seedlings required for this are raised in a separate nursery; this prepared with great thoroughness, a fine tilth is prepared; a heavy dose of manure such as ashes and cattle manure is applied, and the seed is sown in semi-puddle; a seed rate of about 800 to 1,000 *seers* to an acre is usual, so that the seedlings come up very thick. Seed is usually sown dry but sprouted seed is also sown. Water is let in through small shallow drains till the seedlings come up; after this the plot is watered regularly without flooding the field. Prior to transplantation the plot is flooded to soften the soil.

Yields.

Among these various methods, the last-named, *viz.*, transplantation gives a high yield; the expenses of weeding are also less; on the other hand, extra labour is necessary and when such cannot be had, the method cannot be adopted; there is also a great saving in seed; and if economically done, *i.e.*, transplanting the seedlings single or in doubles, the saving may amount to nearly 50 *seers* an acre, as ten *seers* will be enough for such transplantation while 50 to 70 *seers* will be required for broadcasting.

The outturn of paddy varies a great deal; in the Cauvery channel tract, about 15 *pallas* may be taken to be the average. The highest yields are, however, obtained under the tank and well irrigation in Kolar and Tumkur where cultivation is very carefully carried out. From 20 to 25 *pallas* are often obtained on the best lands. The precarious "Punije" will average about 7 to 10 *pallas* an acre.

Preservation.

The grain is always preserved in the husk or in paddy, either in large earthern jars or in pits or store houses strongly floored with plank or in small cylindrical stores made of clay or in bags made of straw called *Mude*. Paddy will keep for two years without deterioration and four years without being unfit for use.

Converting paddy into rice.

There are two ways of converting paddy into rice, one by boiling it previously to beating and the other by beating alone. Rice prepared by boiling is called *Kudupal-akki*. Five parts of paddy are put into a pot with one part of water and boiled for about two hours, till one or two of the grains burst. It is then spread out in the sun for two hours and the drying is repeated the next day, after which the paddy is immediately beaten.

The rice called *Hasi akki* is never boiled. The paddy is exposed two hours to the sun and subsequently beaten. Beating is performed chiefly by women. The common method is by means of wooden pestle, about four feet in length and three inches in diameter, made of heavy timber and shod with iron. The grain is put in a hole formed in a rock or stone. Sometimes the *Yēta* is used. It is a block of timber fastened to a wooden lever, which is supported on its centre. The woman raises the block by pressing with her foot in the far end of the lever and by removing her foot, allows the block to fall down on the grain. Still another method is to pass the paddy

through a large wooden mill of the same type as the stone grinding mill. However, several rice hulling machines have been recently introduced in the State.

Rice pests.

The rice grass-hopper while found widespread in Mysore, has as yet proved a serious pest only in a few isolated localities. The most efficient method of combating these grass-hoppers, according to the Agricultural Department, is by catching them in bags; about which full instruction is given by the Department. The most apparent damage done to the paddy is in cutting through the stem, so that the ears fall to the ground.

In certain years, during the months of August, September and October, when paddy has grown over a foot in height, a serious pest appears in many parts of the State, called *Kokkare rōga*. The popular name describes the usual symptom of the leaves showing white patches here and there and of their tips turning white altogether; the whole crop appears whitish and shrivelled up. The Department suggests a suitable remedy through the use of kerosine oil for effectively dealing with the pest.

Exports and Imports.

Mysore imports a considerable quantity of rice and exports a large amount of paddy to the Madras Presidency. The quantity of rice imported in 1922-23 was 17,671 tons and that of paddy exported 1,967 tons.

Sugar-cane (*Saccharum officinaram*).

Sugar-cane may be considered to be the most important money crop of the State. Between 35,000 and 40,000 acres of cane are grown yearly, the area fluctuating greatly from year to year.

It has to be grown only under the most assured sources of irrigation water where water for irrigation can be had all through the year. The important irrigation tract of the channel areas of Mysore where water is let into the channels only during six months of the

year is not at present suitable for sugar-cane for this reason. With the hot weather supply of irrigation water proposed to be given in this tract on the completion of the Krishnarajasagara Dam, a great extension of cane cultivation in this tract may be expected. It is only under the large tanks that cane is grown principally; wells are also dug to supplement the tanks and also as independent sources of irrigation for sugar-cane.

The area under sugar-cane in 1923-24 was distributed as under:—

		Acres.			Acres.
Bangalore	...	4,754	Hassan	...	5,622
Kolar	...	7,545	Shimoga	...	7,672
Tumknr	...	1,344	Kadur	...	2,003
Mysore	...	5,348	Chitaldrug	...	1,178

Total for the State 37,922 acres.

Soils on which grown.

Sugar-cane thrives best on a light clay with thorough drainage; under most of the tanks, the soils are of this character; in many parts of Kolar and Bangalore, the sugar-cane soils are of a light character; under many of the tanks and channels in Mysore, Tumkur and other districts the sugar-cane soils are very heavy clay. As drainage is very important, the raiyat generally tries to provide it; and further works up his soil with addition of clay or sand to the consistency of a clay loam.

Varieties.

There are three main varieties grown in the State, *viz*:—

(1) The *Cheni* or *Mara Kabbu*, a thin white cane with a hard rind taking 12 to 18 months to mature, and capable of standing considerable shortage of irrigation water; it gives a juice of high sugar content yielding good firm very light coloured jaggory. This is the cane grown to a large extent in Hassan, Shimoga, Chitaldrug and Mysore.

(2) *Pattapatti*, a red and white stripped cane less hardy than *Cheni*, has a rind not so hard as *Cheni*; matures in 12 months, the juice has a high sugar content and yields a good

quality of jaggory; it responds well to manuring and irrigation yielding as high as 400 *maunds* of jaggory per acre as a maximum. It is said to have been introduced into the State from Vellore during the reign of Tīpu Sultān by one Mustapha Alī Khān, paymaster of the forces. It is now very generally grown throughout the State but largely in Kolar, Bangalore, Tumkur and Mysore.

(3) *Rasdali*, a greenish white soft juicy cane, requiring great attention; the juice is not so rich as either *Pattapatti* or *Cheni*; matures in ten months; is grown largely mixed with *Pattapatti*.

New varieties.

The varieties mentioned above may be taken to be the present local varieties; in addition, during the last fifteen years as the result of the work of the State Department of Agriculture, several new varieties have been introduced. Among these the Red Mauritius cane has been taken up extensively; it is a cane with a hard rind, purple in colour, rich in sugar, grows very tall and gives a heavy tonnage per acre. The quality of the jaggory is not so good as that of the local light coloured canes. Besides Red Mauritius cane, Java, B. 208, striped and ashy Mauritius, Elephant cane and several among the new seedling canes originated in the Hebbal Farm may also be found mixed up here and there in many a raiyat's sugar-cane field. These new seedling canes are very large in number and are being tested both on the Government Farms and on private holdings.

Rotation.

The general rotation is of sugar-cane and paddy; other garden crops, irrigated ragi and jola may also be taken. In the Mysore district, it is usual to take a catch crop of vegetables such as radish, onions and greens under the young cane in the first three months after planting.

Ratooning.

Very little ratooning of cane is done in the State except in the Malnād. Even here only a first ratoon is taken and the field is then got ready for paddy.

Preparation of the soil.

The land meant for sugar-cane is given very thorough preparatory tillage; the land is ploughed several times; worked with the *kunte* and harrow; weeds and stubble are gathered and burnt; the clods are broken by mallets; sand or silt is carted and ploughed in; sheep are folded on the land; and cattle manure also applied, usually at from 30 to 60 cartloads an acre. In the case of heavy land, the field is laid into beds 8 to 12 feet broad and as long as the field, and divided from each other by drainage trenches; on these ridges, small pits are made at two feet intervals for receiving the cane sets. In the Kolar District, however, the field is ploughed into ridges and furrows about 1½ to 2 feet apart, and the cane sets are planted in these furrows through which irrigated water is also let in.

Planting method.

The most common season for planting is February and March. An October planting is also prevalent in parts of Mysore and Tumkur. The crop is propagated generally from sets or cuttings and sometimes by planting whole canes. The sets consist of pieces of cane, each with three eye buds and generally about a foot long. Irrigation is given immediately after planting, either by hand-watering in the case of pit planting or by furrow irrigation in furrow planting.

Manuring.

The manuring consists of 30 to 60 cartloads of cattle manure applied as already stated (or less in case sheep are penned on the land) when the land is being prepared. When the canes are three months old, oil-cakes, *honge* leaves and flowers are applied especially in the Kolar and Bangalore districts. The cake is applied at the rate of 10 *maunds* of 25 lbs. of 1,000 sets. The use of oil-cake and other manures like sulphate of ammonia are being popularised by the Department of Agriculture (see under *Manures*).

After cultivation.

Sugar-cane requires constant attention during the first four to six months of its growth. Soon after planting, hand weeding is required, which is repeated as often as necessary. Digging between the rows with a light pick is beneficial. As the crop acquires height, the canes should be supported by earthing them up. This is done three or four months after planting. The canes originally planted in flat beds or in furrows are earthed up with a small hand hoe so as to form ridges the furrows between which serve as water channels for further irrigation. Wrapping the cane in its own dead side-leaves, though costly, is usual and is required where rats, jackals and wild hogs are numerous and destructive.

Harvesting.

The crop matures in from 10 to 18 months depending upon the variety.

The cane is cut with a sharp sickle, one or two inches above the ground. The dry side leaves are striped off with a sickle and the green top leaves removed for fodder. Two or three of the young tops or internodes are removed and are kept aside for being used as seed sets. If these are left on and milled, the resulting jaggory may not set. The cut cane is tied into head-loads or cartloads and carried to the mill.

Milling and mills.

The cane is crushed in iron mills, the old wooden mills having entirely gone out of use.

The iron mills now used are three roller mills of different makes; one of these is of local origin, *viz.*, the Rickie Mill. This was made by Messrs. Rickie and Co., Engineers of Bangalore, and for a long time commanded a wide sale. A large number of mills are made in Madras foundries, one by Messrs. Gopal Nayakar and Sons is much in use. In Chikballapur, Channarayapatna and Kirangur near Seringapatam and Kunigal, lathes are owned and worked by local people to groove worn rollers

and to make petty repairs. The Department of Agriculture has been popularising the "Nahan" bullock power mill which is made in the Punjab, as it gives a high extraction and is substantially built.

Jaggory boiling furnaces.

The furnace over which the juice is boiled is an open hearth dug in the ground sometimes constructed half way up the middle to receive a crude substitute for fire bars; or often without any such arrangement at all. The top of the hearth is shaped so as to receive a large round open iron pan with flaring sides in which the juice is boiled. One or two holes in the ground by the side of the pan serve as a vent for the smoke to escape. These pans take enough juice to make three *maunds* (or 75 lbs.) of jaggory at one charge. The juice is strained and put into the pan, and a quantity of slaked lime is added which is decided by the experience of one or more trial boilings. In certain places, quick lime powder is added instead of slaked lime and in certain parts of Kolar where "Country sugar" is made, no lime is added at all. As the juice heats up, the scum which forms is removed by little basket ladles or metal ladles, especially in Kolar and Bangalore; elsewhere the scum is not removed at all.

Jaggory boiling.

Brisk heating is continued and the stage to stop the heating and remove the pan from the fire is a matter of experience; a little of the thick syrup taken out quickly on the finger point should be able to set with a little kneading and cooling. The professional men are very good judges on the whole and rarely make a mistake. The pan is removed from the fire at this stage, is stirred with long handled wooden stirrers and then poured into a wooden cooling trough from which after a little while it is emptied into moulds to set into jaggory. As it is made in Bangalore and Kolar, the cooling

takes place in the pan itself and when sufficiently cooled and thickened, the mass is taken out in large or small handsful and rolled between the hands into large balls (in the Bangalore District) or into small ones of the size of pastry cakes (in Kolar). In Chitaldrug and parts of Hassan, the syrup is allowed to set as a large one inch thick slab which is then broken up. In the Malnâd the jaggory does not set and even if it does, in the monsoon it begins to run; for this reason, the thick syrup is poured into pots and is preserved as a massecuite. In Kolar and Bangalore, it is also usual to rub down the whole of the concentrated syrup, as it cools and solidifies in the pan, into a fine powder which is sold as "Makudam" sugar; when the colour is good and the powder uniform without any lumps of jaggory in it, it fetches as high a price as sugar.

Country sugar.

In Kolar, again, especially in Sidlaghatta, Bowringpet and Mulbagal Taluks, there are establishments for making local white sugar by a system akin to the old West Indian method of "Claying sugar." For this purpose, the juice is boiled down to a stage just prior to the jaggory stage, *i.e.*, into a good massecuite; it is then poured into pots to crystallise; after a month or three weeks, the pots are punctured at the bottom so that the molasses could drain; when no more molasses drain freely, the pots are broken and the crystalline mass is broken into rough pieces and charged into wicker baskets and covered over with wet moss; more molasses drain out and the sugar also improves in colour; the moss is changed six times, when at the end of 30 days a clear raw sugar results; this is later on dissolved in water and boiled and the syrup is rubbed down so that a fine soft white sugar results, fetching a price much higher than that of even refined sugar. These establishments had all gone out of operation for many years

owing to the competition of cheap imported sugar, but reopened after the last War broke out in Europe. They have nearly all shut down again with the return of normal conditions.

Yields.

The outturn of jaggory per acre varies greatly but if the crop has been at all fair, about 150-200 *maunds* of jaggory can be obtained. Yields, however, as high as 500 *maunds* are reported.

Sugar-cane and the Government Farms.

The Government Farms are all doing considerable work on sugar-cane. At Hebbal, cane varieties are originated and tested; manurial and cultural experiments are conducted; improvements in mills, furnaces and boiling methods are studied; on the Babboor Farm, sugar-cane cultivation is on a large scale and is conducted as a commercial undertaking with experiments in large scale methods, and with varieties and manures incidentally. In Nagenahalli (Mysore District), varietal trials are conducted and good varieties multiplied for seed distribution in the channel tract. The large sale of new mills, new varieties of cane, planting of canes in wider rows, the extended use of oil-cake manure, and the adoption of furnaces with chimneys, fire bars, etc., are all results based on the work of these farms.

IV. Garden Crops.

Areca Palm.

The areca palm (*Areca catechu*) belongs to the group of palms of which the other common representatives in Mysore are the cocoa-nut, date, *bagini* (*Caryota urens*), *kiri ichalu* (*Phœnix acaulis*) and *thadasalu* (*Arenga wightii*). It has an elegant, straight and unbranched stem with a crown of green leaves at the top. Next to the cocoa-nut, it is economically the most important palm, every part of it being useful to man in one form or another.

Area under crop.

The total area under areca palm during 1922-23 was 53,242 acres. It is most extensively grown in the *Malnād* or western part of the State and especially in the *Malnād* of the Shimoga District. The following are the figures for the various districts in 1922-23 :—

	Acres.		Acres.
Bangalore ...	756	Hassan ...	2,821
Kolar ...	636	Shimoga ...	15,409
Tumkur ...	7,994	Kadur ...	6,497
Mysore ...	3,403	Chitaldrug ...	3,226

Total area for the State : 53,242 acres.

Location of the gardens.

In the *Malnād*, the gardens run in long ranges and are situated in valleys where they are sheltered from heavy winds and have an assured supply of water during the summer months. The ranges are bordered on the sides by virgin forests of great luxuriance which serve both as wind belts and as store houses for green manure and fuel for the cultivator. In some of the *Maidān* parts, the gardens are commanded by at least one tank. In other parts, they lie in the open plains, side by side with wet lands and one or more wells dug in the garden serve as a source of irrigation. In a few other places, they lie along the banks of rivers. In any case, one must have an assured supply of water to grow areca-nut successfully.

Planting.

The trees are almost always planted in rows. Usually and almost invariably in the *Malnād*, a drainage channel is found after every two rows. The normal number of bearing trees per acre is usually four hundred, though it is not uncommon to find a much larger number.

Varieties.

There are no markedly distinct varieties, if we except the sweet variety found in small numbers in the *Malnād*.

Seedlings.

The usual custom is to plant the seed-nuts in a nursery and, when they have sprouted and grown sufficiently, to

transplant them farther apart, either in a nursery plot or near the drainage channels. When the plants are from three to four years old, they are planted out in gaps in the gardens, in pits, one and a half to three feet deep and three feet square.

Growth. The plants continue their vegetative growth for about eight years and then put out their first flower stalk.

Manuring. In parts of the *Maidān*, the gardens do not receive any manure. In some places, the river floods the gardens and a valuable amount of silt is left. In other parts the gardens receive a heavy application of cattle manure. Tank silt is also used. In the *Malnād*, cattle manure is always supplemented by green manure. The Agricultural Department is carrying on experiments in manuring areca gardens.

Crops associated with areca-nut. In areca gardens, one or more of the following subsidiary crops are also grown, *viz.*, betel-vines, plantains, pepper-vines and cardamoms.

Laying out a new garden. A suitable piece of land is selected (in a valley in the *Malnād* and under a tank or in a fertile area in the *Maidān* tracts) for making a new plantation. All scrub jungle and roots of dead and decaying trees are removed. Ridges are formed and channels are dug. Plantains are planted about eight feet apart, two rows being put in on each plot of ground situated between two trenches or channels. When the plantains have grown for about twelve months, young areca plants are planted in pits dug in the same rows. The plantains serve to protect the young areca palms from sun and rain and later act as wind breaks to check the velocity of the wind in the monsoon. When the areca palms have grown for sometime, cardamom plants are put in along the channels

and pepper vines are trained to the stems of the areca palm later on.

Life of the palm.

After a period of about twenty years, fresh areca palms are planted so that a fresh lot may come into bearing, in the place of those that have become old and ceased to yield. The gardens have always gaps owing to some of the trees dying a natural death, others being blown down by wind, while the damaged ones are cut down.

Harvesting.

In the *Malnād* there are at least three harvests, the first one in September, the second in October, and the last in December, and in the *Maidān*, only two, in September and December respectively.

There are several ways of harvesting the nuts. In *Malnād*, the climber, after climbing the tree, cuts the bunch and sends it down by sliding it along a rope. In other arecas, the bunch is cut and allowed to drop when it is caught in a blanket stretched tight a few feet above the ground. In other cases, a small gunny bag is thrown up to meet the falling bunch. In other areas, especially in the *Maidān*, the nuts are allowed to harden and the bunches are pulled down by means of a sickle attached to a long bamboo. There is a wastage of labour in collecting the produce under this method.

Outturn.

Each tree yields, on an average, two to three bunches and an acre in the *Malnād* gives roughly 800 to 1,000 bunches. Each bunch consists on an average of 200 to 250 nuts so that the total yield in an acre is 1½ to 2 lakhs. The actual yield in dried nuts varies from 20 to 40 *maunds* per acre.

Shelling and curing the nuts.

The bunches are either brought home or piled up in a cool and shady part of the garden where they are shelled. There are two types of implements used in

shelling areca-nuts, one a small curved knife with a sharp point and the other a flat knife. The husk represents roughly 65 per cent of the total weight of the green nuts. The subsequent operations differ in different parts of the State. The nuts are boiled whole in some places, in some places they are cut into two or more pieces. In the *Malnād* the "Batlu adike," *i.e.*, nuts cut into two across the length, are made; in Sira and Maddagiri, "Chooru adike," *i.e.*, nuts cut into eight or six pieces lengthwise and crosswise are made; in Chamarajnagar the nuts are just jammed flat and boiled and the kind called "Jajju adike" are made. Other fancy kinds are also prepared. When they are boiled in water, various organic and inorganic ingredients are used in conjunction with water to prevent excessive removal of tannin and to improve the colour of the nuts. The substance used for this called "chogaru" is the inspissated remains of the liquor in which the nuts were boiled in the previous year. When required for the first time, the "chogaru" is prepared by powdering up roots af *manjatti* (*Pterocarpus santalinus*), a piece of *Raktahonne* (*Aderianthera pavoria*), a large bundle of "nerale" bark (*Eugenia jambalona*), and boiling the mass in water to which betel leaves and a lump of lime of the size of an orange are added. The mixture is boiled down to a thick consistency, filtered and kept for use. Before boiling the nuts, this is mixed with an equal quantity of water and used; after the season's boiling is over, the liquid which remains in the cauldron is dried into a solid and kept as "chogaru" for the next season.

The nuts are taken out by means of a perforated ladle which allows for straining. They are then exposed to the sun for six to eight days or dried over a fire.

A special drying apparatus, manufactured by the Tyneside Foundry and Engineering Works, was imported

by the Agricultural Department and has given very encouraging results.

Uses of the various parts of the Areca palm.

The nuts are used for chewing and manufacture of *catechu*. The stem is used as fuel and for pillars in constructing sheds, etc., and split into two, as channels to transport water from place to place. Split items are used for rafters, fencing, manufacture of torches and for making sides of country carts, and weirs for catching fish.

The midribs of leaves are used as brooms and the leaves for thatching.

Areca-nut pests and diseases.

The disease known as *Kolerōga* in which the nuts rot and drop off is the most serious of all areca-nut diseases, causing as it does annual losses estimated at Rs. 4,00,000. The Department of Agriculture recommends the spraying of the bunches with a special Boardeaux mixture; the method has been taken up by garden owners and the disease has been greatly checked.

Anuberōga is a disease which attacks the roots and the stems and brings about the death of the tree. The treatment recommended is the burning of the affected plant.

Brownspot of the areca-nut is another disease which attacks the nut and makes it rot. The disease is, however, not yet serious.

Hidimundige is a disease in which the stem becomes constricted at the top and the whole crown of leaves becomes gradually smaller. Finally the top dries and falls off. This is attributed to faulty nutrition.

Export.

The export of areca-nut in 1922-23 was 1,578 tons.

Cocoa-nuts (*Cocos nucifera*.)

The cocoa-nut, an important plantation crop, is grown by itself or in gardens in conjunction with areca, mango, jack and other fruit trees. Except in the taluks of

Tiptur, Chiknayakanhalli, Arsikere and that neighbourhood, cocoa-nuts are grown in gardens capable of irrigation from tanks or flooded by rivers. In the former area, the broad and shallow valleys that are characteristic of the tract are planted with cocoa-nuts; the system of cultivation is such that with ordinary rainfall the gardens thrive. In the taluks of Kankanhalli and Chamrajnagar the gardens are made along the river banks which in the latter taluk overflows into the gardens with its silt-laden flood water. Everywhere else the "Bagayat" or gardens under the tanks carry a mixed crop of cocoa-nut with the other crops mentioned above.

Area under crop.

The area under cocoa-nuts in the State is over 122,970 acres. This acreage was thus distributed in 1922-23 over the State:—

	Acres.		Acres.
Bangalore ...	3,925	Hassan	29,465
Kolar	1,427	Shimoga	149
Tumkur	50,772	Kadur	15,899
Mysore	10,873	Chitaldrug ...	10,460

Soils.

Cocoa-nuts are grown generally on the light sandy soils; but the heavy rich clays under most of the tanks also give excellent crops; the soils of the "Kushki bagayat" plantations round Tiptur and Chiknayakanhalli are light red loams and light coloured sandy loams.

Varieties.

Several varieties of the cocoa-nut can be seen in the State; no attempt is made anywhere to grow any variety by itself; all the varieties are grown promiscuously. The varieties are distinguished by differences not only in the size, shape and colour of the nuts but also in the character of the meat inside. Classed according to colour there are:—

(1) the dark green,
(2) the light green,
(3) reddish yellow,
(4) light orange red.

According to size, there are large, medium and shell sized

nuts which are apparently distinct varieties. The medium sized ones are preferred as they give a large number of average nuts per tree. According to shape, there are the the round type which is general and a longish type which under the name of "Gangapāni" nuts is to be seen in certain gardens in Tiptur.

As regards the character of the meat, most varieties have a firm and thick layer giving a high percentage of copra; in others, the meat is thin, though the nut may be large; there are also special varieties; one of these has a soft buttery kind of meat which can be squeezed between the fingers; in another, both shell and meat are very thin. In the case of the Gangapāni and the ornamental orange red cocoa-nuts, the tender cocoa-nuts form a very sweet drink and are specially esteemed for this purpose. Probably the various characters are correlated with one another but the matter requires study.

Starting a plantation.

To start a plantation large dead ripe seednuts, *i.e.*, unhusked ones are selected; those which drop naturally from the trees are preferred. A nursery bed is prepared by digging the soil two feet deep, then leaving it to weather, then filling the pit with sand nearly to the top, laying the seednuts close to each other with the germ end upwards or pointing sideways; they are then covered with soil mixed with sand. The nursery is watered frequently to keep it moist; seedlings fit for transplanting will be ready in three months. Seedlings are transplanted either in their permanent places in the garden or merely to give them more room to grow into larger seedlings. Seedlings more than a year are seldom used for transplanting; but in Tiptur it is also common to plant three years old plants called "Goppe Sosi."

In the dry land plantations of Tiptur and Chiknayakanhalli, the seedlings are planted at distances of 36 feet each way; more than 40 trees to the acre are seldom planted;

where the gardens are commanded by tanks, they are planted closer to give as many as 60 to 70 trees per acre. For the planting of the seedlings, pits about a yard deep are dug and filled with earth mixed with manure and sand quite up to the top. It is believed that the cocoa-nut should not be planted deep.

In the gardens under tanks, moisture is abundant as they are irrigated whenever necessary; in the dry land gardens, tillage takes its place; the gardens have to be ploughed six times in the year, the earlier ploughings help to soak up the rains and the later ones to retain the moisture in the soil. Manure in the shape of sand and red earth and cattle manure is applied about the middle of the year. In gardens, a good digging up is given after the North-East Monsoons are over about January and February.

Harvest and yields.

The trees begin to bear from the 7th year, more generally from the 10th and continue to bear, it is said, for 100 years. About 100 nuts per year will be the yield of an average well-grown tree. Produce is gathered mostly from the month of October onwards. Except in the Tiptur neighbourhood, the nuts are gathered when they are quite ripe from the nuts and sold in the shell. In the Tiptur area, they are allowed to ripen completely and drop. They are gathered and stacked; when a sufficient number accumulates, they are husked in such a way that both husk and shell are removed and the kernel (called "Gitaku") is got intact; they are sold straightway. A thousand cocoa-nuts will give from 10 to 13 maunds of copra of this kind.

The copra so made is sold for use in confectionery and is too valuable to be used for the extraction of oil. Only those which become mouldy and unfit for this purpose are used for extracting oil.

Coir.

Coir, the most important bye-product of the cocoa-nut tree, is made only in the areas where the cocoa-nuts are

picked for the sake of the nuts in the shell, *i.e.*, before they are dead ripe. With dead ripe cocoa-nuts, the fibre is very coarse and woody. The best coir is made from the husks of the cocoa-nuts which are picked young for the sake of the cool refreshing drink they afford at this stage.

Special shows of cocoa-nuts and cocoa-nut products have been held by the Department of Agriculture to demonstrate strikingly the uses of the cocoa-nut palm; special manures are being popularised; the Government also sent at the cost of the State certain selected merchants to study the manufacture of copra and coir in Ceylon and Travancore. Special shows of cocoa-nuts.

The export of cocoa-nuts and copra is valued at about Rs. 53 lakhs (1922-23). Export.

The betel-vine thrives best in low ground where it can have a supply of water. A black soil is required. In the western parts of the State, the betel-vine is grown with areca palm. Betel vine (*Piper betel*).

In the eastern parts, the garden is divided into rows, 10 cubits in width, having on one side an elevated channel for supplying it with water and on the other side, a canal to carry off what is superfluous. The rows are divided into beds. In the centre of each division, a row of small holes is formed, each one cubit distant from the other. In December or January, in every hole, two cuttings of the vine are put, each two cubits long and covered with earth. The shoots are watered regularly; while the four ends project and form an equal number of young plants, they are allowed to climb upon dry sticks, put in for the purpose. In small drills made across each of the beds, are planted rows of the seeds of the *agase*, *nugge*, and *verjpu*. The garden should be kept clean of weeds and manured once a year. When the plants are a year and a half old, they are Cultivation.

detached from the sticks, two cubits of each are buried in the ground and the remainder, conducted close to the root of one of the young trees, is allowed to support itself on the stem. At the end of two years, two cubits more of each plant are buried in the ground and ever afterwards, this is once a year repeated. A plantain tree is planted at each corner of the bed to give additional coolness to the garden.

In the western parts, where the betel-vine is grown with areca palm, when the plantain is fifteen years old, a hole is dug near every tree, one cubit deep and one and a half in width. The ends of five cuttings of the betel-vine are buried in each hole with the upper extremity sloping towards the palms. In the second year, the vines are tied up to the palm. In the third year, and every other year, so much of the vines next the root as have no leaf must be buried.

Harvest.

At the beginning of the fourth year, the cultivator begins to gather the leaves for sale and for 15 to 20 years, continues to obtain a constant supply. Afterwards, the plants die and a new garden is formed. From 4 to 6 pickings a year are had; the money value of the produce of an acre may come to Rs. 2,000 but few raiyats do more than 1-10th of an acre as the cultivation is very laborious and has to be all done by manual labour.

How used.

The leaves are extensively used in the Indian household for chewing with areca-nut.

Coffee. (*Coffea Arabica.*)

The coffee plant (*Coffea arabica*) is believed to be a native of Abyssinia and most writers agree that it was brought to Mysore about two centuries ago by one Baba Budan who had made a pilgrimage to Mecca. The plant is a many branched small tree or bush, which if left to grow naturally, is 15 to 20 feet high and bears white flowers resembling orange blossom.

Area under crop.

Coffee unfortunately registers a continued decline with 122,000 acres in 1914-1915, 108,000 in 1915-1916 and 104,000 in 1916-1917. There was a slight rise with 108,175 acres in 1917-1918 and 110,066 in 1918-1919. But it again began to decline with 106,066 acres in 1919-1920, 106,946 in 1920-1921, 103,951 in 1921-1922, 103,800 in 1922-1923 and 97,585 in 1923-24. The following are the acreage figures from 1916-1917 to 1923-1924:—

	Acres.		Acres.
1916-17	... 104,416	1920-21	... 106,949
1917-18	... 108,175	1921-22	... 103,951
1918-19	... 110,066	1922-23	... 103,800
1919-20	... 106,066	1923-24	... 97,585

Selection of land.

Coffee grows best at altitudes between 2,000 and 5,000 feet with a rainfall of 60 to 90 inches and a temperate climate. Sloping or even fairly steep land is suitable, provided that surface erosion is prevented; good natural drainage is important and flat and wet lands are unsuitable.

There are five descriptions of land in Mysore in which coffee has been planted :—

(1) The forests termed *kans* generally situated in mountainous country intersected by streams of clear water, with rocky or sandy beds,

(2) Heavy ghat forests termed *male*,

(3) Village jungles termed *uduve*,

(4) *kumri*, or land, the original timber on which having been cut, has been followed by a secondary growth of trees of a smaller type and

(5) *Kanave*, or land covered with hard wood-trees or bamboos.

Some of the finest estates have been formed on lands of the first and third classes which have the decided advantage of possessing a rich deposit of decayed vegetable mould that has not been exposed to atmospheric influences, and hence contain an almost inexhaustible store of organic and

inorganic constituents available as food for the coffee plant.

Soil

The land selected for growing coffee should be a rich sandy loam containing an abundance of humus with a well drained gravelly sub-soil. If clayey soils are used, they must be frequently limed.

Preparation of the land.

The best plan is, after felling and clearing the land, to remove all the stumps of the jungle trees, and then to fork the whole clearing, two feet deep, taking out as many roots as possible. The stumps and roots removed should be subsequently burnt. This work should be done at the beginning of the dry weather and with the first rains, the whole clearing should be thickly sown with a green dressing crop and the permanent shade trees planted and the pits for the coffee plants made.

Selection of seed.

Seed should be obtained from healthy strong trees known to be good croppers and should be fully ripe. The seed should be obtained from another estate or preferably district and only the very best, perfectly shaped beans selected for sowing.

Nurseries.

A light sand soil not too far from a supply of water may be selected. The soil should be dug deeply and reduced to a fine tilth and made up into beds about four feet wide with paths between them. The whole nursery should be well drained. The seeds should be sown in rows at least six inches apart. The beds are shaded by means of *pandāls* about six feet high and the beds are watered by hand as often as necessary and kept carefully free of all weeds. The plants are also grown in baskets.

Planting.

The one or two years old nursery plants are put in five

or six feet apart each way or even wider in pits about two feet deep.

Drainage.

When the land is cleared for planting, the drainage system should be laid out. Main drains about four feet deep and two feet wide at the top should be made in the direction of the natural flow of the surface water, and may be put about eighty to one hundred yards apart The side drains should be three feet deep and eighteen inches wide at the top and should follow the contour of the land, the distance between them depending upon the nature of the soil and climate.

Shade.

It is necessary to grow coffee under shade in South India. As to the best trees suitable for shade, there is much difference of opinion. Probably the best all-round shade tree is the silver oak. After a few years when the tree grows big, the shade needs careful regulation from time to time to prevent its getting too dense, and each coffee grower must find out for himself the best amount of shade for his particular garden and keep it regulated. It will be good to arrange the shade by a number of different trees of different varieties, ages, and sizes throughout the estate.

Topping.

The young trees are usually topped by cutting off the leading shoot with a sharp knife, when they are about five feet high.

The principal objects are to secure the plants against wind and storm and to make it easier to collect the crop. Topping checks a too free upward growth and causes the plant to branch freely.

Pruning.

Careful pruning is really important and where it is neglected, poor crops will usually follow.

The object of pruning is to divert the energies of the plant from forming wood, and to concentrate them upon forming fruit.

Weeding. As a general rule, a coffee estate should be kept clean and as free as possible from weeds.

Mulching. The shade trees establish a thick mulch of leaves on the surface of the ground and this mulch plays an important part in the success of the coffee cultivation, as it tends to preserve moisture and also to supply plant food and humus to the soil. It is in fact a most valuable manure.

Manuring. Coffee is an exhausting crop when in full bearing and requires manure regularly.

Nitrogen, phosphoric acid, potash and lime must all be present in sufficient quantities, if a good crop is to be grown.

As a general rule, it is best to broadcast all fertilisers and lightly work them into the top two inches of the soil. Where there is a good mulch of leaves, these should first be swept up into heaps round the stems of the trees. The ground should not be scraped. Between the rows, the manure should be broadcasted and spread as evenly as possible. Under no circumstances should any manures be applied close to the stems of the bushes. Manure should be put out as soon as the heavy monsoon rain is over. As a fertiliser, cattle manure is a complete manure.

Another source of nitrogenous manure is a composition made out of waste materials, such as coffee pulp, line sweepings and estate sweepings, etc.; another natural manure of great value is bone. Artificial manures are also useful to supplement the above.

Harvest. Good trees will yield a first crop in two years but this is left ungathered, the berries being stripped off before they

develop. If a maiden crop from three year old trees is a heavy one, it is thinned, otherwise there will be little crop in the following year. Full crops may be taken in the fourth year and thereafter. The fruits commence to ripen in October or early in November and continue till January.

Directly the berries are ripe and have begun to turn red, they must be picked. Handling of the crop.

The ripe coffee fruit is termed the cherry, the succulent outer coat of the fruit, the pulp, the inner adhesive layer, the parchment, and the seed coat within the parchment which adheres closely to the seed, the silver skin. The preparation of coffee beans from the cherry is accomplished in the following stages, pulping, fermenting, drying, peeling, milling or hulling and sizing or winnowing. Pulping is done by hand or by machinery. The beans are then fermented to remove a sticky mucilaginous substance. The produce gathered in a day is put into a vat and left for 24 to 36 hours until fermentation sets in. The fermented beans are washed by a stream of water and are cleaned. The washed beans are then carried to the drying floors and exposed to sun and air. Peeling means the removal of parchment and silver skin from the beans, by pounding or by machinery. The parchment coffee is well warmed in the sun before it is peeled and the peeling is not undertaken on a wet or damp day. Manufacture.

The parchment is best sent to the curers at the coast where it undergoes the final process of peeling, polishing and grading.

The average yield from matured plants is from 300 to 400 lbs. of clean coffee per acre. Prices vary according to the size, colour, smell, flavour and uniformity of the coffee beans. Outturn.

Quality.

The Mysore coffee has a high reputation, the best quality of which is commonly quoted at 10s. to 15s. a cwt., above that of any other kind that reaches the London market. This is attributed partly to the soil and climate, and partly to the coffee being slowly ripened under shade.

Coffee diseases.

Of the diseases to which the coffee plant is subject in Mysore, leaf disease is the growth of a fungus named *Hemileia vastatrix*, which distributes its spores in the form of yellow powder. The effect is to strip the tree more or less of its foliage. The disease called *borer* is due to a beetle (*Xylotrechus quadrupes*) black with white lines and about as large as a horsefly. Coffee trees attacked by the *borer* wither away. Another disease of coffee is called *rot*, also the growth of a fungus named *Corticium koleröga*, which covers the leaves and berries with a black slime, which causes them to rot away.

The green bug or the green *scale* of coffee, has always been regarded as a most serious enemy, but fortunately for Mysore the weather conditions do not permit the continued multiplication of the insect so that in normal years nothing serious need be apprehended.

The die back of coffee.

The die back of coffee is a disease which seems to be increasing in seriousness. It is marked by the dying off of young coffee twigs and is accompanied by a particular fungus *Glueosporium coffeanum* on the twigs.

The Agricultural Department is dealing exhaustively with the diseases.

Other money crops: the Potato (*Solanum tumberosum*).

The potato is another crop new to the State the cultivation of which in recent years has extended greatly. It is chiefly confined to the taluks of Bangalore, Hoskote, Devanhalli, Chikballapur, Malur and Sidlaghatta. The extent of land under potato during the year 1922-1923 in the State was 3,726 acres, and in the year 1923-24, 5688 acres.

Soils on which grown and varieties.

The soils on which the crop is grown are mostly the typical red loams of these tracts, some of them strongly lateritic with a considerable mixture of fine laterite nodules of the size of a pepper corn. Water is invariably available in these localities within about 20 feet; rectangular wells are dug and water is baled out by means of the picotah; naturally, under these conditions, individual raiyats can cultivate only from half an acre to an acre. The varieties grown are:—

(1) a round type with pronounced eyes, and with a yellow waxy flesh called "country" and

(2) a kidney shaped or oval type called "Ricketts" which is smooth and white and mealy.

Seed is continuously replenished from Italy, consignments from which country arrive in Bombay and are grown in Poona in the first season, in Belgaum and Dharwar in the second and in Mysore in the third season, *i.e.*, the second year after arrival in India. In some parts, seeds got out directly from Italy are also planted.

Cultivation: yields.

The land meant for potatoes is well dug by hand implements and allowed to dry; it is then broken up, cleared of weeds and other rubbish, and manured with about 50 cartloads of cattle manure per acre. The field is then laid into beds for irrigation and furrows are made from 9 inches to 1 foot apart. Planting is done in two seasons, one, a rainy season planting done in July and another, a "Vaisāke" planting in November and December. Seed potatoes showing eyebuds fairly starting into growth are selected; each tuber is cut into two or three pieces each having at least one eye, the raiyat being exceedingly economical here in this respect; 30 *maunds* of tubers are required per acre. The cut sets are planted very close in the furrows at distances of 4 inches from each other and covered over lightly with soil; water is let into furrows and every three days or oftener, if the soil should require it, irrigation is given. In 15 days the sprouts

appear quite above ground and in a month grow with great rapidity; the field is now hand weeded thoroughly and the rows are earthed up, the ridges being split and converted into furrows. In three months the crop matures, the plants yellowing and drying up. The crop is then dug up, and laid into heaps in the field or in sheds and covered over; it is not handled for a week at least as the skin is liable to be rubbed off otherwise. After this time, the skin becomes firm and the potatoes are ready for sale. If there should be no disease and if the season should be favourable, very heavy crops of up to 400 *maunds* an acre of average size potatoes are obtained. Three hundred *maunds* is reckoned a good yield.

Potato diseases and pests.

Owing to the prevalence of 'Ring disease,' there is considerable risk in the crop; plants affected will die when they are about 12 months old; sometimes when disease is very bad, the loss may be 30 per cent. The potato moth is another enemy, this attacking stored potatoes.

The bulk of the potato crop of the State is exported to Madras and Ceylon.

Mulberry (*Morus indica*).

The rearing of the silk is a very large industry in the State and the cultivation of the mulberry for the feeding of the worm is carried on fairly extensively. The total land under mulberry in the State during the year 1922-1923 was 33,552 acres and during 1923-1924, 29,589 acres. The cultivation of the mulberry is as described below:—

Taluks in which grown.

The mulberry crop is a well established crop in the Taluks of Channapatna, Closepet, Sidlaghatta, Kolar, Chikballapur, Hoskote, Kunigal and Mandya as an irrigated crop and in T.-Narsipur and Chamrajnagar as a dry land crop. The cultivation is steadily extending into new areas as a result of the newly established Department of Sericulture and of the high prices ruling for silk.

Dry land mulberry.

The dry land mulberry can be grown only on the heavy black cotton soil on which sufficient moisture is retained to keep the crop alive through the hot weather months. The bulk of the mulberry is, however, under irrigation and is grown on both heavy clayey soils as well as the red loams of Kolar and Hoskote tracts and the light alluvial soils on the banks of the Arkāvati river in the Closepet Taluk.

Irrigated mulberry.

A good irrigation source is essential, and where it is grown under tanks, wells are dug in the garden to be used when the tank water fails. Throughout the eastern taluks, however, the mulberry is mostly grown under well cultivation.

Varieties.

The variety of mulberry grown is the bush type, which seldom grows more than five or six feet at the most. Of these, two kinds are grown which are however seldom put down separately but are grown mixed together. One of these is distinguished by a whitish stem and the other has a dark green stem and are on this account distinguished as " vili kaddi " and " kari kaddi. "

Tree mulberry.

A few specimens of tree mulberry may be seen, however, in the Government Sericultural Farms and on the Tata Silk Farm at Bangalore. These have not, however, been taken up by the raiyats ; an attempt is being made to start " topes " of tree mulberry in suitable villages.

Preparation of the soil.

The land intended for planting mulberry is invariably dug about three feet deep prior to the hot weather through which the clods dry till the advent of the rains. These are now broken, grass and other weed roots are gathered and removed ; cattle manure is added at about 50 cartloads an acre and the soil is reduced to a fine tilth.

Cultivation methods.

Irrigation beds are formed usually about 6 feet broad, each bed being divided from the other by a prominent

bund; across the beds little furrows are made at intervals of three feet and in these mulberry cuttings about 12″ to 18″ long are planted by sticking them slantingly in the soft mud. As the plants grow up, more manure is added and the rows are earthed up; irrigation is given systematically and copiously. The plants are pruned once a year from November to January being cut right down to the base of the plants; the ground round the base is also dug and manured at this time. The excreta of the worms along with the refuse of the rearing house is also applied as manure. With good irrigation a flush of leaves is ready in a month; this is stripped for the worms, and in another six weeks there is a second flush of leaves, there being generally six such pickings in the year; in the taluks of Kolar it is usual to cut the plants right down to the base and carry home the young twigs themselves instead of stripping only the leaves as is done elsewhere. The plants are trimmed thrice a year in this way. In the case of the black cotton soil mulberry raised as a dry crop, there are only three pickings in the year. Raiyats either rear the worms themselves or sell the leaves to rearers.

Yields.

In recent years the leaves from an acre have fetched as much as Rs. 50 per acre per picking, and the six pickings usual in the year have given Rs. 300 an acre. Leaves fetch a higher price in the hot weather.

Miscellaneous crops: Baje, Annatto, Indigo, Ginger, and Ganja.

Among miscellaneous crops may be mentioned Baje *(Acorus calamus)*, a medicinal crop grown in puddled fields in the taluk of Koratagere, for the sake of its root stocks which have important medicinal properties; annatto *(Rangamale)* grown for the sake of the dye prepared from its seeds, which is grown to some extent in the Closepet Taluk; indigo which was grown in the days prior to synthetic dye at Belakvadi (Mysore), Nadoor, (Sira Taluk) and has again begun to be cultivated near

Mysore, and in certain villages in the Maddagiri and Chikballapur Taluks; pepper, and cardamoms in the Malnād which have been referred to under areca-nut; ginger grown in several areca-nut and plantain gardens; turmeric grown as an important field crop in the Goribidnur Taluk; Ganja *(cannabis sativa)*, the narcotic which is grown to a small extent under the supervision of the Excise Department of the State, from whom a special license has to be obtained before any one can attempt the cultivation. Onions and garlic are quite considerable crops in the Chikballapur, Devanhalli, Sidlaghatta, French Rocks and Hunsur Taluks.

Fruits and vegetables.

A list of the fruits and vegetables grown in the State is given in Volume I, Chapter IV. The Horticultural Department is devoting special attention to the encouragement of fruit cultivation and a survey of the fruit trees in the Bangalore District was carried out by the Superintendent of Gardens in the year 1913-14.

Fruits.

During the season, there is a plentiful supply of oranges, mangoes, plantains, jack-fruits, grapes, figs and rose apples. Apples, pomegranates and peaches are also available; melons are also grown. The plantain, the jack-fruit and the mango are largely availed of by the people as articles of diet. The total extent of land in the State, during 1922-23, under mango was 12,246 acres.

Vegetables.

During all the seasons of the year, there is an unfailing supply of indigenous vegetables in the Cities of Bangalore and Mysore and at Bangalore a fairly large supply of cabbages, cauli-flowers, tomatoes, etc. A large quantity of vegetables and beans is exported from Bangalore to the neighbouring British territories.

V. Farm Animals.

Cattle.

Mysore has, from a very early period, enjoyed a just renown for her superior breed of cattle. The generally mild and salubrious climate of the plateau, with extensive pastures, favoured cattle breeding and attracted nomadic tribes who brought with them excellent breeds which could not fail to improve the indigenous cattle. Cattle play a very important part in local agriculture. Cattle manure serves to enrich the soil. Carts and bullocks enable the removal of manure to distant fields. The operations of ploughing and harrowing the soil, of sowing and thinning the crop and of lifting water from wells for irrigation purposes, are mostly carried on by bullock power. The crop when cut is removed to the threshing floor and trodden out by cattle, and the grain taken to the market in carts drawn by cattle.

Number.

According to the quinquennial census of agricultural stock in the State, held in March and April 1925, the total number of each kind was as follows :—

Bulls	...	...	213,647
Bullocks	...	...	1,327,330
Cows	...	...	1,494,097
Buffaloes—			
(1) Bull	...	...	81,744
(2) Cow	...	...	459,535
Young stock	...	...	993,941
Sheep	...	...	2,492,021
Goats	...	...	1,742,017

During the years 1923 and 1924 owing to the failure of crops over the greater part of the State, there was a serious shortage of fodder. The cattle mortality was very heavy and large numbers were also sold away. The cattle census of 1925 registered therefore a great decline in the cattle

population, the percentage of decline being as shown below :—

Bulls	2·5
Bullocks	6·0
Cows	13·0
Buffaloes—	
(1) Bull	28·0
(2) Cow	17·0
Young Stock	24·0
Sheep	13·0

Goats alone registered an increase, and very materially, due to the increasing practice of goat keeping by ryots and others as well, because of its hardy nature.

Breeds.

The principal breeds of horned cattle in Mysore are the Amrut Mahal, Mahadesvaran Betta, the Kankanhalli and the village cattle.

Amrut Mahal.

The Amrut Mahal cattle comprises three varieties or family groups called the Hallikar, Hagalvadi and Chitaldrug from the districts which originally produced them. This is a far famed breed characteristically different from every other Indian breed. It stands in relation to other Indian breeds, much as the thorough bred horse to horses generally. These cattle are of medium size and white or grey in colour. They are fiery tempered and very active, enduring and hardy. The bullocks are essentially suitable for road work and are capable of quick, long journeys under a light or moderate load. They have fine heads, alert ears and long pointed horns, while the compactly proportioned frame, the shapely limbs and the hard, black feet indicate endurance, activity and strength. This breed matures very slowly and the cows are poor milkers.

Mahades-varan Betta.

This breed comes from the jungles and hills near Biligirirangan Betta on the south-eastern frontier of

Mysore. They are larger than the Amrut Mahal cattle, but are loosely made and not well ribbed up. They have heavy loose-hanging dewlaps, sloping broad foreheads and large muzzles. They are very heavy and slow animals.

Kankanhalli. This breed comes from Kankanhalli in the south-east of Mysore; they are very like the Mahadesvaran Betta breed. They have thick horns, broad sloping foreheads and white, very thick skins.

Village cattle. These vary very much in size, colour and characteristics. As a general rule, they are shunted per lactation.

Cows. The indigenous cows are generally poor milkers. Cows from Kankanhalli are said to be the best among the local breeds of cows; under proper feeding and keep such as they get with the milkmen of the towns, they yield up to 4,000 lbs. of milk per lactation.

Palace cattle. The Palace Establishment of His Highness the Maharaja maintains varieties of breeds of superior cattle. The latest addition is a large herd of Scindi cows.

Feeding. The great majority of the live-stock is maintained by grazing during the day and home feeding at night, while considerable numbers are supported either purely on pasturage or are chiefly home fed. All large herds of cattle which are usually kept in the open, are generally maintained on pasturage alone.

Cattle are also allowed to graze in Government forests on payment of a small fee. All village cattle, except valuable bulls and cows which may be specially taken care of, are collected together in the morning and driven out to the village *Gomal* or common where they are grazed. Most of the pasture lands of the country are very indifferent as to soil, and produce scanty, innutritious grass even at the best

of seasons. In the hot weather or during drought, the pastures afford absolutely no grazing.

The Amrut Mahal cattle are kept in grazing grounds called *kavals* under an establishment of graziers and other attendants. These *kavals* are low and sheltered valleys on the catchments of tanks, where pasturage and water are available in the hot weather. The herds are moved about from *kavals* to *kavals* as each *kaval* becomes grazed down. The cattle are brought up in a semi-wild state ; taming and breaking them to work is an arduous operation; the Department holds sales of these cattle yearly; breeding bulls are also sold at a concession price to *bona fide* breeders.

Breeding tracts.

The chief breeding tracts in the State are the Kankanhalli Taluk where, along the banks of the Cauvery and Arkāvati, large herds are kept by breeders. The jungles and river margins afford good pasturage and water. Breeders have their own *kavals* in which the herds are kept in the open. One year old and ten months old bull calves are bought from these men and taken to the villages far and near to rear. In addition to this taluk, the taluks of Mandya, Malavalli, Nagamangala and Kunigal also form notable breeding areas ; in these latter taluks however the breeders are only the small raiyats who keep one or more cows of the best Hallikar breeds and put them to bulls of proven merit and good quality ; great care is taken in the keeping of these cows; they are never let out with the other cattle, they are tethered and grazed under the eye of the breeder and are led home in the evening ; by this means crossing with the scrub bulls of the village is prevented. Both calves and bulls of known parentage fetch fancy prices. Though no record of pedigree is kept, yet raiyats know it quite well up to one or two generations ; the character and performance of any good specimens are known throughout the tract and remembered even though the animals may change hands many times. So great is

the demand for the bull calves in this tract that the country is depleted of such, and often hardly a single bull calf of over a year can be seen; it is usual to put cows to the plough in these taluks on account of the scarcity of bull calves.

Rearing of cattle.

The rearing of cattle is carried on throughout the Maidān districts; the fodder jola often sown as an early *Mungār* crop, the green grazing afforded by the ragi thinnings, the grazing the field margins which are for this purpose kept very large about 20′ to 30′ broad, jola grown as akadi or mixed crop, the haulms of avare, and horse gram—all these provide a succession of green feed through the season favourable to the rearing of superior cattle.

Cattle fairs, etc.

Outside the local market, the great customers for the Mysore cattle are dealers from Nellore in Madras and raiyats from the black soil tracts of Dharwar. The annual *jātras* at many of the sacred shrines are also great cattle fairs where magnificent cattle are brought for sale in large numbers; at Chunchinkatte in Mysore, at Nandi in Kolar, at Subrahmaniamghatti near Maklidrug in Bangalore, and at Harihar in Chitaldrug and Rampur in Shimoga, the typical heavy cattle of the State are brought and sold. Small sized cattle fancied by raiyats of the Madras Districts of Arcot, Vellore and Chingleput are picked up mostly in the Kolar District, especially at the Āvani *Jātra*.

In addition to these yearly fairs, cattle are brought by dealers in the villages themselves; about September and October, the Nellore dealers come round and their brokers collect together eligible cattle in specified places; after purchasing, the herds are taken to Bellary, Dharwar and the adjacent northern districts.

Castration.

All male stock other than breeding stock is regularly castrated. The operation is, however, seldom performed

until the animals are about 5 years old. It is believed that early castration interferes with the full bodily development of the animal and that the typical bodily configuration peculiar to these animals becomes altered. The result of this belief, so far as the generality of the cattle of the country is concerned, is that it acts as a hindrance to any scheme of cattle improvement. A large number of scrub bulls move freely in the village herds; many cows are covered by these bulls, some of them immature and nearly all of them very poor specimens of bulls, being more or less mongrel in type. The Veterinary Department is, however, trying to effect a great change in the methods by inducing raiyats to have all their bull calves, other than those intended for breeding purposes, castrated at a very early age. The local methods of castration practised by the raiyat are also crude; they are exceedingly cruel, the animals take a long time to recover and the operation itself is often only imperfectly done. The quick and thorough operation, being popularised by the Veterinary Officers, is much appreciated by the raiyats and many of them gladly bring their animals to be castrated by this method both in the Veterinary Hospitals and elsewhere where Veterinary Officers may be touring for this purpose.

Buffaloes.

Buffaloes thrive better than ordinary cattle in districts of heavy rainfall, and in rice tracts male buffaloes are extensively used for both tillage and road work. The best are produced in districts of moderate rainfall where conditions for breeding are favourable. They should have access to deep water or be bathed twice daily. Their sparse coarse hair is usually shaved off several times a year. Buffaloes vary in colour, but the majority have black hair and shining black skins. Some have white markings and a few are grey or light dun and very occasionally albino. Their lowing differs from that of kine and they have no hump, while buffalo milk is richer in butter fat than cow's

milk. Large male buffaloes are used for heavy cartage. They can draw heavier loads or carry heavier packs than bullocks of the same size.

Varieties. There are three varieties, the Hullu, the Gaujri or Gujarat, and the Chokkatu, which comes from the country bordering on the river Krishna. The Hullu is by far the most common and is the native breed of the country. The outside breeds are greatly superior in size to the Hullu, but in this country they very soon degenerate. The female of the first breed has a calf every year and gives milk for seven months while the latter breeds once in two or three years only, and gives a large quantity of milk. In recent years, a large number of Delhi and Jafferbadi buffaloes have been imported by the milkmen of Bangalore.

Sheep. Sheep and goats are bred most successfully in areas receiving a moderate rainfall. Upland or well drained soil, with sparse jungle growth and a considerable variety of natural herbage, is good if of sufficient extent. The notable sheep breeding tracts of the State are Hunsur, Mandya, Channarayapatna, Kolar, Mulbagal and Davangere.

Varieties. There are three varieties, the *Kurubar* or ordinary breed, the *Gollar* which is less common and the *Yelaga* which is the rarest of the three. White, brown and black colours are found in all the three breeds.

The *Kurubar* is a small sheep with horns curling backwards. Both its flesh and wool are superior to those of the other two varieties. The *Gollar* is distinguished from the *Kurubar* by its large size, coarser wool, longer neck and different formation as to the head and jaws. The *Yelaga* is longer in the leg and stands higher than the other breeds, but is less bulky and more resembles a goat in structure.

Feeding. They are solely dependent on pasturage, being never fed on grain.

Wool. Sheep, with the exception of *Yelagas*, are shorn twice a year and fifty fleeces amount to about a *maund* weight. The wool is coarse, and is made into rough *kambalies*. The shepherd usually hands over a hundred fleeces to the weaver who gives him in return a *kambali*.

Goats. There are two kinds of goats, the long legged or *mēke* and the short legged or *kanchi mēke*; but the two can propagate together.

The rapid increase in the number of goats in the State within the last few years is really an outstanding feature of rural life. The increase within the last five years alone was as high as 36 per cent and this notwithstanding the great fodder famine and the period which reduced the cattle population seriously. In the 1925 census, the number of goats registered was 1,742,017.

Goats live entirely on the leaves of bushes and trees. One male is kept for twenty females. Of those not wanted for breeding, the shepherd sacrifices some for his own use and the remainder he castrates and sells to the butcher. They generally breed once a year, about 4 times, after which they are generally killed by the shepherds for their own use. For three months, the kid is allowed the whole milk; afterwards, the mother is milked once a day for two months.

Cattle diseases. The most common cattle diseases met with in the State are:—Rinderpest, black-quarter, foot and mouth disease and anthrax.

Preventive measures. Preventive measures, such as inoculation of all the healthy cattle against the various diseases, have been found very successful. Veterinary hospitals and dispensaries

have been opened in all the district head-quarters and also in the more important taluk head-quarters. All these institutions are in charge of Assistant Veterinary Inspectors. As soon as any infectious disease breaks out in a village, the village headman is to inform both the Revenue and the Veterinary Officers who make the necessary arrangements to combat the diseases.

VI. Irrigation.

Irrigation.

Irrigation forms the subject of a separate Chapter in this Volume, and is also referred to in the earlier part of this Chapter. Without irrigation from wells or tanks or channels, many of the food and commercial crops could not be raised in the State as in other parts of India. Only the direct effects of irrigation on agriculture are indicated below :—

Irrigated area.

The irrigated area during the year 1923-24 was as follows :—

Under Government channels	...	...	124,609 acres
Under private channels		...	11,920 ,,
Under tanks	...	...	465,544 ,,
Under wells	...	...	87,001 ,,
Other sources	...	...	510,064 ,,

thus making up a total of 1,199,138 acres or about 16 per cent of the total cropped area.

VII. Agricultural Statistics.

Area available for cultivation.

The net area available for cultivation during the year 1923-24 omitting forests and other lands not available for cultivation was 8,644,125 acres.

Area under occupancy.

The area under occupancy was 7,953,888 acres of which 2,044,645 acres were current fallows. The net area cropped was thus 5,909,243 acres.

Cultivable waste.

The extent of cultivable waste not under occupancy was 690,237 acres, of which 610,179 acres were dry, 62,227 acres wet and 17,831 acres garden.

The extent of individual holdings classified is given under "extent and size of holdings."

Number of holders according to the amount of revenue paid.

Classifying the number of holders according to the revenue paid by each of them, the figures stand as follows :—

Those paying Rs. 5 and under were 419,508 ; those paying between Rs. 5 and 25 were 436,717 ; those paying between Rs. 25 and 100 were 122,202 ; those paying between Rs. 100 and 500 were 9,235 and those paying above Rs. 500 each were 255.

Incidence of land revenue.

The incidence of land revenue, per acre, on the fully assessed area, was Rs. 1-4-8 for total area ; for cultivated area, 1-11-10 and Rs. 2-0-5 (excluding excess 2-0-4) per head of population.

Ploughs and carts.

In 1923-24, the number of ploughs was 8,329 of the country wooden type and 8,577 of the improved iron type; and the number of carts was 26,315.

VIII. Agricultural Credit.

General.

In Mysore, as in other parts of India generally, agriculture is in the hands of small men and the capital required for the cultivation of the soil is supplied in small sums by small capitalists. Very often the peasant has to work on borrowed capital. From time immemorial, the small village banker has had the monopoly of supplying money to the agriculturist. In some parts of the country, the land itself passes either by sale or by usufructuary mortgage into the hands of the money lending class. The transfer of the land to a class which merely speculates on quick returns has contributed not only to the discontent of the peasantry, but also to the impoverishment of the soil.

The peasants are, as a class, and with but a few rare exceptions, illiterate and men of small commercial intelligence. They are not yet weaned from costly traditional customs.

It is no doubt true that during the last quarter of a century, the value of land and the prices of agricultural products have increased appreciably and thus the security of the peasant and his credit have been enhanced and his receipts also have increased.

Remedial measures.

Among the measures adopted from time to time by the Government of His Highness the Maharaja to improve the economic condition of the agriculturists, the following are the most important :—

(*i*) The formation of Agricultural Banks.

(*ii*) Grant of loans under Land Improvement Loans Regulation IV of 1890 for the construction or repair of wells or tanks, the reclamation of waste or any other work by which the letting value of land for purposes of agriculture will be permanently increased.

(*iii*) Grant of loans under Section 194 of the Land Revenue Code—

(1) for the purchase of :—

(*a*) seed grain (including seed sugar-cane, seed plantations, etc.),
(*b*) ploughing cattle (including cattle used for raising water and carting manure),
(*c*) horse and pony stallions and breeding bulls,
(*d*) fodder for cattle,
(*e*) manure ;

(2) for other agricultural objects, such as :—

(*a*) the building or re-building of houses,
(*b*) the purchase of agricultural implements (including carts),
(*c*) erection of double mhotes or other contrivances for raising water,
(*d*) erection of indigo vats and such like appliances for dealing with raw agricultural produce,
(*e*) for the erection of sugar-cane mills,
(*f*) for the purchase of other agricultural machinery,
(*g*) for the relief of distress.

(*iv*) Formation of Co-operative Societies ;

(*v*) Grant of loans for Fruit Culture, Sericulture, Dairy Farms; and

(*vi*) The supply of seed and machinery by the Agricultural Department on easy terms.

Agricultural Banks.

The following quotation from the Dewan's Address to the Representative Assembly in 1894 explains the origin of these Banks and the lines on which they were formed:—

"On the one hand, we have large accumulations of unused capital in the country as evidenced by the balances in the Presidency and other Exchange Banks, the refusal of the former to receive any private deposits except as current ones carrying no interest and the high premium which the Government of India 3½ per cent securities command. On the other hand, we have the agriculturist suffering from inability to raise the funds required for his *bona fide* purposes, except at ruinous rates of interest. In our own State, the balance of the Government Savings Bank deposits has risen from four lakhs in 1881, to 28 lakhs during the last year, though the rate of interest was recently reduced to 3½ per cent, but the borrowing power of our raiyat is nevertheless as low as ever. The substantial agriculturist, especially the coffee planter and the grower of exportable produce, is able to obtain some credit from the foreign buyer on the security of his crops at 9 and 12 per cent interest, but the ordinary raiyat is unable to get any credit except at usurious rates. How to bridge over the wide gulf that thus separates capital from want is one of the most important problems of the day in this country, and it is not without considerable diffidence that His Highness' Government approach its solution; but we derive the hope of eventual success from what has already been accomplished in some European countries, where conditions very similar to ours have existed. The most successful system has been proved to be that in which the agriculturists forming themselves into an Association on strictly co-operative principles substituted their own united credit for that of the intermediate body, thus securing for themselves the fullest return for their own credit as agriculturists and doing away with the profits of the middlemen. The existing conditions among us offer no insuperable obstacle in the way of the establishment and successful working

of similar Associations in this country under the designation of Agricultural Banks. . . . . The essential principles underlying their constitution are:—

(i) Every Bank to be an association of landholders formed on strictly co-operative principles, and enlisted on the basis of mutual confidence arising from the mutual information of each other's character and resources. The object to be the common benefit of cheap credit and not the earning of divisible profits;

(ii) There should be no share capital, the funds required for the Bank being obtained by means of loans raised or deposits received;

(iii) The members to contribute their liability only. They will be at full liberty to limit this liability by prescribing a maximum for each individual loan or for the sum total of all loans, or to resign at any time and thus escape from further liability;

(iv) The funds raised by the Bank to be lent only to its members, at such moderate rate of interest as will leave the Bank a small margin for the actual expenses of management and for the gradual formation of a Reserve Fund;

(v) The affairs of the Bank to be managed by a body elected from among the members themselves and giving their services gratuitously; and

(vi) No loan to be made except for an approved purpose, such as some agricultural operation, which, with ordinary care, may be expected to yield enough to repay the loan and to leave some profit for the borrower.

And it only remains for me to add that a Bank thus constituted and doing business on such conditions must be solvent and will be able eventually to command ample credit in the open market; but while such credit is in the process of growth—and its growth will take time—the Government will be prepared to help the Bank, with deposits of money at favourable rates of interest. The Government will, in addition, be able to grant exemption from stamp and other duties, to provide for the special registration of loans and their ready recovery, for the custody of funds in public treasuries, for the periodical audit of accounts, etc., but the co-operative spirit to which the Association is to owe its existence must emanate from the agriculturists themselves."

Their growth.

In the year 1895, two Banks were started. In 1896, the Government appointed a special agency to supervise the working of the Banks, and by the year 1901, the number of Banks rose to 64 and the total advances made by Government to them was about Rs. 15 lakhs.

The Banks did not work well and the first serious note of warning was sounded in the Dewan's address to the Representative Assembly in the year 1901 in the following terms:— Their decline.

"It is unfortunate that these Banks have not worked as successfully as was expected at the time of their institution . . . . . The outbreak of plague and the consequent depression in trade and business can only be said to have very slightly retarded the growth of these institutions. There seems to be deeper causes for this unsatisfactory result which require to be investigated. Possibly, the defect lay in the too easy terms granted by Government. The difference between the rates of interest prescribed for the Banks and the current market rate was so great that borrowing was, in a measure, stimulated beyond the actual bounds of necessity. The members also were not perhaps all of them strictly of the class and occupation for whose benefit such Banks were intended. About Rs. 15 lakhs have been advanced by the State, of which, deducting the amount refunded till now, there is still a large outstanding balance of more than Rs. 13,82,000. The Banks have moreover failed to attract deposits to a larger extent than about Rs. 15,000 and the Reserve Fund has not amounted to more than Rs. 35,000. The property of the members which has been looked upon as security for the amount advanced by Government has been valued, it is true, at about Rs. 48 lakhs, but it is possible that the value has been over-estimated or has deteriorated in a number of cases. . . . . The imperative necessity of adhering to a prepared scheme of repayments has been enjoined, and the granting of any further advances has been suspended for the present."

The number of Banks began to decrease year after year, till the year 1917 when there were only two Agricultural Banks, which, however, had repaid their loans to Government.

To promote thrift and providence among the people and to afford to the agriculturists and artisans an easy means of Co-operative movement.

combination to obtain credit and with a view to avoid the defects which marred the successful working of the Agricultural Banks, the Co-operative Societies Regulation, which is an adaptation of the British enactment of 1904, with a somewhat wider range of objects, was passed into law in June 1905 and the Registrar of Co-operative Societies was appointed in September 1905. The progress of the movement is dealt with in Volume IV, Administrative, Chapter IV.

Agricultural Societies.

During the year 1923-24, the number of Agricultural Societies was 1,184.

Loans for Agricultural purposes.

The total amount of loans granted during the year 1923-24 for productive purposes was Rs. 43·24 lakhs or nearly 77·6 per cent of the total loans.

Loans for necessary purposes.

A sum of Rs. 1·09 lakhs was given for payment of *kandayam* due to Government and Rs. 10·52 lakhs for purchase of food and other necessaries of life and Rs. 16·01 lakhs for discharging prior debts.

Co-operative Societies in place of Agricultural Banks.

It was decided in 1912 to establish, where conditions were favourable, Co-operative Societies on the unlimited liability basis by the side of the defunct Agricultural Banks, and thus give an opportunity to the members of the latter institutions to enjoy the facilities afforded by Co-operative Societies. Accordingly, from 1912 to the year 1915, thirty-three such societies were started.

IX. Work done by the Departments of Agriculture, Veterinary Science and Sericulture, and the Central Agricultural Board.

Classification of work.

The work of the Agricultural Department may be broadly classed into (I) Research, (II) Extension or Popularisation, and (III) Agricultural Education.

Research is carried on in the laboratories of the Department and on the different Government Farms, through the following sections :— Research.

(*a*) *The chemical section.*—Undertakes the analysis of soils, manures and produce; conducts manurial and other experiments on soils by pot-culture methods, and on experimental plots in the Government Farms and in the holdings of selected raiyats; carries out all the chemical work connected with the trial of varieties of sugar-cane, ground-nuts and with the manufacture of jaggory, sugar, etc.

(*b*) *The entomological section.*—Carries on investigations into the insect pests of the State, both of growing crops and stored produce, with a view to the devising of remedial measures through its insectory and other indoor work, and on the field; undertakes demonstration of remedial measures on raiyats' holdings; supervises the working of the 'Pest Act' recently passed as the result of the work of this section in regard to the *Kambli Hula* (or caterpillar pest) in parts of the Chitaldrug and Kadur Districts. Researches on the Jola grasshopper, *Kambli Hula*, ground beetles, pests of stored grain, Castor semi-looper, and the mango-hopper are some of the noteworthy items of the work accomplished.

(*c*) *The mycological section.*—Carries on investigations into the fungus and other diseases of crops both in the laboratory and on special gardens and fields taken up for the purpose from time to time; carries out spraying and other combative measures on the holdings of applicants; supervises the working of the Pest Act in regard to the *Kole Roga* of areca-nuts in the Shimoga Malnād. Work on (1) the ring disease of the potato, (2) the *Kole Roga* of the areca-nut which alone has meant the saving in the aggregate of a very large sum of money to the areca growers whose annual losses used to be very great and (3) the spike disease of sandal, are noteworthy items of the work accomplished so far.

(*d*) *The section of botany.*—Carries on work in plant breeding; varieties of the field crops of the State are tested, pure strains isolated and compared and new varieties originated for the production if possible of better varieties. The work on ragi and sugar-cane accomplished so far is notable, a yearly increasing area is being put under the improved strain of Ragi

(H22) recommended by this section; a very large number of seedling canes have been originated, one of which, *viz.*, H.M. 544, is now grown over large areas.

(*e*) *The engineering section.*—Carries on studies regarding implements with a view to improve or adapt foreign ones or devise new implements; assistance to raiyats in drainage and irrigation matters is given; experiments on the duty of water are carried out; all the heavy machinery of the department such as cane mills, engines, tractor, etc., are looked after. The new mould-board plough referred to under "Implements" in this Chapter is a promising piece of work.

(*f*) *The Government Farms.*—Carry on both experimental and demonstration work and incidentally supply seeds, implements and manures:—

(1) The Hebbal Farm is the oldest; much promising work on ragi, paddy and sugar-cane has been done; the plant breeding work on ragi and sugar-cane is done here. The Government Agricultural School is also located on this Farm.

(2) The Marthur Farm in the Shimoga District studies *Malnād* problems regarding the cultivation of areca, paddy and sugar-cane. The cultivation of sugar-cane and the manufacture of jaggory has extended in the locality as the result of the example of the Farm.

(3) The Babboor Farm in the Marikanave tract of the Chitaldrug District is a large sugar-cane Farm in which sugar-cane is grown as a commercial undertaking; plant breeding work on cotton and jola is conducted on this Farm. The Farm provides cane mills and cotton gins, the latter to handle the raiyats' cotton also.

(4) The Nagenahalli Sugar-cane Farm in the Cauvery channel tract close to Mysore City is to test sugar-cane varieties, select suitable ones for the tract, and undertake the supply on a large scale of the seed of the selected varieties. Incidentally manuring, cultivation and manufacture and other studies regarding sugar-cane are undertaken.

Extension or Popularisation.

This section is the largest and is in direct touch with the raiyat. The results attained by the various scientific sections and deemed fit for being taken up by the raiyat are popularised; the co-operation of the raiyats is enlisted for the trial of these recommendations on their own holdings; as the result of the field trials, arrangements are made to bring them into general adoption with such modification as may be found necessary. Demonstrations of all these recommendations are carried out; advice and help given to all raiyats; estates are inspected; depôts are maintained in the district head-quarters and in some

taluk head-quarters for the stocking and sale of improved implements, manures and seeds. These depôts are also the offices of the Agricultural Inspectors who are to interview and advise raiyats when called upon. Lectures, demonstrations and exhibitions at *Jātras* and other gatherings, village talks and other means of propaganda work are undertaken. Through co-operation with the various district and taluk organizations, Co-operative Societies, Agricultural Associations and so on, improvements are popularised. The whole work is in charge of two Divisional Officers helped by a large staff of Agricultural Inspectors and Fieldmen.

Education.

(1) Instruction in Agriculture is imparted in the Hebbal Agricultural School, which provides a three-year course. The instruction is in English.

(2) At Chikkanahalli in the Tumkur District, a Vernacular Agricultural School gives a one-year course.

(3) In all the Government Farms, short courses are held for small periods for practical instruction in the various operations recommended by the Department.

(4) In co-operation with the Educational Department, "Rural Science" classes are held in certain selected Village Schools.

Live-stock including Veterinary Science.

In addition to the above, the Department also embraces two sub-departments, one being the Veterinary and Live-Stock and the other Sericultural.

Through Veterinary hospitals throughout the State, veterinary aid is rendered, while considerable itineration is done also for preventive inoculation of the raiyats' cattle, for castration of stock and so on.

The study of cattle and sheep, with a view to improvement, forms the functions of the latest addition to the Agricultural Department, *viz.*, the section of the Live-Stock Expert. Advice on Dairy matters, supply of Dairy machinery, etc., are also undertaken.

The Sericultural Department.

This is also a recent addition to the Agricultural Department.

Mysore is well-fitted by soil, climate and local conditions for silk production. There is practically no parts of the State, with the exception perhaps of portions of Chitaldrug, where it cannot be successfully introduced. In Mysore, a distinct race of the silk worm has been evolved which is multivoltine, and admittedly superior to other multivoltine races in robustness and yield.

Extent and distribution.

The industry is at present practised as an important subsidiary occupation to the south of a line joining Chikballapur, Kunigal, Mandya and Nanjangud. The total area under mulberry is nearly 35,000 acres, the value of silk production is annually about Rs. 60 lakhs and some 120,000 persons find employment in the various branches of the industry.

Department of Sericulture.

Some years ago, the Education Department was entrusted with teaching sericulture through the agency of village schools, but with no great success. The subject was then taken up in 1911 by the Agricultural Committee of the Economic Conference and men trained at Tata's Silk Farm in Bangalore were sent out for work in Sericultural Taluks. In the years 1914 and 1916, the services of Signor Washington Mari, an Italian Expert, were secured by the State and he organised a small farm with a school and grainage at Channapatna, established a few outstations for propagandist work and made a small beginning in the preparation and issue of disease-free eggs. In 1916 the Government sanctioned temporarily the formation of a Sericultural Department and its activities are indicated below :—

(i) Seed production grainages.

(ii) Demonstration of better methods of rearing, popular schools, farms and village demonstrations.

(iii) *Finance.*—Technical part of the enquiry relating to applications for sericultural loans under rules sanctioned by Government at the instance of the Agricultural Committee.

(iv) *Organization.*—Stimulation of Co-operative effort, study of markets; improvement of reeling; introduction of doubling and twisting, etc.

(v) *Experimental work.*—Determination of the best manures and cultural methods for mulberry; the best methods of selective breeding; the improvement of reeling; the increase of output by the partial substitution of higher yielding races and hybrids; the most efficient grainage technique, etc.

Scholarships for Sericulture.

Government have also sanctioned temporarily scholarships ranging from Rs. 10 to 20 per mensem according to qualifications, to male and female candidates for learning Sericulture, with a view to encourage the recruitment to the Department of qualified agency.

The Department was strengthened lately by the appointment of two Japanese experts, one of whom is a lady expert intended for the benefit of Purdah women Sericulturists. The Department has been put under the Administrative control of the Director of Agriculture.

The Central Agricultural Board.

The work of the Central Agricultural Board of the Economic Conference is being carried on in close co-operation with that of the Agricultural Department.

The encouragement of horticulture and fruit culture, the opening of dairy farms, the organization of co-operative societies for agricultural production, the extension of sugar-cane cultivation, the investigation of conditions connected with the coffee industry, the improvement of agricultural stock and sheep rearing, the improvement of the cocoa-nut and potato and cultivation of tea and camphor and the use of better manures, forest and fuel plantations and organization of rural credit, are some of the subjects engaging the attention of the Board.

As regards commercial crops, special attention has been devoted to the extension of cultivation of sugar-cane and mulberry and the improvement of coffee. Steps have been taken to collect information regarding the economic condition and subsidiary occupations of raiyats. The Board have prepared estimates of production for the whole State. They have taken part in organizing several agricultural demonstrations and exhibitions. For some time past, the Board have been concentrating their attention on—

(1) still further popularising the business of improved agricultural implements;

(2) utilizing the co-operative movement in furthering agricultural improvements;

(3) developing of agriculture in the Malnād;

(4) developing of live-stock industry; and

(5) improving of fodder supplies and utilisation of existing fodder resources, *e.g.*, Malnād grass, grazing lands, etc.

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