CHAPTER IV

AGRICULTURE AND IRRIGATION

Land utilisation

THE total geographical area of the district, according to the survey figures, is 12,31,185 acres. But according to village papers, the total area works out to 11,78,659 acres. Out of this total, the extent of land put to agricultural use in 1964-65 was 6,75,817 acres, forming more than half of the total land area. The following table indicates the cultivable and uncultivable areas in the district during 1964-65, taluk-wise :

Taluk	Cultivable area in acres				
	Total cropped area	Forests	Permanent pastures	Cultivable waste	Area sown more than once
Mandya ..	96,668	..	38,503	1,478	608
Maddur ..	94,105	..	10,012	22,361	1,700
Malavalli ..	1,22,944	4,470	30,755	14,320	16,100
Pandavapura ..	77,946	3,373	30,390	761	6,530
Krishnarajpet ..	1,10,755	3,785	56,789	..	5,614
Nagamangala ..	1,01,145	6,232	2,241	74,718	2,135
Srirangapatna ..	72,254	470	14,240	1,468	16,622
Total ..	6,75,817	18,330	1,82,930	1,15,106	49,309

Uncultivable area in acres

Taluk	Current fallows	Other fallows	Land put to non-agricultural use	Barren land
Mandya ..	17,888	100	2,412	16,488
Maddur ..	2,120	..	18,141	..
Malavalli ..	9,504	2,329	12,270	10,305
Pandavapura ..	4,654	..	11,001	7,012
Krishnarajpet ..	24,344	..	15,090	..
Nagamangala ..	26,608	3,810	20,941	2,238
Srirangapatna ..	3,120	..	7,987	4,738
Total ..	88,238	6,239	87,842	40,781

Total cropped area

The total cropped area in the district was 6,75,817 acres, according to tables of agricultural statistics of 1964-65. The area sown with different crops is proportionately more in Mandya, Maddur, Malavalli, Krishnarajpet and Nagamangala taluks. The Nagamangala, Maddur and Malavalli taluks have a fairly higher proportion of cultivable waste than the other taluks of the district. Out of the total area, only 18,330 acres were covered with forests, mostly scrub jungles. Only in the Nagamangala taluk and to a lesser extent in the Malavalli, Krishnarajpet and Pandavapura taluks, is there any semblance of forest. In two taluks, *viz.*, Mandya and Maddur, out of the seven, there is no forest at all.

Agricultural population

The population of the district is divided into two distinct groups, *viz.*, agricultural and non-agricultural. Agricultural population includes owner-cultivators, tenant cultivators, cultivating labourers and non-cultivating owners. The non-agricultural population is composed of producers other than those engaged in farming practices, like commerce, transport and other services. It is relevant for this chapter to take note of only the agricultural population. Figures available from census reports reveal that in 1951, there was a total agricultural population of 6,09,827. The figures supplied by the agricultural authorities indicate that about 85 per cent of the total population in the district formed the agricultural population in 1964-65.

Size of holdings

As per the Mysore Tenancy Agricultural Land Laws Committee Report (1958), the distribution of land-holdings according to size-groups owned in the district was as follows :—

Number of land-holders in various size-groups in the taluks of Mandya District

Sl. No.	Size-group	Mandya	Maddur	Malavalli	Pandavapura
		1	2	3	4
1.	100 to 500 acres ..	123	7	3	..
2.	50 to 100 acres ..	685	31	52	26
3.	10 to 50 acres ..	1,525	5,667	1,639	125
4.	5 to 10 acres ..	420	4,101	3,067	469
5.	1 to 5 acres ..	330	8,328	6,443	7,250
6.	Below one acre ..	2	208	3,044	1,890

Sl. No.	Size-group	Krishnaraj-pet	Sriranga-patna	Nagaman-gala	Total
		5	6	7	8
1.	100 to 500 acres ..	..	3	..	136
2.	50 to 100 acres ..	32	81	53	960
3.	10 to 50 acres ..	3,689	928	3,068	17,641
4	5 to 10 acres ..	3,910	2,074	4,375	18,416
5.	1 to 5 acres ..	5,855	3,593	7,010	37,809
6.	Below one acre ..	1,436	1,940	1,850	10,368

From the above table, it is clear that uneconomic units held by a majority of cultivators constitute a large portion of the holdings. In Srirangapatna taluk, there were 1,940 persons who owned land below one acre each. In Malavalli taluk, the problem of uneconomic holdings is very acute. There were 3,044 persons owning land below one acre. It is noteworthy that out of 136 land-holders owning land from 100 to 500 acres in the district, as many as 123 were found in the Mandya taluk alone. Similarly, out of 960 land-holders owning land from 50 to 100 acres, the taluk had 685 of them. Yet another significant feature was that the taluk had only two land-holders owning land less than an acre.

Agricultural meteorology

The seasonal rainfall begins with the pre-monsoon showers from about the last week of March to the middle of May. This period provides the district with two to four inches or 55 to 110 millimetres of rain. By about the middle of June, the south-west monsoon begins with high winds, thus causing a lowering of the temperature. The south-west monsoon season covers the period from June to August. This period gives a precipitation of 10 to 12 inches or 250 to 300 millimetres of rain. After the end of the south-west monsoon, the wind stops, with an appreciable rise in humidity. Then the north-east monsoon breaks in. The average fall in this period is from 15 to 25 inches or 375 to 625 millimetres. This season lasts upto the middle of November. These rains belonging to the north-east monsoon are very essential to all the crops grown in the *maidan* region. With the end of the two monsoons, the weather turns dry and cold and the growth of crops stops. The district average of rainfall is 691.2 millimetres or 27.21 inches.

Agricultural seasons

The agricultural seasons in the district are broadly classified into (1) *Kar* and (2) *Hain* seasons. The *Kar* season corresponds to early *Mungar* season beginning in the month of April or May. The *Hain* season begins from July. In addition to this, there is another season called the *Hingar* season commencing in September or October. In modern agricultural parlance, the two prominent seasons are the *Mungar* and the *Hingar*, *Mungar* being the kharif season and the *Hingar* being the rabi season. The following table indicates the periods during which principal crops are sown and harvested :

Sl. No.	Crop	Season	Sowing	Inter-culturing	Harvesting
1.	Paddy ..	Hain	Jun.-July	Aug-Sept.	Dec.-Jan.
		Kar	Feb.-March	Apr.-May	June-July
2.	Ragi ..	Hain	June-July	Aug.-Sept.	Dec.-Jan.
		Kar	Feb.-March	Apr.-May	June-July
3.	Jowar ..	Mungar	Mar.-April	Apr.-May	June-July
		Winter	Sept.-Oct.	November	Dec.-Jan.
4.	Sugarcane .. (Factory area)		Jan.-Feb. Sept.-Oct.	Apr.-May Dec.-Jan.	June-July Jan.-Feb.

Forestry

As the rainfall in the district is scanty, the forest area is small and restricted, extending to only 18,330 acres. Scrub jungles of inferior variety are found in Narayanadurga, Basavankal and Mudibetta State forests. The most important species found are Jalari, Alale, Dindiga, Devadari, Hippe and Bilimathi. Sandal is scattered all over the district. The minor forest produces are gallnuts, honey, wax, tupra leaves, thangadi and kakke barks, grass and lac, which are collected under a lease system. The grass is often sold to the cultivators on pre-paid licences. Scrub type forests of poor quality are located in Pandavapura, Krishnarajpet and Nagamangala taluks. The problem of erosion is being systematically tackled by contour-trenching and afforestation works. From 1956 to the end of the Third Five-Year Plan, 2,551 acres had been afforested. During 1962-63, 200 acres of land were utilised for planting eucalyptus. The cultivators in the district are raising large-scale Casuarina plantations on their own lands for purposes of obtaining fuel.

Irrigation

Agricultural production depends to a great extent on the development of irrigation. The tanks are the oldest in the irrigational system. In ancient days, the cultivators constructed small tanks across streams to impound sufficient water for their farming needs. There were any number of tanks of this description. The Moti Talab in Mandya district was one of the big tanks, supplying water for wet cultivation. Major Sankey, one of the earliest Engineers, who worked in the State, addressed himself to the task of repairing tanks. In memorable words he has said : "To such an extent has the principle of storage been followed, that it would now require some ingenuity to discover a site for a new tank. While restorations are, of course, feasible, any new work of this description would within the area be almost certainly found to cut off the supply of another, lower down and to interfere in fact with vested interests." Though there are many isolated tanks in various regions, the vast majority of them are constructed on a connected system of streams and their feeders, which are abundant in the table-land of old Mysore.

During the regency of Dewan Purnaiya, a generous sum was spent on irrigation works. This expenditure was, to a great extent, incurred on the repairs of old tanks and canals, the majority of which had fallen into disuse during the reigns of Haidar Ali and Tipu Sultan. During the period when the British Commission was in power in Mysore, a large amount was spent on irrigation works. Most of the tanks were improved and many reconstructed from the disused condition into which they had fallen. After the formation of the Public Works Department in 1856, the expenditure on irrigation went up. Special attention

was directed to irrigation between the years 1872 and 1878, because a separate irrigation branch of the Public Works Department was constituted. Since the rendition in 1881, grants for irrigation were increased and a liberal policy pursued. In 1913, on the specific recommendation of the Chief Engineer, the Government raised the annual grant for promoting irrigation works and the grant was distributed under various heads like major tanks, minor tanks, canals and investigation.

Tank policy

The restoration of disused tanks had come to a definite state of advancement by the time the State was handed back to the Mysore Maharaja in 1881. In 1886, the Government of Mysore decided to hand over all the minor tanks or those yielding a revenue not exceeding Rs. 300 to the Revenue Department, the cultivators doing the earth work themselves and the Government only paying for masonry works where needed. All the other tanks were called major tanks. The restoration of these major tanks was the direct responsibility of the Government and the cultivators contributed a moiety for their betterment. This scheme was tentatively introduced in one taluk of each district and after trial, was extended to all the other areas. A Tank Inspector was appointed in each taluk to assist the Amildar and a trained sub-overseer was posted in each district to help the Tank Inspectors in technical matters. Under the rules issued in 1904, the cultivators were required to contribute one-third of the total cost of restoration including earthwork, the other two-thirds being met out of public funds. In selecting tanks for restoration, perference was given to those where the cultivators came forward with their contribution.

With a view to making the minor tanks restoration scheme a success, it was decided that larger and more liberal Government grants be made available for the improvement of such tanks. During 1914-15, the responsibility for working the minor tanks restoration scheme and the entire control of the operations were vested in the Revenue Commissioner. In regard to maintenance, the cultivators were responsible for doing the earthwork, so as to keep the bunds in strong condition. The repairs to stone revetment and masonry were done by the Government. In order to provide for the obligation of cultivators in regard to the maintenance of major tanks and the restoration, repair and maintenance of minor tanks, the Government of Mysore, in 1911, passed a regulation called the Tank Panchayat Regulation (No. 1 of 1911). The panchayats constituted under this regulation had absolute control over the tanks as also the power to administer the funds earmarked for their restoration, repair and maintenance. The preparation of serial maps and tank registers was also undertaken. In 1916, the Minor Tanks Restoration Regulation XIII of 1916 was passed, providing for the recovery of the cultivators'

share of cost of restoration compulsorily. Later measures fixed the cultivators' contribution at one-fourth of the actual cost of restoration.

Among the many tanks in this district, the Thonnur tank, called also the Moti Talab, in the Pandavapura taluk, is an old tank with historical associations. Moti Talab or ' the lake of pearls ' is situated about three miles to the left of the seventh mile of the Pandavapura Railway Station—Nelligere Road. This tank has been constructed by putting up an earthen bund across the gap between two rocky hills. The bund of this tank is said to have been constructed in the 12th century by Sri Ramanujacharya who named it as Tirumalasagara. Nasir Jung, son of the then Subedar of the Deccan, gave it the name of Moti Talab.

New Tanks

Several new irrigation works were approved under the Plan schemes. These are under way and are expected to be completed within a short period. Some of the more important works which are under execution are dealt with in the following paragraphs.

The construction of a new tank across the Hardihalla in Malavalli taluk at a cost of Rs. 1,90,000, having an atchkat of 130 acres, is in progress. This is situated at a distance of 12 miles from Malavalli, in between a ridge line of Dasanadoddi and Hosahalli villages in Malavalli taluk. It is an earthen bund across the stream flowing in the area.

The opening up of a high level sluice channel from the Koppa tank on the south flank to feed lands near Chikkanahalli village in Maddur taluk at a cost of Rs. 2,50,000 is also under way. This has an atchkat of 400 acres. This is situated near Koppa in Maddur taluk. This high level sluice channel has been opened from the Koppa tank to feed the tail-end lands of the 26th and 27th distributaries (Keregode branch) of the Visvesvaraya canal. The length of the channel is five miles and three furlongs.

The capacity of the Heragonahalli major tank in Nagamangala taluk is being increased at a cost of Rs. 1,16,000.

The Sindaghatta major tank is being restored at a cost of Rs. 1,71,000. This tank is situated in Seelanere hobli of the Krishnarajpet taluk on the right side of the Melkote—Krishnarajpet Road.

Fresh projects have been investigated and project reports have been sent to the Government. These relate to construction of a new tank called the Hulikere—Koppal tank, construction of another tank near the Gaviranganathaswamy temple in Krishnarajpet taluk, restoration of the Aghalaya major tank and opening

up of a feeder channel in Devalapur tank. All these projects are estimated to cost about five lakhs of rupees.

Use of rivers for irrigation

Mandya district is blessed by nature with perennial rivers, the waters of which are used for raising wet crops. Even in the old days, anicuts were constructed across these rivers, and the canal waters were let into fields for growing paddy, sugarcane and other water-fed crops. The rivers in the district, which have been put to irrigational use, are the Cauvery, Hemavathi, Shimsha and other small rivers and streams.

The Cauvery river enters Mandya district near the Krishnarajasagar dam in the Srirangapatna taluk. It flows from north to south and then turns towards the east. The river leaves the district near a point on the Malavalli—Kollegal taluk border.

The Hemavathi river enters the district from the north-western side of the Krishnarajpet taluk near Guddehosahalli and then flows in the western side of the same taluk from north to south and leaves the district from the south-western side of the taluk.

The Shimsha river forms the eastern boundary line of the Nagamangala taluk and enters the district from the northern side of the Maddur taluk near Kirangur. This river flows in the eastern side of the Maddur and Malavalli taluks from north to south and leaves the district in the south-eastern side of the Malavalli taluk near the Basavanabetta forest and joins the Cauvery.

The Lokapavani river takes its origin in the Honakere hobli of Nagamangala taluk and flows from north to south in Nagamangala, Pandavapura and Srirangapatna taluks and joins the Cauvery river near Baburayanakoppal in the Srirangapatna taluk.

The Veeravaishnavi river enters the district in the Bellur hobli of the Nagamangala taluk and flows from west to east and leaves the district from the eastern side of Nelligere hobli.

The more important of the streams made use of for irrigation purposes are the M. Sarahalla in Pandavapura taluk, Narayanadurga *thore* in Krishnarajpet taluk, Koppa tank waste-weir *halla* and Nidasale tank waste-weir *halla* in Maddur taluk. These important streams are made use of for irrigation by constructing pick-ups and anicuts across them.

Anicuts

There are six anicuts in the district out of which three are old ones and the rest are newly constructed. The old anicuts are the Mandagere, Hemagiri and Thaggally anicuts, while the

new ones are the Bolenahalli, Uyyanahalli and Dummasandra anicuts.

The Mandagere anicut is an old one, constructed across the Hemavathi river near Mandagere in Akkihebbal hobli of the Krishnarajpet taluk. This anicut is 666 feet in length. There are two channels from this anicut, *viz.*, the Mandagere right bank channel running to a length of 37 miles and the left bank channel running to a length of 21 miles.

The Hemagiri anicut is also an old one, constructed across the Hemavathi river near Bandihole in Akkihebbal hobli of the Krishnarajpet taluk. This anicut is of size-stone masonry in *surki* mortar and it is 1,360 feet in length. The left bank channel taken out of this anicut called the Hemagiri canal is 23 miles in length.

The Thaggally anicut is constructed across the Shimsha river near Thaggally in Maddur taluk. This anicut is of burnt brick in *surki* mortar and is 825 feet in length. There are two channels opening from this anicut, *viz.*, the Shimsha right bank channel running to a length of 12 miles and the Shimsha left bank channel running to a length of 23 miles.

New Anicuts

The Bolenahalli anicut is constructed across the Lokapavani river near Bolenahalli in Melkote hobli. The length of the anicut is 132 feet and it is constructed with size-stone masonry. There is a feeder channel for a length of three and three-fourths miles to feed the Madarahalli tank.

The Uyyanahalli anicut is also constructed across the Lokapavani river, near Uyyanahalli in Nagamangala taluk. The length of the anicut is 370 feet and is constructed with size-stone masonry. The length of the channel is three miles and one furlong.

The Dummasandra anicut is constructed across the Veeravaishnavi river near Dummasandra in Nagamangala taluk. The length of the anicut is 400 feet, while the length of its right bank channel is four miles.

The construction of a reservoir across the Bhima stream in Malavalli taluk, has been taken up at an estimated cost of Rs. 8,50,000 to irrigate about 530 acres. The proposed reservoir will be situated near Dalavoy-Kodihalli village of Halagur hobli in Malavalli taluk. It will be an earthen bund of about 500 feet in length.

Cauvery Canal system

Even before the Krishnarajasagar dam was built across the Cauvery river, the waters of the river were made use of for

irrigation to a certain extent. Several anicuts were constructed across the Cauvery and its main tributary, the Hemavathi, and from these anicuts, canals were opened out for supplying water to the irrigated tract. The anicuts and the canals, though very old, fulfilled the needs of the cultivators in the area to some extent. At the time of the construction of the Krishnarajasagar dam, a statement was prepared showing the area and assessment under the various channels in the Cauvery valley. The following figures pertaining to the Mandya district have been taken from that statement. They show the extent of the area irrigated by the Cauvery and the Hemavathi rivers and the amounts of revenue realised at that time :—

Name of channel	Area irrigated in acres			Amount of Revenue
	Government	Inam	Total	
1	2	3	4	5
				Rs.
Chikkadevarayasagar ..	13,328	917	14,245	92,286
Devaraya ..	1,832	190	2,022	14,181
Virajanadi ..	7,047	373	7,420	47,265
Bangaradoddi ..	681	81	762	5,408
Maddur Anicut ..	1,377	116	1,493	8,207
Kemmanu ..	925	33	958	6,269
Vaidyanathpur ..	222	27	249	1,555
Bairan ..	240	40	280	2,002
Chamanahalli ..	576	31	607	3,841
Mandagere ..	2,497	546	3,043	20,770
Hemagiri ..	19	1,362	1,381	9,506
Akkihebbal ..	330	50	380	2,490
Kalhalli } Since submerged in	869	347	1,216	8,433
Kannambadi } the reservoir.	1,087	69	1,156	8,102

Lower channels

The lower channels in the Cauvery valley are the Virajanadi, Devaraya, Chikkadevaraya and Bangaradoddi, the right bank low-level channel and the left bank low-level channel. As already stated, even prior to the construction of the Krishnarajasagar dam, these channels were existing and were supplying water for irrigation. The following statement shows the length of each channel and the extent of irrigation under each of them :

Channel	Length	Extent of irrigation
Virajanadi Channel ..	42 miles	10,094 acres
Devaraya Channel ..	23 miles	2,409 acres
Chikkadevaraya Channel ..	72 miles	Not available
Bangaradoddi Channel ..	5 miles	920 acres
Right Bank low-level Channel ..	19½ miles	3,420 acres
Left Bank low-level Channel ..	13 miles	1,430 acres

Close to the village of Sitapur in the Srirangapatna taluk, is the Madadkatte dam, a low straggling structure of rough stone, 776 yards in length and averaging 15 yards in width. From this small dam, the Chikkadevaraya channel is led off. This channel runs to a total length of 72 miles in both Mandya and Mysore districts. In its course, the channel crosses the Anche-halla and Mosale-halla streams and also the Lokapavani river. The Chikkadevaraya channel passes through Haravu, Kyatanahalli, Nelamane, Patsomanahalli, Settihalli and Arakere. Both the anicut and the channel were constructed at the time of Sri Chikkadevaraya Wodeyar, a celebrated ruler of Mysore.

A few yards below the Madadkatte, is the Devaraya anicut, giving rise to a small channel of the same name. On the right bank, the length of the channel is eight miles. This channel ends at the village of Palahalli, which was once the headquarters of the Mysore Ashtagram taluk.

The Balamuri anicut on the Cauvery river is situated one mile from Belagola, giving rise to the Virajanadi channel on its right bank. This channel runs to a length of 38 miles through the Mysore taluk of the Mysore district and passes through Palahalli, Kalasthavadi, Naganahalli, Hebbadi and ends near Ankanahalli.

The Bangaradoddi anicut is constructed across the Paschimavahini branch of the Cauvery river. The channel drawn from this anicut (Bangaradoddi channel), after crossing the little Paschimavahini island, is led over to the Srirangapatna island by means of an aqueduct. It then divides itself into three branches, one entering the Srirangapatna fort by means of an underground duct, the second terminating at the Darya Daulat garden and the third after traversing the island ends near the Gumbaz.

Canal management

The management of the Cauvery irrigation canals was a major factor which exercised the minds of the State engineers, who were constantly asked by the Durbar to increase the potentialities of irrigation. The Government of the State earmarked generous amounts to reconstruct some of the old anicuts and repair the canals. In 1886, during the Dewanship of Sir K. Seshadri Iyer, a new division of the Public Works Department, called the Channel Division, was formed to deal specifically with the restoration and extension of channels drawn from the Cauvery, Hemavathi, Kabini and Lakshmanathirtha rivers. Improvement and extension of channels engaged the earnest attention of this new division. Proposals were submitted to the Government to extend the Virajanadi channel. The Dewan was assured that the channel had immense possibilities of extension and expansion in the lower reaches. The Government did not delay any considerations of the proposal and in 1888, the improvement works connected with the Maddur anicut channel and the Virajanadi

channel extension were taken up and promptly executed. As a result of these improvement works, the acreage of wet cultivation increased considerably. In the Virajanadi channel atchkat, 3,000 additional acres were included in the irrigation command, the Maddur Ane atchkat brought 900 additional acres and the Mandagere channel atchkat 1,500 acres. In 1890, the Maddur tank was restored so as to allow more water for irrigation.

At the time of retirement of Colonel Bowen, who was the Chief Engineer of the State, investigations were under way to improve the irrigation capacity of all the anicuts on the Cauvery river and this work was completed in 1892. In 1893, the Dewan took personal interest and ordered the improvement of the Maddur Ane channel and also the Kalhalli channel in Krishnarajpet taluk. The Sulekere tank in Malavalli taluk required much improvement and this was also attended to.

Improvements to anicuts

About that time, repeated representations were made in the Mysore Representative Assembly to extend the irrigation command under the Kalhalli channel in the French Rocks sub-division. This was also attended to and more water was supplied to irrigated fields. In 1899, the Devaraya anicut was improved and strengthened. In 1900, a new aqueduct was constructed at a point near the seven-and-a-quarter mile of the Chikkadevaraya-sagar channel. The Chikkadevarayasagar anicut was a very old one and due to periodical heavy floods in the Cauvery river, the strength of the anicut was not up to the mark. In 1904, the Government decided to construct a new anicut and sanctioned Rs. 1,03,319 for this purpose. In that year, under the personal directions of Dewan Krishnamurthi, the work was taken up in right earnest and was completed in 1905. The same year, reconstruction of the Hemagiri anicut in Krishnarajpet taluk was sanctioned at an estimated cost of Rs. 93,000 and the work was finished within a year.

As stated earlier, irrigation, as practised within the Mysore State at that time, was either from tanks, a vast number of which existed all over the area or from channels which were in the Cauvery valley. The tanks played an important part in producing rice and garden crops, but the irrigation from this source was not always dependable. In 1876-77, a year of extreme drought, the country suffered much for want of food and about one-fifth of the population of the old Mysore State is said to have died from the effects of the disastrous famine. The irrigation from the old Cauvery channels was more secure, but its command area was small. Water from these channels was usually available only for the first crop and the irrigation of perennial crops suffered from serious disabilities. Water supply in summer was very precarious and crops like sugarcane and mulberry could not be extensively cultivated. It was, therefore,

proposed to provide water for irrigation throughout the year for perennial crops. In pursuance of this proposal it was thought best and feasible to impound the waters of the Cauvery on a large scale by recourse to modern aspects of hydraulic engineering. The Government embarked on a sound policy of utilising the potential to a greater extent, and earnestly went about surveying the possibilities that the Cauvery river offered to construct a reservoir.

Stages of investigation

Although anicuts across perennial rivers were known to exist from ancient times, it was only during 1870-1880 that attempts were made to construct high masonry dams across large rivers. Ever since the feasibility of high masonry dams became apparent, the question of constructing a reservoir on the Cauvery river engaged the attention of the successive Chief Engineers of the State. A reservoir would have been built long ago, had the principles involved in the building of high masonry dams been so well understood formerly as they were later. Colonel Sankey, a late Chief Engineer of the State, ordered investigations for an irrigation reservoir project about the year 1870. As a result of the surveys, it was reported that there was one suitable site for a high dam on the Cauvery at Ramaswamy Kanive, close to the borders of Coorg and Mysore. The cost of a reservoir at this site was considered prohibitive. About the year 1885, Mr. McLaughlin, an Executive Engineer, was placed on special duty by Colonel Bowen, the Chief Engineer, to investigate a reservoir scheme for the combined purpose of irrigation and water supply to the city of Mysore. This project was also abandoned on account of its high cost.

In 1898, the Mysore Government undertook the construction of a reservoir at Marikanive in the Chitradurga district at an estimated outlay of Rs. 37 lakhs. As all available funds were required for this undertaking, attention for a time was diverted from the Cauvery project. But since the power station came to be established at Shivasamudram in 1902, a reservoir on the Cauvery or one of its tributaries became an urgent necessity. Under the orders of Mr. McHutchin, the then Chief Engineer, Mr. V. H. Karve, a former Superintending Engineer, re-investigated the Ramaswamy Kanive site and came to the conclusion that the foundations there would be unsatisfactory. He then selected two other sites for a dam on the river near Kannambadi, eight and ten miles respectively west of Srirangapatna. The late Captain Bernard Dawes, who was Deputy Chief Engineer at the time, after careful investigation, recommended the lower site. This site was approved by Mr. McHutchin after Dr. W. F. Smeeth, the then Government Geologist, had examined the foundations and pronounced them to be strong and sound. In his final report dated 25th July 1908, Captain Dawes proposed to construct a reservoir with a dam, 70 feet high, to be eventually raised

to 115 feet. Rough estimates were prepared for the first stage of the scheme.

Captain Dawes' idea was to earn a large revenue by supplying power to Madras and Coimbatore, besides the Kolar Gold Fields, and from the net income so earned, to construct a system of canals capable of irrigating 3,00,000 acres eventually. Captain Dawes summed up his financial forecast in these words: "In the 30th year, the original debt will be liquidated, and by the beginning of the 39th year, the whole of the irrigation channels will be complete. The State will then be the owner of a property free of all charges except Rs. 8 lakhs for maintenance and bringing in a revenue of Rs. 60 lakhs per annum and this on an original borrowed capital of Rs. 175 lakhs". Under the advice and guidance of Mr. McHutchin, Captain Dawes worked on these proposals with great zeal and ability, but partly on account of the heavy cost and partly because he contemplated expenditure on works outside the State, the project was not carried to the stage of practical action.

Later on, on the 5th May 1911, the Government of Mysore received another report from the Chief Engineer on the Cauvery Project. After careful consideration of the project report, the Government in their order dated 12th October 1911, gave final sanction for the construction of the first stage of the reservoir scheme estimated to cost about Rs. 80 lakhs. The reservoir was named 'Krishnarajasagar' after the late Sri Krishnaraja Wodeyar in whose reign its construction was undertaken.

Krishnarajasagar Reservoir

The Krishnarajasagar Reservoir was thus formed by the construction of a dam across the Cauvery river, nine miles on the upstream side of the historic town of Srirangapatna and 12 miles from Mysore city. The lake, at the maximum water level, has a water-spread of about 50 square miles. Construction of this reservoir was undertaken with the object of ensuring steady supply of water for the generating station at Shivasamudram to meet the growing demand for power in the State and to supply water for irrigation in the arid tracts of Mandya district. In the words of late Dr. M. Visvesvaraya, the scheme was to "open out a vista of possibilities of ever-increasing value in the State by adding to the productive power of the people with the increase in agricultural produce and development of industries and manufacture". The catchment area of the river above the dam is 4,100 square miles, half of which lies in the regions of Coorg and Mysore districts. The flow of the river at the site of the dam fluctuates from a normal high flood of 1,00,000 cusecs during the monsoon months to a flow of even less than 100 cusecs in summer. The highest flood discharged in the river, which occurred in 1924, was 2,90,000 cusecs.

Progress of construction work

In the first stage of the construction of the Krishnarajasagar reservoir, it was the intention of the Government to raise the dam to a height of 97 feet with weir crest at 80 feet above the bed of the river. A sum of Rs. 91 lakhs was earmarked for this stage of the work. The first stage progressed according to schedule. The excavation of the foundation in the river-bed, however, gave considerable trouble owing to the presence of water and springs and the existence of a deep mica vein close to the south bank. The storage of water secured at the first stage not only enabled the Government to guarantee to the Kolar Gold Mines power supply upto 9,321 H.P. as previously agreed to, but also to supply additional power to the extent of 5,000 H.P.

As there were differences of opinion between Madras and Mysore in respect of the second stage of the reservoir, the Government of India appointed in 1914, a committee of arbitration headed by Sir H. D. Griffin. The award contained a proviso placing the Mysore Government under an obligation to deliver a constant water supply of 900 cubic feet per second in summer months, while the natural river flow was on occasions as low as one-tenth of that discharge, compelling Mysore thus to pay a heavy price under the award. With regard to the future raising of the storage capacity, there arose a dispute between Mysore and Madras as to the extent of their respective rights to share the river waters. A conference took place at Mysore on 13th November 1923, at which Lord Willingdon, then Governor of Madras, was present and Sir Albion Banerji, Dewan of Mysore, represented the Mysore State. After a full discussion, an agreement was arrived at between the two Governments in February 1924 and this agreement was subsequently ratified by the Secretary of State for India.

Initial stages

The first stage of construction of the dam took a definite shape by 1914 when the laying of the foundation in the river-bed was over. The difficult portion of the work in the river-bed and on the banks was completed and the masonry rose to a height of 60 feet above the bed on the south side and to 36 feet on the north bank. Water was stored to a height of eight feet at the gap in the centre of the dam. Arrangements were made for the construction of turbine sluices in the dam with a view to installing a power station at the reservoir itself, from which electric energy was contemplated to be supplied to the Belagola pumping station, which supplied protected water supply to Mysore city. In 1915, the dam rose to a height of 65 feet. With the aid of scouring sluices fixed in the dam, the discharge in the river, except during high floods, was regulated according to requirements. The outlay on the construction of the dam during 1915 was Rs. 26,92,000, bringing the total upto the end of July 1915 to Rs. 71,45,000. During the year 1916, the outlay earmarked was

Rs. 20,93,170 and the total upto the end of June 1916 was Rs. 92,39,373.

By 1919, the height of the dam was raised to 107 feet on the two flanks and the low level canals and other channel works were attended to. The expenditure on the construction of the dam exceeded Rs. 155 lakhs. In order to give effect to the rules and regulations framed under the terms of the Griffin award, a temporary division of the Public Works Department, called the Gauging and Regulation Division, was formed with headquarters in Mysore city. All the works connected with the Cauvery valley irrigation were made the sole responsibility of a separate Chief Engineer, who was also appointed Joint Secretary to the Government. During the year 1920, the construction work in the reservoir project further progressed and the temporary weir gap was raised from +63 feet to +75 feet. The turbine sluices, high level irrigation and scouring sluices on the north bank were constructed. The top of the dam on the south bank was at +107 feet and that on the north bank +100 feet. The sides of the south bank low level canal were properly rivetted. By 1921, the first stage of the reservoir works was nearly completed. The gap in the dam was raised to a height of 80 feet above the river-bed, thus completing the storage contemplated for the first stage. A portion of the body wall of the waste weir was constructed upto 77 feet above the river-bed. All these works were completed before the outbreak of the monsoon, and a flood of nine feet was safely passed over the river gap of the dam. In order to help the cultivating raiyats, the available water from the reservoir was given for ten days in the month in the near reaches of the sluice for raising food crops.

After 1922

In 1922, a special committee, presided over by Sir Frederick St. John Gebbie, was appointed to go into the question of future policy in regard to the reservoir project. The opinion of the committee centred on the feasibility of combining the Cauvery power scheme and the reservoir works. By 1923, the total expenditure on the reservoir project came to Rs. 211 lakhs. The grant during the year 1925 for the reservoir works was Rs. 14,69,875. The low gaps in the dam were all filled up, and the raising of low portions to 122 feet went on as scheduled. During the high floods in 1925, water was stored upto 106 feet and passed over the 106 feet weir to a depth of one-and-three-fourths feet. The programme envisaged in that year was to raise the masonry to 122 feet throughout the whole length of the dam and subsequently to raise it to 130 feet as recommended by the special committee. The total expenditure upto the end of 1924 including the canal works came to Rs. 227.9 lakhs. During 1926, a sum of Rs. 10.5 lakhs was provided for the reservoir works. The work of raising the dam to its full contemplated level of 130 feet progressed satisfactorily. The supplies of water

available in the storage level of 106 feet were sufficient to irrigate over 60,000 acres. In 1926, the excavation of the high level canal was in full progress, the first three miles having been completed and water allowed for irrigation.

The year 1928 was a notable one in the construction of the Krishnarajasagar reservoir works. In that year, the construction of the dam to a height of 130 feet was completed leaving the crest of the weir at R.L. 106 feet. The original estimates of the project were closed at this stage. But it was felt that the raising of the weir to 124 feet required earnest attention. During 1929, a sum of Rs. 8.90 lakhs was earmarked to push through the remaining works. The excavation of the high level canal went on as programmed. The Hulikere tunnel was bored to a length of 4,000 feet against the full length of 9,200 feet. The dispute, which was pending settlement with the Government of Madras regarding the interpretation of certain rules of the 1924 agreement, was settled by compromise through the good offices of Mr. S. E. Pears, the British Resident in Mysore, in collaboration with Justice Sir A. Page of the Calcutta High Court.

By 1932, the Krishnarajasagar dam works were practically over. It was the largest of the engineering works undertaken in the old Mysore State and a standing monument to the talent, skill and resources of the Mysore engineers.

Later stages

By 1936, the Krishnarajasagar reservoir and allied works accounted for a total investment of Rs. 323.47 lakhs. The gross revenue from the new irrigation works for 1936-37 was Rs. 63.39 lakhs. The work on the Shimsha branch from the Maddur branch channel progressed satisfactorily. In 1938, the opening of a new branch of the Shimsha canal was proceeded with. A special division was established for this purpose. By 1939, the extent of irrigable land under the high level canal and distributaries rose from 48,025 to 51,630 acres. The extension of the 24th mile distributary canal and the second section of the Cauvery branch canal were also completed. The Lokasara branch of the canal was being vigorously pushed through. The Shimsha branch of the canal was excavated upto a length of 18 miles. By 1940, the total command area under the high level canal was 70,239 acres. Later on, the full command was reached and water made available for irrigation.

Details of the dam

The reservoir dam is 8,600 feet long, 130 feet high above the river-bed and is intended to store 124 feet depth of water at full reservoir level. The height above the deepest foundation is 140 feet and the width of the dam at this depth is 111 feet. The storage capacity of the reservoir is 43,934 million cubic feet (M.Cft.) above the sill of the irrigation supply sluices, which are 60 feet above the bed level and the total capacity is 48,335

million cubic feet. A motorable roadway, 14½ feet wide, is formed on the top of the dam with ornamental parapets on both sides lit with electric lights. The profile of the dam is of the non-overflow gravity type with necessary front and rear slopes. It can withstand the water pressure of 124 feet depth at its face.

Surki mortar

The masonry of the dam is of random rubble stone set in *surki* mortar, the facing being built of roughly hewed stones and laid in horizontal position to the required profile. The stone used for the construction is hard granite, obtained from quarries situated within a radius of five to seven miles. The mortar used for the masonry was specially prepared at the site with natural hydraulic lime and clay available in the locality. It is called *surki* mortar and is manufactured by burning the natural hydraulic lime at the site and mixing this quicklime with burnt broken bricks in the ratio of 1 : 4 and grinding the mixture to a paste in the power mills. This special kind of mortar was first evolved by the Mysore engineers during 1889 and was used in the construction of the Vanivilas Sagar dam across the Vedavathi river in Chitradurga district. This mortar was subsequently perfected on the Krishnarajasagar dam construction, as cement manufacture in India was still in its initial stage in those days and the material had to be imported at a high cost from foreign countries. Since then, this kind of mortar is being exclusively used in the construction of other dams also. This mortar has certain inherent superior qualities over cement mortar on account of its low rise in temperature during setting. This special quality of mortar has rendered the provision of contraction joints unnecessary for structures built of it.

The whole dam, being of a magnitude requiring special attention for each detail, was carried out under piece work agency and daily labour under departmental supervision. No contractors were employed at any stage. This system of work called for great organising ability and intensive supervision on the part of the engineering staff.

The quantity of masonry in the dam is roughly 30 million cubic feet and the cost of the masonry worked out to Rs. 31 per 100 cubic feet. The quantity of excavation involved for the foundation was 8.73 million cubic feet at Rs. 55 per 100 cubic feet. The number of labourers employed during the peak construction period was as many as 10,000.

Sluices

There are, in all, 171 sluices of different sizes in the dam at various levels providing for flood disposal and scouring, irrigation and power generation. The flood disposal and scouring sluices comprise: (*a*) 40 vents of eight feet by twelve feet with sill at 106 feet above the bed situated immediately after the entrance gate at the south end. These vents are provided with lift gates

worked electrically by a travelling crane; (*b*) 48 vents measuring ten feet by eight feet with their sills at 103 feet above the bed located in continuation of the above sluices and worked electrically by another travelling crane. These are also provided with lift gates; (*c*) on the top of these lift gates, there are 48 vents of ten feet by ten feet with their sills at 114 feet above the bed and provided with automatic gates, which are placed in six batteries of eight gates each. These gates open automatically with the rise of water level in the reservoir above the maximum water level. This was patented by the late Dr. M. Visvesvaraya. The above lift and automatic gates numbering 136 are all of cast iron and were manufactured at the Mysore Iron and Steel Works, Bhadravathi; (*d*) in continuation of the automatic gates, are located 16 sluices of ten feet by twenty feet with their sills at 80 feet above the bed, each provided with a gate operated electrically by an independent crab winch; (*e*) at the centre of the dam, *i.e.*, at the original river course, are situated eight deep level scouring sluices of six feet by twelve feet with their sills at 12 feet above the bed. These gates are operated mechanically by independent crab winches; and (*f*) on the north bank of the river, are located three more scouring sluices of six feet by fifteen feet with their sills at 50 feet above the bed, also with gates worked mechanically by independent crab winches. The maximum discharge which can be passed through all the above sluices is 3,50,000 cusecs. The surplus waters are let off through suitable waste weir channels with necessary protective works.

The irrigation sluices at the dam consist of (*a*) three vents, six feet by twelve feet, with their sill at 60 feet above the bed situated on the north bank of the river to feed the north bank high level canal known as the Visvesvaraya canal, which is designed to irrigate 1,20,000 acres, and also a left bank low level channel commanding about 1,500 acres and (*b*) one vent of six feet by eight feet at 60 feet above the bed located at the south end of the dam. The right bank low level channel takes off from this vent emerging through a tunnel immediately below the entrance gate of the dam. This channel is designed to irrigate an extent of 3,500 acres. All these irrigation sluice gates are worked independent of each other mechanically by crab winches. The turbine sluices consist of four pen-stock pipes of six feet diameter with their centres fixed at 53 feet above the bed; the gates and their parts for these were obtained from Switzerland.

Brindavan Gardens

At the entrance to the dam, an ornamental gate-way has been built from which a concrete road leads over the dam. Below the dam are situated the famous Brindavan gardens laid out on both sides of the river. At the entrance to the garden on the south side, in a niche built in the face of the dam, is located a beautiful image of the Goddess Cauvery with a bowl in her hand from which a continuous stream of water flows, indicative of

continuous prosperity and benevolence. On the eastern side is an orange grove with a plant nursery for ornamental, shady and economical trees which supplies plants to different parts of the State. At another place, there is a horticultural farm where many varieties of fruits are grown. The variegated colours of the beds with a large number of fountains, big and small, arranged all over, with the subdued roar of the cascades from the pavilions, give the whole place the appearance of a wonder-land. At night, a string of electric lights adorns the full length of the dam and mildly illuminates the flowery landscape below.

Rehabilitation of displaced persons

The reservoir submerged 9,520 acres of irrigated wet lands and 13,923 acres of dry lands, as also 8,500 acres of Government waste land. It also involved rehabilitation of about 15,000 people from 25 villages, which got submerged in the lake. In order to give quick relief in this direction, a scheme was evolved to settle the expropriated people in the newly formed villages and giving them lands in exchange for the lands submerged. In the submerged villages, each house was assessed and valued and the owner paid half the value in cash and was permitted to take all the materials that could be had from the submerged houses. In addition, timber was also sold at half the prevailing rates, the losses on this account being shared equally by the reservoir works and the Forest Department. For building the villages, suitable sites were formed and given free of cost. In addition, the Government formed roads and drains, excavated wells, paid the cost of acquisition of lands for sites and constructed schools, *chavadis* and also temples, mosques and churches.

Fresh channels were opened out for providing water to lands for cultivation both above and from the reservoir and all waste lands commanded by these channels were awarded to the expropriated raiyats in compensation. Whenever each private holding under these channels exceeded three acres in extent, one-third of the extent was taken away from the owner for award purposes. By these methods, it was possible to render the necessary relief with a minimum of hardship to the population involved. The cost of acquisition came to Rs. 46.5 lakhs.

The dam was designed by the late Dr. M. Visvesvaraya, when he was Chief Engineer of the State. The project was investigated and surveyed from 1910 to 1911. The final surveys and the preparation of the project commenced in July 1910, with the approval and under the orders of Sri T. Ananda Rao, the then Dewan of Mysore and the sanction of His Highness the Maharaja of Mysore. The estimates for the hydro-electric part of the scheme were furnished by Mr. H. P. Gibbs, Chief Electrical Engineer to Government, who had for several years been in charge of the Cauvery power scheme and whose knowledge of similar schemes in other parts of the world was an advantage. The

reservoir project received energetic and capable treatment at the hands of Sri B. Subba Rao, Executive Engineer, assisted by Messrs. M. A. Anandalwar and K. R. Seshachar, Assistant Engineers. The last-named officer had for many years worked on the Marikanive dam (Vanivilas Sagar in Chitradurga district). The work on this project which began in 1911, was practically completed in 1932.

Investigation for canal system

The Cauvery Reservoir Scheme included a proposal to construct an irrigation canal starting at a level of 60 feet above the river-bed at the dam site. At a point 25 miles from the head works, a hill saddle known as the Hulikere ridge had to be crossed. The irrigation canal had to be taken across this ridge, partly by means of a tunnel about one and a half miles long before the canal gained command of a large area of fairly level country. Beyond the cost involved, the proposed tunnel presented no special engineering difficulties. After crossing the ridge, the canal was to extend about 50 to 70 miles and command a large tract of land on both sides of the railway line. The yearly rainfall in this area was less than 30 inches and some portion of the population earned their livelihood by going outside the tract. Even in the mild famine of 1908-09, a large number of cattle died in this tract for want of fodder.

The line for the irrigation canal was so traced that it commanded three to four times the extent of land that was proposed to be actually irrigated. It was also proposed to develop irrigation according to the block system with a view to preventing over-saturation of the soil and the land becoming unhealthy. The land to be traversed on the bank of the river and in the Lokapavani valley—miles 0 to 25 of the canal line—was very rough and the cutting for the canal was costly. There was, further, a formidable obstacle in the Hulikere—Karighatta range of hills—miles 25 to 29 of the canal line—separating the Lokapavani and Shimsha drainages. The lowest point in the ridge was 140 feet above the bed grade of the canal in this section. Several saddles were examined as also the possibility of taking the canal in contour round; the southern terminus of the range at Karighatta was also fully investigated. All these were found to be very costly and were given up. Beyond this range of hills, there were numerous valleys and some ridges to be crossed, but no difficulty was likely to be met with. The larger streams, Bindenahally stream, Shimsha, Amruthur stream, Nidasale *thore* and Kanva, had to be crossed either on aqueducts or by constructing reservoirs and taking off channels beyond. In some places, it was found possible to tail off the canal into the streams and draw off supplies lower down at anicuts or new anicuts to be constructed. There were several large cuttings also to be resorted to. Under the main canal up to Channapatna, 110 miles in length, the extent of lands commanded came to about 938 square miles or 6,00,538

acres. Of this extent, excluding the area under irrigation by the then existing river channels, 37,538 acres were under wet or garden cultivation and 2,41,347 acres were *Kharab* lands including jungles, unassessed waste and the like. A good portion of this *Kharab* land was also capable of being irrigated. The lands under the first portion of the canal upto the French Rocks were inferior. The Chikkadevarayasagar channel ran close to it. The canal from the French Rocks to the east side of the Hulikere range of hills ran in the steep Lokapavani valley. It was proposed in the first instance not to irrigate any lands until the Hulikere—Karighatta range was crossed. The lands to the east of the Hulikere range were fairly good. The lands beyond the Shimsha in the Kunigal, Huliyurdurga and Channapatna areas were superior and the land in the Channapatna taluk was flat. The canal network constructed under this project was being formerly called the Irwin Canal system. Later, it was renamed as the Visvesvaraya Canal system after the great engineer-statesman Dr. M. Visvesvaraya.

North Bank Canal

The proposal to construct the main irrigation canal from Krishnarajasagar underwent several technical investigations. Sri B. Subba Rao, Executive Engineer, prepared a note in April 1911 on the project for a north bank canal from the Cauvery reservoir. The salient features of the note, which has now become historical, relate to a line for the canal on the north bank of the Cauvery river to irrigate lands in the dry tracts of Mandya, Malavalli, Nagamangala, Kunigal and Channapatna taluks. This line was further continued towards Closepet (Ramanagaram) and Kanakapura to tail off into the low ground in the State forests on the left bank of the Arkavathi, a little above its junction with the Cauvery. This alignment was taken with the object of finding out the utmost limits of irrigation on the north bank. The canal line as envisaged by Sri B. Subba Rao started from the reservoir at 60 feet above the bed of the river and ran near the French Rocks town (present Pandavapura) and crossed the Lokapavani river about five miles beyond the French Rocks town. Then it had to cross the formidable Hulikere—Karighatta range of hills. The line then followed close to the northern boundary of the Mandya taluk, crossing the Bindenahalli tank valley, and passing by Devalapura in Nagamangala taluk, it crossed the Shimsha valley into Kunigal taluk.

In the first stage of the Cauvery reservoir project scheme, no canal was excavated. The storage in the reservoir was made use of to guarantee minimum supplies in the hot weather months for power generation at Shivasamudram. The waters were also used for protecting hot weather crops in the valley, besides bringing under irrigation 25,000 to 30,000 acres of new lands by extending the Chikkadevarayasagar channel on the north bank. In the second stage of the scheme, excavation of the north bank canal

was completed upto 48 miles, tailing off into the Bindenahalli stream, a tributary of the Shimsha river. The bed fall for the canal varied from 0.8 foot per mile to one foot per mile in ordinary ground. It was two to three feet per mile in the smaller cuttings, four feet per mile in open cuttings on either side of the Hulikere saddle and eight feet per mile in the Hulikere tunnel. The depth of flow in the canal was 12 feet or ten feet at the start and five and a half feet at the tail end of the main canal. The bed width varied from 43 feet to 86 feet where the line ran in contour and 46½ feet to 53 feet in cuttings.

The canal was led off at +60 level of the Krishnarajasagar dam on its northern bank. The maximum carrying capacity of the canal is 2,200 cusecs. This canal was designed and executed by Sri K. R. Seshachar. Its first four miles were completed and tested in 1930. In the first reach, the canal runs about 26 miles in a rugged country, crossing deep valleys by means of large aqueducts and spurs by deep cuttings. The canal then passes through a range of hills by means of a tunnel (Hulikere tunnel) 9,200 feet in length, probably the longest irrigation tunnel in India. On emerging from the tunnel, the canal commands a wide expanse of nearly 3,00,000 acres in extent, out of which only 1,20,000 acres were selected for irrigation. In the entire canal system, a number of branch canals and sub-branch canals have been constructed to a total length of 180 miles. The Krishnarajasagar Division of the State Public Works Department looks after the first 28.5 miles of the canal and the rest is looked after by other divisions. The cost of the canal system amounted to about Rs. 200 lakhs.

Hulikere Tunnel

As already described, the alignment of the main irrigation canal was not taken out on a detour, because it would have unnecessarily traversed a longer distance through rough hilly country with no substantial addition to irrigation. Many saddles were examined and given up as they would have involved greater increase in the length of the tunnel. After careful consideration of all possible alternatives and aspects, the Hulikere alignment was suggested as the best one, as it secured substantial economy in head maintenance and initial outlay. The canal, between 25 and 29 miles, includes the Hulikere tunnel and the two adjoining deep apron cuts. The tunnel pierces the Karighatta range of hills near Hulikere village, five miles from the Byadarahalli railway station on the Bangalore-Mysore railway section and is served by a motorable road. The tunnel, which lies from 67 to 150 feet below the ground level, is aligned in one straight line from one end to the other and is situated practically east to west. There are in the tunnel, two portals and two shafts giving six working faces. The sides slope to the centre and the tunnel is surmounted by a semi-electric arch giving it the

shape of a horse-shoe measuring 16 feet by 14 feet. The completed tunnel is one mile, six furlongs and 440 feet in length. The length of the approach open cutting is one furlong and 16 feet. The average depth of the tunnel below the ground is 100 feet. The cost of the tunnel including deep cuts came to Rs. 45,62,000. Soon after the Hulikere tunnel, the canal divides itself into the Maddur branch and Cauvery branch.

Almost annually, improvements are effected to these irrigation canals so as to ensure adequate supply of water to the atchkats. The statement given below indicates the several branches of the Visvesvaraya canal system and the acreage irrigated thereunder :

Name	*Area under irrigation (in acres)*
Main canal upto Hulikere tunnel ..	8,208
Maddur branch ..	23,798
Cauvery branch ..	14,744
Shimsha branch ..	10,280
Keregode branch ..	11,500
Lokasara branch ..	1,682
Hebbakavadi branch ..	15,153
Nidaghatta branch ..	5,203
Thuraganur branch and extension ..	11,124
Hebbahalla pick-up channel ..	7,293
Total ..	1,08,985

Visvesvaraya Canal Division

There is a separate division of the State Public Works Department to look after these canals, called the Visvesvaraya Canal Division, located at Mandya. All the improvement works such as removal of silt, lining and the like are done by the Visvesvaraya Canal Division with a regular programme and on priority basis. By constant care and timely improvements of the canal system, not only the old atchkats have sufficient water supply, but also there is a possibility of finding out fresh atchkats. There is a committee called the Advisory Board for Irrigation Development under Krishnarajasagar and Nugu projects, which gives suggestions from time to time. All the improvements and developments are executed under the expert advice of this special board. This Advisory Board meets once in every three months to review the progress achieved and to suggest fresh improvements. The Divisional Commissioner, Mysore Division, is the president of the Advisory Board and the Executive Engineer, Krishnarajasagar Division, is the secretary.

The construction of the Visvesvaraya canal, which is the main irrigation canal of the Krishnarajasagar reservoir, has enabled the setting up of the Mandya Sugar Factory and the Co-operative Sugar Mills at Pandavapura. The opening of sugarcane cess fund roads in the Visvesvaraya canal region is playing a vital part in the development of irrigation in the tract. The creation of a two-furlong dry belt zone around the several villages has been implemented in the canal area as an anti-malaria measure.

It was estimated that a total extent of about 7,200 acres was under unauthorised irrigation in the village reserve zones in the canal area. This large-scale unauthorised irrigation in the upper reaches resulted in shortage of supplies of water to the tail-end areas under the several branches. As a result, several branches and distributaries of the canal were being allocated for raising semi-dry crops. To examine the issue thoroughly and to make suitable recommendations, the State Government appointed a committee called the Visvesvaraya Canal Team. The team after actually examining the local conditions, was satisfied that the two-furlong dry zone was quite flexible and suggested the reduction of village reserves. The team did not suggest a general reduction in the village reserves. A reduction generally to a one-furlong dry zone would cause greater dampness due to raising of sub-soil water in the villages and consequent increase in diseases associated with such dampness. When the recommendations are fully implemented, the unauthorised irrigation would be regularised to an extent of 2,500 to 3,000 acres.

Problem of silt

Silt gets deposited along the several channels and erosion is the immediate problem. The removal of silt is being attended to periodically to avoid the head-up so as to facilitate the easy flow of water in the channels upto the tail end. The clearance of silt and repairs necessitated by erosion on the canal system are done by registered contractors.

The Irrigation Officer is the authorised authority who is to enforce the Irrigation Act. He is competent to dispose of minor cases. The Assistant Engineer, who looks after the canals and water distribution, is the Irrigation Officer. If the cases under the Irrigation Act are of major magnitude, they are brought before courts of law. The Mysore Irrigation Act, 1932, as amended by Acts VII of 1938 and VIII of 1952, is in force in the canal area. Water from the canals is let out from the outlets in branch canals. Through the *hikkals* excavated by the cultivators, water is led to the fields. There are controlling arrangements for several distributaries and the channel water is led according to the atchkat below the sluices.

The question of revising the Act so as to make it more comprehensive is under the consideration of the State

Government. The regulation of water supplies under the Visvesvaraya canal system is looked after by the Public Works Department with necessary technical staff. The water supply for the monsoon irrigation starts from July every year and continues till December. For sugarcane, water is supplied from January to June. Several notifications indicating the regulation of water in various branches are issued from time to time for the information of the public, well in advance of the commencement of the monsoon or at the time of summer supplies, as the case may be.

The common irrigation offences in the channel area are tampering with the sluices, breaching of distributaries or closing of *hikkals* and drawing water for unauthorised irrigation within the village reserve where irrigation is prohibited for health reasons. During summer supplies, unauthorised use of water for raising *Kar* paddy is quite wide-spread throughout the irrigated tract. The Irrigation Officer is empowered to take action on the defaulters. In cases such as breaking of sluice gates, the help of the police is sought and after investigation, prosecutions are launched.

Mysore-Madras Agreement, 1892

As stated earlier, with the progress of construction work in respect of the Krishnarajasagar dam, a dispute arose between the Mysore and the Madras Governments regarding the sharing of the Cauvery waters. Due to the complicated nature of the dispute and the important issues involved, the dispute between the two Governments dragged on for several years delaying the early completion of the work. An agreement, dated the 18th February 1892, commonly known and cited as the 1892 agreement, had been earlier entered into between Mysore and Madras. The agreement contained rules and schedules defining the limits within which the waters were to be shared. Under clause III of the 1892 agreement, the Mysore Government requested consent of the Madras Government to the construction of the dam and the reservoir across the Cauvery river at Kannambadi, that is, the Krishnarajasagar dam and reservoir.

Among the more important events of interest to Mysore State in respect of development of irrigation was the arbitration award of Sir H. D. Griffin who, along with Mr. Nethersole, had gone into the whole question of Cauvery waters. This arbitration committee, appointed by the Government of India in 1914 to decide the terms and conditions under which the Madras Government should give its consent to the construction of the dam and the reservoir at Kannambadi, gave its award in 1916, which was quickly confirmed by the Government of India. As a result, many points of difference between Mysore and Madras regarding the storage of water were settled. This enabled the Mysore Government to undertake the second stage of the Cauvery

reservoir project. At that time, there appeared to be considerable misconception, particularly among the inhabitants of the delta in the Thanjavur and Tiruchirapalli districts regarding the effect of the Griffin award. Statements appeared in the Madras press and speeches of protest were made at public meetings that the award of Sir Henry Griffin was favourable to Mysore and injurious to the interests of Madras.

Re-appraisal of dispute

At the time of the award in 1916, the total area irrigated in the Cauvery valley in Mysore was 1,15,000 acres. But the corresponding area in the lower reaches of the river within Madras State was 12,25,500 acres. That is to say, 92 per cent of the area irrigated by the Cauvery river was in the Madras territory and only eight per cent was in Mysore. But nearly three-fourths of the total water supply of the river passed through Mysore territory. A large surplus of this water went to waste. The Madras Government appealed to the Secretary of State for India for a fuller and detailed examination of the issue. The Secretary of State ordered a reappraisal of the dispute. Afterwards, both the Mysore and the Madras Governments entered into negotiations for an amicable settlement of the issue. As a result of these negotiations, certain rules and regulations were framed and agreed to by the Chief Engineers of the Mysore and Madras Governments on 26th July 1921. Later on, the technical officers of the two Governments met in conference and examined the question of extension of irrigation in their respective territories. As a result, certain points in respect of such extension were agreed to by the Chief Engineer of Irrigation, Madras, and the Special Officer, Krishnarajasagar Works, Mysore. This was the background of the 1924 Cauvery agreement between Madras and Mysore already referred to. According to this agreement, the minimum flow in the river that must be ensured at the upper anicut in Madras before any impounding is made in the Krishnarajasagar reservoir was fixed on the basis of certain prescribed gauge readings at the dam. It was agreed also that the discharges connoted by the gauge readings should be finally fixed on the basis of the gaugings of ten years ending with 1926. As the floods of 1924 had brought about a state of affairs not foreseen at the time of the 1924 agreement, the Mysore Government proposed that the period as the basis for calculating the discharges should be seven and half years preceding the 1924 floods. The Madras Government felt unable to accept this proposal. The whole matter was referred to arbitration with Justice Sir A. Page of the Calcutta High Court as arbitrator assisted by Mr. W. H. Howly and Mr. S. G. Forbes. A fresh agreement was arrived at by the two Governments in 1924.

The clauses of the agreement entered into between the Madras and Mysore Governments in 1924 were as follows :

Mysore-Madras Agreement, 1924

(i) The Mysore Government shall be entitled to construct and the Madras Government do hereby assent under clause III of the 1892 Agreement to the Mysore Government constructing a dam and a reservoir across and on the river Cauvery at Kannambadi, now known as the Krishnarajasagar—such dam and reservoir to be of a storage capacity of not higher than 112 feet above the sill of the under-sluices now in existence corresponding to 124 feet above bed of the river before construction of the dam, and to be of the effective capacity of 44,827 m.cft. measured from the sill of the irrigation sluices constructed at 60 feet above the bed of the river up to the maximum height of 124 feet above the bed of the river. The level of the bed of the river before the construction of the reservoir being taken as 12 feet below the sill level of the existing under-sluices, and such dam and reservoir to be in all respects as described in schedule forming Annexure II to this agreement.

(ii) The Mysore Government at their part hereby agree to regulate the discharge through and from the said reservoir strictly in accordance with rules of regulation set forth in the Annexure I, which rules of regulation shall be and form part of this agreement.

(iii) The Mysore Government hereby agree to furnish the Madras Government within two years from the date of the present agreement, dimension plans of anicuts and sluices or open heads at off-takes of all existing irrigation channels having their source in the river Cauvery, Lakshmanathirtha and Hemavathi showing thereon in a distinctive colour all alterations that have been made subsequent to the year 1910 and further to furnish maps similarly showing the location of the areas irrigated by the said channels prior to or in the year 1910.

(iv) The Mysore Government on their part shall be at liberty to carry out future extension of irrigation in Mysore under the Cauvery and its tributaries to an extent now fixed at 1,10,000 acres. This extent of new irrigation of 1,10,000 acres shall be in addition to and irrespective of the extent of irrigation permissible under the rules of regulation forming Annexure I to the Agreement, namely, 1,25,000 acres plus the extension permissible under each of the existing channels to the extent of one-third of the area actually irrigated under such channel in or prior to 1910.

(v) The Madras Government on their part agree to limit the new area of irrigation under their Cauvery-Mettur Project to 3,01,000 acres and the capacity of the new reservoir at Mettur above the lowest irrigation sluice to 93,500 m.cft.

Provided that scouring sluices be constructed in the dam at a lower level than the irrigation sluice, the dates on which such scouring sluices are opened shall be communicated to the Mysore Government.

(vi) The Mysore Government and the Madras Government agree with reference to the provisions of clauses (iv) and (v) preceding that each Government shall arrange to supply the other as soon after the close of each official or calendar year as may be convenient with returns of the areas newly brought under irrigation and with average monthly discharges at the main canal heads as soon after the close of each month as may be convenient.

(vii) The Mysore Government on their part agree that extension of irrigations in Mysore as specified in clause (iv) above shall be carried out only by means of reservoirs constructed on the Cauvery and its tributaries mentioned in schedule 'A' of 1892 Agreement. Such reservoirs may be of an effective capacity of 45,000 m.cft. in the aggregate and impounding therein shall be so regulated as not to make any material diminution in supplies connoted by the gauges accepted in the rules of regulation for the Krishnarajasagar forming Annexure I to this agreement. It being understood that the rules for working such reservoir shall be so framed as to reduce to within five per cent any loss during any impounding period by the adoption of suitable proportion factors, impounding formulae or such other means as may be settled at the time.

(viii) The Mysore Government further agree that full particulars and details of such reservoir schemes and of the impounding therein shall be furnished to the Madras Government to enable them to satisfy themselves that the condition in clause (vii) above will be fulfilled, should there arise any difference of opinion between the Madras and Mysore Governments as to whether the said conditions are fulfilled in regard to any such scheme or schemes, both the Madras and Mysore Governments agree that such difference shall be settled in the manner provided in clause (xv) below

(ix) The Mysore Government and the Madras Government agree that the reserve storage for power generation purposes now provided in the Krishnarajasagar may be utilised by the Mysore Government according to their convenience from any other reservoir hereafter to be constructed and the storage thus released from the Krishnarajasagar may be utilised for new irrigation within the extent of 1,10,000 acres provided for in the clause (iv) above.

(x) Should the Mysore Government so decide to release the reserve storage for power generation purposes from the

K. R. Sagar, the working tables for the new reservoir from which the power water will then be utilised shall be framed after taking into consideration, the conditions specified in clause (vii) above and the altered conditions of irrigation under the Krishnarajasagar.

(xi) The Mysore Government and the Madras Government further agree that the limitations and arrangements embodied in clauses (iv) to (viii) *supra* shall at the expiry of 50 years from the date of execution of these presents be open to reconsideration in the light of experience gained and of an examination of the possibilities of further extension of irrigation within the territories of the respective Governments and to such modifications and additions as may be mutually agreed upon as a result of such reconsideration.

(xii) The Madras Government and the Mysore Government further agree that the limits of extension of irrigation specified in clauses (iv) and (v) above shall not preclude extension of irrigation effected solely by improvement of duty without any increase of the quantity of water used.

(xiii) Nothing herein agreed to or contained shall be deemed to qualify or limit in any manner the operation of the 1892 Agreement in regard to matters other than those to which this agreement relates or to affect the rights of Mysore Government to construct new irrigation works on the tributaries of Cauvery in Mysore not included in Schedule 'A' of the 1892 Agreement.

(xiv) The Madras Government shall be at liberty to construct new irrigation works on the tributaries of Cauvery in Madras and should the Madras Government construct on the Bhavani, Amaravathi or Noyal rivers in Madras, any new storage reservoir, the Mysore Government shall be at liberty to construct as an offset, a storage reservoir, in addition to those referred to in clause (vii) of this agreement on one of the tributaries of the Cauvery in Mysore of a capacity not exceeding 60 per cent of the new reservoir in Madras.

Provided that the impounding in such reservoirs shall not diminish or affect in any way the supplies to which the Madras Government and Mysore Government respectively are entitled under this agreement or the division of surplus water which it is anticipated will be available for division on the termination of this agreement as provided in clause (xi).

(xv) The Madras Government and the Mysore Government hereby agree that, if at any time there should arise any dispute between the Madras Government and the Mysore

Government touching the interpretation or operation or carrying out of this agreement, such dispute shall be referred for settlement to arbitration, or if the parties so agree shall be submitted to the Government of India.

18*th February* 1924. (Sd.) P. HAUKINS,
Secretary to Government,
Public Works Department,
Madras.

18*th February* 1924. (Sd.) A. R. BANERJI,
Dewan of Mysore.

Under the 1924 Agreement with the Madras Government, besides the 1,25,000 acres under the Krishnarajasagar reservoir, the Mysore State was entitled to irrigate 1,10,000 acres more by constructing additional reservoirs in the Cauvery valley and its tributaries. Investigations conducted showed that under the Kabini, 40,000 acres could be secured for irrigation and remaining area in the Hemavathi and Lakshmanathirtha valleys. Mysore was also at liberty to extend irrigation by improvement of duty under each of the existing channels in the Cauvery valley by 33-1/3 per cent of the area irrigated in 1910 remaining unsubmerged.

Classes of irrigation works

Irrigation works are now classified into three categories, *viz.*, major, medium and minor works. The major schemes are those which cost more than five crores of rupees while the medium schemes are those which cost more than rupees 15 lakhs but less than rupees five crores. The schemes which cost less than rupees 15 lakhs are called minor works. Wells are used for lift irrigation, the water being raised from a lower level. The raising of water is effected either by manual labour or by animal or mechanical power. At present, sustained efforts are being made to introduce pumping sets for irrigation.

Acreage under irrigation

Out of a total of 6,75,817 acres of land put to agricultural use in the district, 1,80,911 acres came under various irrigation sources like canals, tanks and wells. The following table indicates the areas under different sources of irrigation during 1964-65 :

Taluk	Irrigated Area		
	Government Canals	Tanks	Wells
		(in acres)	
Mandya ..	37,991	5,278	160
Maddur ..	27,838	9,600	200
Malavalli ..	27,460	3,952	500
Pandavapura ..	13,600	3,489	196
Krishnarajpet ..	14,008	2,779	320
Nagamangala ..	565	9,447	100
Srirangapatna ..	23,272	131	25
Total ..	1,44,734	34,676	1,501

It is seen from the above table that, out of 1,80,911 acres under various sources of irrigation, 1,44,734 acres were fed by Government canals drawn from the perennial rivers like the Cauvery, Hemavathi and Shimsha. Tank water irrigated 34,676 acres. Mandya district has a number of tanks in all the taluks, except the Srirangapatna taluk, where the Cauvery canals are the main source of irrigation. Maddur taluk has the largest irrigated area under tanks, having a command area of 9,600 acres.

Agriculture

Soils.

The soils of Mandya district are derived from granites and gneisses interspersed with occasional patches of schists in Srirangapatna, Mandya and Pandavapura taluks. The soils range from red sandy loams to red clay loams, shallow in ridges and in higher elevations and comparatively deep in valley portions. The soils in Mandya, Malavalli, Maddur and Nagamangala taluks are shallow gravelly with a preponderance of quartz pebbles, iron concretions and coarser fractions. They are usually underlain with a murram zone containing powdered rock. The soils are highly leached and poor in bases. The water-holding capacity is low. The soils under the old channel areas in Malavalli, Srirangapatna and Pandavapura taluks are rich in clay.

The following table gives particulars of the soil types found in the district :

Types of soils	Chief characteristics	Places of occurrence	Chief crops
Red sandy loams	Shallow to medium, intermixed with quartz pebbles and iron concretionary materials, gravelly to sandy loam in texture, highly leached and poor in bases. Water-holding capacity is low.	Mandya, Malavalli, Maddur, Nagamangala, parts of Pandavapura and Krishnarajpet taluks.	*Irrigated.*— Ragi, paddy, sugarcane, plantains, coconuts, arecanuts and tobacco. *Rainfed.*— Ragi, Jowar, groundnut, oilseeds, pulses and castor.
Red clay loams	Shallow to medium, reddish to pale brown in colour, clayey to clay loams in texture, well-drained with gravelly sub-soil. Good water-holding capacity in the top soil. Lime concretions occasionally present.	Parts of Pandavapura, Srirangapatna and Nagamangala taluks.	*Irrigated.*— Paddy, sugarcane, plaintans and coconut *Rainfed.*— Ragi, castor, jowar, groundnut and pulses.

The Mandya district has old tank atchkats, *nala* and newly opened tank atchkats, where the nature of soils varies from clay soils to clay loamy and sandy loam soils and red sandy loam soils to gravelly soils in the new *nala* atchkats, particularly in the Visvesvaraya canal areas. Red sandy loam to gravelly soils is mostly found. In the other dry land regions of the district, only red gravelly soils and in some places, sandy loam and red soils exist. So far as the soil conditions are concerned, it varies from clay red to gravelly. Here and there in the area, there do exist patches of sandy soil.

Clay soils are generally rich and they are under good cultivation for a long period. These are found under all old irrigation channels of Srirangapatna, Krishnarajpet and Maddur taluks and parts of Pandavapura and under old tank atchkats. The red loam soils are deep, free and easy to work. They respond well to good treatment and are found in the taluks of Maddur, Malavalli, Pandavapura and Krishnarajpet. The gravelly and stony soils are found usually under new irrigation schemes. Not being under intensive cultivation under the previous crop farming and due to the geological formation, these lands are generally coarse, shallow and poor and they are found in parts of Mandya, Malavalli and Nagamangala.

Soil test results

The soils are largely neutral in reaction throughout the district with a tendency to develop alkalinity under conditions of restricted drainage. Fifty per cent of the soils are neutral and forty per cent are alkaline, being confined mostly to arid and

water-logged areas. There are a few acidic soils also. The soluble salt content is generally low and only in about five per cent of the cases, it reaches harmful concentrations and these are confined to badly drained areas. Organic matter is deficient in about 65 per cent of soils. The available phosphorus is uniformly low, only about three per cent being barely sufficient in this regard. Forty-eight per cent of the soils are poor in potash content also, the rest having sufficient and high quantities of this nutrient.

In 1930, a complete soil survey of the Visvesvaraya canal area was undertaken with a view to determining the areas fit for growing sugarcane and other crops.

Principal crops

The following figures indicate the principal crops grown in the district and their acreages in 1964-65 :

Crop		*Acreage*
Ragi	..	1,99,875
Paddy	..	1,51,391
Horsegram (*Hurali*)	..	1,03,703
Jowar (*Jola*)	..	38,674
Sugarcane	..	31,695
Groundnut	..	14,791
Coconut	..	11,218
Castor	..	6,060
Tobacco	..	2,198
Banana	..	2,285
Mango	..	1,377
Chillies	..	3,933

Cropping pattern

In the perennial zone, paddy and sugarcane crops are grown on a rotation basis. The other alternative is to grow annually two crops of paddy, one of long duration and the other of short duration, for the main and summer seasons, respectively. The third alternative is to grow a green manure crop followed by paddy cultivation, while the fourth alternative is to grow irrigated ragi followed by paddy. The last alternative is becoming popular. In some areas of the wet zone, three crops of paddy are grown every year. The prevalent practice in the district is to grow a green manure crop followed by long duration varieties of paddy, such as Coimbatore selections, *viz.*, Ratnachudi, S.R. 26, D-Bangarakovi and the like. In the dry zone, the main crop is ragi. This is sown in the months of June and July and harvested during December. Jowar or Jola is another important food crop grown in the district.

Paddy

Paddy (*Oryza sativa*)—Kannada name: *Bhatta*. Paddy is grown in all the taluks of the district, the acreage being large in Maddur, Mandya, Malavalli, Krishnarajpet and Srirangapatna taluks. The following statement gives the acreage under paddy in the seven taluks of the district for the year 1964-65 :

Taluk		*Acres*
Mandya	..	29,376
Maddur	..	26,020
Malavalli	..	25,974
Pandavapura	..	15,064
Krishnarajpet	..	21,788
Srirangapatna	..	23,157
Nagamangala	..	10,012
Total	..	1,51,391

Paddy has been a major crop in the Mandya district and consequently the important aspects of its cultivation have been fully investigated. The Chemistry Division of the State Agricultural Department has conducted investigations bearing on the aspects of the optimum soil conditions for paddy growing and the question of the manurial requirements of paddy grown under different conditions. In fact, along with the development of high-yielding varieties, the application of manures to the paddy crop as a direct means of enhancing the crop yields, has been one of the more important lines of work. As is well known, paddy is a crop which thrives in the warm humid climate of the tropics under assured sources of irrigation. The crop is semi-aquatic in habit and is grown under plentiful supply of water for the major period of its growth. It is grown under a variety of soil and climatic conditions and the major deciding factor is the availability of a continuous supply of water throughout the life period of the crop.

Before the advent of improved strains, many kinds of paddy were cultivated in the district, especially in the Cauvery valley, *viz., Dodda-bhatta, Hotte Kembatti, Arsina Kembatti, Sukadas, Elakki-raja, Konavalli, Bili Sanna, Putta-bhatta* and *Kari-kallu.* With the exception of *Dodda-bhatta,* which takes seven months, all the other kinds are harvested in five and a half months.

Transplantation

The common method of growing paddy is to transplant seedlings from a seed bed. Especially, in the canal areas of the district, this method is followed as a rule. The field is well-ploughed soon after the previous harvest. Water is then let in and the green manure crop is trampled in. After this, the field is again

ploughed. The bunds are trimmed and the puddle is levelled. Into this puddle, seedlings, about 30 to 45 days old, are transplanted in bunches containing, on an average, five to ten plants at intervals of about a span. Water is let in slowly till the yellow of the transplanted seedlings changes into green. The field is continuously irrigated till about ten days prior to the harvest, when water is completely stopped.

The other mode, called the *mole bhatta* method, is also in vogue in some places in the district. But the local raiyats believe that the transplantation method yields a prolific crop and also allows time for raising a crop of *uddu* or *hesaru* before the transplantation takes place. During the three months previous to sowing or transplanting, as the case may be, the land has to be ploughed from three to five times, manuring being resorted to between the fourth and fifth times. Under the transplantation method, the paddy field is ploughed in the month of April or earlier, provided there are some summer showers. In June, water is let into the fields. The green manure crop rots for a week, when the field is again ploughed. Then the seedlings are planted. This method is known to give high yield; the expenses of weeding are also less. The cultivators in the district have evolved their own method by which they sow ten seers of seed per acre. The outturn of paddy in the Cauvery channel tract is about 15 pallas (one palla equals 100 seers) per acre.

Mole method

The sowing of sprouted seed in puddled land is called the *mole* method of cultivation and is practised under big tanks, more especially in the case of the Vaishakha or summer paddy, that is, the one which is sown about December and harvested about April. Under this method, the paddy 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 off. Leaves and twigs are spread on the field uniformly and then trampled in. Sprouted seed is then sown by broadcast method. The seed sinks in the soft mud and the next day, the field is drained thoroughly. For two weeks thereafter, water is let in carefully for a few hours daily and then drained off, 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 cross-wise and diagonally. Hand-weeding follows and the crop requires no further attention except continued irrigation till harvest time. The sprouting of seed for this method, as well as for raising seedlings for transplantation, is done by soaking the seed tied up in a bag for one full night. The bag is then taken out and the contents heaped in a cool place, covered up with straw and leaves. This heap is kept moist for two days after which the sprouts begin to appear.

The harvesting of paddy begins as soon as the field gets dried after draining off the water. Harvest generally begins when the grain is quite ripe. After the crop is harvested, it is allowed to dry on the fields for a few days and then brought over to the threshing yard. The threshing is taken up immediately or after about ten days, if the sheaves are put up in the stack. The threshing is carried out by beating the earheads on an inclined plank or a bench or a stone and the grains get separated, though in some cases, a small quantity may be left over in the straw. This is laid aside and after the first threshing by beating is over, the straw is taken up for a fresh threshing to separate the grain that had been left over. This second threshing is done by means of trampling out the grain under the feet of cattle. The grain is then winnowed to remove chaff or empty grains.

Japanese method

The Japanese method of paddy cultivation is a new method of intensive cultivation of paddy, which is becoming quite popular in the region. Adoption of this method produced encouraging results in several parts of the country. The Mysore State experimented with this method for the first time in 1953. As a result of sustained hard work with this method, the yield of paddy per acre increased from one to one-and-a-half times or even twice the normal average yield. Besides this higher yield, there is yet another advantage under this method. That is, there is a considerable saving of the seed paddy as a lesser seed rate per acre is sufficient. In this method, the nursery plot required to raise seedlings per acre is only two guntas. The plot is well-ploughed, levelled and divided into beds of eight feet by four feet, leaving a space of one foot between the beds. The length of the bed may vary from eight feet to 25 feet, depending on the length of the nursery plot. The beds are covered with a thin layer of wood ash. The paddy seed is sown very thin on the beds. After sowing, the seeds are covered well with earth or manure. The beds are well irrigated. Care is particularly taken to see that the beds are fully wet during the first week of sowing. During the second and the third weeks, water is let in. In the course of 25 days after sowing, the seedlings become ready for planting. The transplanting is completed when the seedlings are 25 to 30 days old. The field for planting paddy under the Japanese method is well ploughed with the application of eight to ten cart-loads of green manure. At the time of transplantation, four maunds of ammonium sulphate per acre are applied. After a month, another two maunds of ammonium sulphate is given as top dressing. In the Japanese method, line planting is an important feature. This is in contrast with the old traditional method, where the plantings are done at random. This planting in line facilitates easy interculturing. The spacing between the rows is nine inches to ten inches.

In order to step up rice production in the Mandya district region, the Japanese method was tried with a modest target of 75,000 acres in 1958-59. The achievement of this target exceeded anticipation and in that year, 79,509 acres were brought under this new method. During 1959-60, a target of 80,000 acres was fixed and in that year, a record acreage of 86,000 acres was achieved. In 1964-65, the target fixed was 1,10,000 acres and the achievement was 92,120 acres. In order to give sufficient impetus to cultivation, provision was made for giving short-term and medium-term loans to agriculturists. The increase derived by the adoption of this new method was roughly five and a half pallas per acre. The achievement of this good progress was due to intensive propaganda undertaken by the Agricultural Department. Nurseries were invariably raised and many cultivators came forward to take up this improved method on the lines suggested by the department. This new method is gaining ground in all parts of the district and is quite popular with the cultivators. The following figures indicate the area transplanted under the Japanese method in 1964-65 :

Taluk		*Area transplanted.*
		(in acres)
Mandya	..	20,950
Maddur	..	18,050
Malavalli	..	17,720
Srirangapatna	..	15,000
Pandavapura	..	9,000
Krishnarajpet	..	9,200
Nagamangala	..	2,200
Total	..	92,120

Recent trends

About sixty per cent of the total paddy area in the district has been sown with improved varieties of paddy seeds such as *Coimbatore Sanna* selections (S. 661, S. 699, S. 139, S. 701, S. 749, S. 784 and S. 1092). Of these, fine varieties like S. 1092 are proving popular in the area. After the introduction of the Package Programme, the number of varieties have been reduced. Now S. 701 and S. 1092 cover the largest area in the district. Among the summer varieties, S. 705, S. 317, China 245 and H. 497 have become popular.

The fertiliser-way to grow more paddy became quite popular along with the rapidly advancing technique in farming practices

after the advent of the Package Programme in the district. Necessary trials were conducted and in practically all the trials, the application of nitrogen was found to increase the paddy yields. The application of one-and-a-quarter maunds or 20 lbs. of nitrogen per acre increased the yield of paddy by 4.5 maunds per acre. Two-and-a-half maunds of ammonium sulphate per acre increased the yield by 6.6 maunds.

Ragi

Ragi (*Eleusine coracana*).—This is another principal food crop grown mostly as a rain-fed crop during the monsoon period (July to December). It is grown in all the taluks of the district, comparatively more in Nagamangala, Krishnarajpet, Malavalli and Maddur taluks. The following figures indicate the extent of ragi area in the several taluks of the district in 1964-65 :

Taluk	*Acres*
Nagamangala ..	44,737
Krishnarajpet ..	41,192
Malavalli ..	31,933
Maddur ..	26,600
Mandya ..	25,362
Pandavapura ..	20,666
Srirangapatna ..	9,385
Total ..	1,99,875

The estimated average yield of this crop in the district is three to three-and-a-half pallas per acre (a palla equals 100 seers). Ragi is grown during summer also in some taluks. An area of 8,178 acres was under summer ragi in 1964-65. The estimated average yield of summer ragi is six pallas per acre. In fact, ragi is the foremost crop in the district ranking first among the principal crops.

Special features

Ragi is the staple food of the people in several parts of the State. It has many valuable features which distinguish it from other foodgrains. It is one of the hardiest crops suited for dry farming. It can grow under conditions of very low rainfall and can withstand even severe drought. It is a grain of high nutritive value and is considered to give sustenance to people doing hard physical work. It can be grown as a dry crop and also under irrigation. The straw of this crop is considered as a valuable food for the working and milch animals. This crop is grown on loamy and sandy-loam soils. It grows well generally on soils free from stones and gravel. The root system of this crop is

remarkably extensive though somewhat shallow, and soils possessing proper texture and moisture-holding capacity are required for its cultivation. Ragi is also raised on clayey soils.

Seasons.—Mandya district has three distinct seasons for growing ragi, *viz., Kar, Hain* and *Rabi*. *Kar* and *Hain* are rain-fed crops, while *Rabi* is completely an irrigated one. *Kar* crop is sown in April and harvested in August-September. *Hain* crop is sown in July and harvested in November-December. Preparation for the *Rabi* crop commences from February and it does not depend upon the south-west or the north-east monsoons like *Kar* and *Hain,* since it is completely an irrigated crop.

The ploughing for ragi crop proper begins with the first showers of rain and repeated ploughings are done or in the alternative, the *kunte* is worked. The improved mould-board ploughs are of great advantage and effect considerable saving in the number of ploughings required. Since transplanting involves more time and more labour than drilling, use of mould-board ploughs has been again found to be of advantage. About fifty per cent of the ragi crop is sown broadcast.

Manuring.—The usual application of four to six cart-loads of farmyard manure or compost manure before sowing is practised in all taluks. In addition to this, one cwt. of fertilizer mixture consisting of ammonium sulphate and superphosphate is also applied. If this mixture is applied to the ragi field before sowing, better results are obtained. In the case of irrigated ragi, about 15 cart-loads of farmyard manure or compost manure and two tons of green leaf manure per acre become necessary. The application of manures depends upon the soil fertility also.

Inter-cultivation

Inter-cultivation is an important factor for controlling weeds, removing extra seedlings and loosening of soils. In order to achieve good results in this regard, the *kunte* is extensively used. The slit-harrow and the blade are also used. Generally, three or four inter-cultivations are done on the ragi field.

The main season for inter-cultivation of ragi is from beginning of October and the crop is fully in earheads in about a fortnight thereafter. The earheads mature and become ready for harvest in about 40 days and the actual harvest begins from the middle of November and continues upto the middle of December, depending upon the variety and the month when the crop is sown. The crop usually takes about five to five-and-a-half months to mature. Harvest is done by means of ordinary sickles and the plants are cut close to the ground so as not to waste any of the straw which is considered very valuable. The sheaves are tied and put in large field stacks temporarily or carted straightaway to be stacked on the threshing floors. The threshing of ragi is

done in three ways, *viz.*, by beating out the grains with sticks, by treading out the grains under the feet of oxen and lastly by working a stone roller over the sheaves.

There are many local varieties of ragi grown in the area, the important ones being *hullubile, madayangiri, gudubile, giddaragi, hasarakambi, doddaragi, karigidda, jenumudde, majjige, jadesangha* and *rudrajade*. Of late, new varieties are being propagated like H. 22, Co. 2 and K. 1. About five per cent of the total ragi area in the district is stated to be under the improved varieties and the remaining under the local varieties. The local varieties are being gradually replaced by improved varieties like H. 22 and K. 1. The performance of *Aruna* and other new ragi varieties are still in the experimentation stage and these are also gaining popularity among the cultivators.

New strains

Ragi is cultivated under irrigation mostly during summer under canal and tank atchkats. It is grown as a second crop in rotation with the main-season crops like sugarcane, paddy, chilli and other vegetable crops. The varieties required for summer cultivation are quite distinct from both the *Kar* and the monsoon dry-land types. In order to evolve varieties for summer cultivation, breeding work was undertaken both by pure line selection and hybridisation. *Aruna*, a pure line selection, was first isolated and subsequently two more new strains, *viz.*, *Udaya* (*Aruna* plus K. 1) and *Purna* (*Auna* plus Co-1) were evolved by hybridisation. These strains were found to be immensely suitable for cultivation in many of the irrigated tracts. On account of their improved features like early and uniform maturity, seasonal adaptability and high vigour, they have become popular in the Visvesvaraya canal area for summer cultivation in rotation with sugarcane and monsoon paddy.

Ragi grains are ground into flour and then cooked either as a pudding or as a porridge. It has been established that ragi has high protein content. The ragi grain can be malted and used as a nourishing form of food. For this purpose, the grain is first soaked in water from 36 to 48 hours and removed and spread out on the floor and allowed to germinate over a period of seven days. After germination, the grain is dried in the sun and then roasted over a low fire and ground into flour.

Jowar

Jowar (*Sorghum vulgare*)—Kannada name: *Jola*—Jowar or *jola* is one of the popular dry land foodgrains grown in all the taluks of the district. The total area under this crop, during 1964-65, was 38,674 acres. The figures given below indicate the extent of acreage of jowar in the several taluks of the district during 1964-65 :

Taluk		*Acres*
Malavalli	.. ..	17,740
Srirangapatna	.. ..	6,875
Maddur	.. ..	4,600
Mandya	.. ..	4,405
Nagamangala	.. ..	2,500
Pandavapura	.. ..	1,814
Krishnarajpet	.. ..	740
	Total ..	38,674

Jowar grows well in tracts of low rainfall and it can withstand considerable drought. It has comparatively a quick growth. It also yields large quantities of fodder. Jowar is a crop suited mostly to plains, though on the Mysore pleateau it grows at an elevation of about 3,000 feet. Being an important millet, it occupies a considerable acreage in some of the taluks of the district. It is grown both in *Kharif* and *Rabi* seasons in the district. The *Kharif* crop is sown between April and May and harvested in the months of August and September. The *Rabi* crop is sown between September and November and harvested between February and March. The yield per acre varies from eight to ten pallas. The cultivation of jowar is almost similar to that of ragi. The cultivators have, of late, started drill-sowing instead of broadcast-sowing in order to get better results. Dibbling is also in vogue, but it has not gained much popularity.

Split application of fertilisers

About ten cart-loads of farmyard manure or compost manure, together with a mixture of 50 lbs. of fertilizers consisting of Ammonium Sulphate and Superphosphate per acre are applied. After six weeks from the date of sowing, one cwt. of this fertilizer mixture is applied again in order to get better results. The split application of fertilizers is found to increase the yield considerably. The cultivators have learnt through propaganda and experience the need for selection of good seeds which are free from attack of pests and diseases. Before sowing, the seeds are treated with recommended fungicides against the attack of diseases. The treating of the seed with dry sulphur dust—325 mesh quality—is an absolute assurance against smut disease. Inter-cultivations are done two to three times with slit hoes to eradicate weeds in the plots and for better crop growth.

A considerable extent of the jowar growing area formerly concerned itself with evolving better varieties and also improving cultural practices. Recent work done by the Indian Agricultural Research Institute, New Delhi, has shown that even under

rain-fed conditions, the green fodder yield from jowar can be considerably increased. Besides, experiments done in research centres in respect of jowar cultivation, indicate that trials were conducted on one-acre plots, each of which was divided into four parts with strong and well-protected bunds all round to check erosion and outflow of rain water. A fertilizer mixture was well incorporated into the soil. The crop was sown broadcast. The normal yield in the selected plot was 60 maunds per acre. When five tons of farmyard manure were applied, the average yield increased to 113 maunds. But when the farmyard manure was supplemented with 150 pounds of ammonium sulphate and 125 pounds of single superphosphate, the average yield went up to 173 maunds. Thus, by using fertilizers, an extra yield of about 59 maunds was obtained.

The usual jowar varieties grown in the Mandya area are the *Mungar Jola* and *Bili Jola*. A larger area is sown with *Bili Jola* varieties. A suitable new strain for the *Mungar* crop is in the offing.

Sugarcane

Sugarcane (*Saccharum officinarum*)—Kannada name : *Kabbu*.—Sugarcane is yet another important crop grown in the district. It has an assured market in the district from the two sugar factories, *viz.*, the Mysore Sugar Mills, Mandya and the Sahakara Sakkare Karkhane, Pandavapura. As a result, sugarcane cultivation has received an impetus in the district. The total area under this crop, during 1964-65, was 31,695 acres. It is grown in all the taluks of the district and the following statement shows the extent of its acreage in the seven taluks in 1964-65 :

Taluk	*Acres*
Mandya	15,417
Pandavapura	5,684
Maddur	4,700
Malavalli	320
Krishnarajpet	2,520
Srirangapatna	2,004
Nagamangala	1,050
Total ..	31,695

From the above statement, it is seen that Mandya and Pandavapura taluks in which the two sugar factories are situated have the largest acreages of sugarcane. The area under this crop is being stepped up to meet the demands of these two sugar

factories in the area. The Visvesvaraya canal tract with its assured water supply is being developed as an area of intensive cultivation of sugarcane. The cultivation of this crop plays an important part in the agricultural economy of this district.

Even before the starting of the sugar factories, sugarcane was being grown in about 5,000 to 8,000 acres in the composite district of Mysore. Two kinds of cane called *Rasadali* and *Pattapatti* were being grown in the area. While *Rasadali* was being grown from earlier times, *Pattapatti* was introduced into Mysore from Arcot at the time of Haidar Ali by Mustafa Ali Khan who was the paymaster-general at that time. Both these kinds of cane yield good jaggery (gur). In those days, when there were no large sugar factories, the cultivators were extracting sugar from the *Pattapatti* variety of cane. The *Rasadali* variety was usually planted during the summer months, while the *Pattapatti* after the monsoon showers. The duration of the *Rasadali* type was one year and that of *Pattapatti,* fourteen months. In some cases, it was being followed by a second crop. The *Rasadali* variety is not suited for a second crop.

Germination

For the cultivation of sugarcane, the land is prepared well by ploughing. As ploughing is to be deep, a mould-board plough is generally used. The field is then laid out into flat beds or ridges and furrows. Sugarcane is propagated vegetatively. The whole cane or the top portion of it is cut into pieces or setts, each containing three buds. The top of the cane is better used for planting as it contains less sucrose and the buds sprout quicker. In an experiment conducted by the agricultural personnel with different setts, it was found that the percentage of germination was 100 in the case of top setts, 40 in the case of middle setts and 19 in the case of bottom setts.

The furrow system of planting the cane setts is found to be more convenient. In this method, water is let into furrows and the setts are pressed into the soft soil, taking care to see that the buds are placed laterally. The setts are planted along or across the furrows or even diagonally in the furrows. In the trench method of planting, the trenches are 1 to 1½ feet deep and 3 to 4 feet apart.

In the factory areas around Mandya and Pandavapura, the planting is spread over a longer period so that the canes could be available for a longer crushing season ; short, medium and long duration cane varieties are selected for planting so that a continuous supply of canes to the factories during the crushing season could be assured.

Cane is planted in Mandya district in February and March every year, mostly with setts from the CO-419 variety. It is believed that a late-planted cane suffers from an attack of borers.

The water requirement of the crop depends upon the variety of the cane, the nature of the soil and the distribution of rainfall. Sugarcane requires 80 to 90 acre-inches of water inclusive of rainfall. Thin cane requires less water than the thick cane. In the furrow system, the demand for water is less.

Sugarcane responds well to the application of manures. Tank silt, red earth and sometimes even sand are applied to heavy soils at the rate of 50 cart loads per acre; cattle manure upto 50 cart loads is also ploughed in. Castor cake or groundnut cake is largely used by cultivators. Lands of average fertility are manured with ten tons of cattle manure, two cwts. of ammonium sulphate with castor cakes. In the prepared stages, green manure crop is ploughed in. The yield of cane varies from 30 to 40 tonnes per acre.

Improved varieties of cane have been largely tried in the area. Of these, the CO-419 has become popular throughout the district. This variety is grown in about 16,000 to 18,000 acres and the yield works out to 30 to 35 tonnes per acre. HM-320, another improved variety, is also grown in Mandya, Krishnarajpet and Maddur taluks.

Groundnut

Groundnut (*Arachis hypogaea*)—Kannada name: *Kadalekayi*.—This is an important oilseed grown in all the taluks of the district, extending to an area of 14,791 acres in 1964-65. The following is the taluk-wise break-up of the acreage:

Taluk	*Acreage*
Malavalli	5,810
Maddur	4,580
Pandavapura	2,616
Srirangapatna	1,099
Krishnarajpet	283
Mandya	253
Nagamangala	150
Total ..	14,791

It is evident from the above statement that Malavalli and Maddur are the two leading taluks in the district for the cultivation of groundnut. The irrigated, improved Spanish groundnut is largely grown in these taluks. Besides the Spanish variety,

H.G. 8 and T.M.V. 2 varieties are also popular. It may be of interest to note that the Department of Agriculture in Mysore was the first in India to start intensive work on groundnut crop.

Groundnut is cultivated both as a dry-land and an irrigated crop. This crop is sown in the better class soils, the light-red and ash-coloured loamy soils being preferred. The sowing season commences usually in May, June and July and the crop is ready for harvest during September, October and November. In the preparatory stage, three to four ploughings are given by the country-plough and one to two ploughings are given by the mould-board. Five to six cartloads of farmyard manure are applied per acre. The sowing is done in plough furrows, nine inches apart. Three to four interculturings are done till the crop comes to flowering. After a period of three-and-a-half to five-and-a-half months, the leaves become yellowish and begin to dry. Then the crop is harvested. The harvest time usually coincides with the cessation of the rains for the year when the ground becomes hard. If the ground is very hard, it is usual to plough the land in order to help the pickers to gather the pods more easily. The pods are dried well before they are sold or sent to the market for sale. Under irrigation, a better yield is obtained by sowing early duration varieties.

Minor millets

During 1964-65, the total area under minor millets such as *Navane*, *Haraka* and *Save* was 6,033 acres in the entire district. *Navane* is an important dry land crop. In this district, this crop is grown on red soils. Mostly, *navane* is grown along with ragi. There are several varieties of this millet, which fall into two types, one having a thin low compact earhead and the other, a thick heavy and much larger earhead, which bends down by its weight. In both these types, there are whitish yellow, dark and orange-yellow grains. In the district, *navane* is sown in the month of May along with the early ragi. The cultivation methods adopted for this crop are similar to those of other dry land crops. The duration of this crop is only three months. It is harvested like the ragi crop. *Navane* is used in the same way as rice. The average yield of this crop is 600 lbs. per acre.

Haraka (*Panicum semiverticullatum*).—This is perhaps the hardiest among the dry land crops. It is sown generally on rough and poor variety of soils, far away from the villages. The land for *haraka* is given very little preparatory tillage. The grain is sown either broadcast or in rows, about the middle of June, before sowing for the main ragi crop commences. It receives hardly any attention except one hoeing with the *kunte*. The crop takes six to seven months to ripen. The grain is exceedingly coarse. It is pounded to remove the thick shiny husk and then ground into flour. The straw is not a good fodder.

Save (*Panicum miliare*).—This is another minor crop grown in the district. It is grown both as a pure crop and also as a mixed crop along with ragi. When grown alone, it is sown mostly on the poorer sandy soils. In the event of ragi not being sown due to the vagaries of the seasons, *save* is sown on the better class of soils. Two varieties of *save* are recognised, a tall heavily bearing variety called *hire-save* and a dwarf variety called *kiri-save*. Varieties of this grain, differing in colour, 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. The dwarf variety is suitable for poor quality soils. The crop is generally sown after the end of the main *mungar* rain and before the beginning of the *hingar* showers. The grain ripens in about three months and is harvested and threshed in the same way as the other grains. The grain is boiled and eaten like rice and also ground into flour for making cakes.

Horsegram

Horsegram (*Dolichos biflorus*)—Kannada name: *Hurali*.— Horsegram is a very important crop in the district, occupying an area of 1,03,703 acres, in 1964-65. It is grown in all the seven taluks of the district. It is raised as a dry crop almost invariably and also under conditions of moderate rainfall. It is grown on a wide range of soils. There is no type of soil, excepting the bad alkaline soils, on which it is not sown in the district. Good deep red loams, clayey soils, stony and gravelly upland soils can all be sown with this crop. It is a kind of preparatory crop, two or three crops of this being taken before the land is put under ragi, jowar or other main crops. Most of the surplus land belonging to the cultivator, which he cannot possibly prepare in time for ragi cultivation, is put under horsegram. Horsegram is generally sown in rows and in some cases broadcast. In the former method, it is sown in plough furrows about nine inches apart. For broadcasting, the field is divided into long narrow strips of about ten feet width by means of plough furrows. Seeds are sown broadcast in these strips successively and the sowing is followed by ploughing to cover the seed. Where the crop is sown in rows, the field is once intercultured. Horsegram is sown in many places with a mixed crop of niger, which is sown in rows about three to six feet apart, simultaneously with horsegram. The crop is always sown thick, a seed rate of 40 lbs. per acre being common. The crop is harvested by pulling out the plants. They are removed to the threshing floor, stacked for a week, allowed to dry and then threshed by trampling under the feet of oxen or with the stone threshing roller. A good crop of horsegram yields about 600 lbs. per acre. The produce requires a good deal of cleaning by means of winnowing and sifting in order to remove the seeds of the various weeds. Horsegram is the poor man's food and is eaten boiled or fried. It is also given as food for horses.

Other pulses

Other pulses like blackgram, greengram, *avare* and *togari* are also grown in the district. The total acreage under pulses was 1,24,021 in 1964-65. *Avare* (*Dolichos lablab*) is an important pulse grown in the district. Many cultivators raise at least as much of *avare* as they need for their domestic use. *Avare* crop is grown generally as a mixed crop with ragi. Sown along with ragi, it comes to maturity only by 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 with sticks. The pulse is usually split and then marketed.

Blackgram, locally called *uddu* (*Phaseolus mungo*), is grown as an early monsoon crop. It is also grown as a mixed crop with jowar. There are two varieties of this pulse, a small-seeded one and a large seeded one, the latter being rather larger than a pepper corn. The sowing is done in the months of April and May. The crop is harvested three-and-a-half months after sowing.

Greengram, called *hesaru* (*Phaseolus aureus*), is raised in the district in the same way as blackgram. Two varieties of this pulse are grown, one with a large seed and luxuriant leaf growth and the other which is small-seeded and less bushy.

Tur

Togari or *tur* is an important pulse crop in the district. It is grown on all kinds of soils. Soils not deficient in lime are said to yield the best quality of *togari* dhal. The quality of the pulse is determined by the quickness with which it softens on boiling. *Togari* is grown as a mixed crop with ragi or jowar. As in the case of *avare,* this crop also comes to maturity long after ragi or jowar is harvested, that is, about the middle of January. The plants are cut at the base when mature and are brought to the threshing floor and stacked. The pulse is threshed out by piling the crop in a thick layer on the threshing yard and beating out with a stick. The empty pods and chaff are used as fodder. The pulse is husked by inducing incipient sprouting and then dried and split in a grinding mill. The germination is brought about by mixing the pulse with red earth and piling it loose. The pile is opened and heaped twice in the course of the day. The sprouts then become slightly visible. The pulse is then dried in the sun.

Bengalgram or *kadale* is another pulse grown in the district. Unlike *avare* and *togari,* this pulse is always grown pure, that is, by itself. It is a cold weather crop and is sown late during the north-east monsoon period, *i.e.,* from October onwards upto December. Little attention is paid to interculture. The crop comes to maturity in about three months, the heavy dews of the cold months being beneficial to the same. 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 sweet-meats.

Coconut

Coconut (*Cocos nucifera*)—Kannada name: *Tengu.* This is an important plantation crop in the district, having an acreage of 11,218 in 1964-65. Out of this total, Nagamangala taluk alone had an acreage of 5,407 and Maddur taluk came next with 1,670 acres. The following is the taluk-wise break-up of the acreage:

Taluk	*Acres*
Nagamangala ..	5,407
Maddur ..	1,670
Krishnarajpet ..	1,667
Mandya ..	884
Srirangapatna ..	785
Malavalli ..	441
Pandavapura ..	364
Total ..	11,218

Coconuts are grown generally on light sandy soils, but heavy rich clays under most of the tanks also give good crops. The trees begin to bear from the seventh year, more generally from the tenth and continue to bear, it is believed, for about a hundred years. About 100 nuts per year is the average yield of a well-grown tree.

Coconut is used for two important purposes, *viz.*, as an edible product and for the preparation of oil. As an edible product, it forms an ingredient of many Indian dishes. It is an article consumed often even in poorest households. It is, however, as a source of oil that it finds a more extensive use. Coconuts grown in Maddur taluk are noted for their size and sweet water content; they are also sometimes dried into copra which has a ready market. Tender coconuts are also sold in bazaars.

Castor

Castor (*Ricinus communis*)—Kannada name: *Haralu.*— Castor is the most extensively grown oil-seed in Krishnarajpet and Pandavapura taluks. Out of a total area of 6,060 acres of castor in the district in 1964-65, Krishnarajpet taluk accounted for 1,307 acres, whereas Pandavapura taluk accounted for 1,016 acres. The acreage figures for the other taluks were Malavalli 810, Mandya 743, Maddur 720 and Srirangapatna 664. The lands are given a thorough preparation by repeated ploughings and then worked with *kuntes*. After all these operations, a good seed-bed is prepared. Plough furrows are then made, both lengthwise

and crosswise, with a distance of about four feet between them and at the intersection of the furrows, a little cattle manure is put and two seeds of castor are planted. The sowing is done in the month of June. Within three months, the plants begin to flower and bear fruit. Picking is done from December onwards as the fruit bunches keep ripening. The fruits are spread out in the sun and well beaten out to separate the hard husk from the seed. The seeds are used for the extraction of oil, which finds use as a medicine, unguent and lamp oil. The seeds are also exported.

Chillies

Chillies (*Capsicum annuum*)—Kannada name : *Menasinakai*.—Krishnarajpet taluk in Mandya district has a large area of 1,187 acres under chillies and the total acreage for the whole district in 1964-65 was 3,933 acres. Like tobacco, chillies form an important crop, grown both on dry lands and under irrigation. It is an indispensable dietary article of the people and many a cultivator grows chillies on a small patch of land for his domestic needs. The cultivation has to be as careful as for tobacco. The field has to be ploughed several times and then worked with *kuntes* producing a fine and deep tilth. The variety of chillies grown in the Mandya district is mainly a long, thin, stringy type, which is a heavy yielder. Seedlings are raised in small nurseries and they are sown in the month of June. Transplanting is done about the same time as sowing ragi in mid-July or early August. In three months, green chillies can be picked up. The crop continues to bear even till February, though the bulk of picking is completed by the end of December.

Among other crops grown in the district, tobacco occupies 2,198 acres, of which Maddur taluk has the largest acreage, *i.e.*, 1,400 acres.

As a result of the several agricultural development programmes implemented in the district under the successive Five-Year Plans, the total production of food and commercial crops in the district has increased considerably over the last few years. The total food production in the district which was 5,61,228 tons at the end of the First Five-Year Plan (1956-57), increased to 11,10,363 tons at the end of the Second Five-Year Plan (1960-61). This quantity has further increased during the Third Five-Year Plan period.

Promotion of Scientific Agriculture

Agricultural practices in the district, which hitherto were tradition-bounded, are being gradually replaced by scientific methods. The Agricultural Department, the Community Development Programme and the Intensive Agricultural District Programme have been mainly responsible for this development. There was once a belief that agricultural pursuits were more a gamble than a profitable occupation. But this belief has been

now dispelled to a considerable extent by new methods, which have conclusively proved that money invested in farming can be profitable. With the execution of irrigation schemes, provision of electric pump sets, distribution of fertilisers and good seeds, improved plant protection and the like, the land is yielding more. In the following paragraphs, an account of the efforts that are being made to popularise scientific methods of agriculture in the district is given.

Agricultural implements

The farmers in the district are using various types of implements, both traditional and improved. In recent years, improved agricultural implements like the K. M. ploughs, Mysore-pattern ploughs, Eureka ploughs, Gurjar ploughs, Cooper ridgers, Japanese hand-rakes, Japanese weeders, green manure tramplers and blade harrows are becoming popular.

Tillage is perhaps one of the oldest agricultural operations. The main functions of tillage are to modify the soil structure in such a way as to produce suitable tilth for germination of seeds and subsequent growth of plants. It is also important to incorporate manure into the soil. In order to promote favourable conditions for the growth of useful soil organisms, tillage under scientific conditions becomes a necessity. The type of preparatory cultivation varies with the type of soil, kind of crop to be grown, climatic factors, the extent of weeds and the time available for preparation of the soil.

The country-plough is still the most common implement used in the district. This plough consists of a wooden body to which an iron share, a shaft pole and a handle are attached. The body is usually wedge-shaped and triangular or rectangular in section. This plough is easily made and repaired. Compared with the improved ones which are becoming popular, the country-plough opens only a V-shaped furrow and unless the plough is run a number of times, many portions of the field remain unploughed. It has been realised by progressive farmers that the country-plough has no proper adjustment for varying the depth or width of the furrow. So, in order to get the best results, improved ploughs are being made use of by many. Though it is not possible to give exact numbers of old and new ploughs in the district, it is estimated that there were 1,60,000 ploughs of all kinds in the district during 1965-66.

Manures and fertilisers

Good soil management involves adoption of suitable cultural practices and supply of adequate plant foods to the soil in the form of manures and fertilisers. The nutrients required for the growth of a crop must be supplied to the soil so that a proper

balance between the nutrients removed from the soil and the nutrients added to it by the application of manures and fertilisers is maintained. Manure is defined as a substance, which when added to the soil, restores or increases its production capacity. On the basis of their organic matter content, manures are classified as organic and in-organic manures and on the basis of their origin, they are classified as natural and artificial manures. Among organic manures, the most important is the farmyard manure. It is the oldest and most popular manure in use. The manure contains the dung and urine of farm animals mixed with a certain amount of litter or waste fodder. The farmyard manure provides nitrogen, phosphoric acid and potash to field crops. The other natural manures used in the district are the compost, sunn-hemp, glyricidia and sesbania.

'Compost' is the term applied to the material resulting from the decomposition of waste organic substances under the action of micro-organisms. Compost is prepared by decomposing the farm wastes in heaps or pits. This decomposed material resembles farmyard manure. In Mandya district, compost is being prepared by all the ten municipalities and also in rural areas. During 1965-66, a sizeable quantity of compost was obtained from these sources; the following figures show the quantity procured from urban areas of the district during the year:—

Towns	*Quantity in tons*
Mandya ..	2,425
Srirangapatna ..	939
Maddur ..	790
Malavalli ..	730
Krishnarajpet ..	674
Pandavapura ..	615
Nagamangala ..	574
Melkote ..	384
Belakavadi ..	354
Bellur ..	328

Rural compost

Compost preparation in the rural areas was more than in the urban areas. The following figures indicate the quantities obtained from the rural areas in 1965-66:—

Taluks	*Quantity in tons*
Mandya ..	45,000
Maddur ..	41,600
Malavalli ..	37,500

Taluk		*Quantity in tons*
Krishnarajpet	..	37,000
Nagamangala	..	29,800
Pandavapura	..	29,500
Srirangapatna	..	28,000

Of the 1,333 villages in the district, a total number of 1,201 villages actively participated in compost production. The total number of compost pits, which were in use during 1965-66, was 10,530.

In the preparation of compost, trenches, about four feet deep, are dug. A layer of refuse (nine to ten inches thick) is placed in the trench and over this layer, night soil is spread to thickness of about three inches. The filling in of the trench is continued day after day, as the materials become available, till the heap rises one foot above ground level. Due to decomposition, the temperature in the heap rises rapidly after three or four days. In about three to four months the compost is ready.

Green leaf manure

Application of green leaf manure is being widely practised in paddy cultivation all over the district. Green manuring is a very old practice. It has been established by experiment and practice that green manuring improves soil fertility. It is particularly suitable for wet lands. Where only one crop of rice is taken, a green manure crop can be raised before or after the rice crop. Even in the case of a double-cropped land, it is possible to raise a green manure crop after the harvest of the second crop.

Chemical fertilisers

The application of organic manures like farm-yard manure, green manure and compost is quite essential to keep the soil in good tilth and balance, but they are in short supply and cannot meet the full requirements. This deficiency is made up by the use of inorganic or chemical fertilisers. The artificial fertilisers have an advantage in that they are easily soluble in water and therefore, the nutrients in them are easily available to the plants. Nitrogen is the most important plant food. Phosphates are used in the cultivation of pulses. Among nitrogenous fertilisers, which are in use in the district, ammonium sulphate, sodium nitrate, calcium nitrate, ammonium nitrate, ammonium chloride, potassium nitrate, calcium cyanide, urea and ammonium sulphate nitrate are important. These chemical fertilisers are broadcast over the whole field or are applied in such a way that they serve the crop to the best advantage. Fertilisers are applied either before planting the crop or during the growth period or at both times, depending upon the soil, the crop and the season. All phosphatic fertilisers are applied at the period of sowing. Potash

is given either as basal dressing or top-dressing. Soluble nitrogenous fertilisers are applied before sowing the seed or at intervals during the growing period of the crop.

For field crops in Mandya district, the rate of application of fertilisers is anywhere from 150 to 500 lbs. per acre. The following table indicates the quantity of fertilisers used in various taluks of the district during 1965-66 :—

(In tonnes)

Taluk	Ammonium sulphate	Urea	Ammonium sulphate nitrate	Calcium nitrate
Mandya ..	7,601	1,905	113	154
Maddur ..	5,609	1,168	228	972
Malavalli ..	2,535	675	61	677
Pandavapura ..	2,316	688	33	696
Srirangapatna ..	2,107	366	83	436
Krishnarajpet ..	415	134	..	145
Nagamangala ..	420	89	38	79

During the same year, potassic-phosphatic fertilisers were distributed as shown below :

Fertilisers	*Tonnes*
Super-phosphate ..	9,668
Triple super ..	10
Muriate of potash ..	1,181
Nitro-phosphatic mixture ..	4,950

Power tillage practices

Power-tillage operations by progressive farmers is a special feature in the district. These progressive farmers are convinced that modernisation of agriculture is the sure path to achieve more from the arable land. Tractors have, of late, played an important part in the mechanisation of farm practices. The advantages of having a tractor are a saving in labour costs, quick agricultural operations and over-all reduction in the cost of production. There are in all ten Massey-Fergusson tractors of 32 H.P. with the Deputy Director of Agriculture under the Package Programme, in addition to six bull-dozers. During 1965-66, these tractors and bull-dozers were used for a period of 6,113 hours.

Seed Farms

Good seed is absolutely essential for raising a good crop. For this purpose, healthy, well-grown and mature plants bearing large and well-developed ears with plump seeds are selected in established seed farms. There are two seed farms in the district, one at Shivalli, some six miles from the headquarters town, and

another at Halebeedu in Pandavapura taluk. The Shivalli farm was started in April 1957 and the Halebeedu farm in June 1961. In these farms, multiplication of nuclear seeds is done in a systematic and scientific manner and these seeds are supplied to cultivators. Mostly paddy and ragi seeds were raised in these farms. On an evaluation done during 1965-66, it was found that seeds worth Rs. 23,548 were raised and distributed among the agriculturists at a subsidised cost of Rs. 14,146.

Plant protection

The paddy crop in the district in recent years suffered from caseworm, stem-borer, thrips and blast attacks. The aphis and the leaf-eating caterpillar menaced a large area. The major pests of ragi in the district were the ragi cut-worm and the caterpillar. The groundnut crop was attacked by *surat poochi* and also by *tikka* while sugarcane was attacked by the stem-borer. Various plant protection methods were adopted to check these pests and diseases in the district. During 1965-66, an area of 12,020 acres was covered by plant protection methods in the seven taluks. The total expenditure on plant protection during the year came to Rs. 64,935. Pesticides were also distributed on subsidy basis.

Indo-Japanese Agricultural Demonstration Farm

The Government of India in collaboration with the Government of Japan decided to set up demonstration farms in various places in India, with the object of furthering the economic and technical co-operation between the two nations. One of the farms started under this scheme is located at the Agricultural Research Station, Mandya. The Japanese expert staff began the work on the farm in April 1965. The area of the farm was 12 acres with a pond inside. Formerly, it had 272 plots of various dimensions, having different gradients, with no proper drainage, water channel or farm roads. One of the first operations launched by the Japanese technicians, after they took charge of the farm, was to level up the entire farm area to form plots of a bigger size. While levelling, the top-spill over a depth of six inches was first scraped by means of bull-dozers and kept on one side. Then the levelling of the sub-soil was taken up, after which the top-soil was again spread and levelled on the sub-soil. This method of levelling was unique in the sense that the top-soil was not disturbed and the fertility was not lost, which would have happened if the local method of levelling was pursued. Besides, as against the total number of 272 plots of the old, 49 new rectangular plots of equal dimensions were formed. The entire farm was divided into seven blocks, keeping a net area of about ten acres for cultivation. The remaining two acres were utilised for putting up roads, construction of water channels and the setting up of farm buildings.

According to the terms of agreement, the Japanese Government has made available a complete set of different types of

farm machinery to be made use of in the demonstration farm. The Japanese experts are mainly concentrating their efforts on raising more paddy per acre, using the available strains like S-707, S-1092, SR-26-B and CH-2. In addition to these recommended varieties, two new varieties called S-2222 and Taichung-65 were also tried along with the popular Orissa variety, CR-2001, supplied by the Rice Research Station, Cuttack. When this demonstration farm had established its roots and the crops had grown fairly satisfactorily, the formal inauguration of the Indo-Japanese Demonstration Farm took place in October 1965. The administrative block attached to the farm was opened in December 1965 by the Japanese Ambassador in India.

The farm is attracting the attention of progressive cultivators in the district, who throng in numbers to know at first hand the achievements in the farm. The following statement shows the yield per acre of different strains of paddy in the farm during 1965-66 :

Name of strain	*Yield per acre in Kilograms*
S-1092	2,130
S-701	2,080
S.R-26-B	1,908
CH-2	1,108
Taichung-65	1,346
S-2222	1,680
CR-2001	2,174

The average yield of all these varieties of paddy on the farm was about 1,800 kilograms per acre in 1965-66. In addition to the regular farming practices under the Japanese method of paddy cultivation, the farm has also an extension and training programme.

Intensive Agricultural District Programme

Mandya district was chosen for the Intensive Agricultural District Programme, popularly known as the Package Programme, to grow more foodgrains by employing modern methods of farming. This programme aims at, among other things, maximisation of production by providing facilities such as supplies of improved seeds, fertilisers, agricultural credit and technical know-how and marketing to all the participating farmers and also at providing opportunities to the officers concerned to get training and experience. Mandya district was selected for this experiment because of its high irrigation potential, existence of efficient co-operatives and other institutions and the progressive out-look of farmers. The office of the Intensive Agricultural District Programme was set up on 1st January 1962.

Amongst the many incentives offered under the intensive agricultural programme, the preparation of individual farm production plans constitutes an important item. These individual plans assist the farmers in increasing their agricultural production. The progress achieved so far indicates that there has been a steady response in taking up farm planning in the individual holdings. The planning factor has resulted in the judicious use of fertilisers and adoption of suitable cropping pattern so as to get a better yield from the fields. The following table indicates the progress achieved from the inception of the scheme up to 1966-67 :

Year	Plans processed	Area covered (in acres)		Quantum of credit given
		Wet	Dry	
				Rs.
1962—63 ..	11,000	31,639	34,599	80,46,684
1963—64 ..	24,595	59,917	28,915	78,09,564
1964—65 ..	63,703	1,02,570	1,09,288	82,03,187
1965—66 ..	86,057	1,56,605	1,23,108	1,08,31,128
1966—67 ..	90,432	1,21,957	1,38,929	1,50,10,104

A unique feature of this scheme is that all the production requisites such as seeds, fertilisers, chemicals and improved implements are made available through a single agency, *i.e.*, service co-operative institutions.

Improved strains

Improved strains of seed play an important role in stepping up food production in general. To achieve this objective, a programme for multiplication and distribution of improved seeds was taken up in right earnest. A phased programme of covering about 25 per cent of the total cropped area with improved strains each year has proved useful.

The use of modern fertilisers expanded steadily after the Package Programme came into force in the district. Efforts are being continued to persuade the cultivators to use balanced fertilisers, which help to get a better yield at less cost. Several composite demonstration plots have been laid out to educate the cultivators in the application of balanced fertilisers. This has resulted in reducing the use of one particular type of nitrogenous fertiliser, mainly ammonium sulphate. The farmers are now applying urea and calcium ammonium nitrate as well. During 1966-67, a total quantity of 63,339 tonnes of fertilisers was distributed under the Package Programme.

The farmers, at the beginning, were not enthusiastic to take up plant protection measures, but due to intensified efforts made under the programme, there has been an encouraging response from the cultivators. Up to the end of 1965-66, 410 hand-operated

sprayers were supplied at subsidised rates. In addition to this, 128 power sprayers were distributed to several blocks for demonstration purposes. Area-wise demonstrations on plant protection measures were intensified and 33,457 acres were treated against pests and diseases during 1966-67.

The use of improved, labour-saving implements in the intensive methods of cultivation is as important as that of any other improved practices recommended. Different categories of agricultural implements such as iron ploughs, seed drills, ridgers, levellers, puddlers, tramplers, cultivators and rotary paddy-weeders were distributed to cultivators at 25 per cent subsidised rates, through the blocks. The Taluk Boards and the Community Development Blocks also purchased implements out of their funds and made them available to the farmers. The following statement gives the total number of different categories of improved agricultural implements distributed to the cultivators at subsidised rates from 1963-64 to 1965-66 :—

Implements	*Number distributed*
Iron ploughs (K. M., Gurjar and Ureka ploughs) ..	3,642
Cultivators	1,443
Ragi seed drills ..	227
J.P.C. and hand-weeders ..	1,824
Modified cooper ..	460
Levellers, ridgers, puddlers, tramplers, etc. ..	673
Total ..	8,269

To enable the cultivators to understand the economics of the Package Programme and to convince them regarding its efficiency in increasing agricultural production, composite demonstration plots were laid out in respect of paddy, ragi and subsidiary crops like irrigated ragi, groundnut, potato, vegetables and green manure crops. During 1965-66, 935 demonstrations were held in respect of various crops.

Better yields

The yield data of demonstration and check plots analysed for the years 1962-63, 1963-64 and 1964-65 indicate that there was an average increase of three to four quintals of paddy and one-and-a-half to two quintals of ragi per acre over the previous yields. In addition, demonstrations on high-yielding varieties like hybrid maize, jowar and Taichung-65 paddy have been taken up since 1965.

Training programme

One of the main activities of the Package Programme is the training of officials and non-officials in matters such as developing a programme, package of practices of different crops, pattern of credit, demonstrations, soil testing, plant protection and role of co-operation.

Soil testing service for the individual farmer is also provided in the district. During 1966-67, a total number of 13,994 samples were tested. A separate soil testing laboratory for the Mandya district is being set up.

Horticulture

Development of fruit crops is the major activity of the Horticultural Department. Even prior to the advent of scientific methods in the pursuit of horticulture, several taluks in the district were known to be centres of banana and mango cultivation. During 1964-65, a total area of 2,285 acres was planted with bananas in the district. Of this, Maddur taluk alone accounted for 568 acres followed by Krishnarajpet with 470 acres. Mango is grown in Mandya, Pandavapura, Krishnarajpet, Srirangapatna and Nagamangala taluks. The total acreage under this crop in the district in 1964-65 was 1,377 acres.

Fruits like guavas, sapotas, mangoes and grapes are being grown in the orchards at Krishnarajasagar. Glyricidia, one of the green manure producing plants, is being grown extensively in the district and this has, to a certain extent, helped to supplement the manure requirements of the cultivators. The growth of both indigenous and exotic vegetables like brinjals, beans, cabbages, tomatoes, onions and potatoes is being encouraged. The required seeds in this connection are being distributed to the cultivators through the department. The objectives of the scheme formulated by the department for development of fruit production in the district are : increasing the area under fruit crops, rejuvenation of old orchards, control of nursery production, establishment of progeny orchards-*cum*-nurseries and production of fruit plants, provision of long and short-term loans for the formation of new orchards and carrying out effective propaganda with reference to manuring, pruning and protection of fruit plants.

The Mysore Horticultural Department is maintaining two farms, one at Maddur and another at Mandya. Various fruits are raised in these farms, including grapes, apples, pomegranates, papayas, oranges, other citrus varieties and the like. The produce is sold to the public. These farms are situated close to the Bangalore-Mysore Road.

Famines and Floods

It is on record that since 1891-92 the district has been free from any famine of a serious nature. Due to failure of expected rains, conditions of scarcity of food, water and fodder have prevailed now and then. The years when rains failed were 1891-92,

1898-99, 1901-02, 1908-09, 1918-19, 1922-23, 1928-29, 1935-36, 1940-41, 1946-47, 1952-53, 1958-59, 1963-64 and 1965-66. The distress or scarcity was at no time widespread and was confined only to the dry tracts of Mandya, Nagamangala, Krishnarajpet and Malavalli taluks. In 1891-92, the expected north-east monsoon failed with the result that the later crops suffered a set-back in the dry regions. Prompt relief measures were undertaken in the taluks of Mandya and Malavalli. The next years of inadequate rains, 1898-99, 1901-02 and 1908-09, did not affect the economic conditions of the people to any great extent and the situation was relieved by the rains following. In the taluks of Mandya, Nagamangala and Krishnarajpet, however, there was a certain amount of scarcity of water and fodder. The distress of 1922-23 was restricted to Nagamangala and that too, to nine villages. It was only temporary in nature and prompt relief measures were undertaken.

Relief measures

Whenever conditions of scarcity occurred, the State Government gave liberal remissions and also generous cash grants in the shape of *taccavi* and land improvement loans. Sinking of wells to overcome water difficulty was yet another programme initiated by the State Government. State forests were thrown open for free grazing of cattle. The establishment of fodder depots at selected centres greatly alleviated the distress. Again during 1965-66, conditions of distress caused hardship in several taluks on account of the failure of the monsoons. The Government sanctioned liberal sums of money to alleviate the distress. Periodic floods in the Cauvery and the Hemavathi rivers have been a major factor affecting the river valley portions of the district. Whenever the rains from south-west monsoon are above normal in the west coast, the Cauvery and the Hemavathi rivers are in spate. Serious floods have occurred before in the rivers but not all of them are noteworthy. To mention a few will not be out of place. The extraordinary floods in the Cauvery which occurred in 1911, between 19th and 22nd July, caused heavy damages to anicuts along the river. The flood of 19th July 1911 is reported to be the highest known within the living memory of the people. The floods rose to a height of eight feet at the anicuts or two-and-a-half-feet higher than the flood which caused a breach in Chikkadevaraya anicut in 1909. This flood caused damage to Kalhalli and Virajanadi anicuts. The waters of the Cauvery over-flowed the Wellesley bridge at Srirangapatna to a height of one foot above the parapet.

In 1924, the Cauvery and the Hemavathi were again in floods. Large tracts of agricultural fields were inundated all along the banks. As the Krishnarajasagar dam was under way at that time, the reservoir acted as a moderator. Due to excessive rains in the west coast in that year, all the rivers flowing east were in spate. The State Government undertook relief measures in time.

In 1955, the Cauvery was again in spate. Due to excessive inflow into the Krishnarajasagar reservoir, all the sluices were opened. The flood waters over-flowed the old Wellesley bridge to a height of four feet. Serious damage to approach roads at the bridge occurred. Again, in 1960, the Cauvery floods were abnormal. The inflow into the Krishnarajasagar reservoir exceeded the two-lakh cusecs mark. Consequent on these high floods, it was felt that a new road bridge at Srirangapatna was absolutely necessary. The bridge has been since built and opened for traffic as also new bridges on the railway tract at the island.

Animal Husbandry

Early period

One of the Viceroys of Vijayanagar is said to have brought to Srirangapatna some families of professional cattle-breeders belonging to the Hallikar community along with some 'superior breeds' of cattle, which came to be known after them as Hallikar breed. These cattle formed the nucleus of the famous breeds of draft cattle in the erstwhile Mysore State. This may also be regarded as the starting point for the establishment of the nucleus of Amrit Mahal cattle, which was the name given to them subsequently by Tipu Sultan.

The Animal Husbandry Department, in the days of the Vijayanagar Viceroys, was called the Karnhalli establishment. The Wodeyars of Mysore, some of whom, notably Chamaraja Wodeyar (1617-1637), Kanthirava Narasaraja Wodeyar (1638-1659) and the celebrated Chikka Devaraja Wodeyar (1673-1704) improved the breed of cattle, assigning extensive pasture lands (kavals) for ranching them in different parts of the State. It was at the time of Chikka Devaraja Wodeyar that the cattle establishment obtained priority as one of the development departments of the Government. The establishment got a new name, *viz.*, *Benne Chavadi*. The cattle were also said to have been branded with the initials of the ruler and also their years of birth. Incidentally, this is said to be the very first attempt in the history of cattle-breeding in the country that hot-branding of cattle was introduced as a reliable means of identifying the animals and maintenance of pedigree records.

Haidar Ali made extensive use of these cattle, especially the bullocks, as beasts of burden in his campaigns against other rulers and it is on record that his spectacular successes in those days were to a certain extent due to the stamina and speed with which these cattle stood the strain of war transport. It is reported that Haidar Ali kept nearly 60,000 bullocks in different parts of the State. His son Tipu Sultan, who succeeded him, added to these herds those of the Hagalvadi Paleyagar. The name *Benne Chavadi*

for the department, which had been entrusted with the management of this breed, was changed by Tipu as Amrit Mahal. The cattle department was firmly established in his time.

However, the department came to be neglected after 1799. In 1813, the Madras Government took over the administration of the cattle breeding department along with all the *kavals*, which were handed over to them. This arrangement continued till 1839, when again the Mysore Government resumed the management of the department. Till the rendition of the State in 1881, no appreciable alterations of policy were made in this regard. On 1st January 1882, the Mysore Government purchased, at a cost of Rs. 2¼ lakhs, the Amrit Mahal cattle from the Madras Government. Till 1896-97, the department was being administered by the Military Assistant to the Government, assisted by a separate technical officer. In August 1897, the Government sanctioned the appointment of a Superintendent for the Amrit Mahal Department, which was made a subordinate branch under the control and direction of the Military Department of the Government. The control and direction of the department was transferred in 1915-16 from the Military Secretary to the Chief Commandant, Mysore State troops. In 1923, this was transferred to the Department of Agriculture. Later on, the Amrit Mahal Department was merged with the Civil Veterinary Department which had been set up under the Department of Agriculture. Subsequently, it formed a part of the independent Department of Animal Husbandry created during the year 1944. Consequent upon the change in the Government policy in regard to this breed in the context of the developments, the strength of Amrit Mahal cattle and the *kavals* earmarked for them were reduced considerably.

Hallikar breed

Mandya district is the home-land of the Hallikar breed of cattle. The breeding of this type is undertaken throughout the district by individuals on a small scale from early times. The male stock of the breed are sold during annual cattle fairs held all over the district and are highly priced for their excellent draft qualities.

The following figures indicate the livestock population of the district as per the 1961 census

Cattle	..	3,49,163
Buffaloes	..	1,56,318
Sheep	..	4,21,452
Goats	..	1,44,107
Poultry	..	6,24,503

There is a large preponderance of non-descript cattle. Pure Hallikar variety accounts for over a lakh of animals. There is a small number of Sindhi and other breeds also introduced recently.

Though there are no cattle-breeding farms in the district, the Animal Husbandry Department has undertaken various measures to improve the existing breeds. Mass castration of all scrub-bulls has been done and stud bulls of improved breed are supplied free to selected breeders. In order to encourage the preservation of green fodder during summer months, the cultivators are asked to construct silage pits and are given a token grant of ten rupees per pit. *Taccavi* loans are being granted throughout the district for obtaining pure bred cows. With a view to encouraging breeders to maintain best bull calves, till they attain maturity, a subsidy of ten rupees per month is being given to a select few. Arrangements are also being made to upgrade the non-descript cattle by artificial insemination with Jersey semen obtained from Bangalore.

Key Village Centre, Malavalli

The Key Village Centre at Malavalli, which serves a group of about ten villages, is meant for taking up intensive animal husbandry activities in a concentrated area. The activities include artificial insemination of cattle and buffaloes, castration of scrub bulls, identification and marking of animals by tattooing, milk recording, fodder cultivation, feeding of cattle with mineral supplement, organisation of co-operative units for the sale of feed for the cattle, disposal of milk and milk products, prevention and control of animal diseases, treatment of sterility and minor ailments.

Cattle Fairs

Principal annual cattle fairs are held at Bellundagere, Karighatta, Bindiganavale, Kotebetta, Adichunchanagiri, Hemagiri, Maddur town, Chikkanakanahalli, Bebi and Melkote in the district. Hemagiri cattle fair is among the largest cattle fairs in the State and attracts about 30 to 40 thousand heads of cattle.

During 1964-65, a total number of 31,000 scrub-bulls were castrated.

A number of agriculturists grow fodder for their livestock. During 1964-65, an area of 22,734 acres was under fodder crops.

Dairy development

Mandya district was at one time noted for butter and ghee and was also able to cater to the needs of other districts in the State. But with the advent of intensive irrigation, the menace of liver-fluke disease, to which cattle fell victims, increased. As a result, the production of butter and ghee in the district decreased. Efforts are being made to control the liver-fluke menace. The Mysore Sugar Factory at Mandya is maintaining some Sindhi bulls in order to breed good cows for increased milk production.

Sheep farming

Mandya district is reputed for a special breed of sheep called the Bannur breed, known for its quality mutton. This superior breed contributes to the income of the average agriculturists, who maintain generally a few sheep on their small holdings. There is also a growing demand for this breed of sheep from other regions and large number of sheep are purchased by people from outside.

There was no sheep-breeding farm in the district till recently and, therefore, no appreciable improvement was noticed in this respect. There were, however, two sheep-breeders' associations at Nagamangala and Krishnarajpet in 1965-66. The local breeders are yet to be aquainted with scientific breeding methods. A scheme for the establishment of a sheep-breeding farm for the Bannur breed in the Dangur forest of Malavalli taluk has recently been sanctioned by the Government and it is expected to go into operation soon. The object of this farm is to take up studies on the improvement of the breed both by selective breeding and cross-breeding. For the latter, some exotic breeds of sheep, noted both for mutton and wool, like the South downs and Dorset horns are being imported from abroad.

Poultry

A poultry farm has been established at Malavalli. Another farm, under the Danish-Mysore Project, has been started recently at Shivaragudda in Maddur taluk to popularise scientific poultry-breeding. Under the applied nutrition programme aided by the UNICEF Organisation, an ambitious scheme of poultry development has been taken up in this district.

The White Leghorn and to some extent, the Rhode Island Red, are the two breeds popular in the district. In order to encourage poultry keeping, selected breeders are given necessary encouragement by supply of birds, eggs and equipments. Interested breeders are also trained by the department for a period of 30 days in the Malavalli Poultry Extension Centre.

Veterinary aid

The veterinary section of the Department of Animal Husbandry and Veterinary Services deals both with the treatment of ailments of livestock and the prevention of diseases. In 1965-66, there were 20 veterinary institutions in the district. Particulars of these institutions were as follows :

Category	Number	Location
Veterinary Hospital	One	Mandya Town
Veterinary Dispensary.	Seven	1. Maddur 2. Malavalli 3. Krishnarajpet 4. Nagamangala 5. Pandavapura 6. Srirangapatna 7. Arakere

Category	Number	Location
Rural Veterinary Dispensary.	Twelve	1. Basaral 2. Gramsevaks' Training Centre, Agricultural Research Station, Mandya. 3. Koppa 4. Belakavadi 5. Halagur 6. Kikkeri 7. Santebachahalli 8. Bukinakere 9. Bellur 10. Bindiganavale 11. Belagola 12. Melkote

Murrah buffaloes and breeding bulls are being made available in villages for purposes of upgrading the local breeds of she-buffaloes and cows. In all the taluk veterinary dispensaries, artificial insemination centres have been established and this method of breeding is gaining popularity.

Animal diseases

Non-contagious diseases do not pose a serious problem and are easily tackled by qualified personnel of the department in the veterinary institutions and by visiting the villages. But contagious diseases, which were once difficult to combat, are now being controlled both by preventive and curative measures.

Black Quarter, Haemorrhagic Septicaemia and Anthrax, which are common, are controlled by preventive vaccinations. Rinderpest has been stamped out and the district is free from this disease for the past nearly two decades.

Parasitic Diarrhoea among cattle and sheep, caused by liver-fluke, is rampant in irrigated tracts. This disease is taking a heavy toll in all parts of the district. The department is striving to bring this disease under control by a systematic drive for eradicating the intermediate host, *i.e.*, snails, and by periodical dosing of all animals with suitable drugs.

Poultry diseases, especially Ranikhet, have been controlled to a great extent by systematic protection of all young birds. One day in a week is specially set apart in each veterinary institution for Ranikhet vaccination.

Intensive propaganda on cattle-breeding and poultry-farming is done by the staff of the department both in the towns and villages for mass castrations or for combating contagious diseases. Cattle fairs, *gosamvardhana* celebrations and other important occasions are also made use of for propaganda work and other animal husbandry activities. The co-operation of the personnel of the Community Development Blocks is also enlisted in this work.

Fisheries

Mandya district has more than 76,500 acres of water area available for extensive fish culture in the district. The area has many major and minor tanks, irrigation channels and reservoirs.

Details of fishing industry

The Department of Fisheries has taken up fish culture in Krishnarajasagar water-spread, the reservoir at Shivasamudram and 46 major tanks by systematic stocking of quick-growing varieties of fish seed, *viz.*, Catla, Rohu and Mrigal every year. Several panchayats have also taken up fish culture in tanks within their jurisdiction. Important indigenous fishes of the district are Barbus tor, Labeo carnaticus, Labeo calbasu, cat fishes like Wallago attu, Mystus species, Saccobranchus fossilus, Murrels and Eels. There are two fish farms in the district, one at Krishnarajasagar and the other at Shivasamudram. These fish farms are engaged in rearing the imported fish seed and also in producing fish seed of common carp (Cyprinus carpio) to meet the increasing demand of fish seed in the area. Thus, it is proposed to increase the fish production through systematic stocking, conservation and exploitation wherever water is available for its rearing.

Fishermen

Nearly 5,000 fishermen are engaged in the fishing industry in the district, out of whom about 1,600 are active fishermen. They operate different types of indigenous fish-gear called cast net, drag net, gill net, rod and line, basket traps and the like. In recent years they have taken up improved methods of fishing by making use of nylon nets.

The following table indicates the number of families engaged in fishing in the district during 1966 :

Name of Taluk	*Number of fishing tanks*		*Number of families engaged in fishing*
	Major	*Minor*	
1. Mandya ..	7	64	250
2. Maddur ..	9	100	150
3. Malavalli ..	6	23	1,000
4. Srirangapatna ..	2	25	250
5. Pandavapura ..	2	111	50
6. Krishnarajpet ..	10	158	75
7. Nagamangala ..	31	75	150
Total ..	67	556	1,925

The department issues licences or auctions the right to exploit the fishery in the district. These licences and auctions yield an average revenue of Rs. 6,000 per annum.

Co-operative enterprise

The fishermen in and around Ganjam in Srirangapatna taluk formed a co-operative society in the year 1960. In 1965-66, there were 237 members on its rolls having 327 shares with a share capital of Rs. 4,000. All the assistance provided by the State Government, such as long-term loans, short-term loans, subsidy on gear and craft, is channelled through this co-operative society in order to help improve the socio-economic conditions of fishermen.

In order to improve educational facilities for the fishermen's children, the department has started a fishery primary school at Ganjam in Srirangapatna. The strength of students in the school in 1966 was 107.

Training

To train inland fishermen in fish culture and exploitation of the fishery in deep-waters, the department has set up an inland fishermen training centre at Krishnarajasagar. The duration of the training course is three months and in each batch, 20 fishermen receive training.