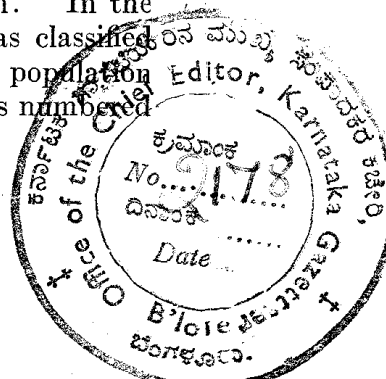


CHAPTER IV

AGRICULTURE AND IRRIGATION

THE total geographical area of the district is 26,11,134 acres, of which a net area of 12,00,458 acres was sown with crops during 1965-66 and an area of 1,77,784 acres of land was current fallow and 1,44,610 acres were other fallow land. The area sown with crops is proportionately more in Tumkur, Tiptur, Pavagada, Sira and Gubbi taluks. Madhugiri, Pavagada and Chiknayakanahalli taluks have a fairly larger proportion of cultivable waste than the other taluks. A total extent of 1,08,172 acres is forest area, mostly of scrub jungles. The forest areas are proportionately larger in Sira, Gubbi, Pavagada, Kunigal and Chiknayakanahalli taluks than in others. A proportionately low percentage of forests is found in Tiptur, Tumkur and Turuvekere taluks.

The population of the district can be grouped into two distinct categories, *viz.*, agricultural and non-agricultural. The 1951 Census divided each of these two main groups into four sub-groups. Owner-cultivators, tenant-cultivators, cultivating labourers and non-cultivating owners came under the first group, while the non-agricultural population consisted of those engaged in production other than cultivation, commerce, transport and other services. For purposes of this chapter, only the agricultural population is taken into account. The percentage of agricultural population in the district is far more than the percentage of non-agricultural population, the chief occupation of the people of the district being agriculture. The percentage distribution of agricultural population for the four sub-groups was—owner cultivators 71.5 per cent, tenant-cultivators 3.5 per cent, cultivating labourers 5.5 per cent, and non-cultivating labourers 3.1 per cent, the total agricultural population being 83.6 per cent. The percentage of the non-agricultural population was 16.4 to the total population. In the 1961 Census, the working population of the district was classified under nine broad categories. Out of the total working population of 6,88,515, the cultivators and the agricultural labourers numbered 4,87,472 and 61,482 respectively.



Size of holdings

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

<i>Size of holding</i>	<i>No. of holdings</i>	<i>Area in acres</i>
Below 5 acres ..	81,500	1,95,000
5 to 10 acres ..	35,000	2,45,000
10 to 15 acres ..	12,800	1,40,000
15 to 30 acres ..	12,200	2,53,000
30 to 60 acres ..	4,200	1,67,000
60 to 100 acres ..	800	61,000
100 to 200 acres ..	300	42,000
200 and above ..	100	33,000

The above figures show that a sizeable portion of the cultivated area consisted of uneconomic units held by a majority of cultivators. The average holding per head of the population in the district comes very near an acre.

Land utilisation

Seasonal conditions have been the main factor causing fluctuation in the acreages under cultivation. Out of a total geographical area of 26,11,134 acres in the district, the extent of land put to agricultural use was 12,00,458 acres in 1965-66, forming less than half of the total land area. In 1912-13, the net area sown with crops was 9,58,626 acres and during 1959-60 it was 12,40,180 acres. From time immemorial, Tumkur district has occupied a pre-eminent place in dry crop cultivation. Agricultural practices in the area still largely conform to a traditional type depending on the rains. The following table indicates the cultivated and un-cultivated areas in the district during 1959-60 and 1965-66 :—

1959—60

<i>Taluk</i>	<i>Cultivable area in acres</i>				
	<i>Net area sown</i>	<i>Forests</i>	<i>Permanent pastures</i>	<i>Cultivable waste</i>	<i>Area sown more than once</i>
Tumkur ..	1,41,597	10,174	34,837	3,979	5,320
Koratagere ..	55,000	8,836	25,198	9,203	5,550
Madhugiri ..	1,03,825	6,837	41,482	13,841	5,000
Pavagada ..	1,59,278	14,618	40,500	8,988	6,286
Sira ..	1,86,735	24,544	57,963	16,668	26,896
Chiknayakanahalli ..	1,10,986	20,370	74,358	12,315	..
Turuvekere ..	90,403	1,383	42,341	6,964	1,975
Tiptur ..	99,880	816	25,600	5,616	2,768
Kunigal } ..	1,03,791	14,840	87,862	85,476	3,225
Amruthur } ..	45,447	532	..	15,116	..
Gubbi ..	1,49,238	25,751	78,705	22,502	1,588
Total ..	12,40,180	1,28,906	5,08,146	2,44,138	38,458

Un-cultivable area in acres

<i>Taluk</i>	<i>Current fallows</i>	<i>Other fallows</i>	<i>Land put to non-agricultural use</i>	<i>Barren and un-cultivable land</i>
1	2	3	4	5
Tumkur ..	20,988	3,431	14,243	23,528
Koratagere ..	15,272	..	..	46,902
Madhugiri ..	23,895	6,975	14,256	7,641
Pavagada ..	36,532	8,108	18,344	13,228
Sira ..	46,438	2,070	26,096	15,769
Chiknayakanahalli ..	21,320	8,893	13,472	7,050
Turuvekere ..	19,888	10,830	14,001	26,740
Tiptur ..	13,226	..	12,875	6,059
Kunigal ..	20,605	4,939	15,042	1,415
Amruthur } ..	5,426	..	1,000	16,137
Gubbi ..	33,570	..	..	..
Total ..	2,57,152	45,246	1,29,329	1,67,499

1965-66

Cultivable area in acres

<i>Taluk</i>	<i>Net area sown</i>	<i>Forests</i>	<i>Permanent pastures</i>	<i>Cultivable waste</i>
1	2	3	4	5
Tumkur ..	1,34,390	2,043	25,469	4,560
Koratagere ..	82,617	7,612	26,548	6,272
Madhugiri ..	1,12,812	8,106	45,390	45,202
Pavagada ..	1,63,405	14,517	33,766	68,547
Sira ..	1,35,576	13,472	60,304	21,693
Chiknayakanahalli ..	1,25,911	20,348	14,650	48,998
Turuvekere ..	1,00,598	1,383	43,241	5,733
Tiptur ..	1,10,562	1,470	30,178	3,320
Kunigal ..	95,246	14,340	56,520	13,857
Gubbi ..	1,39,341	24,906	42,293	15,133
Total ..	12,00,458	1,08,172	3,78,359	2,33,315

Taluk	Un-cultivable area in acres			
	Current fallows	Other fallows	Land put to non-agricultural use	Barren and un-cultivable land
1	2	3	4	5
Tumkur ..	28,865	16,596	25,123	11,739
Koratagere ..	12,420	2,920	8,988	7,692
Madhugiri ..	13,003	2,010	1,834	43,445
Pavagada ..	11,335	14,263	14,783	14,143
Sira ..	45,000	23,692	29,072	47,435
Chiknayakanahalli ..	14,618	12,800	16,379	19,110
Turuvekere ..	4,823	18,984	11,245	1,002
Tiptur ..	3,440	850	16,589	12,051
Kunigal ..	21,725	14,894	12,055	12,970
Gubbi ..	22,555	7,601	26,412	32,013
Total ..	1,77,784	1,44,610	1,62,480	2,01,600

According to the above figures supplied by the District Statistical Office, Tumkur, there was a total of 2,33,315 acres of cultivable waste in the district during 1965-66. In order to reclaim the culturable waste, the State Government is giving several incentives, such as, financial assistance, facilities of bulldozers and tractors. (Particulars of financial assistance are given in Chapter VI, Banking, Trade and Commerce).

Agricultural meteorology

Tumkur district is situated between 12° 45' and 14° 20' north latitude and 76° 20' and 77° 31' east longitude. The district receives a major portion of the rains from the south-west monsoon which sets in usually by the end of May. The north-east monsoon sets in by the end of September and continues till the end of November. The cold season is generally free of rain. The normal average rainfall of the district is 27.08 inches or 687.9 millimetres. The normal average rainfall in different taluks is as follows :—

Pavagada and Sira ..	Between 20 and 22 inches
Koratagere, Tiptur and Madhugiri ..	Between 22 and 25 inches
Chiknayakanahalli and Turuvekere.	Between 25 and 26 inches
Gubbi and Kunigal ..	Between 28 and 31 inches

The cold weather rains falling from December to March are scanty and not much needed for the standing crops. But they are useful in one respect, that is, to keep up the pasture supply of the area. The hot weather rains called mango showers, falling in April and May, are of the 'accidental' kind coming in heavy short storms from the east. These rains are very important to cultivators, as a copious fall replenishes all the tanks and enables the agriculturists to prepare the land for the following south-west monsoon rains. The south-west monsoon showers, during the period from June to September, are very essential for the tillers. The steady drizzling and persevering rains of the season make the soil productive. The north-east monsoon rains, occurring during October and November, are specially important for filling the tanks and providing a storage of water to last for the lean months.

The agricultural seasons in the district are reckoned in the traditional way and are comprised within the periods of the south-west and north-east monsoons. The weather in the district is at no time of the year so cold as to preclude agricultural operations, and provided there is sufficient supply of water for irrigation, crops can be raised all the year round. As a matter of fact, those lands, which are under well irrigation or under the larger tanks, are found to be under some crop or the other throughout the year. The traditional agricultural seasons are mainly two and the produce is called *Karthika fasal* and *Vaishakha fasal* according to the time of harvest. *Karthika* falls about October and November or early December and *Vaishakha* about April and May or early June. The cultivators depend on their own calendar, which is regulated by the rains which fall under each of the *nakshatras* or lunar asterisms.

The agricultural year, which begins about April, is divided into 27 rainfall periods called after the lunar asterisms, each period being of a fortnight's duration. Each asterism is further divided into four quarters called *pada*. The names of these asterisms and the dates corresponding to them are as follows: *Ashvini*—April 14 to 27; *Bharani*—April 28 to May 10; *Krithike*—May 11 to 24; *Rohini*—May 25 to June 7; *Mrigashira*—June 8 to June 21; *Aridra*—June 22 to July 5; *Punarvasu*—July 6 to 20; *Pushya*—July 21 to August 2; *Ashlesha*—August 3 to 15; *Makha*—August 16 to 30; *Purvaphalgun*a—August 31 to September 11; *Uttaraphalgun*a—September 12 to 28; *Hasta*—September 29 to October 11; *Chitra*—October 12 to 24; *Swati*—October 25 to November 5; *Vaishakha*—November 6 to 19; *Anuradha*—November 20 to December 2; *Jeshta*—December 3 to 16; *Mula*—December 17 to 29; *Purvashadha*—December 30 to January 10; *Uttarashadha*—January 11 to 23; *Shravana*—January 24 to February 5; *Dhanishta*—February 6 to 18; *Satabhisha*—February 19 to March 3; *Purvabhadra*—March 4 to 17; *Uttarabhadra*—March 18 to 31 and *Revati*—April 1 to 13.

The *Bharani* rain, which falls about the last week of April and early May, is considered to prognosticate good agricultural seasons throughout the year. The rains from *Mrigashira* (June 8 to August 15) to *Ashlesha* fall usually in the sowing season for food-grains in the earlier part, and horsegram in the later. *Swati* and *Vaishakha* rains (October and November) mark the close of the rainy season. *Anuradha* to *Mula* (November-December) is the harvest time when only dew falls on the fields. During this season, the future rains are supposed to be engendered in the womb of the clouds. Sugarcane is planted in *Purvabhadra* and *Uttarabhadra* (December-January). In general practice, however, the following well-marked seasons are observed :—

1. The *kar* or early *mungar* season, which is the earliest, beginning in the months of April and May.
2. The *hain* season or *mungar*, beginning in July.
3. The *hingar*, commencing in September and October.

These terms are generally used in respect of dry crops. In Tumkur district, the *hain* or *mungar* crop forms the only crop of the season, as it is harvested too late for growing a *hingar* crop. The *hingar* crop may either follow a *mungar* or *kar* crop or be the only crop of the year. In the case of paddy lands, the seasons are called *karthika* and *vaishakha*, the former being the monsoon crop, *i.e.*, sown from July onwards and harvested in December, and the latter, sown from December onwards and harvested in April and May. In recent years, two seasons for paddy are particularly noted, *viz.*, *kharif* and *rabi*. The *kharif* season begins in June and ends in December, while the *rabi* season begins in December and continues till April.

Forests

Out of a total geographical area of 26,11,134 acres, an extent of only 1,08,172 acres of land was under forests in 1965-66. During the First Plan period, an extent of 565 acres was afforested at a cost of Rs. 15,696. During the Second Plan period, soil conservation work by afforestation was done in an area of 4,856 acres at a cost of Rs. 2,94,235 and the rehabilitation of degraded forests was done over an area of 2,459 acres at a cost of Rs. 1,91,668. New plantations were also raised over an area of 170 acres at an expenditure of Rs. 10,066 and planting of agaves was done over a total length of six miles and three furlongs. A sum of Rs. 8.90 lakhs was allotted to the district under the Third Plan for the implementation of several schemes, such as, rehabilitation of degraded forests, development of minor forest produce, grazing and pasture improvement, cashewnut development, soil conservation by afforestation, agave planting, etc.

IRRIGATION

The area under irrigation during 1967, according to the agricultural statistics of the district, was 1,67,036 acres, including the *atchkat* under Marconahalli reservoir. The break-up of this net area is as follows : Area irrigated by channels 17,862, by tanks 99,656, by wells 45,042 and from other sources 4,476 acres. The irrigated area shows variations from year to year, depending on the availability of seasonal rains. While during 1913-14 the total area under irrigation was stated to be 1,78,006 acres, in 1958-59 the total irrigated area was 1,26,612 acres, and in 1960-61, it was 1,58,627 acres. According to the District Statistical Office, the area under irrigation during 1965-66 was only 1,08,000 acres. But in 1967, it was considerably more, *i.e.*, 1,67,036 acres. As the year 1965-66 was a bad year from the point of view of rains, the extent of the area under irrigation had fallen. But due to good rains in the later half of 1966, all the tanks in the district got filled up and the normal *atchkat* was utilised for growing crops. The irrigational facilities in the district are utilised for growing crops like paddy, irrigated ragi, irrigated groundnut, sugarcane, chillies and arecanut. The paddy acreage is more in Tumkur, Pavagada, Gubbi, Tiptur and Kunigal taluks, while irrigated ragi is grown more in Pavagada and Madhugiri taluks. Sugarcane crop is grown largely in Kunigal taluk, making use of the Marconahalli and Mangala reservoirs.

During the First Plan period, six medium irrigation works, **Plan schemes** *viz.*, (1) construction of a new tank at Honnamachanahalli, (2) laying of the right-bank channel to the Marconahalli reservoir, (3) construction of the left-bank channel of Sanaba pick-up, (4) opening of a feeder channel to Bukkapatna tank, (5) construction of a new tank at Irakasandra and (6) formation of a new tank at Sannaikanahalli were taken up. Of these irrigational works, the first three were completed during the First Plan period, and the remaining three were carried over and completed in the Second Plan period. Also during the First Plan period, 261 minor irrigation works were taken up and all of them were completed ; 30,407 acres of old and 4,100 acres of new *atchkats* were benefited by these works.

During the Second Plan period, 600 minor irrigation works were taken up and, of these, 167 works were completed. A total of 13,533 acres, comprising both old and new *atchkats*, were benefited from these works. The construction of the Mangala reservoir across the Nagini river near Tigalarapalya in Kunigal taluk, estimated to cost Rs. 13.7 lakhs, was taken up. The work of this project was continued in the Third Plan period and completed. It has a command area of 1,300 acres.

During the Third Five-Year Plan period, several schemes were executed under the minor irrigation programme. A sum of Rs. 118.60 lakhs was allocated on this account. The particulars of these schemes and the financial allocation made in respect of each category of schemes are indicated in the following statement :

<i>Particulars of Schemes</i>	<i>Financial Allocation</i>
	(Rs. in lakhs)
Construction of new tanks ..	4.80
Restoration of tanks including breached tanks.	43.50
Desilting of tanks ..	0.60
Percolation tanks ..	1.00
Construction of new anicuts, pick-ups and bhandaras.	3.32
Opening up of feeder channels to existing tanks.	0.80
Improvement to existing anicuts, pick-ups, bhandaras and channels.	0.60
Spill-over schemes ..	4.38
Sinking of new irrigation wells ..	17.50
Well-boring scheme ..	2.00
Supply of electric pumpsets ..	33.50
	(to irrigate 3,625 acres)
Supply of diesel pumpsets ..	1.10
Extension of power line ..	5.50

The first four of these schemes relate to storage works and the next four to diversion works while the last five schemes pertain to irrigation by wells. The well-boring scheme for irrigation purposes was a new one in the Third Plan period. Before that, well-boring activities were restricted to provision of drinking-water facilities only. The scheme was entrusted to the agricultural engineering section of the State Agricultural Department to help the cultivators in putting up test-bores for digging irrigation wells and to augment the water supply of the existing wells by deepening them.

Irrigation tanks

During 1966-67, a total number of 1,281 tanks provided the major water resources for agricultural operations in the district. There were eight tanks, each having an *atchkat* of more than 1,000 acres. A total of 918 tanks had an *atchkat* of less than 100 acres each. The total area irrigated under these tanks was 66,015 acres during 1965-66. This command area increased to 99,656 acres in 1966-67 because of good rains in that year. The *atchkat* or command area of each tank increases or decreases according to

rainfall variations. When the tanks are constructed, the approximate *atchkat* is determined on the actual average rainfall in the area. The details furnished in one of the following tables, *i.e.*, for the year 1965-66, gives the command area in each taluk. Kunigal taluk has the largest *atchkat* under tanks, as the two large irrigation reservoirs in the district, *viz.*, the Marconahalli and Mangala reservoirs are constructed in that taluk. Sira taluk comes next followed by Koratagere and Tumkur taluks.

Area under irrigation in Tumkur district as in
1913-14 (in acres)

Under rivers	..	..	3,664
Under tanks	..	..	1,21,899
Under channels	..	..	3,662
Under tank channels	..	..	1,583
Under wells	..	..	43,057
Under springs or talapariges	..	..	4,141
Total area under irrigation	..	..	1,78,006

Area under irrigation in Tumkur district as in 1958-59 (in acres and guntas)

Taluk	Total area irrigated	By channels	By tanks	By wells	By other sources
1	2	3	4	5	6
	A. G.	A. G.	A. G.	A. G.	A. G.
Tumkur	.. 18,394—14	..	16,768—04	1,536—18	89—32
Gubbi	.. 16,220—00	..	15,500—00	630—00	90—00
Kunigal	.. 12,161—00	..	9,435—00	347—00	2,319—00
Tiptur	.. 7,280—00	..	7,090—00	180—00	..
Turuvekere	.. 7,984—04	..	7,642—04	342—00	..
Chiknayakanahalli	2,807—00	..	2,606—00	201—00	..
Madhugiri	.. 19,572—00	..	14,479—04	2,913—00	2,180—00
Sira	.. 13,581—13	..	8,085—13	4,600—00	..
Koratagere	.. 9,900—29	721—24	8,085—10	1,500—00	315—19
Pavagada	.. 18,712—00	..	7,533—00	11,129—00	..
Total	.. 1,26,612—20	721—24	97,223—35	23,377—18	5,003—11

Sources of irrigation in Tumkur district as in 1960-61

Sl. No.	Name of taluk	Sources and command area (in acres)				No. of tanks	No. of wells	No. of oil engines	Electric pumpsets	Mhotes	
		Channels	Tanks	Wells	Total						
1	2	3	4	5	6	7	8	9	10	11	
1.	Tumkur	..	20,899	2,500	23,399	171	410	16	140	18	
2.	Koratagere	..	1,417	8,085	1,650	97	480	6	275	150	
3.	Madhugiri	..	2,180	11,050	4,500	118	3,200	18	500	..	
4.	Pavagada	..	763	7,533	11,129	150	3,463	70	332	..	
5.	Sira	..	..	14,540	7,500	91	1,350	40	661	..
6.	Chiknayakanahalli	..	..	11,298	..	137	150	27	102	60
7.	Turuvekere	..	..	7,778	305	59	45	9	8	13
8.	Tiptur	..	..	4,500	220	153	18	4	10	12
9.	Kunigal	..	2,850	7,905	144	57	125	2	16	8	
	Amruthur	..	16,000	4,000	..	61	..	..	..	..
10.	Gubbi	..	..	9,851	..	148	300	10	10	..
	Total	..	23,240	1,07,439	27,948	1,58,627	1,242	9,541	202	2,054	261

Area under irrigation in Tumkur district as in 1965-66 (in acres and guntas)

<i>Tabuk</i>	<i>Channels</i>	<i>Tanks</i>	<i>Wells</i>	<i>Other sources</i>	<i>Total</i>
1	2	3	4	5	6
	A. G.	A. G.	A. G.	A. G.	A. G.
Tumkur .. ..	..	10,587—33	2,914—36	..	13,502—29
Gubbi .. ..	..	810—00	1,940—00	224—00	2,974—00
Chiknayakanahalli .. ..	..	230—00	420—00	..	650—00
Kunigal .. ..	..	15,356—00	436—00	188—00	15,980—00
Turuvekere .. ..	..	3,793—00	684—00	318—00	4,795—00
Koratagere	823—00	10,800—00	3,380—00	420—00	15,423—00
Sira	50—00	11,000—00	5,600—00	145—00	16,795—00
Madhugiri .. ..	..	..	10,687—00	..	10,687—00
Pavagada .. ..	..	7,939—00	13,640—00	..	21,579—00
Tiptur .. ..	..	5,500—00	185—00	..	5,685—00
Total ..	873—00	66,015—33	39,886—36	1,295—00	1,08,070—29

Particulars of irrigation tanks and wells in Tumkur district as in 1966-67

Taluk	Number of Tanks					Total No. of tanks	Number of Wells			
	Atchkat of more than 1,000 acres	Atchkat between 500-1,000 acres	Atchkat between 250-500 acres	Atchkat between 150 and 200 acres	Atchkat of less than 100 acres		Old wells in use	No. of wells dug through National Extension Service	No. of wells dug with the aid of Land Development Bank	Total number of wells
1	2	3	4	5	6	7	8	9	10	11
Tumkur ..	1	9	18	23	138	189	1,562	763	214	2,539
Koratagere ..	1	3	3	11	84	102	1,344	378	15	1,737
Madhugiri ..	..	..	9	8	106	123	3,892	208	Not available	4,100
Pavagada ..	..	2	8	24	30	64	2,784	719	103	3,606
Sira ..	..	7	33	45	110	195	4,233	767	135	5,135
Chiknayakanahalli ..	1	2	7	13	73	96	157	50	14	221
Gubbi ..	1	3	5	19	88	116	1,384	476	107	1,967
Tiptur ..	..	..	1	45	107	153	126	179	15	320
Turuvekere ..	..	4	18	13	42	77	120	287	Not available	407
Kunigal ..	4	6	11	5	140	166	910	173	143	1,226
Total ..	8	36	113	206	918	1,281	16,512	4,000	746	21,258

The following list gives the names of almost all the important major tanks in the several taluks of the district :—

Gubbi : Gubbi, Amanikere, Nittur, Kadaba, Chandrashekhara-pura, Kallur, Mookanahalli, Pattana, Belavatta, Mavinahalli, Changavi and Ankasandra ; *Sira* : Kallambella, Yeliyur, Lakshmi-sagara, Chikkasandra, Brahmasandra, Borasandra, Magodu, Dodda-Agrahara, Bhoopasandra, Changavara, Sira-Doddakere, Sira-Chikkakere, Ramalingapura, Bukkapatna and Chirathahalli ; *Koratagere* : Agrahara, Thumbadi and G. Gollahalli ; *Chik-nayakanahalli* : Chiknayakanahalli tank, Settikere, Thimmalapura, Boranakanive, Doddannagere and Gopalapura ; *Turuvekere* : Malla-ghatta Amanikere and Turuvekere Amanikere ; *Kunigal* : Amruthur (Doddakere and Chikkakere), Kodigehalli, Hosahalli, Holalagudda, Kaggere, Sankanapura Anicut, Jainagara, Hosakere, Sanaba, Kailara, Kuppe, Banavara, Marconahalli Reservoir, Kadasettihalli, Bisanale, Kunigal Amanikere, Begur, Kottigere and Deepambudhi ; *Madhugiri* : S Mallenahalli, Midigeshi, Bedatur, Bidarakere, Reddi-halli ; and *Tiptur* : Nonavinakere, Echenoor, Soorgurkere and Ganganaghatta.

Out of a total cropped area of 12,00,458 acres (1965-66) in the district, 1,08,000 acres of land was under wet cultivation. An extent of 10,92,458 acres was under dry crops. There are no perennial rivers in the district ; the Jayamangali, Shimsha, Nagini and Suvarnamukhi rivers flow only during the rainy season and they are considerably made use of for irrigation. A number of tanks, reservoirs and pick-ups have been constructed across these streams.

Among the reservoirs in the district, the Marconahalli dam across the river Shimsha is the biggest. This is constructed very near Amruthur in Kunigal taluk. The project work was completed in 1939 at a cost of Rs. 29 lakhs. The *atchkat* provided under the anicut is 11,000 acres. The capacity of the waterspread equals 8,890 units. This is a composite dam. Two volute siphons of eight feet diameter each are installed in the masonry portion of the dam with a discharging capacity of 2,000 cusecs each. The reservoir is maintained by the State Public Works Department.

The Boranakanive reservoir in Chiknayakanahalli taluk was constructed as a famine relief work at a cost of Rs. 2,20,000 across the Suvarnamukhi river. The work was commenced in May 1888 and completed in October 1892. The capacity of the reservoir is 3,682 units, while the *atchkat* under it is 1,400 acres. The water distribution is done by controlled *Madubois*.

The Sankanapura anicut was constructed across the Nagini river in Kunigal taluk in 1901. A feeder channel from the anicut

is taken to feed the series of tanks in and around Amruthur. The *atchkat* under the anicut extends to 600 acres.

The Deepambudhi tank is one of the oldest tanks in the district and has some historical and mythological associations. It was constructed by Magadi Kempegowda.

Mangala Reservoir

A new reservoir has been constructed across the Nagini river near Mangala in Kunigal taluk. The cost of this project, the work on which was commenced in 1960, came to about Rs. 13.7 lakhs. The reservoir is designed to irrigate a total area of 1,300 acres.

Due to deforestation and cultivation of slopy lands without due consideration to prevention of soil erosion, many tanks in the district are getting heavily silted up. It is estimated that at least 50 per cent of the silt was deposited during the last decade. A few silt dams and erosion-preventing bunds have been constructed.

Irrigation, with the help of electric and diesel pumpsets, is popular in Madhugiri, Koratagere, Pavagada, Sira and Tumkur taluks. The number of electric pumpsets used in irrigation in the district was 10,178 in 1966-67.

Appliances

Appliances for the baling of water for irrigation from wells are of two kinds, *i.e.*, those suited for manual power and those suited for bullocks. The first is the familiar *picota* which is a long lever mounted on a central vertical fulcrum. One end of the lever is suitably weighted and the other end carries the water bucket tied to a long bamboo. The weight at the rear end is heavy enough to be of help to the man to raise the full bucket and is, at the same time, not too heavy when the empty bucket is lowered. In order to further assist the man at the bucket, ropes are also tied on one or both sides of the central pivot, at which a second man pulls, now the one and now the other, as the bucket is raised or lowered. The *kapile* lift is of the second type and is adopted for bullock power. The buckets hold from 30 to 50 gallons of water. The bucket is made out of leather and is circular in shape with a wide and long leather hose stitched on to the bottom.

Water Table.—The water-level in the wells in the district varies in different localities, the average depth being 25 to 30 feet. In river basins, water is found at a depth of only 10 feet.

Soil conserva- tion

As soil conservation has assumed importance, several schemes have been proposed to conserve the soil and moisture. Contour bunding, the maintenance of bunds, land utilisation, survey of waste lands, reclamation of alkaline and acid soils, afforestation and planting of hedges in areas vulnerable to soil erosion are some of

the important measures pursued in the district. The contour bunds, constructed on catchment basis at suitable distances from ridge to valley, not only save soil from erosion but also help to conserve moisture received during the monsoons. In 1966-67, the area covered by contour-bunding and other measures implemented under the scheme was 56,550 acres, the talukwise break-up being as follows :—

<i>Taluk</i>	<i>Area banded (in acres)</i>
Koratagere	2,799
Madhugiri	16,368
Pavagada	1,162
Tumkur	9,147
Gubbi	4,420
Sira	19,395
Turuvekere	709
Chiknayakanahalli	1,094
Tiptur	456
Kunigal .. ..	..
Total	56,550

The State Government have recently decided to launch an integrated scheme in Tumkur, Koratagere and Gubbi taluks in the district at a total cost of about Rs. 1.23 crores. Under this scheme, 1,550 irrigation wells will be sunk in these three taluks and an equal number of pumpsets will be installed, besides levelling of land wherever necessary. For this purpose, the State Government have decided to float special development debentures. Ten per cent of the debentures would be borne by the State Government, while the remaining amount would be made up through Agricultural Refinance Corporation.

AGRICULTURE

The soils in the district are generally hard and poor with the exception of lands irrigated by tanks, *nalas* and spring channels, which are fertile. Pasture land is abundant but poor, except in the Amrit Mahal Kavals. The red soil, which is known as the *ragi* soil, is common in the southern and western taluks and black soil is found to some extent in the northern taluks, while sandy soil is common in the eastern tracts. The nature of the soil has been categorised according to the pattern obtaining in different areas. Red, gravelly, sandy, clay loam, black soil, sandy loam, sandy clay, clay and alkaline soils are found in the district. The approximate extent of each variety of soil is indicated below :—

The red soil is found in the taluks of Tumkur (1,18,362 acres), Madhugiri (50,000 acres), Pavagada (20,000 acres), Tiptur

(1,00,060 acres), Turuvekere (54,200 acres), Kunigal (65,250 acres) and Gubbi (2,00,000 acres). In Tumkur, Kunigal and Sira taluks, the soils are red loams, fairly deep (2 to 5 feet) and are underlaid with murrum. They are well drained but poor in lime and bases.

The gravelly soil is located in the taluks of Tumkur (24,176 acres), Sira (4,200 acres), Tiptur (25,000 acres), Turuvekere (15,000 acres), Kunigal (23,367 acres), Gubbi (80,000 acres) and Chiknayakanahalli (71,920 acres), while the sandy soil is found in the taluks of Koratagere (200 acres), Sira (11,000 acres), Turuvekere (10,000 acres), Kunigal (8,387 acres), Gubbi (10,000 acres) and Chiknayakanahalli (40,500 acres).

Madhugiri (8,000 acres), Pavagada (85,000 acres), Sira (3,55,444 acres) and Turuvekere (10,500 acres) taluks have clay loam, while the red loam soil is to be found in the taluks of Tumkur (30,036 acres), Koratagere (10,000 acres), Turuvekere (75,489 acres) and Chiknayakanahalli (60,130 acres).

The black soil, suitable mostly for cotton crop, is found in the taluks of Madhugiri (25,000 acres), Sira (8,000 acres), Pavagada (450 acres), Tiptur (2,500 acres), Turuvekere (1,500 acres), Gubbi (5,200 acres) and Chiknayakanahalli (6,080 acres). The sandy loam soil is found in Tumkur (61,100 acres), Koratagere (20,000 acres), Pavagada (25,632 acres), Sira (5,000 acres) and Tiptur (39,500 acres) taluks.

Clay soil is abundant in the taluks of Tumkur (20,000 acres), Koratagere (3,000 acres), Pavagada (9,400 acres), Tiptur (22,000 acres), Turuvekere (16,000 acres) and Gubbi (1,000 acres), while alkaline soil is confined only to Koratagere taluk extending to 2,000 acres.

The red and red loamy soils possess good drainage and are generally considered suitable to grow a wide variety of crops with manuring and proper irrigation. These soils occur in regions of medium rainfall ranging from 25 inches to 60 inches. The crops raised in these soils are varied, comprising almost all crops, with the exception of plantation crops like coffee and cardamom. The black soils are rich in bases and have a high water-holding capacity. The rainfall in these tracts is generally lower than in other parts, and farming is of the dry type. Black soils are particularly suited for rain-fed crops like short staple cotton, groundnut, jowar and tur.

Principal crops

The following table gives the acreages under principal crops in the district for the years 1961-62 to 1966-67 :—

Area under different crops in Tumkur district from 1961-62 to 1966-67 (in acres)

<i>Crop</i>	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67
1	2	3	4	5	6	7
Ragi—Dry	4,24,667	4,38,376	4,43,574	4,48,208	4,07,110	4,41,712
Ragi—Irrigated	35,979	40,691	40,000	41,044	30,400	20,905
Paddy—Kharif	21,831	93,867	44,324	91,750	64,131	75,548
Paddy—Summer	98,127	35,978	85,488	42,041	20,393	63,241
Jowar—Kharif	80,777	82,982	79,663	85,919	70,901	58,432
Jowar—Rabi	2,016	2,630	1,912	2,000	566	Not available
Total cereals	7,98,919	8,24,942	6,50,013	8,05,803	6,67,353	9,00,764
Total pulses	2,00,229	2,03,636	3,79,923	2,07,944	1,90,951	2,53,292
Groundnut	90,765	1,03,851	1,07,348	1,07,679	89,788	1,31,994
Sugarcane	4,712	4,217	4,426	5,310	2,951	7,682
Chillies	13,354	13,954	11,718	12,644	9,363	10,741
Coconut	75,914	76,396	76,567	77,422	81,300	84,252
Areca nut	7,440	7,391	7,900	8,118	8,300	8,437

TUMKUR DISTRICT

Ragi

Ragi (*Eleusine coracana*) is a major food crop grown extensively in the district. This crop occupies roughly one-third of the whole cultivated area of the district. Ragi crop has many good features which mark it off sharply from the other foodgrains. It is one of the hardiest crops, well suited for dry farming. It can grow under conditions of very low rainfall and can withstand severe drought, reviving again with vigour after a good shower of rain. The grain is of a great nutritive value and is considered very sustaining to people doing hard physical work. Ragi is largely grown as a dry crop in the district. This crop is remarkably free from pests and diseases. Ragi grain can be stored for long periods without damage, provided it is stored in places and receptacles not subject to damp or wetting by water. Its straw is a valuable fodder, highly favoured both for working and milking animals. Ragi is grown as a dry crop in regions where the rainfall ranges from 20 to 35 inches. The yield of ragi under dry cultivation is correlated with the total rainfall in the five months from July to November.

The red and light-red ashy-coloured loams and sandy loam soils are most suited for the ragi crop. Ragi does well generally on the better class of soils, free from stone and gravel, of good depth and well prepared. Rough stony and gravelly land is not utilised for the cultivation of this grain. The root system in the plant is remarkably extensive, though somewhat shallow, and only good soils possess the proper texture and the moisture holding capacity required for this crop. In Tumkur, the red ragi soils are predominant. They are characterised by depth and uniformity in colour and texture. They are mostly underlaid by unweathered whitish clayey material, the decomposed product of the gneisses and granites, which are the main rocks in the area. Even in light ashy coloured and somewhat sandy types of soils, the red soils are found to underlie them as sub-soils. During the rainy months, water penetrates to a depth of six feet and more and the soils become almost saturated. The water-holding capacity of the soils is not very high and amounts to roughly 21 per cent. They retain the moisture with considerable tenacity, and even when the top six inches are quite dry in the hot weather, with as little as two per cent moisture, the lower layers retain moisture upto 12 per cent. When dry and in the hot weather, they set very hard and ploughing becomes difficult.

If, however, the soils are ploughed up immediately after the harvest, then the moisture in the lower layers is retained upto 17 per cent as against 12 per cent in the unploughed fields. Soils under cultivation show a sharp difference in colour between soil and sub-soil. In chemical composition, they are characterised by a rather low content of plant foods. The minimum nitrogen content is 0.08 per cent, phosphoric acid from traces to 0.09 per cent, potash from 0.14 per cent to 0.47 per cent and lime from 0.2 to

0.4 per cent. It is, therefore, obvious that good crops can be grown only with liberal manuring. The composition of some of the soils show clay ranging from 7 to 10 per cent, silt from 10.7 to 13.4 per cent, sand from 58.3 per cent to 70.4 per cent and gravel from 7.5 to 14.6 per cent.

The main ragi-sowing season is normally the middle or early part of July. If there is a lack of timely and sufficient rains, the sowing season is put off till the end of August. This is the latest season for sowing dry land ragi. The ragi crops grown in this season are called *hain* and they take a longer time to mature and they generally give a better yield. The dry-farming methods of cultivation of ragi adopted in different taluks of the district are all well designed to conserve rain water and soil moisture so as to reduce, as far as possible, the risks of crop failure. For example, the practice of ploughing the dry fields immediately after harvest is universal in tracts where crops are harvested early and further rains permit of such ploughing. By this method, not only is the soil moisture conserved against the drying action of the following hot weather, but also the soil is left in such a condition as to soak up without loss by surface drainage. Wherever the nature of the soil allows of such ploughing after harvest, it is adopted in the belief that such ploughing almost amounts to the application of manure. Where the soil is too hard to take the plough, the heavy-bladed harrow is used so that the surface is left with a loose soil mulch on it. Ploughing and tilling are repeated many times to obtain a good tilth before sowing, to prevent weed growth and to conserve moisture after every rainfall. The seed is invariably sown in rows for facilitating thorough interculture. Thorough weed removal is done so as to reduce the drain on the soil moisture and to utilise it for the growth of the crop. The seed is often sown mixed with manure so that the seedlings obtain a good start. If the soil is loose and blowing, then it is firmed up or slightly compacted after sowing so as to bring up the moisture to the germinating seeds, by passing a wooden log drawn by bullocks round and round over the field. Crust-formation on the sprouting seed is broken up and loss of moisture is prevented. There is, furthermore, the system of mixed cropping, which is very general, and in which a pulse crop like *togari* or *avare* is sown along with ragi. By this practice, the best use is made of the rainfall. If the rains are unfavourable for ragi, they often benefit the *avare* or the *togari* crop and *vice versa* so that at least one of the crops is obtained even with a poor or untimely rainfall and a total crop failure is prevented. In recent years, due to the propaganda and demonstrations conducted by the Department of Agriculture, the cultivators are raising ragi nurseries, wherever there are facilities, and transplanting the seedlings. This has proved to be advantageous to the cultivators.

Cultivation
methods

Mixed crops

The first ploughing takes place immediately after the harvest of the previous crop. A good proportion of the crop grown in the main *hain* season is raised without any definite rotation. The practice of growing mixed crops of ragi and *avare*, *i.e.*, a cereal and a legume, which is very general, probably avoids the need for a definite system of rotation which may otherwise be necessary. In recent years, owing to the popularity of the groundnut crop, it has become the practice to rotate ragi with groundnut. It is also usual to sow an early crop of gingelly, fodder jowar or greengram and follow it with horsegram in the first two cases and with fodder jowar in the third case and then sow ragi in the following year. In this way, two minor crops are grown in one year and the major crop, *i.e.*, ragi, is grown in the following year. Very often, owing to the delay in the rains, the sowing season for *hain* ragi is missed or if *hain* ragi is sown and becomes dried up for want of rains, then a crop of horsegram or a minor grain crop like *baragu* is raised in the late rains and is followed in the next year by ragi.

In the preparation of the field for ragi cultivation, if the soil becomes too hard to take the plough, a shallow stirring is given by means of a heavy *kunte* (bladed harrow) or a disc harrow. In view of the decided advantage, which the ploughing or stirring of the soil during this season affords to the succeeding crop of ragi, this practice is strongly recommended by the agricultural authorities. If the land is thus ploughed or stirred, the ploughing proper can begin with the very first shower of rain. Otherwise, a good soaking rain will have to be awaited and the ploughing could be commenced only thereafter. With every succeeding rain, the ploughing is repeated or, in the alternative, the *kunte* is worked. By these means, the field is stirred completely to the depth required, and in case the improved plough is used, the soil is also inverted and the roots of weeds are cut and exposed to the sun. The clods are broken and the weeds freed from them and brought to the surface. The further working with the toothed harrow, gathers the weeds which are then burnt. Manure is then spread and mixed either by ploughing again or by working a cultivator.

Manuring

As ragi is the main food crop in the area, the ragi fields are manured to the fullest capacity and are further supplemented in various ways, such as, by the supply of silt from tanks, of fresh red soil from spots considered fertile and of earth from old village sites and mounds, which have considerable manurial value, and lastly by the penning of sheep. The penning of sheep, which is a common practice in Tumkur district, is a favourite form of manuring both for dry land crops and for valuable irrigated crops like sugarcane, tobacco, etc. The amount of cattle manure applied may vary from 15 to 20 cart-loads per acre, which are supplemented by another 10 to 15 cart-loads of silt or red earth. Cattle manure is applied not only when the soil is being prepared, but in certain

areas, it is also used mixed with the seed and applied in furrows at sowing time. Artificial manure and oil-cake are also applied at a later stage when the process of inter-cultivation comes to an end. The use of artificial manure is hindered by the consideration that in the case of dry land ragi, the rainfall may turn out to be poor and thus render the costly manuring infructuous. In view of the very low organic matter in the ragi soils and the great need for enhancing it so as to make the soils more receptive and retentive of moisture, the question of growing a green manure crop and ploughing it in has been studied. It has been found that it is possible to grow a sufficient quantity of some green manure crop, like sunn-hemp, or one of the pulse crops, if these can be sown early enough. This can be done only if the soils had been ploughed after the harvest of the preceding crop. In that case, a green manure crop can be sown in April or early in May, so that it may attain a moderately sufficient growth to be ploughed in the month of July. In 1966-67, 150 quintals of sunn-hemp seeds, 10 quintals of sesbania seeds and 100 kilograms of glyricidia were distributed for raising green manure crops in the district; besides, in the departmental nurseries, 75,000 seedlings of glyricidia were raised and distributed. It has been found that an interval of about two weeks is required before the green material disintegrates in the soil. As ragi can be sown almost upto the end of July or even upto the first week of August, it will often be possible to adopt this practice of growing a green manure and ploughing it in for dry land ragi.

Ragi is sown broadcast or in rows through seed drills or in shallow furrows or may be transplanted. By far the commonest method in the district is to sow it in rows through drills or in shallow furrows. Seed-drills are made in more than one size, having different tines; some sow in 12 rows, some in six rows and some others only in three rows. In the latter two cases, the rows are much wider apart than the former, viz., about ten inches as against five or six inches of the twelve-tine types. After the sowing is finished, a brush harrow made by tying together a number of leafy branches in a flat layer of about six feet in length, is dragged over the field to cover the seed and to smoothen the surface. Seeds are also covered by working a light-bladed *kunte*. If the soil is somewhat wet and the drill is likely to be clogged, then seeds are sown broadcast even where drill-sowing is the practice. Elsewhere, the seed is sown broadcast as a regular practice and covered by a shallow ploughing. The mixed crop is then sown by a *sadde* tied behind a plough and drawn at regular distances of about six feet from each other. The seed thus sown is covered by ploughing another furrow adjacent to the drilled furrow or by pushing the earth into the furrow by the feet. In these areas, the sowing of the ragi seed is followed by compacting the surface, for which purpose a herd of sheep is driven round and round all over the fields.

Another interesting method pursued is to sow ragi mixed with cattle manure. For this purpose, furrows are drawn by means of a three-tined drill with the seed bowl and seed tubes removed. Seed ragi is mixed with cattle manure at the rate of about one kilogram of seed to a cart-load of manure, which is, of course, in a dry and powdery form fit for such mixing and sowing. The mixture is filled into a large basket tied to the waist of the person sowing the seed and from this it is taken out and strewn into the furrows in large handfuls. The field is then worked with a light-bladed harrow and the seed covered. A variation of this practice is to put the mixture at regular intervals in the field instead of in continuous rows as above. The field is worked, lengthwise and breadthwise, with one of the above furrow-making drills, and at the intersections of these furrows, a large handful of the mixture is put in, and the field then worked with a light-bladed *kunte* for covering the seed.

Raising of seedlings

The seed rate for ragi is now about five to eight kilograms per acre. A fairly large quantity is used principally to guard against non-germination owing to lack of moisture in the soil or the poor quality of the seed. Ragi seed sprouts readily without any dormant period. In fact, grains are sometimes seen to sprout even in the earheads if harvest is greatly delayed and a heavy rain should fall at the time. Germination becomes poor as the grain becomes old and also depending upon the methods of storage adopted. Ragi is transplanted under dry cultivation also. Much of the *hain* ragi is raised by this method. Seedlings are raised in special nurseries, using two to three kilograms of seeds to transplant an acre, and thinnings from broadcast or drill-sown fields are also made use of for transplantation. Fields for transplanting ragi seedlings are prepared for a longer time than when seeds are sown, and the transplanting is done after the rains have well set in and the soils moistened to a good depth. After the field is well prepared, furrows are drawn length-wise and breadth-wise—in the chessboard fashion—by working a cultivator with two tines or the furrow-openers of a three-tined seed drill, length-wise and across the field. At the intersections of the furrows, one or two seedlings are planted and some cattle manure is also applied. At the same time, all blanks in the sown fields are filled with transplanted seedlings. With transplanted ragi, mixed crops of *avare* or *togari* are seldom sown.

The main-season ragi begins to grow from the beginning of October and 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, beginning from the middle of November, may continue upto the middle of December depending upon the variety and the month in which the crop was sown. The crop usually takes about five to five and a half months to mature.

Harvesting 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. It remains in the stack for a month or two until the dewy season is over and the weather regularly warms up about the middle of February. By this time, all the mixed crops are also harvested and the threshing begins. The mixed crops like *avare* and *togari* and the minor crops like horsegram, niger and gingelly are all threshed first and ragi is taken up last. The threshing of the ragi is done in one of three ways, *viz.*, by beating out the grains with sticks, by treading out the grains under the feet of oxen, which are driven in a team round and round over the sheaves spread on the ground, and lastly, by working a stone roller over the sheaves. Harvesting

The first method is both slow and laborious and requires a good deal of manual labour; it is suited only to a small farm. The sheaves are well dried in the sun and are put out until about 1 or 2 O'clock in the afternoon. They are then spread thin and the earheads are beaten by long bamboo sticks. In the course of three and a half hours, two men usually thresh out 125 to 150 lbs. of grain. The second, the treading method, is the most common method and until the introduction of the stone-threshing roller, it was the only method in use. About six to eight oxen are tied abreast in a team and are made to walk round and round over a thick layer of well-dried sheaves, which are spread circularly on the threshing floor around a central post, to which the animal in the team nearest to the central post is loosely tied. After the threshing, there is always a small proportion of earheads left unthreshed which has to be beaten out. A team of ten animals form a unit and thresh about 1,200 to 1,500 lbs. of grain in a day. The stone roller is simpler and needs only one pair of bullocks. It will also turn out in a day the same amount of work, *i.e.*, about 1,200 to 1,500 lbs. of grain. The straw obtained from the cattle-threshing is softer and better relished by livestock than the straw from the roller-threshing. The threshing of the ragi is more difficult than that of rice or of jowar as the grains are held much more firmly in the glumes and require considerable pressure.

The yield of dry land ragi, in fairly good seasons and under modern methods of cultivation, will be about 1,500 lbs. per acre, but, on an average, it will seldom amount to more than about 900 lbs. under the traditional method of cultivation. The straw of ragi is regarded as a highly nutritious fodder and is carefully conserved by piling up in large well-built stacks. About a ton of straw is expected generally from an acre.

Preservation of grains

Formerly, it was usual to preserve ragi in ordinary earthen receptacles like other grains and, to a much larger extent, underground in large pits excavated in suitable places. The chief requirement for such pits is that they should be on dry and high ground, with no chance for any water to percolate inside. They are dug in the shape of a huge pot with a narrow neck and may be seven to eight feet deep, sufficient to hold 2,000 to 3,000 seers or 2 to 2½ tons of grain. The neck is narrow, about 18 to 24 inches in diameter, just enough to allow a thin person to climb down. Before filling the pit with the grains, the walls and floor of the pit are smoothed and plastered with cowdung paste, and are lined with loose straw or with long straw twist. The pit is then filled with grain, the neck is well plugged with straw and covered over with a heavy stone slab and then with earth in the shape of a small and inconspicuous mound. If water does not enter the pit and it remains quite dry, the ragi in it lasts for a number of years. But if moisture gets in, then the ragi grains undergo fermentative changes which result in the formation of ptomaine poison. The practice of storing ragi in such pits is, however, rapidly dying out as it is now not stored for such long periods and as the ordinary gunny bags serve this purpose equally well. Bulk storage in good metallic or earthenware bins or in suitable store-rooms or wicker-bins are also now adopted.

Varieties

The varieties of ragi grown in Tumkur district are known by a number of local names. The following are the main varieties :—

<i>Hullubili</i>	..	Green open type
<i>Guddabili</i>	..	Green compact
<i>Karigidda</i>	..	Violet compact
<i>Jenumudde</i>	..	Green open
<i>Madayanagiri</i>	..	Violet open
<i>Hasarukambi</i>	..	Green open
<i>Doddaragi</i>	..	Green open
<i>Biliragi</i>	..	Green open
<i>Balepatte</i>	..	Green open
<i>Karimurakalu</i>	..	Green open
<i>Majjige ragi</i>	..	Green open
<i>Rudrajade</i>	..	Violet compact
<i>Jade Shankara</i>	..	Green compact

A strain, which is now generally grown, is H-22, a selection from *Madayanagiri* ragi. It is a long duration variety with open-type earhead, best suited to the Tumkur area. The RO-870 is a short duration variety giving a heavy yield and hard grain. This has close earheads and is drought-resistant. This variety is newly introduced in selected areas in the district. The K-1 ragi is also a short duration variety with close earheads. This gives a good yield and is specially grown under tank *atchkats*. Kaveri and ES-11 varieties are also becoming popular.

Ragi, for food, is ground into flour and then used cooked either as a pudding or as a porridge. It has been found that the protein content of ragi is of the type known as biologically complete as in the case of milk. The ragi grain can be malted and used as a nourishing form of beverage. For this purpose, the grain is first soaked in water for 36 to 48 hours and then 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.

Of late, improved agricultural practices have helped the ragi-growing farmers to raise more from their fields. After sustained research and experimentation, the Department of Agriculture has evolved a package of practices, which, if followed in right earnest, gives a better yield and healthy grains. As ragi is a very important crop, occupying a major portion of the cultivated area in the district, new methods of farming are being popularised and a brief description of these methods is given in the following paragraphs. **Improved practices**

With a view to securing a good tilth of the fields for cultivation of both dry land and irrigated ragi crops, the field is ploughed two or three times with an iron plough for a depth of about six inches. After the ploughing, the land is levelled, using the *halube*. Manuring is done with about 10 cart-loads of farmyard manure or compost per acre. The application of modern fertilisers is then resorted to. Ammonium sulphate, at the rate of 75 kgs. per acre, together with 60 kgs. of superphosphate and 20 kgs. of muriate of potash, is applied. The manurial process begins before sowing or before transplantation. A portion of modern fertilisers is applied at this stage and repeated after 35 or 40 days of sowing. The manure application depends on the soil-moisture.

Improved ragi seeds are now being largely used as a result of persistent propaganda by the Agricultural Department. The H-22 variety is sown in June-July and the duration of this variety is 135 to 140 days. The duration of E.S-11, another improved variety, is 110 to 120 days and this is also sown in June-July. The 'Kaveri', yet another improved variety, is sown in irrigated areas, the duration of this variety being 135 to 140 days. If seeds are broadcast (as is generally the practice among the ragi-growing cultivators), the seed-rate adopted is four to five kgs. per acre. In the process of transplantation, two kgs. of improved seeds are sown in a selected plot of about 25×4 feet called *madi*. Fifteen *madis* are required to transplant an acre of ragi land.

As a measure of plant protection, insecticides like Agrosan, Ceresan or Captan are used. The ragi seeds are immersed in these chemicals before sowing so as to prevent plant diseases. The sowing is done in rows, nine inches apart. Two to three plants are transplanted in each pit. Fifteen to twenty days after

sowing, *kuntas* are used. The harvesting is done after the earheads become ripe. The average crop yield, with this improved method, is 600 to 700 kilograms per acre.

In recent years, the acreage under ragi has considerably increased in Tumkur district. In 1959-60, the total acreage under ragi was 3,18,128 while in 1966-67, it had increased to 4,62,617 acres. Normally, the production is large enough not only to meet the local consumption, but also to leave enough surplus for export. The following table gives the acreage extent of ragi in the ten taluks of the district for the years 1959-60 and 1966-67 :—

<i>Taluk</i>	1959-60 <i>Acreage</i>	1966-67 <i>Acreage</i>	
		<i>Kharif</i>	<i>Summer</i>
Tumkur ..	47,561	87,319	+ 1,800
Koratagere ..	25,000	30,000	+ 1,000
Madhugiri ..	34,500	19,880	+ 9,810
Pavagada ..	1,100	19,400	+ 2,000
Sira ..	22,237	27,030	+ 3,000
Chiknayakanahalli ..	36,950	46,181	+ 85
Turuvekere ..	32,025	51,628	Not available
Tiptur ..	46,215	39,540	+ 460
Kunigal ..	66,440	52,314	+ 1,000
Gubbi ..	6,100	68,500	+ 1,750
Total ..	3,18,128	4,41,712	+ 20,905

From the above table, it is seen that the taluks of Tumkur, Gubbi, Kunigal and Turuvekere have a higher acreage when compared to other taluks.

Rice

Rice (*Oryza sativa*)—unhusked rice or paddy—(Kannada name : *Bhatta*) is grown in all the taluks of the district. The total acreage under paddy cultivation in the entire district during 1959-60 was 1,10,472 and this increased to 1,38,789 acres in 1966-67. This is the most important crop next to ragi and is mainly grown under tanks and canals. The paddy strains used in the district are S-317, S-661, S-749, S-718, S-1092, S-705, Ch-45, Ch-10, Ch-2, SR-26 B, T-65 and T.N-1. Tumkur district is particularly noted for the cultivation of paddy during summer months. There are a number of major tanks scattered all over the district. These tanks receive their major supply of water during the north-east monsoon period and hence sufficient quantities of water are available for paddy cultivation. An extent of 63,243 acres was brought under paddy cultivation during the summer months of 1966-67. The

rice plant belongs to the natural order of gramineae and is a tufted aquatic grass. The root system is fibrous and generally consists of two whorls, of which one is a primary set which is permanent and springs from the first node. From the same spot, successive whorls of roots develop which, though appear to spring from one node, are really derived from separate nodes which are so close to each other as to appear one and the same node. Though the roots develop under water, they require considerable aeration for proper development.

The *kharif* season for paddy cultivation begins in the district during June, July or August and ends in November, December or January. The *rabi* or summer season begins during January or February and ends in May, June or July.

The usual method of growing paddy is to transplant seedlings from a seed-bed. The field is ploughed soon after the last harvest ; it is then watered and green manure crop is trampled in. Then the field gets another round of ploughing. The bunds are trimmed and the puddle is levelled. Into this puddle, seedlings, about 22 to 30 days old, are transplanted in bunches, containing two to four 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 10 to 15 days prior to harvest, when water is completely stopped. The crop is then harvested and threshed. **Transplanting**

In the traditional method of cultivation, usually five to six ploughings are given by the country plough. Then the levelling is done by using a plank harrow. Inter-culturing is done by hand-weeding. Two to three thousand lbs. of *honge* (*Pongamia glabra*) leaf and six to eight cart-loads of farmyard manure are applied per acre. The sowing is done by the broadcast method, the seed rate being 75 lbs. per acre. In the improved method, three to four ploughings are done by using the mould-board plough. Two to three harrowings are done by the cultivator and the paddy puddler. By way of manure application, a green manure crop of either horsegram, sunn-hemp, sesbania or daincha is grown and ploughed in. In addition to this, 15 kgs. of phosphate, 10 kgs. of nitrogenous compound and 15 kgs. of potash are also applied at the time of planting. Another 10 kgs. of nitrogenous compound are applied as top-dressing at the time of weeding.

The *punaji* or dry cultivation of paddy is resorted to in several parts of the district. The variety grown under this practice is called *Barabhatta*. The land is ploughed twice or thrice during the early rains till about June. When the field gets the adequate moisture after the showers, the seed grain is sown broadcast or harrowed in the wooden *halube*. The crop receives practically little attention for the next two months and then water is let in. **Punaji cultivation**

Varieties

The varieties of rice cultivated in the district are many. It is possible that several of them, which are known by different names—mostly local—are really one and the same, but even making allowance for this fact, rice is unique in respect of its large number of varieties. These varieties can be divided according to the season to which they are suited and they can be divided also according to the quality of the starch in them. There are also the trade distinctions, of course, for instance, medium and fine varieties of rice, which are descriptive of the shape and the size of the rice grain. There are again the red and white varieties classified according to the colour of the husked rice. The plants in the field too show marked differences in the height of growth, in the tillering capacity, in the strength of the stems, in the size of the panicles and the number of grains therein, in their ability to shed their grain, in the proportion of grain to straw, in the yielding capacity, in the proportion of rice to paddy and so on. In a large number of varieties, the grains possess awns. These are very long in some and short in others and rudimentary in still others. In some varieties, the paleae at the base of the grains are developed so much that they resemble wings and the grains are accordingly described as 'winged'.

Fine rice of the red coloured varieties are fancied as more tasteful than the white sort of the same variety. An important feature in which the varieties differ is their ability to shed the grains. In some varieties, the grains break off from their rachis very readily. The more readily a variety sheds its grains, the greater is the loss of grains in the field or on the way to the threshing floor. Some varieties are very bad in this respect, while others are either only moderately so, or more or less hard to thresh. Some of the good varieties, which are grown in the hot season, are very prone to shed their grains and this greatly neutralises the other advantages they possess, such as, earliness of season and fineness of grain.

Harvesting

The harvesting of paddy commences as soon as the field dries, after draining off the water, and becomes fit enough for the labourers to walk about. Harvesting is generally begun when the grain is quite ripe, but there is much to be said in favour of harvesting at an earlier stage and thus allowing the completion of the ripening to take place in the stack. After the crop is harvested, it is allowed to lie on the fields for some time—upto three days—and then brought over to the threshing floor. The threshing work is taken up immediately thereafter, or the sheaves are put up in stacks and taken up for threshing after about 10 days when all the crop has been harvested. The threshing is carried out by beating the earheads on an inclined plank or a bench or a stone. The grains separate with great ease, though in many cases a small proportion is left over in the straw. Such straw is taken up for a second threshing to get the grain that has been left over. This

second threshing is by means of trampling out the grain under the feet of cattle. The grain is then winnowed to remove chaff or empty grains.

Empty grains are produced as a result of the flowers of the rice not having been fertilised owing to a spell of cold weather, or to a shower of rain having interfered with the fertilisation. The pollen is not shed in the former case at the proper time and in the latter case, it is washed off, either of which results in the grain not setting. The winnowing is done by pouring the grain out of a basket or tray, held overhead and letting the wind blow off the chaff and dust as the grain falls to the floor, and further, by frequently fanning the heap on the ground vigorously. The heavy grain collects straight below the winnowing tray, while the chaff and the lighter grains around the periphery of the heap, far or near.

The yield of paddy per acre varies a great deal with the varieties and the season in which they are grown, not to speak of the soil manuring, irrigation and general excellence of the cultivation methods. The highest yields may go up to 40 quintals per acre, but generally only about 20 to 25 quintals of paddy are obtained in the best of tracts. On fertile tank-irrigated lands, 15 to 20 quintals are usually expected, while in the channel areas, the yield may be put down between 12 to 15 quintals. Several areas in Tumkur, Madhugiri and Koratagere taluks account for 15 to 20 quintals per acre. In Pavagada, the average yield is 18 to 20 quintals. In other taluks, however, the yield is only 10 to 12 quintals. The rice straw is an important fodder. However, it is considered much less nutritious than the ragi straw.

Yields

The grain is stored only in the unhusked condition and, for this purpose, it has to be well dried before being put in storage. There is considerable difference between the weight of the grain after the harvest and its weight after drying for storage, and this loss in weight may amount from 10 to 15 per cent. Several methods of storage are followed, and various types of storage receptacles can be seen. The grain is merely heaped in large rooms, well protected from sparrows and vermin. Tall circular wicker bins, well-plastered over with mud, are erected on elevated platforms for storage of grains. Substantial wooden stores, made of heavy planks like huge boxes with legs, and with bottoms well above the ground and covered with flat heavy wooden planks with a trap door for pouring in the grain and with an aperture for drawing off the paddy near the floor of the structure, are common in the better class of households. The storage of paddy over long periods greatly improves the cooking quality of the rice. The new rice is difficult to cook in the proper way as it generally gets into a pasty condition, whereas the rice from paddy stored for about six months or more, cooks well. The fresh rice contains an active

Storage

enzyme, which passes into a dormant stage after a certain period of storage. In the new rice, the proportion of amylose to amylo-pectin is stated to be 1 : 4, whereas in the old rice, the amylose proportion becomes very much reduced. The starch content in the rice also appears to be altered in some way by storage, as it is found that the starch of the old rice is more easily digested than the starch of the new rice.

The following table gives the extent of acreage under paddy cultivation in the various taluks of the district in 1959-60 and 1966-67 :—

Taluks		1959-60	1966-67
Average		Average	Khairi Summer
Average			

Tumkur	9,589	15,000	+ 8,600
Koratagere	9,100	4,500	+ 5,000
Madhugiri	20,950	3,227	+ 6,503
Pavagada	5,840	6,120	+ 7,640
Sira	8,602	8,500	+ 4,200
Chiknayakanahalli	4,112	3,722	+ 1,620
Turuvekere	6,400	3,557	+ 1,028
Tiptur	5,336	5,100	+ 5,650
Kunigal	28,678	13,822	+ 16,000
Gubbi	11,865	12,000	+ 7,000
Total	1,10,472	75,548	+ 63,241

The Kunigal taluk accounts for 29,822 acres in view of the canal system under the Marconahalli reservoir built across the Shimsha river. The acreage depends, to a considerable extent, on the seasonal conditions of particular years. The cost of cultivation has been worked out, and the average in the district comes to about Rs. 500 per acre.

Japanese method

The Japanese method of cultivation of paddy has been successfully introduced in the area. It has become popular with the cultivators and, as a result of this new technique, introduced in the State in 1953, it has been possible to increase the yield of paddy per acre to one-and-a-half times or even twice the former yield. As against an yield of 1,600 to 2,000 lbs. of paddy per acre in the traditional method, the yield under the Japanese method has gone up to 3,000 to 4,000 lbs. per acre. There are a few cultivators who have grown even upto 10,000 lbs. by following this improved method. Besides the higher yield obtained under this method, another advantage, in the form of reduced seed-rate and consequent

saving of the paddy grain, has also been secured. The cultivators used to have a seed-rate ranging from 25 to 50 seers per acre (50 to 100 lbs.) under the traditional method. In the Japanese method, the seed-rate never exceeds eight to ten seers (16 to 20 lbs.). There are many instances wherein some of the master-farmers have used a minimum seed-rate of 10 lbs. only. This reveals that a larger quantum of paddy grain was unnecessarily put into the soil and wasted under the traditional method. The reduced seed-rate in the Japanese method has caught the imagination of cultivators. The other indirect benefit accruing to the cultivators after the introduction of the new technique, was that it gave them an impetus to turn to the improved agricultural practices like the use of chemical fertilisers, crop protection measures and inter-culturing in the fields. This is indeed a good sign of agricultural improvement.

With a view to bringing more and more paddy lands under the Japanese method in the district, the State Government have sanctioned a special staff. Besides this special technical staff, there was already the staff of the National Extension Service, ready to help the cultivators to adopt these improved methods. The more important factors relating to the Japanese method are the selection and use of good and improved seeds, dressing of the seeds with fungicides, growing of strong and healthy seedlings, application of manures and fertilisers in the required quantities, transplanting seedlings in rows, good weeding and inter-culturing and the protection of crops against pests and diseases. The nursery plot required to raise seedlings for an acre of land is about two guntas. The plot is ploughed, levelled and divided into beds of eight feet length and four feet width, leaving a space of one foot between each bed. The length of the bed may vary from eight feet to 25 feet depending upon 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 these beds. After sowing, the seeds are covered well with earth or manure. Care is taken to see that the beds are fully wet during the first week of sowing. During the second and third weeks water is let in. In the course of 21 days after sowing, the seedlings become ready for planting. The transplanting is completed when the seedlings are 21 to 28 days old.

The field for planting paddy under the Japanese method is ploughed well with the application of eight to ten cart-loads of green manure. At the time of transplantation, 50 kgs. of ammonium sulphate, 95 kgs. of superphosphate and 25 kgs. of potash per acre are applied. After a month, another 50 kgs. of ammonium sulphate are given as top-dressing. In this method, line planting is an important feature and is in contrast with the old method, where the plantings are done at random. Planting, with two to three seedlings, in lines with definite spacing from plant to

Line planting

plant has been recommended. The planting in line facilitates easy inter-culturing. The spacing between row to row is nine inches to ten inches. The seedlings are planted erect 5"×6" apart in rows. The recommended spacing for Taichung varieties is 6"×4". The new method is encouraged both for *kharif* and *rabi* seasons. The taluks of Tumkur and Kunigal have proportionately more acreage under the new method. The table given below indicates the acreage under this method during the period from 1959-60 to 1965-66 :—

Year	Acreage
1959-60	28,369
1960-61	25,077
1961-62	26,287
1962-63	30,742
1963-64	28,975
1964-65	36,402
1965-66	11,225

Kharif and Rabi campaigns In order to help grow more paddy, the State Government initiated special campaigns both for *kharif* and *rabi* crops. The District Agricultural authorities did intense propaganda work in the countryside asking the cultivators to adopt improved methods and grow more paddy, making full use of the technical help offered. During 1966-67, the campaigns were continued in all the taluks of the district. The following table indicates the targets and achievements of the acreages brought under the improved methods both for the *kharif* and *rabi* seasons, during that year :—

Taluk	Kharif		Rabi	
	Target (acres)	Achievement. (acres)	Target (acres)	Achievement. (acres)
Tumkur	12,210	8,600	3,300	2,350
Pavagada	..	..	..	..
Sira	3,000	1,400	4,000	4,500
Chiknayakanahalli	1,100	300	..	2,000
Turuvekere	2,100	2,100	3,000	2,750
Gubbi	2,000	474	1,920	2,220
Koratagere	2,000	2,000	..	..
Madhugiri	4,554	2,538	7,500	6,085
Tiptur	5,100	4,490	1,500	1,427
Kunigal	7,290	6,600	4,070	3,644

In most of the taluks of the district, Taiwan strains popularly known as Taichung varieties, were introduced as an experimental measure. These new strains have become now quite popular in all the taluks. They are short duration strains capable of planting in both *kharif* and summer seasons. The strains are best suited to fields with well-drained and non-alkaline soils. The fertiliser way to grow more paddy has also become popular. Several trials were conducted in this regard and, in practically all the trials, the application of nitrogenous compound increased the yields. The application of $1\frac{1}{2}$ maunds of ammonium sulphate or 20 lbs. of nitrogenous compound per acre increased the yield of paddy by 4.5 maunds per acre. Two-and-a-half maunds of ammonium sulphate or 40 lbs. of nitrogenous compound per acre increased the yield by 6.6 maunds. Good increase in yields are also obtained with phosphates, especially on soils which are deficient in phosphorus.

The recommended paddy varieties for the *karthika* crop are : **Improved varieties** S-661 (Coimbatore *Sanna*), SR-26-B, S-317 (*Halubbuku*) and Ch-2 (Chaina variety). The duration of all these varieties is 115 to 160 days. For summer paddy, S-317 and Ch-2 varieties are used. Plant protection is particularly important in respect of paddy crop. In order to prevent pests and diseases, insecticides are sprayed 15 days after transplantation. The average yield obtained under these new practices is 1,400 to 1,500 kgs. per acre.

Taichung-65 Paddy.—*Taichung-65*, a high-yielding paddy strain, is used for intensification of paddy cultivation. *Taichung* varieties are suitable for both *kharif* and summer seasons. For the *kharif* crop, the *Taichung* strain is sown sometime before the middle of July and for the summer crop, sowing is done from about January 15th to February 15th. The paddy field is ploughed three times with an iron plough. Afterwards, four cart-loads of green manure and ten cart-loads of farmyard manure are applied. The transplantation of *Taichung* varieties is done in fields submerged in about an inch of water. The planting is done in rows, six inches apart. The one-inch submersion is maintained for ten days after transplantation. Afterwards, the water is drained. The field is again watered, with two to three inches of water, after 60 days of transplantation. Manuring is done twice. The duration of the *Taichung* varieties is 120 to 130 days. The yield of paddy per acre is about 25 to 30 quintals.

Taichung Native-1.—The *Taichung Native-1* variety is particularly suitable to Pavagada, Sira, Madhugiri and Koratagere taluks. The paddy field for this strain is ploughed well, three to four times, with mould-board iron plough. Four cart-loads of green manure and ten cart-loads of farmyard manure are applied per acre. Line planting is advised ; the field is submerged in three

inches of water. Manurial application is the same as for Tai-chung-65 variety. The yield from this variety is 25 to 30 quintals per acre.

Jowar (*Sorghum vulgare*)—Kannada name: *Jola*.—Jowar is one of the popular dry-land foodgrains grown in some taluks of the district. Its suitability to tracts of low rainfall and its ability to withstand considerable drought, make it an ideal crop for cultivation in the area. It is comparatively a quick-growing crop and gives not only good yields of grain, but also large quantities of fodder. The existence of several varieties of this grain suited to different seasons, for growing both as a dry crop and under irrigation, either for purposes solely of fodder or of both fodder and grain, greatly widens the scope for its cultivation. The *sorghum* is a crop suited mostly to plains, though in the Mysore plateau, it grows even at an elevation of about 3,000 feet. The average temperature required during the growing season ranges from 80 degrees to 90 degrees Fahrenheit, but many varieties can even stand a minimum temperature of about 60 degrees Fahrenheit and a maximum temperature of about 105 degrees Fahrenheit. They mature, however, with a much smaller amount of rainfall than ragi, about 10 to 15 inches, from sowing to harvest, being sufficient. It cannot be grown as a dry crop if the annual rainfall is very low in which case it will have to be raised under irrigation.

Jowar crop is not confined only to the black cotton soil, but is grown, to a certain extent, on other types of soils also, such as, the red, ashy grey, light red, etc. Except on stony, gravelly or very rough soils, it is grown on a wide variety of soils, both heavy and light alluvial loams, and even on sandy soils. The best crops are grown, however, on the clay loams, either red or black, and if under irrigation, with adequate drainage. On low-lying fields and dry tank-beds, the crop attains a luxuriant growth, but if water is stagnant or the moisture does not drain off soon, the crop becomes sickly and gives only a poor yield.

In the Tumkur district, jowar is raised as a *mungar* crop; the sowing commences in May, June or July, and the crops are harvested in September, October or November. In the preparatory cultivation, traditionally, one or two harrowings are given by the *heggunte* or one or two ploughings by the ordinary country plough. Sowing is done with the help of a country plough followed by a *sudde* (three-tined seed drill). It is sown in lines, nine inches apart, and the seed-rate is about four to five kgs. per acre.

Features of the plant

Jowar belongs to the natural order of gramineae; it is a tall annual grass, with a robust solid pithy cylindrical stem, and attains a height of 10 or even 15 feet, according to the soil types and the variety grown. The stem may be thick, about one to two-and-a-half inches in diameter, or thin, about only half an inch in diameter,

Jowar

or even less, if sown very thick. The root system is fibrous and profuse, and some of the lower nodes send out roots which are mostly serial; they also sometimes reach the ground and function as true roots. The leaves are about two to three-and-a-half feet long and from one to three inches broad, with a conspicuous midriff, which is white in colour in contrast with the green of the blade, and are smooth except at the margins which are rough. The flowers open from the top of the panicle and extend downward gradually, taking about eight days for completion. The glumes are four in number; the grains are formed clear of the glumes. In certain types, however, the glume encloses the seed either completely or to a large extent.

Unlike the other straws, jowar fodder has to be cut into pieces **Fodder** before it can be fed to cattle. It is usual to cut it into lengths of a foot or a foot-and-a-half by ordinary long-handed, large and curved knives or by local types of chaff-cutters, which have straight blades with a long handle, working up and down like a nut-cracker. Owing to its coarseness, the fodder is usually softened by soaking in water before it is fed; but even then a good portion of the stems is rejected by the animals.

Jowar is eaten by breaking the grain and cooking it in the same way as rice or by grinding it into flour and preparing unleavened bread out of it. To a small extent, it is eaten parched; some varieties yield jowar which can be converted into popped grain. Such grain, after popping, is eaten as it is or ground into flour. The varieties, which lend themselves to popping, are those with the open branched earheads and not those with the compact heads.

Jowar also can be malted. The malt is prepared by steeping the grain in water overnight and then draining the water out and keeping the grain moist and heaped up until sprouting begins and the radicles are plainly visible. The grains are then spread out to dry, rubbed free of the radicles and then roasted and ground into flour.

The *mungar jola* or *kharif* jowar is sown in all taluks of the district and a total of 58,432 acres was under this crop in 1966-67. Of this, a large extent of 35,100 acres was in Pavagada and Sira taluks. The following table indicates the acreage under jowar cultivation in the ten taluks of the district in 1959-60 and 1966-67 :—

<i>Taluk</i>	<i>Acreage</i>	
	1959-60	1966-67
Tumkur	2,777	..
Koratagere	1,900	1,920
Madhugiri	6,255	3,635
Pavagada	22,130	13,500
Sira	2,400	21,600
Chiknayakanahalli	5,701	7,519
Turuvekere	2,500	..
Tiptur	3,620	3,988
Kunigal	3,500	..
Gubbi	5,000	6,270
Total	55,783	58,432

The cost of cultivation of this crop comes to about Rs. 120 to Rs. 150 per acre.

Hybrid Jowar

Cultivation of hybrid jowar has become popular in the district in recent years. The C.S.H-1, which is a high-yielding variety, is mostly used for sowing. Moist fields are not suitable for hybrid varieties. This kind of jowar is raised in the *Bharif* as well as summer seasons. The field is ploughed three to four times with an iron plough and levelled well with a *heggunte*. Before using the *heggunte*, about ten cart-loads of compost are applied per acre. Modern fertilisers, at the rate of 60 kgs. of ammonium sulphate, 125 kgs. of superphosphate and 35 kgs. of murate of potash, are also applied. The manuring is repeated after 20 to 25 days. The sowing is done in lines, 18 inches apart. Interculturing is done once in 15 or 30 days. Water is let in every 10 days. The hybrid jowar is ready for harvest within 115 days of sowing. The average yield is about 25 to 30 quintals per acre. In irrigated areas, the sowing is done in June.

Hybrid Maize

Hybrid maize of the Deccan variety is raised on red sandy soils and also on black sandy soils. The field is ploughed three to four times with an iron plough for a depth of six inches. Compost is applied at the rate of ten cartloads per acre; modern fertilisers are also used. The seed-rate for the Deccan variety is six to six and-a-half kgs. per acre. The sowing is done in rows, 10 to 12 inches apart, and at a depth of one to one-and-a-half inches. Inter-culturing is done after 15 to 30 days of sowing and water is let in once in seven days or so. The duration of this crop is 110 to 120 days and it gives an yield of about 30 to 35 quintals per acre.

Haraka (*Panicum semiverticulatum*) is easily the coarsest **Haraka** among the foodgrains and also remarkably drought-resistant. It is relegated to rough gravelly and stony soils, high upland soils or the red, ashy grey and light red type soils. Even in adverse seasonal conditions, the crop survives on these soils and yields a type of coarse grain and straw, low both in quality and quantity. The crop occupies the field for six months, a period longer than that of any other dry-land grain. Only one crop is raised in a year and it is followed, in the next year, with horsegram or castor. The field intended for *haraka* cultivation is ploughed several times, between May and July after heavy rains, and is prepared well as for the better class of grains. The grain is sown broadcast after a good rain, about the end of July. It is also sown in rows either in drills or in plough furrows. The seed-rate is about five to six kgs. per acre. In the preparatory stage, only one or two harrowings are given by a *heggunte*. Generally, no manure is applied. Two to three inter-culturings are also done by a *hede-kunte*. The average yield of this crop per acre is about 200 kgs. *Haraka* belongs to the genus panicum and is quite distinct from the other cereals. It is a smooth annual grass, growing somewhat erect, attaining a height of 18 inches to two feet. The leaves are stiff and thick adding to the erect appearance of the plants. Both the stems and leaves are suffused deep red, especially when conditions are very dry. The grain is recommended as a substitute for rice to patients suffering from diabetes.

In Tumkur district, the taluks of Pavagada and Sira account for large acreages under this crop. A total acreage of 68,195 was under this crop in the district in 1966-67. The cost of cultivation per acre varies from Rs. 40 to Rs. 60. The table given below indicates the talukwise acreage under *haraka* in the district in 1959-60 and 1966-67 :—

<i>Taluk</i>	<i>Acreage</i> 1959-60	<i>Acreage</i> 1966-67
Tumkur	350	1,700
Koratagere	1,200	1,940
Madhugiri	1,250	5,471
Pavagada	10,819	39,530
Sira	14,375	12,000
Chiknayakanahalli	250	1,015
Turuvekere	144	4,900
Tiptur	3,050	3,600
Kunigal	3,400	..
Gubbi	10,000	39
Total	44,888	68,195

Navane

Navane (Setaria italica).—Pavagada, Madhugiri and Sira taluks are particularly noted for the cultivation of this minor dry-land foodgrain, which comes to maturity within a period of about a hundred days. The ordinary red loams are best suited and, under normal rainfall, very good crops are raised on such soils. The crop is either grown pure without a mixed crop or as a subsidiary mixed crop with ragi. On red soils, *avare* is sown as a mixed crop with *navane*. It is usually followed by jowar or *sajje* in the next year. When *navane* is grown pure, it is generally followed by ragi or jowar. The preparatory cultivation methods are generally the same as practised for *haraka*. No ploughing is done before the seeds are sown; only one or two harrowings are given by a *heggunte*. Generally, manure is not applied. The seed is sown in lines, nine inches apart, by using the three-tined seed drill. Two to three inter-culturings are done by a *hedekunte*. The average yield of this crop per acre comes to about 200 kgs. The *navane* grain is cooked and eaten like rice. It is also made into sweet puddings and porridge.

The following table shows the extent of acreage in respect of *navane* in the various taluks of the district for 1959-60 and 1966-67 :—

<i>Taluk</i>	<i>Acreage</i>	
	1959-60	1966-67
Tumkur	500	280
Koratagere	1,000	1,269
Madhugiri	100	11,426
Pavagada	15,650	10,793
Sira	15,890	7,000
Chiknayakanahalli	62	931
Turuvekere	94	258
Tiptur	850	3,650
Kunigal	200	..
Gubbi	8,416	278
Total	42,762	35,885

The cost of cultivation is not expensive. It comes to about Rs. 20 to Rs. 40 per acre.

Horsegram

Horsegram (*Dolichos biflorus*)—Kannada name: *Huruli*.—Horsegram is extensively grown in almost all the taluks of the district. The total area under this crop in the district in 1966-67 was 1,28,028 acres. The Chiknayakanahalli, Tiptur, Gubbi and Tumkur taluks have large acreages under horsegram. It is grown as a dry crop almost invariably and under conditions of only a moderate rainfall not exceeding 35 inches. It is raised over a

wide range of soils. There is almost no type of soil, excepting the bad alkaline soil, on which it is not sown. It is a kind of preparatory crop of which two or three crops are taken before the land is put under ragi, jowar or other grain crops. Most of the surplus land of the cultivator, which he cannot prepare sufficiently well in time for ragi, is put under horsegram. This crop is sown in rows and is also broadcast. In the first method, it is sown in plough-furrows, about nine inches apart, and covered by the adjacent furrow, or through the jowar seed-drill and covered by working the light-bladed harrow. 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 the strips successively, and the sowing is followed by ploughing so as to cover the seed. Where the crop is sown in rows, the field is inter-cultured once.

In many places, horsegram is sown with a mixed crop of niger, **Harvesting** which is sown in rows, about three to six feet apart, simultaneously with horsegram. The crop is always sown thick, a seed rate of 10 to 12 kgs. being common. The harvesting is done by pulling out the plants. They are removed to the threshing floor, stacked for a week and then threshed by being trampled under the feet of oxen or with the threshing stone roller. A good crop of horsegram yields about two to two-and-a-half quintals per acre; but, however, the yields are generally low in the district, owing to the poor attention the crop receives and the belated sowings. The produce requires a great 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 pulse crop and is eaten both boiled and fried. In contrast with the other pulses, horsegram is not converted into split pulse. It is largely used as a food for horses and cattle. The following table shows the acreages in respect of horsegram in several taluks of the district for the years 1959-60 and 1966-67:—

<i>Taluk</i>	<i>Acreage</i>	
	1959-60	1966-67
Tumkur	10,537	15,000
Koratagere	9,000	9,500
Madhugiri	..	10,991
Pavagada	23,690	6,000
Sira	23,828	10,500
Chiknayakanahalli	13,306	19,500
Turuvekere	2,255	4,554
Tiptur	250	19,439
Kunigal	6,600	13,544
Gubbi	22,200	19,000
Total	1,11,666	1,28,028

Avare

Avare (*Dolichos lablab*) is one of the important field beans, very largely grown in the district. In the dietary of the working classes in Tumkur district, whose staple food is ragi, this bean is quite often an ingredient, and it supplies the protein supplement to the ragi grain. It is cultivated almost entirely as a dry crop, in regions where the rainfall ranges from 25 to 35 inches. It is grown, almost invariably, as a mixed crop, the main crop being ragi. The preparation of the field for the ragi crop, applies to this crop also. This crop is sown along with ragi in the months of June—July. The sowing is carried out either simultaneously with ragi, in which case it is sown through a single furrow seed-drill, the saddle being tied behind the twelve-tined ragi drill, or is sown separately after ragi has been sown broadcast, being dropped into plough furrows drawn about six feet apart. The crop shares, during its growth, the same inter-culturing, weeding and thinning operations which are carried out for the ragi crop. Its growth is only moderate during the time the ragi crop occupies the ground, but soon after ragi is harvested, it grows quickly, and flowering commences very soon thereafter, generally about the middle of November.

The *avare* plant is a semi-climbing low bush and, under conditions of good rainfall, covers the whole ground between the rows. The flowers are borne on a straight upright stalk, often a foot high, on which they open successively. The pods are gathered both in the green and ripe stages. Large quantities of green pods are gathered and sold as vegetable; the seeds are removed from the pods, cooked and eaten like green peas. The pulse from the dry pod is eaten both fried or boiled and salted; generally, it is the split pulse that is cooked and eaten. A considerable quantity of the pulse is sold in the form of *dhal* or split pulse, as in the case of *togari dhal*. The statement given below shows the taluk-wise acreage of *avare* in the district for 1959-60 and 1966-67 :—

<i>Taluk</i>	<i>Acreage</i>	
	1959-60	1966-67
Tumkur	806	3,000
Koratagere	3,800	1,557
Madhugiri	500	2,299
Pavagada	423	2,060
Sira	230	12,050
Chiknayakanahalli	2,500	5,000
Turuvekere	8,000	2,984
Tiptur	16,000	4,540
Kunigal	986	..
Gubbi	3,600	2,429
Total	36,844	35,919

The average yield of *avare* in the district varies from place to place. In some places, the yield is only about 50 kgs. per acre and in other places, it comes to about one-and-a-half to two quintals. The cost of cultivation comes to about Rs. 25 per acre.

Tur (*Cajanus indicus*)—Kannada name: *Togari*.—*Tur*, **Tur** sometimes called also as redgram, is an important crop, which forms usually a part of the daily dietary of the households in this part of the country. The crop is grown mixed with ragi, jowar or *sajje* in rows, about six feet apart, the space between the rows being occupied by the cereal crop. The seeds are dropped into plough furrows either by hand or through a one-furrow seed drill and covered by a harrow or merely with the feet, as the sowing goes on. Sown in this way, about 4 lbs. of seed are used for an acre.

Sowing takes place from May to July, the early sowing being with the *kar* ragi or early season jowar, and the later sowing with the main season ragi or jowar. After the plants show up above the surface, hand-weeding, inter-culturing and other operations are carried out. The plants are considerably thinned out, so that they may stand about 12 to 18 inches apart in the rows. The growth of the plants are slow until the cereal crops are harvested and removed. The yield of *tur* ranges between 200 to 300 kgs. per acre when grown as a mixed crop. If grown pure, it may go up to about three to four quintals per acre.

Tur is converted into *dhal* or split pulse, with the husks removed, before it is sold for consumption. The boiling quality of the *dhal* is an important characteristic which decides the price of the article. Those varieties, which boil or soften quickly with a large portion of the constituents, diffusing into the water in which they are boiled, are considered to be the best and those which are poor in this respect and are slow in softening and diffusing, are ranked lower. The varieties in which the *dhal* is thick, small and almost rounded, are preferred to those in which it is thin, flattish and somewhat larger in size. Sometimes, the *dhal* is cooked and eaten as it is, but more often, in combination with other ingredients in the shape of curried soup and other dishes. It is an important protein food of the people of the district.

The acreage under cultivation of *tur* in the district in 1959-60 and 1966-67 is indicated in the following table:—

<i>Taluk</i>		<i>Acreage</i> 1959-60	<i>Acreage</i> 1966-67
Tumkur	.. ..	1,078	1,800
Koratagere	.. ..	500	200
Madhugiri	.. ..	90	..
Pavagada	.. ..	3,000	3,620
Sira	.. ..	640	1,500
Chiknayakanahalli	.. ..	160	6,702
Turuvekere	.. ..	200	2,038
Tiptur	.. ..	354	5,082
Kunigal	.. ..	1,218	..
Gubbi	.. ..	1,000	2,714
Total	.. ..	8,240	23,656

Groundnut

Groundnut (*Arachis hypogaea*)— Kannada name : *Kadalekayi*.—This oilseed is grown in all the taluks of the district, extending to an area of 1,31,994 acres, Pavagada, Madhugiri and Sira taluks alone accounting for nearly 1,11,137 acres in 1966-67. The following table shows the taluk-wise acreage under groundnut cultivation in the district in 1959-60 and 1966-67 :—

<i>Taluk</i>		<i>Acreage</i> 1959-60	<i>Acreage</i> 1966-67
Tumkur	.. ..	3,380	3,084
Koratagere	.. ..	8,000	10,000
Madhugiri	.. ..	16,500	26,757
Pavagada	.. ..	28,000	58,690
Sira	.. ..	18,500	25,690
Chiknayakanahalli	.. ..	1,048	1,000
Turuvekere	.. ..	853	358
Tiptur	.. ..	271	65
Kunigal	.. ..	2,600	800
Gubbi	.. ..	5,360	5,550
Total	.. ..	84,512	1,31,994

Groundnut is cultivated in the district as a dry-land crop. It is sown in the better class soils, the light red and ashy coloured loams being preferred. Even stiffer loams tend to foster its growth. The sowing season commences usually in May, June or July and

the crop is ready for harvest during September, October or November. In the preparatory stage, three to four ploughings are given by the country plough and one to two ploughings 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 inter-culturings are done till the crop comes to the flowering stage. After a period of three-and-a-half to five-and-a-half months, the leaves become yellowish and begin to dry. The crop is now ready for harvest.

The improved methods adopted in the cultivation of ground-nut have given increased yields, *i.e.*, 500 to 600 kgs. per acre under rainfed conditions and 800 to 1,000 kgs. under irrigation. The improved varieties in use in the district are HG-7 for rainfed areas and TMV-2 and Spanish improved varieties for irrigated areas. The duration of all these varieties is from 100 to 140 days.

**Improved
methods**

In the preparatory stage, the field is ploughed twice or thrice with an iron plough, for a depth of five to six inches. The cultivator is used to level up the field. Before the actual sowing, eight to ten cart-loads of farmyard manure or compost per acre are applied. In irrigated fields, ten to fifteen cartloads of farmyard manure per acre are used, or modern fertilisers at the rate of 25 kgs. of ammonium sulphate, 65 kgs. of super-phosphate and 10 kgs. of muriate of potash per acre are applied. For the irrigated crop, the application of super-phosphate is increased. The seed-rate employed is about 25 to 35 kgs. per acre.

For the irrigated varieties, water is let in once in every 10 days. Altogether, water is let in eight to ten times during the duration of the crop. The *kunte* is used after 15 to 20 days of the actual sowing. This prevents the growth of weeds. Line-planting is done as a rule. The yield per acre, for rainfed crops, is five to six quintals per acre and for irrigated crops eight to ten quintals per acre.

Sugarcane (*Saccharum officinarum*)—Kannada name: **Sugarcane**
Kabbu—Sugarcane is grown in several parts of the district, except in Chiknayakanahalli and Tiptur taluks. The acreage under sugarcane cultivation is higher in Kunigal, Sira and Madhugiri taluks. The total area under this crop in 1966-67 was 7,682 acres. The following table indicates the extent of acreage in the several taluks of the district for 1959-60 and 1966-67 :—

<i>Taluk</i>	<i>Acreage</i>	
	1959-60	1966-67
Tumkur	93	187
Koratagere	250	255
Madhugiri	1,200	537
Pavagada	20	100
Sira .. ..	..	1,000
Chiknayakanahalli .. ..	..	..
Turuvekere	79	80
Tiptur .. ..	..	40
Kunigal	4,132	5,270
Gubbi	3,000	213
Total	8,774	7,682

The soils suited for sugarcane cultivation are the light-coloured brown or reddish loams, of at least some three feet in depth, and underlaid suitably for drainage. In great many places, the sugarcane soils are dark rich clay loams such as are to be found under tank irrigation. But these soils have usually to be improved by the addition of sand and red earth annually or at longer intervals. Moreover, they require, by reason of their situation as well as texture, considerable drainage.

The planting season for sugarcane is, more or less, uniform throughout the district. There are two seasons, one commencing during January or February and the other in June, July or August. The second planting is of minor importance compared with the first. The canes planted in the main season, *viz.*, January or February, get the full advantage of the monsoon rains during their growth and develop an extensive root system. With the cessation of rains, they grow rapidly and become mature enough for harvesting and milling. The second season, on the other hand, does not enjoy the same advantages, as the crop requires heavy irrigation during the period of its rapid growth.

Varieties

The old indigenous varieties of cane grown in Tumkur district are soft, which can be easily milled in the wooden mills, and are also soft enough to be used as chewing cane. This variety is called *Rasadali*, of which there are two types, one thick and another thin. It is a very soft cane, with a greenish yellow rind, matures in ten months, has a sucrose content of 16 per cent, gives a light coloured jaggery and yields moderately well. It requires ample irrigation

and manuring and cannot stand dry conditions. A later introduction is the cane called *Pattapatti* (*i.e.*, striped), which is said to have been brought from Vellore. This is a slightly harder cane than the *Rasadali*, with a rind striped yellow and red longitudinally. It grows vigorously, tillers well, grows much taller than the *Rasadali*, is somewhat top-heavy, gives rich juice with a sucrose content of about 22 per cent, takes 12 months to mature, yields a good quality of jaggery, requires heavy watering and manuring and gives a high yield of about 40 tons per acre. In recent years, H.M. 320 and C.O-419 canes, which are well-suited to the district, have been introduced. The H.M-320 cane is noted for its high yield and superior out-turn of sugar. The CO-419 is a thick cane, growing erect with a good tillering and a remarkably high yielding capacity, ranging from 55 to 60 tons an acre. It is very adaptive to varying conditions of soil and soil moisture and stands even flooded conditions.

During the preparatory stage of cultivation, three to four ploughings are given by the mould-board plough, followed by one to two harrowings. Ten to 20 cartloads of farmyard manure, 50 lbs. of phosphate and 50 lbs. of nitrogenous compound are applied at the time of planting. Another 50 lbs. of nitrogenous compound are applied after three months. Sowing is done in ridges and furrows, three feet apart. The seed-rate generally varies from place to place, but it is usual to plant 10,000 three-budded sets per acre.

**Cultivation
methods**

When the cane becomes ripe for harvesting and milling, the appearance of the leaves as also the cane slightly changes; the succulent tender green of the leaves changes slightly into a dry, yellowish and ripe tint. When the cane crop is considered mature, it is usual to confirm it by means of a trial-boiling, for which canes enough for one charge are cut, milled and boiled and the ripeness of the cane judged by the quality of the jaggery it makes. If good and hard jaggery is made without difficulty, then general harvesting is taken up. Canes for milling are cut down close to the ground and are stripped off the dry leaves.

Coconut production has always been very important in this district because of the extent of acreage and quality of the nuts. The Tumkur district has an extensive acreage under this crop. The Tiptur, Chiknayakanahalli and Turuvekere taluks have large areas under coconut and the nuts gathered from these gardens are relished throughout the State. Out of a total acreage of 84,252 (1966-67) in the entire district, the three taluks of Tiptur, Chiknayakanahalli and Turuvekere account for 67,313 acres. The table

Coconut

given below shows the talukwise acreage of coconut cultivation in the district in 1959-60 and 1966-67 :—

<i>Taluk</i>	<i>Acreage</i>	
	1959-60	1966-67
Tumkur	262	1,630
Koratagere	150	227
Madhugiri	158	932
Pavagada	55	560
Sira	1,467	6,000
Chiknayakanahalli	19,984	25,223
Turuvekere	11,600	14,275
Tiptur	24,697	27,815
Kunigal	339	..
Gubbi	4,905	7,590
Total	63,617	84,252

Soils

The coconut palm is a perennial tree grown as a permanent garden or plantation crop. In all parts of the district and in other parts of the State, where the palm flourishes, it provides not only food and drink to the inhabitants but also forms a useful ingredient in many cooked dishes. The soils suited to the coconut palm are sandy loams, light sandy soils and the river valley soils. Where, however, the soil is mixed with easily crumbling rocks and rock debris, the palm thrives exceedingly well. Experiments have been conducted in the Mysore Government Farm at Babboor near Hiriyur in Chitradurga district to prove that the palm grows well in rock debris. In the tract, where this farm is situated, the soils are mostly of this nature.

Water needs

The gardens are raised only where irrigation facilities exist, such as, irrigation tanks and canals or wells. In fact, the underground moisture is really much more important for coconut than even the rainfall. Tracts, where a good deal of flood water flows during the rains and thoroughly soaks the soil, possess very good coconut gardens, even though the rainfall is much below 25 inches, as the soil moisture in those tracts is conserved by proper methods of cultivation. Many of the planted areas are broad shallow valleys which form drainage lines for the rainfall of the tract. Other gardens are situated along the banks of shallow streams, which are too small for the monsoon rains, and therefore, overflow the almost level banks for considerable distances, the water standing for several days and depositing fertile silt as well. In the shallow valleys, it is usual to hold up the rain water for some days by erecting low earthen bunds across, with a small weir for

the surplus, so that water can stand for some days in the garden and saturate the soil to great depths. The soils of such gardens are fertile red loams with enough sand for proper drainage and sufficient clay to absorb and retain the moisture. The necessity for ensuring moisture in the ground, limits coconut gardens to flat or only slightly sloping situations.

Coconut plantations are largely plantations of coconut trees **Mixed gardens** only. But it is usual, to a small extent, to lay out mixed gardens in which coconuts are grown along with arecanuts, jack fruit and mangoes. Although this kind of cropping has advantages to the small owner, especially in reducing risks due to failure of crops or low prices for any particular crop and also in providing him with something like a succession of crops throughout the year, this practice is considered as detrimental to the proper growth of coconut palms. The shade and proximity of the other trees interfere with the normal growth and productivity of the coconut trees, which would then grow thin and slant away from large trees and bear only a small number of nuts.

Coconut seedlings for planting are of two classes according **Seedlings** to the age of the seedling. They are either in the stage when the seed-nut remains entire and attached to the growing shoot or when they have passed this stage, the seed-nut has decayed away and the seedling has established itself on its own root system. In the first case, the seedlings are about one year old and in the latter, they are older. On the whole, the advantage is on the side of planting young seedlings, which, in addition, cost only about a fourth or even less of the price of the older seedlings. The coconut is a cross-pollinated plant and trees cannot breed true to the parent. Nevertheless, when the seed-nuts come from gardens where the bulk of the trees are of one type, there is a greater chance of the trees proving to be similar to the parent type. Seed-nuts are harvested from bunches which ripen after the main picking season, *i.e.*, about the month of October. The selected bunches are allowed to remain on the trees until two or three of them begin to drop, when the whole bunch is harvested.

The nuts are allowed to dry for about a month or two, but not to the extent as not to have any water in the nut. The coconuts should, if shaken, indicate that a little water is present. The ground for the nursery is well dug, roots and stems are removed and the earth piled into the form of an elevated bed, about 18 inches high and five feet broad, and the length depending upon the number of seed-nuts to be planted. The planting of the nursery is usually done in the month of March or later on in August. September. The beds are watered regularly every three days and oftener if the soil looks dry. The bed is kept free from weeds. From about the sixth month, the shoots begin to appear, and if

the plants are not uniform, then the germination is delayed and irregular. Seed-nuts planted about the end of September show, for instance, a germination of about 60 per cent towards the end of April and the remainder come up slowly in the subsequent months.

Plantings

Before planting the seedlings out in their permanent places, arrangements are made for ensuring irrigation water, which is necessary for watering the plants, especially during the hot weather. If tanks and canals are not anywhere nearby, then wells are dug for baling out water. The ground intended for the coconut garden is prepared by clearing and levelling and digging out white-ant nests, if any. The land is then given two ploughings during the early rains and then pits are dug, about three feet square and two or three feet deep. The distances between the pits are varied. The coconut plants are remarkable for the way they seek the light and bend away if there is any tree vegetation, which shuts out the light, and they suffer as much from the shade or obstruction of a neighbouring coconut tree. A distance of about 24 feet each way is considered to be the closest permissible limit. Large areas of coconuts are grown without irrigation; in such areas, the distance is about 33 to 36 feet, planting some 40 trees in an acre. In the Tumkur area, the garden is divided into rows, ten cubits in width, having on one side an elevated channel for the supply of water and, on the other side, a canal to carry off what is superfluous. In the dry-land plantations of Tiptur and Chiknayakanahalli taluks, the seedlings are planted at distances of 36 feet each way. More than 40 trees per acre are seldom planted.

The plants have to be regularly watered every day in the early stages and later on, once in two or three days throughout the hot weather and in between the rains also if the soil should need it. The soil round the plants has to be frequently stirred and a close watch kept against white-ants, rhinoceros beetle and cut-worms, which should be removed when the slightest trace is noticed.

Bearing of nuts

The trees begin to bear flowers in about seven years from planting. This may be deemed somewhat early for the average plantation. Generally, the bearing of nuts begins about the tenth year, and delays thereafter should be attributed to poor cultivation or setbacks due to other causes. The first inflorescences usually shed all their flowers and no nuts are borne; but subsequent ones begin to bear nuts. From about five years after the trees begin to bear, the trees are said to be in full bearing. In about 12 to 15 years generally, the trees must be yielding full crops. There is great variation in the number of bunches of nuts a tree may carry. One inflorescence per month or twelve in the year is a good average and at least ten are seen on even ordinary trees.

Though the inflorescences appear only successively, they follow quickly one after the other in the months of February and March when some six or seven inflorescences may appear.

From July onwards, another set of inflorescences appears which are fewer and open at longer intervals. The number of inflorescences is no sure index of the number of nuts that may be gathered. In good years, there is a strikingly large setting of fruits and the bunches bear a heavy crop. The number of nuts in a bunch is generally in inverse proportion to the size of the nuts which the tree bears. They are small in number in the case of very large nuts and *vice versa*. On the Government Farm at Babboor, the largest number picked in a year off a single tree was 250 nuts of average size, but growers point out to individual specimens in their gardens known to produce over 300 nuts in a year. Such bearing is not unusual especially on trees near the dwelling houses and close to cattle stalls where they receive the sullage of the house and washings from the cattle stalls. These large yields demonstrate incidentally the effect of manuring and watering on the yield. It has been found that the yield in any particular year is governed, as far as rainfall is concerned, by the rainfall of that year and of the preceding year. It takes, therefore, fully two years before the effect of the favourable rainfall can be felt and noticed on the crop yield.

Coconuts begin to be harvested in about eight months after the female flowers are fertilised. They are then sold as husked coconuts for the numerous domestic, religious and ceremonial uses to which they are put. At about the same stage too, are picked nuts for the preparation of the copra. For this purpose, the husked nuts are broken into two and put out to dry in the sun. A little drying makes it possible for the meat or kernel inside to be detached from the shell by a little levering and this is then put out to dry in the sun or, when the season is rainy, it is dried under artificial heat. The husk at this stage is also in a fit condition for being used for coir-making purposes. There is also another stage at which the nuts are harvested and that is at the dead ripe stage when the nuts begin to drop from the trees. **Harvesting**

The harvesting of coconuts is sometimes concentrated in two periods, one in the month of October and another about April and May, when all the bunches, which are in a more or less fit stage to gather, are cut, although they may not all be in one and the same stage of ripeness. More generally, however, the practice is to harvest about six times in the year as and when the nuts ripen and become ready. If harvested regularly once a month as and when the nuts ripen, the months of March, April, May and June will give, between them, about 50 to 60 per cent of the year's produce, the remainder being spread over the other months. Coconuts

are gathered by pickers who climb the trees, test the fruits, cut the ripe bunches and then let them down along ropes or merely drop them on to the ground. If the trees have not grown taller than 25 feet or so, nuts are often gathered from the ground itself by the use of a long bamboo pole with a knife fastened at the end.

Varieties

There are several varieties among the coconuts grown in the district. Differences are seen firstly in the colour of the coconuts, which are green, brown or dark brown. In each of these colour-groups, striking differences exist in the size of the fruits, which may be distinguished as large, medium and small. The large coconuts may be as much as three times the size of the small nuts. The size of the coconut may not correspond to the size of the nut inside or of the thickness of the meat; the latter may be larger and thicker in the medium and small varieties than in the large-sized coconuts. A tree, which bears a large number of medium-sized fruits per bunch, is preferable to the one which bears only a few and showy fruits per bunch. Differences are seen again in the thickness of the meat, which may vary from one-third of an inch to one inch. The meat differs in hardness and in the oil content. Though hard and firm in most varieties, in the butter coconuts it is soft, even though dry.

There are also differences in the sweetness of the water in the fruit. Some are specially distinguished for this quality and are often much sought after. One such variety, which is grown in the Tumkur district, is the 'Gangapani' coconut. This is a green longish type of nut favoured for the sake of its sweet water. In addition to varieties already referred to, the 'king' coconuts are esteemed for the sweetness of the water in them. Coconuts grown in this district are noted for their size, sweet water content and the possibilities of converting them into copra, which has a ready market in the northern parts of India. Tiptur has become the largest centre of coconut trade in the district and large quantities of copra are exported from there to several parts of India.

The coconut is used for two important purposes, *viz.*, for use as an edible product and for the preparation of oil. As an edible product, it forms an ingredient of numerous Indian dishes. In fact, there is hardly an Indian dish, which it does not improve. It is an article which is consumed often even in the poorest households. It is the ordinary ripe coconut which is used for this purpose generally, but the dry copra is also used. It is, however, as a source of oil that it finds its commercial and industrial use. But the bulk of the copra production of Tumkur district is exported for edible purposes. Moreover, the nuts produced in the district are more known for their sweetness of meat than for oil content.

Coconuts are noted for yet another important commercial product, *viz.*, coir. In fact, the coconut may be regarded as a

fibre-yielding crop quite as much as an oil-yielding crop. It will also not be inappropriate to regard the coconut as a food crop. The fibre of the coconut (called coir) is largely made use of for cordage of all kinds. The fibre is specially suited for this purpose as it does not decay or perish by use in salt water.

Tumkur district is one of the main coconut producing districts in the State. In order to help the further development of coconut plantations, a whole-time Assistant Coconut Development Officer is stationed at Tumkur. As a measure of intensification in this field, two nurseries have been established, one at Gubbi and the other at Tiptur, which distribute seedlings to interested planters. There are proposals to establish new coconut farms in the other taluks also. With a view to stepping up production of coconuts, a scheme for providing long-term loans to coconut cultivators, through the Agricultural Refinance Corporation, has been approved. This scheme will bring in an additional area of 1,200 acres under coconut cultivation over a period of three years from the date of commencement of the programme. Long-term loans will be canalised through the Central Land Development Bank to meet the initial expenditure like fencing, preparation of land, purchase of fertilisers and manures, planting materials, etc., to the cultivators bringing new areas under this crop.

Coconut development scheme

Among other crops in the district, castor occupied 26,637 acres, arecanut 8,437 acres, chillies 10,741 acres, tobacco 6,889 acres, bengalgram 3,946 acres and cotton 2,200 acres in 1966-67.

Fruit crops are grown in almost all the taluks in the district, and mostly plantains, mangoes and grapes are raised. Mangoes are grown in all the taluks of the district, the total area under this crop in 1965-66 being 5,500 acres. Plantains are also raised in all the taluks, especially in Tumkur, Kunigal, Chiknayakanahalli and Gubbi taluks. The total area under plantain cultivation in the district came to 2,274 acres in 1966-67.

Fruit crops

Vegetable crops like onions and potatoes are also grown in the district, but the extent is not very significant. A total area of 1,448 acres was planted with onions and 101 acres with potatoes in 1966-67. The total acreage under fruits and vegetables in the district was 11,987 during the year.

The Mysore Horticultural Society, which was started as early as in 1912, has opened branches in the taluk headquarters of the district to propagate the great need to grow more fruits and vegetables. The society affords facilities to the members by way of providing technical advice and supply of plants and seeds. Under a fruit development scheme, new orchards have been established in selected areas and old orchards have been rejuvenated. Financial

and technical assistance have been provided in order to increase the fruit production. Under a vegetable development scheme, technical guidance and good seeds have been provided. A new scheme has been under way in the district to intensify vegetable and fruit production. Under this scheme, plants and seeds are supplied at 50 per cent concessional rates to the growers.

Mulberry, which is an important commercial crop, occupied 2,475 acres in the district in 1966-67. (See Chapter V for particulars).

**Progress of
scientific
agriculture**

There was a belief that agriculture was not a paying proposition. At one time, the cultivator was satisfied with what he raised from his fields, because the produce was sufficient for his needs. But with the rise in population and aspirations for a better standard of living, what was being produced was found to be far short of the requirements. This necessitated the campaigns to grow more food, and various incentives are being given to the farmers to adopt improved methods and to make use of the results of agricultural research.

**Manurial
resources**

As the district has a large acreage under coconut and arecanut cultivation, growing of green manure crop with super-phosphates was not in practice in the district. The cultivators of the district have now understood the advantages and benefits of growing green manure crops, particularly in the coconut-growing areas. As such, there is a great demand in recent years for getting green manure seeds. It was estimated that in 1966-67, 56,130 acres were under green manure crops in the district.

Compost and farmyard manure are extensively used by the cultivators in the district. The compost is prepared both in urban and rural areas. The State Government have been offering incentives by way of subsidies to encourage the cultivators to purchase and transport compost from various places. The following table gives particulars relating to the production and use of local manures in the district from 1961-62 to 1966-67 :—

<i>Particulars</i>	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67
Production of rural compost in tonnes.	61,195	84,512	81,514	46,909	52,016	1,28,424
Production of urban compost in tonnes.	9,046	9,272	9,149	9,432	7,376	8,057
Payment of transport subsidy in rupees.	10,242	9,920	12,567	..	4,599	16,114

Particulars	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67
Green manure seeds distributed in quintals—						
(1) Sesbania ..	0.48	10	15	13.48	28.80	10
(2) Glyricidia ..	0.09	..	1.10	3.39	7.81	2
(3) Sunn-hemp ..	31.60	165	556	237.20	83	150
(4) Others ..	0.36	2	..	..	34.60	1
Seedlings and cuttings distributed in numbers.	2,25,000	1,30,000	1,30,645	10,11,258	37,500	2,10,200
Area covered by green manure crops in acres.	15,835	42,533	27,977	17,072	5,243	56,130

A wide use of organic manures like farmyard manure, green manure and compost is necessary to maintain the soil in good condition and balance. As the policy of stepping up of food production is being pursued, the supply of organic manures could not cope with the demand and it became increasingly necessary to use inorganic or chemical manures. One advantage of the use of chemical fertilisers is their solubility in water so that the nutrients in them are easily available for the growth of the plants. Of the three varieties of chemical fertilisers, *viz.*, nitrogenous, phosphatic and potassic, nitrogenous fertilisers are the best. Phosphates are used for growing of pulses; potash is employed wherever the soil is poor in potassium.

Use of chemical fertilisers

In the nitrogenous variety, there are a number of fertilisers like ammonium sulphate, sodium nitrate, calcium nitrate, potassium nitrate, ammonium nitrate, ammonium chloride, calcium cyanamide, urea and ammonium sulphate nitrate.

In the category of phosphatic fertilisers, super-phosphate is widely used. Ammoniated super-phosphate is also used. All kinds of wood ashes supply potash in the form of potassium carbonate. Mixtures are used as primary plant food. The rate of application of a fertiliser depends on the intensity of cultivation and the cost of the fertiliser. For field crops, 150 to 500 pounds of a chemical fertiliser per acre are applied. For vegetable and root crops, the rate varies from 200 to 500 pounds per acre. The

following table indicates the quantities of different kinds of fertilisers used in Tumkur district from 1961-62 to 1966-67 :—

(In metric tonnes)

Category of fertiliser	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67
1	2	3	4	5	6	7
Nitrogenous fertilisers.	2,361	2,274	3,649	4,756	3,633	6,177
Phosphatic fertilisers.	1,575	1,985	3,056	2,412	1,987	2,144
Potassic fertilisers	344	72	67	644	287	220
Mixtures ..	350	550	690	437	843	1,467
Total ..	4,630	4,881	7,462	8,249	6,750	10,008

Much headway has been made in popularising improved methods of agriculture. But old methods of cultivation still hold the field to a considerable extent in the district. Several schemes to grow more food were in operation during the Plan periods. Use of local manurial resources has been stepped up in all the taluks. Land reclamation and settlement schemes are put in operation wherever there is need ; tractors and bull-dozers are given on hire basis for cultivation and also to reclaim waste lands. An organisation has been set up in the district to render ready help to the cultivators in respect of installation, servicing and repairs of oil engines, pumpsets and other machines owned by farmers.

Implements

Both old-time and modern agricultural implements are in use in the district. The old implements are the wooden plough, *koorige* (seed-drill) and *heggunte*. Among the improved implements, the K.M. Plough, K.M. Cultivator and the Eureka and Gurjar ploughs are popular. Paddy-puddlers and paddy-weeders were unknown in the district until recently. Due to intensive demonstration of these useful implements, the cultivators have now understood their advantages. These improved implements have now become popular. Paddy-weeder, mumty, spade, *guddali*, *pikasi* and sickle are in use for weeding, digging, puddling and harvesting operations. Harrows, cultivators, puddlers, green-manure trampers and seed-drills are becoming common. In the paddy-growing areas, now hand-weeders are put to use for the removal of weeds. Due to the increased attention paid in respect of plant protection practices, the cultivators either themselves own or hire sprayers. Green manure trampers are used for incorporating green manure into the soil.

Tractors and bulldozers.—There are 59 tractors, four power-tillers and three bulldozers in the district owned by individual cultivators and the Department of Agriculture. According to statistics furnished by the District Agricultural Office, a total area of 8,000 acres was ploughed by tractors in 1966-67. The bulldozers were active for 2,003 hours.

Ploughs.—Wooden country ploughs are greatly in use in the district. The number of iron ploughs is gradually increasing. The following list furnishes the number of ploughs in the various taluks of the district in 1959-60 and 1966-67 :—

<i>Taluk</i>	1959-60	1966-67	
	<i>Wooden ploughs</i>	<i>Wooden ploughs</i>	<i>Iron ploughs</i>
Tumkur ..	24,764	24,000	160
Koratagere ..	10,508	8,792	3,000
Madhugiri ..	18,175	17,628	N.A.
Pavagada ..	11,530	13,541	N.A.
Sira ..	16,700	17,902	N.A.
Chiknayakanahalli ..	13,050	15,873	904
Tiptur ..	13,914	13,500	3,000
Turuvekere ..	13,120	15,840	932
Gubbi ..	15,232	27,920	1,185
Kunigal ..	18,100	24,133	4,429
Amruthur ..	18,703		
Total ..	1,74,596	1,79,129	13,610

N.A. = Not Available.

Carts.—In 1967, there were, in all, 58,751 country carts put to agricultural use in the district, spread over as follows : Tumkur 8,750, Koratagere 2,778, Madhugiri 4,000, Pavagada 4,033, Sira 4,003, Chiknayakanahalli 6,482, Turuvekere 5,366, Tiptur 6,250, Kunigal 7,764 and Gubbi 9,325, while in 1959, the total number of such carts in the district was about 48,000.

Cane-crushers.—There were, in 1967, 649 cane-crushers in the various taluks of the district as follows : Tumkur 140, Koratagere 10, Madhugiri 95, Sira 7, Turuvekere 14, Tiptur 15, Kunigal 283 and Gubbi 65.

**Seed multipli-
cation and
distribution**

Three seed farms are located in the district, one at Hirehalli, one at Ungra and the other at Mathighatta. They are managed by two Agricultural Demonstrators and for purposes of management they are called Seed Farm Managers. Particular attention is given by the department for the production of quality seeds. The nucleus seed is produced in small quantities at the Agricultural Research Station under the close supervision of research workers, and the raised seed is supplied to seed farms for bulk production of the foundation seed. This foundation seed is further supplied to the registered seed-growers in the taluks for large-scale production, under the close supervision of the department. Special attention has been paid by the department for the production of quality seeds of paddy, ragi, groundnut and castor in the district. The quality seedlings of arecanut and coconut raised on the research farms of the State are supplied to the cultivators at a concessional rate.

During 1966-67, paddy seeds of the improved variety were supplied to the extent of 2,013 quintals. Besides, 1,355 quintals of improved ragi seeds and 114 quintals of groundnut seeds were also distributed to the farmers. Several new schemes were formulated on a campaign basis for development of various crops in the district. The groundnut scheme was inaugurated on 1st April 1955 with necessary sanction to continue it as long as necessary. The object of this scheme was to replace the local inferior varieties by good and improved seeds. By practising the cultivation of these new varieties, the yield of groundnut has increased from one to one-and-a-half pallas per acre as against half-a-palla by the old method; H.G-7, H.G-8, H.G-10 and Spanish improved varieties have become quite popular. The improved seeds are largely used in Tumkur, Pavagada, Koratagere and Madhugiri taluks. A total of 114 quintals of these improved seeds was distributed in 1967. The oilseed extension scheme, which was inaugurated in July 1958, is being continued.

**Pests and
diseases**

The paddy crop in the district, raised under irrigation, is commonly attacked by caseworm, stem-borer, thrips and blast. Aphis and the leaf-eating caterpillar are not uncommon. The stem-borer is a menace from about July to October. During 1966-67, the area infested with pests and diseases in the district in respect of paddy was 16,117 acres. By timely plant protection measures, a total area of 11,000 acres was brought under control. The scientific remedies pursued vary in different localities. Spraying of contact insecticides like Parathion, Diazinon, Endrin or B.H.C. compound is common. A large number of the cultivators are alive to the need to pursue timely plant protection measures. Caseworm was subjected to elimination by planting calotropis along the bunds of paddy fields. The traditional kerosene treatment was pursued everywhere. The thrips were controlled by

dusting five per cent B.H.C. or spraying any of the well-known contact insecticides. The blast, known familiarly as *benki-roga*, is a fungus disease often caused by excessive application of nitrogenous fertilisers, later planting, infection from the previous crop and by humid cloudy weather. The disease is controlled by a prior seed treatment with Agrosan G.N. or Ceresan. Spraying with Bordeaux mixture or with any copper fungicide also controls the disease. Spraying in nursery stage and early on transplanting with Folidol or Basudin is also being practised to control the pest of stem-borer.

The two major pests of ragi in the district are the ragi cut-worm and the caterpillar. The cut-worm attacks the plant during the nursery and flowering stage. The caterpillar lodges itself on the plant and eats away the leaves making the plant to wilt. The shoots are also affected. For the *kharif* ragi, attack by hairy caterpillars is common. They feed on leaves and shoots. The treatment adopted is spraying of Endrin, Diazinon, Parathion, B.H.C. and D.D.T. compounds. **Ragi pests**

When compared to other staple crops, ragi is remarkably less subject to infestations. The 'flea beetle' is one of the pests which is common in the ragi-growing area. It sucks the milk of the grain and thereby causes the wilt of the plants. Usually, June and July are the months when the plant is infested by this pest. The treatment recommended in this case is Hexidol spraying, about 15 lbs. per acre. The 'ragi blast' is particularly troublesome during the period from June to September. Similar to the paddy blast, the disease makes the ragi plant wither. The affected plants are treated with Bordeaux mixture.

The shoot-borer or the leaf-webber is another insect which attacks the stem and thereby causes a slow death of the plant. It lodges itself inside the stem and after its attack, the foliage withers. If the stem is cut, the borer can be seen. The usual treatment for this is spraying of any one of the insecticides.

Coconut, which is the major garden crop in the district, is often infested by rhinoceros beetle, *Anabe roga*, bleeding disease and rats. To avoid infestation by the rhinoceros beetle, planting of *Kalli* (*Euphorbia tirukalli*) near the affected tree is recommended. It was also suggested by the plant protection experts to have the compost pits far away from the coconut garden. The insects are removed by using hooks and the eaten holes are plugged with a mixture of B.H.C. (5 per cent) salt and sand. The cultivators of coconut gardens are advised to apply three to five lbs. of sulphur dust to the trees affected by *Anabe roga* and also other trees round about, as a control and preventive measure. It is also recommended to remove the seriously affected trees and burn them. **Coconut pests**

The rats, which play havoc in the coconut gardens, are destroyed by using zinc phosphate bait, cynogas-dusting and plugging the rat holes.

Areca crop is infested by *Anabe roga*, *Hidimundige-roga* and 'yellow disease'. Sulphur dust, at the rate of about half to one pound, is applied to each infected tree. Experiments are going on about effective remedial measures to control the *Hidimundige-roga*. The groundnut crop in the district is severely attacked by *Surali-poochy* and also by 'Tikka' disease. Dusting and spraying methods are adopted to check this infestation. B.H.C. (5 per cent) dusting and spraying of contact insecticides are usually recommended.

**Intensive
Agricultural
Area
Programme**

As a measure of intensification of agricultural production in the district and with a view to popularising improved practices in respect of paddy, ragi and groundnut, an Intensive Agricultural Area Programme was introduced in the district from 1st April 1966. In order to carry out this crash programme effectively, sufficient propaganda was done among the cultivators about the methods to be adopted to get more out of the land.

During 1966-67, along with the Intensive Agricultural Area Programme, a High-Yielding Varieties Programme for paddy, hybrid jowar and hybrid maize was also launched. The programme was introduced in the *kharif* season. As the expected pre-monsoon showers did not materialise, sowings for ragi, groundnut and paddy were delayed by a month. From August 1966, the district had heavy rains from the south-west monsoon and the irrigational tanks were full by about September 1966, except at Nagalamadike in Pavagada taluk and Hulikunte in Sira taluk. The average rainfall during the year (1966-67) was from 600 to 700 mm. This favourable seasonal condition helped the execution of the programme.

Rotation of crops.—The cultivators followed the rotational methods which gave them good results. The dry-land ragi crop was followed by groundnut or jowar or *navane* or horsegram. The jowar crop was followed by groundnut or ragi or minor millets. The groundnut crop was followed by ragi or other minor millets. The paddy crop was followed by ragi or groundnut, while the irrigated ragi crop was followed by ragi or groundnut.

**Helpful
measures**

In order to show to the cultivators actually the advantages of intensive agricultural practices, the District Agricultural Staff conducted demonstrations in selected fields under paddy, ragi and groundnut crops; during 1966-67, 70, 106 and 12 demonstrations were held respectively for these three crops. About 10,000 copies of booklets explaining the improved methods were also distributed. Improved seeds form the mainstay for intensification of agriculture. For paddy, 240 registered seed-growers were selected in an area of

490 acres. In respect of ragi, 210 seed-growers were chosen in an area of 427 acres. The seed distribution was done according to a schedule. A total of 2,013 kgs. of paddy seeds, 1,355 kgs. of ragi seeds and 114 kgs. of groundnut seeds were distributed in 1966-67.

Application of modern chemical fertilisers has assumed considerable importance for intensification of agriculture. Ammonium sulphate, urea and other fertilisers were distributed in all the taluks for the purpose. Modern fertilisers have been stored for ready release whenever needed by the cultivators. The stock position as on 1st April 1967 was 5,932 metric tonnes.

The intensification programme requires adequate funds. In order to help the needy cultivators, large amounts of loans have been issued both under the Intensive Agricultural Area Programme and the High-Yielding Varieties Programme. During 1966-67, loans amounting to Rs. 16,08,261 were issued for the *kharif* season and Rs. 2,34,660 for the *rabi* season under the Intensive Agricultural Area Programme. In addition, a sum of Rs. 1,20,054 was advanced under the High-Yielding Varieties Programme of the *rabi* season.

Maximisation of agricultural production depends much on the adoption of improved practices. In order to achieve the best possible results under intensification of farming, improved methods have been employed in the district. Green manure leaves like *honge*, neem, etc., have been used in the preparation of paddy fields. Growing of green manure crops in the paddy fields and coconut gardens is also being attended to. Sunn-hemp is grown as an *akkali* crop in agricultural lands. The use of improved seeds, as recommended by the Department of Agriculture, is also increasing in the district. The cultivators have begun to realise the importance of using improved agricultural implements such as iron ploughs, cultivators, seed drills and rotary-weeders. There is also a considerable demand for modern fertilisers for growing paddy, ragi, groundnut and sugarcane crops. Transplantation of ragi in rows is being done according to expert advice. Interculturing and the modern plant protection methods have also helped the cultivators to a great extent.

There are Farmers' Forums at the taluk-levels which are helping the cultivators to understand the new techniques of farming. The District Forum, which is affiliated to the Mysore State Farmers' Forum, besides undertaking propaganda work, also trains selected farmers in the improved practices. It holds meetings, seminars and exhibitions for the benefit of the farmers. In 1966-67, there were 415 active members and 21 life-members on the rolls of the District Forum.

Statements showing the results achieved under the Intensive Agricultural Area Programme and the High-Yielding Varieties Programme in the district in 1966-67 and during the *kharif* season of 1967-68 as also the amounts of loans advanced under the programmes during the year 1966-67 have been given below :—

Blockwise acreage covered under the Intensive Agricultural Area Programme in Tumkur district in 1966-67.

PADDY

Block	Target Achievement	
	(In acres)	
Tumkur-I	2,100	1,045
Tumkur-II	1,300	1,300
Koratagere	2,000	2,030
Madhugiri	2,440	2,250
Kodigenahalli	3,500	3,400
Pavagada	4,000	1,500
Sira	1,500	1,000
Patnayakanahalli	1,000	550
Chiknayakanahalli	500	..
Tiptur-I	500	..
Tiptur-II	1,900	..
Gubbi	1,920	2,020
Turuvekere	500	370
Kunigal	1,600	550
Amruthur	4,000	..
Total	28,760	15,965

RAGI

Tumkur-I	600	25
Koratagere and Madhugiri	200	98
Kodigenahalli	2,050	225
Pavagada	4,550	1,500
Tiptur-I	25	..
Tiptur-II	180	180
Gubbi	580	198
Turuvekere	125	90
Kunigal	640	30
Amruthur	1,000	..
Total	9,950	2,346

GROUNDNUT

<i>Block</i>			<i>Target</i>	<i>Achievement</i>
			(In acres)	
Koratagere	}	..	250	405
Madhugiri and		..		
Kodigenahalli		..		
Pavagada		..	200	335
Sira		..	250	350
Patnayakanahalli		..	400	400
Tiptur-II		..	50	..
		Total	1,150	1,490

Statement showing targets and achievements under the Intensive Agricultural Area Programme in Tumkur district during the kharif season of 1967-68 (in acres)

Block	Paddy		Ragi		Groundnut	
	Target	Achievement	Target	Achievement	Target	Achievement
1	2	3	4	5	6	7
Tumkur—I	4,000	3,025	18,000	6,022	1,150	200
Tumkur—II	2,000	2,498	15,000	7,550	600	325
Koratagere	2,250	2,200	2,400	2,000	4,400	4,332
Madhugiri	1,100	2,431	7,800	4,185	4,500	3,674
Kodigenahalli	1,100	1,412	8,800	2,340	4,500	1,815
Pavagada	2,900	1,024	4,000	2,210	11,500	3,900
Sira	2,200	1,503	9,600	1,647	10,000	256
Patnayakanahalli						
Chiknayakanahalli	2,200	282	17,400	11,857	350	..
Turuvekere	2,300	1,000	17,900	18,000	350	..
Gubbi	4,200	2,700	26,900	18,645	2,200	1,006
Tiptur—I	2,350	2,931	16,000	10,085	50	..
Tiptur—II						
Kunigal	2,750	2,265	13,000	10,325	..	..
Amruthur	5,250	2,020	10,600	8,500	750	30
Total	32,300	24,291	1,67,400	1,04,279	40,000	16,000

Statement indicating the results achieved under the High-Yielding Varieties Programme in Tumkur district in 1966-67

Crop	Target acreage for 1966-67			Achievement in acres during 1966-67			Additional yield of grains in metric tonnes		
	Kharif	Summer	Total	Kharif	Summer	Total	Kharif	Summer	Total
1	2	3	4	5	6	7	8	9	10
Taichung—65 Paddy	5,650	5,650	273	4,465	4,738	273	4,465	4,738
Taichung Native—1 Paddy	1,000	1,000	13	797	810	13	797	810
Hybrid Jowar	1,380	1,380	88	315	403	172	630	802
Hybrid Maize	555	555	164	288	452	410	720	1,130
Total	8,585	8,585	538	5,865	6,403	868	6,612	7,480

Acreage achievements under the High-Yielding Varieties Programme in Tumkur district during the Kharif season of 1967-68

Name of Block	Paddy							
	Taichung-65		Taichung Native-1		Hybrid Jowar		Hybrid Maize	
	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
1	2	3	4	5	6	7	8	9
Tumkur—I ..	150	58	..	..	5	4	100	111
Tumkur—II ..	100	27	..	3	5	4	100	103
Koratagere ..	300	140	..	6	5	6	100	500
Madhugiri ..	250	119	..	94	5	7	100	56
Kodigenahalli ..	150	35	..	..	5	12	100	60
Pavagada ..	300	16	..	10	40	20	100	40
Sira } ..	300	104	..	33	40	10	200	27
Patnayakanahalli } ..								
Gubbi ..	200	30	..	..	5	8	100	105
Chiknayakanahalli ..	200	6	..	1	10	18	100	43
Tiptur—I } ..	200	62	..	..	10	36	200	103
Tiptur—II } ..								
Turuvekere ..	200	60	..	..	5	26	100	40
Kunigal ..	200	32	..	..	10	11	100	61
Amruthur ..	300	23	..	..	5	10	100	185
Total ..	2,850	712	..	147	150	172	1,500	1,434

Statement showing amounts of short-term loans advanced to cultivators by the State Government during the Kharif and Rabi seasons of 1966-67 under the Intensive Agricultural Area Programme.

<i>Taluk</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Total</i>
	Rs.	Rs.	Rs.
Tumkur ..	2,31,763	3,150	2,34,913
Koratagere ..	87,515	31,950	1,19,465
Madhugiri ..	1,11,044	61,810	1,72,854
Pavagada ..	68,330	8,590	76,920
Sira ..	1,84,826	13,840	1,98,666
Chiknayakanahalli ..	96,936	20,932	1,17,868
Turuvekere ..	1,21,052	61,825	1,82,877
Tiptur ..	3,20,628	8,793	3,29,421
Gubbi ..	1,48,193	4,410	1,52,603
Kunigal ..	2,37,974	19,360	2,57,334
Total ..	16,08,261	2,34,660	18,42,921

Certain areas in the district are always vulnerable for scarcity brought about by periodic droughts. In order to help rehabilitate and improve such areas in the State, the Central Government requested the State Government, in May 1962, to prepare a well-thought out plan so that the areas may get proper attention. They also suggested that the work may be taken up, in the first instance, on a pilot basis for a period of three years. After assessing the achievements of the pilot schemes, it was visualised that a further large-scale development programme may be undertaken. This pilot scheme was to include soil conservation measures, irrigation work and diversification of agriculture. In 1963, it was decided to undertake the pilot projects in the taluks of Madhugiri and Pavagada, as these two taluks were typically backward taluks in the district. Accordingly, a committee of officers was constituted with the Deputy Commissioner of the district as the Chairman. The district authorities were asked to implement a comprehensive scheme for the development of agriculture and to pay particular attention to diversification of agriculture in those areas.

Hitherto, in the scarcity regions, the traditional pattern of Governmental assistance during drought and periods of scarcity has been one of offering doles and providing employment to the needy population. Such works do not create permanent assets and the money spent on scarcity works often became wasteful expenditure

**Special
Long-term
Programme**

as no provision could be made for their maintenance year after year. Therefore, there was a great need to undertake measures which, in course of time, would prevent conditions of scarcity from arising. It was felt that the ultimate objective should be that in spite of certain natural factors, which are adverse to the development of such areas, a sufficient number of positive factors should be created, making use of the existing conditions to the best advantage, which would eventually result in the elimination of scarcity.

As such areas have scanty rainfall, it was considered quite essential that every effort should be made to ensure sufficient water for agricultural operations. This was sought to be achieved by the construction of minor irrigation works, such as tanks and wells, and also by contour bunding, wherever possible. Introduction of rational cropping was also decided upon. This was essential for achieving the maximum benefit from irrigation. As already stated, the development of backward areas fell mainly under (1) land improvement, (2) minor irrigation and (3) diversification of agriculture. For the improvement of land, the utilisation of tractor and bulldozer services at appropriate places became quite necessary. This method brought under cultivation lands which were formerly lying fallow.

The areas affected by scarcity conditions in Tumkur district consist of the following hoblies: Sira, Kallambella, Bukkapatna, Hulikunte, Badavanahalli, Ittigadibbanahalli, Honnavalli, Huliya, Handanakere and Urdagere. The extent of area and population affected by scarcity conditions in the district are as follows:—

<i>Taluk</i>	<i>Area in square miles</i>	<i>Population</i>
Madhugiri	.. 422	1,53,824
Sira	.. 584	1,53,983
Koratagere	.. 256	89,386
Pavagada	.. 523	1,17,138
Gubbi	.. 466	1,47,150

The allocation of funds for carrying out the Special Long-Term Programme for the development of backward areas in this district has been fixed at Rs. 1,331.37 lakhs. The time that would be required to complete the schemes would depend on several factors, such as the availability of funds, trained personnel and materials. Some schemes like those relating to fisheries, sericulture and irrigation wells can be completed in a short time, while those relating to contour-bunding and minor irrigation works may take a longer time. It is estimated that completion of the entire scheme for the development of the backward areas may take about 25 to 30 years.

Marconahalli Agricultural Colony

An agricultural colony, called the Marconahalli Agricultural Colony, was started in 1942 in the Marconahalli Reservoir channel area near Yedavani in Kunigal taluk in order to help landless educated persons and young farmers to settle themselves to achieve best results from agricultural pursuits. In the early stages, 20 candidates were selected and out of them, 11 persons got the required training. During the year 1947, six persons were taken as colonists and during the next year, three more persons were trained. Since then, an average number of four persons are being given the facility to settle down there. Under the scheme, 229 acres of wet land, 91 acres of dry and 16 acres of garden lands have been set apart for the colonists.

Since the great famine of 1877-78, there have been bad years occurring now and then in the district. The distress was acute in 1891-92, 1908-09 and 1923-24 calling for instant relief operations.

Floods and famines

Whenever *mungar* rains fall, the cultivators have to postpone their farming operations indefinitely. Especially, the north-east monsoon is a veritable gamble and one cannot be sure of its onset. If the winter rains fail, which is often the case in the district, the tanks get much depleted. In 1904-05, the situation became critical because of failure of rains and this gravity was intensified in 1905-06 as the south-west monsoon also failed. The north-east monsoon in the succeeding year was most disappointing. The distress in 1908-09 was more acute than in 1891-92 as it extended over a very large area. The distress was particularly severe in Kunigal, Gubbi, Turuvekere, Tiptur and Pavagada taluks.

In recent years, due to improvements in transport and communications, sufferings from famine or scarcity conditions have been mitigated since foodgrains can be speedily brought and sent to even remote areas. Drought conditions are quite common, especially in the Madhugiri sub-division, because of monsoon failures. It has been said that in the areas that are subject to chronic scarcity conditions, in a cycle of five years, two years are of scarcity and another year of famine or near-famine. Intensive efforts are now being made, as stated earlier, to solve this difficult problem on a permanent basis. Any large spell of drought condition will naturally affect severely the food production. If scarcity occurs, relief works are started according to the needs of the tract and gruel centres are immediately set up to feed the hungry. Sinking of irrigation wells is one of the permanent measures undertaken to relieve the scarcity. During 1968 also, there were widespread scarcity conditions in the district. To alleviate the sufferings of the people, the State Government took up 1,203 scarcity relief works in the district at a cost of about Rs. 25 lakhs, thereby providing employment to about 35,590 persons. There is no threat of floods in the district. The streams and rivers, which may be full during the

rainy season, get dry for the other several months. Even during the rainy period, these streams do not ordinarily burst their banks.

ANIMAL HUSBANDRY

In the sphere of farming and in meeting the nutritional needs of the people, to a considerable extent, the livestock play a prominent role. A large number of cultivators keep, as a rule, a pair of bullocks, a few cows and a couple of buffaloes. The farmer's social status in the rural areas is still judged, to a certain extent, by the number of cattle he maintains. Most of the field work like ploughing, drawing water from the wells, threshing the grain and carrying the produce from place to place is done by cattle.

Early history

It is said that one of the viceroys of Vijayanagara brought to Srirangapattana some families of professional cattle-breeders belonging to the Hallikar community along with some superior breeds of cattle, which later came to be known after them as the 'Hallikar' breed. These cattle formed the nucleus of the famous breeds of draft cattle in the erstwhile Mysore State, including Tumkur district. 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.

In the days of the Vijayanagara viceroys, the Animal Husbandry Department was called the *Karuhatti* establishment. The Wodeyars of Mysore improved the breed of cattle by 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, and it came to be known as *Benne Chavadi*. The cattle were also said to have been branded with the initials of the ruler and also their years of birth. Haidar Ali made extensive use of these cattle, especially the bullocks, as beasts of burden in his campaigns against other rulers, taking into consideration the stamina and speed with which these cattle stood the strain of war transport. It is said that he had maintained about 60,000 bullocks in different parts of the State.

The cattle department was firmly established during the time of Tipu Sultan and its name was changed from *Benne Chavadi* to Amrit Mahal Department. However, the department came to be neglected after 1799. Till 1896-97, the department was being administered by a Military Assistant to the Government, assisted by a separate technical officer. In August 1897, the Government sanctioned the appointment of a Superintendent for the department, which was made a subordinate branch under the control and direction of the military department of the Government. In

1915-16, the control and direction of the department was transferred to the Chief Commandant of Mysore State troops. In 1923, it was transferred to the Department of Agriculture and later on it 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 in the year 1944.

Statistics in respect of livestock prior to 1911 are not available. However, in the Tumkur District Handbook published by the Government in 1915, some figures of the livestock population have been given. Those figures, which pertain to the year 1913-14, are as given below :—

Bulls and bullocks	..	..	2,09,609
Cows	..	..	1,72,878
Male buffaloes	..	..	11,596
Female buffaloes	..	..	53,287
Young stock (Calves and buffalo calves)			1,36,944
Sheep	..	..	5,95,904
Goats	..	..	3,32,202
Horses	..	..	2,634

Livestock
census

According to the livestock census taken in 1961, there were 6,47,780 cattle, 1,62,533 buffaloes, 7,66,675 sheep, 2,88,897 goats, 1,725 horses and 25,284 other livestock in the district. As against this, there were 6,13,345 cattle, 1,52,638 buffaloes, 7,23,499 sheep, 2,55,557 goats, 3,823 horses and 24,117 other livestock in the district as per the livestock census conducted by the Department of Animal Husbandry and Veterinary Services in 1966. (See also Appendix for more details).

The predominant breed of cattle found in Tumkur district is the *Hallikar* breed, already referred to above, though cross-bred and nondescript varieties are not uncommon. Though there are no cattle-breeding farms in the district, the Animal Husbandry and Veterinary Services Department has undertaken various measures to improve the existing breeds of cattle in the district. Mass castration of all scrub bulls is done and stud-bulls of improved breeds are supplied free to selected breeders in the community development blocks. *Taccavi* loans are granted to cattle breeders for obtaining pure-bred cows. With a view to encouraging them to maintain good breed of bull calves, a calf subsidy of ten rupees per month is given to a select few till the calves attain maturity. 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. Besides, other schemes of fodder development such as supply of chaff-cutters to prevent

wastage of fodder, laying of pasture demonstration plots for introducing improved varieties of grass and growing of leguminous fodder crops are also implemented in the district.

**Artificial
insemination**

Steps have been taken to upgrade the local nondescript cattle by artificial insemination with the semen of stud-bulls of superior breeds. For this purpose, an Artificial Insemination Centre has been established at Tumkur with a number of sub-centres all over the district. This centre, which was started in the year 1952 at the Tumkur Veterinary Hospital, receives semen of superior breeds, such as Jersey bulls and Murrah buffaloes, from the National Dairy Research Institute, Bangalore, and distributes the same among the several sub-centres in the district. During 1967-68, 211 male and 257 female calves were born in the district out of artificial insemination, as against 149 and 186 respectively in 1966-67.

In addition, there is a Key Village Centre at Kunigal, with five sub-units, which has taken up intensive animal husbandry activities in the villages round-about, within a radius of ten miles. The activities of this centre include artificial insemination of cattle, castration of scrub bulls, milk recording, fodder cultivation, organisation of co-operative units for the sale of cattle feed, disposal of milk and milk products, prevention and control of cattle diseases, treatment for sterility and minor ailments. The Key Village Scheme was started in the year 1957.

Sheep-breeding

The breed of sheep generally found in the district is the mutton type, but the local nondescript breed is also not uncommon. The standard of the local breed is generally poor compared to the modern breeds. The total number of sheep in the district in 1966 was over 7.23 lakhs. With a view to improving the breed of local stock of sheep, a number of stud rams have been supplied to the sheep breeders in the district under the successive Five-Year Plans. A Sheep-Breeders' Association has been functioning in the district at Tumkur since 1947. In 1960, the Association had about 210 members and this number had increased to over 1,000 by 1967. The members of the Association are encouraged to rear good breeds of sheep. The sheep are sheared twice a year and the wool is collected by the Association and woven into blankets. The blankets are supplied to the members or, if they so desire, their equivalent cost is paid to them. There is a proposal to start a wool weavers' co-operative society under the auspices of the Association so as to provide marketing and other facilities to its members. There is a stockman and three shearers attached to the Association, which is being actively assisted by the department.

**Poultry
farming**

The total number of poultry in the district, as per the livestock census of 1961, was 5,98,849. This number registered a slight fall in 1966, in that there were 5,52,078 poultry in the district during that year, as disclosed by the livestock census figures of 1966.

With a view to developing poultry farming in the district, a Poultry Extension Centre was established at Tumkur during 1960-61. The centre obtains day-old chicks of superior breed from the Regional Poultry Farm, Hessarghatta, and rears them upto the breedable age. Then, they are supplied to the poultry-farmers in the district through the community development blocks. During 1967-68, about 4,000 birds were thus distributed by this centre, the popular breeds being the White Leghorn and the Rhode Island Red. Hatching eggs are also made available to the poultry breeders both in the urban and rural areas of the district, while table eggs are supplied to the local hospital and the general public. A Veterinary Assistant Surgeon is in charge of this centre, assisted by a Poultry Assistant and two attendants.

A number of young and enthusiastic farmers in the district have been given training at the Hessarghatta Poultry Farm in modern methods of rearing and managing poultry. Many of these trained youngmen have already started small poultry units in their villages which serve as demonstration centres. There is also a Taluk Poultry Farmers' Co-operative Society at Tumkur. It advances materials worth about Rs. 1,000 to poultry farmers in the taluk by way of loans. The Church of South India, a private organisation, is also running a poultry farm at Tumkur.

The veterinary section of the Animal Husbandry Department deals both with the treatment and prevention of cattle diseases. **Veterinary services** There were, in all, one Veterinary Hospital, eleven Veterinary Dispensaries, 33 Rural Veterinary Dispensaries, six Key Village Scheme Units, one Sheep-Breeders' Association and one Poultry Extension Centre in the district as at the end of August 1968. A statement showing the location and other particulars of these institutions is given at the end of this chapter.

The animal diseases generally prevalent in the district are Black Quarter, Anthrax, Haemorrhagic Septicaemia, Sheep-pox, Foot and Mouth Disease, Ranikhet and Parasitic Diarrhoea. Among non-contagious diseases, respiratory, digestive, generative and surgical are more common. 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 the contagious diseases are not so easy to combat since they occur in an epidemic form. Efforts have, however, been made in recent years to control these diseases both by preventive and curative measures and some success has been achieved in this respect also.

During 1966-67, a total of 1,455 livestock had been attacked by various contagious diseases in the district, of which 1,439 livestock had died. As against this, during the subsequent year, *i.e.*,

1967-68, the attacks and deaths of livestock were 2,193 and 2,184 respectively. These included 364 cases of Black Quarter, 97 cases of Haemorrhagic Septicaemia, 32 cases of Anthrax, 147 cases of Sheep-pox, 219 cases of Ranikhet and 85 cases of Parasitic Diarrhoea. There was, however, no out-break of Rinderpest in the district during the year. The Department took necessary steps to control these diseases by resorting to large-scale inoculations of livestock in the affected areas, as also by performing surgical operations and dosing the animals with phenovis and carbon tetrochloride, wherever necessary. In all, about 2.40 lakhs of livestock were thus treated during the year (1967-68) in the various veterinary institutions in the district. This also included about 10,280 cases treated by the veterinarians by visiting the villages personally. The following table indicates the number of livestock treated against various diseases in the district during the years 1965-66, 1966-67 and 1967-68 :—

Sl. No.	Disease	1965-66	1966-67	1967-68
1.	Rinderpest ..	5,741	50,884	..
2.	Haemorrhagic Septi- caemia ..	28,317	15,014	20,989
3.	Black Quarter ..	80,864	19,236	62,267
4.	Anthrax ..	12,568	12,376	5,991
5.	Sheep-pox ..	37,773	40,088	54,494
6.	Fowl-pox ..	707	..	1,735
7.	Ranikhet ..	70,781	39,282	52,928
8.	Pigeon-pox ..	340	2,285	..
9.	Parasitic Diarrhoea ..	26,470	28,517	18,742

As stated earlier, castration of scrub bulls, with a view to checking the breeding of nondescript cattle, forms an important item of work of the department. During 1967-68, a total of 67,578 scrub bulls and buffaloes were castrated in the district, both in the veterinary institutions and by visiting the villages. As against this, the number of animals castrated during 1966-67 and 1965-66 were 54,382 and 49,633 respectively.

Cattle fairs and shows

Tumkur district is noted for cattle fairs and rallies. The fair season begins in November and closes by April. One-day cattle shows are regularly held in all the taluk centres during the *Gosamvardhana* Week celebrations and prizes are awarded to the best cattle breeders. A *Hallikar* Breeding Bull Show is held at Gubbi every year and it is unique in the history of animal husbandry activities in the district. Important cattle fairs are held in Siddhaganga *Matha*, Seebi in Sira taluk, Yedeyur in

Kunigal taluk, Kyamenahalli in Koratagere taluk, Nagalamadike and Hariharapura in Pavagada taluk, Tavarekere and Patnayakanahalli in Sira taluk, Gubbi, Kallur and Chelur in Gubbi taluk and at Madhugiri, Turuvekere and Mathighatta.

During 1967-68, in all, 25 cattle fairs and shows were held in the district at various places. A total number of about 2,51,350 cattle had been brought to these fairs. The Department of Animal Husbandry and Veterinary Services organised temporary veterinary dispensaries, with the necessary staff, drugs and instruments, at these places during such fairs so as to provide necessary veterinary facilities to the cattle gathered there. Educative propaganda about the need to make use of the results of animal husbandry research is done during these cattle fairs and shows by means of exhibiting improved cattle, exhibition of pictures of good breeds and charts, lectures and the like.

A sum of Rs. 4.77 lakhs had been provided towards the expansion and development of animal husbandry activities in the district during the Third Plan period. The schemes included provision of more veterinary facilities, poultry development and opening of more Artificial Insemination Centres.

Mysore State was the pioneer in establishing a horse-breeding centre, and the starting of such a farm at Kunigal in this district gave a lead to other States in India. This Stud Farm is the oldest in India and the stock bred on this farm have earned a well-deserved name not only in this country but also in some foreign countries. The performances of some of this farm-bred young-stock compare well with those of foreign breeds. Several of the horses bred on the Kunigal Farm have come out as the best in the various turfs by setting up records. The vast area surrounding the farm is well suited for breeding quality horses. The soil all around Kunigal is rich for growing fodder and sufficient water facilities are also available. The climate is salubrious all the year round.

**Government
Stud Farm,
Kunigal**

The farm is situated very near the taluk headquarters town of Kunigal and has an area of 350 acres, divided into 25 paddocks of different sizes where plenty of nourishing grasses are available. Nearby there are two large tanks, *viz.*, Kunigal Amanikere and Begur Amanikere. In the *atchkat* area, improved varieties of grasses suitable for horse-feeding are grown. In addition to the tank *atchkat* fodder areas, the Herur *Kaval*, having an extent of 70 acres, also serves as a fodder reserve. The layout of the Stud Farm follows the pattern obtaining in Western countries. The paddocks, stables, etc., are all well maintained.

Primarily, this Stud Farm was started to breed good horses intended solely for the Indian Army. The stallions then in use

were Arab and the mares were purely country-bred ; the result was a failure. It was only in 1886 that the first thorough-bred English stallion named ' Pero Gomez ' was imported and introduced on the Kunigal Farm with the object of breeding horses for the turf as also to remount breeding. In the beginning, control over the farm was exercised by the central administration from Delhi. Men like Colonel Hay, General Stewart, Colonel McIntire and others took great interest in firmly establishing this farm as a centre of horse-breeding. The progress of the farm and the fame it achieved was, to a large extent, due to the keen interest evinced by the royal house of Mysore. His Highness the late Sri Krishnaraja Wodeyar took great interest in the day-to-day development of the farm. Several races and horse-shows were conducted annually on the farm for nearly 20 years in order to improve horse-breeding.

The farm was being maintained for nearly three decades by the Mysore Military Department. In 1948, its control and management were transferred to the State Animal Husbandry Department. The question of maintaining the farm on a self-supporting basis had been a problem over the decades. The chief cause for the heavy expenditure and low income of the farm was the low birth rate and infertility among mares. In 1948, when the farm came under the control of the Animal Husbandry Department, the cost of management was considerably reduced and it was possible to make the venture almost self-supporting. This was due largely to the adoption of scientific methods in overcoming sterility among mares and thereby increasing the percentage of births. Further, the adherence to the principles of breeding hygiene, proper exercising of livestock, timely feeding on balanced diet and provision of nutritious fodder in sufficient quantities had all been responsible for better results and increased income.

The Kunigal Farm is the only farm in India which has had the reputation of possessing and maintaining many high class reputed stock. In this connection, it would be of interest to note that during the period 1946-54, the great stallion ' Kimberley ' was on this farm. He was in great demand and the number of private mares covered during the period was at its peak. The stallion was responsible to get the farm a net income of Rs. 7 lakhs during his stay. Since 1956, there has been, however, a fall in the number of boarders in the farm as their owners preferred to withdraw and transfer their mares to other studs where better stallions were available.

The Stud Farm has an advisory committee consisting of five non-officials. The farm has facilities to accommodate 80 mares. At present (1968), there are 25 Government-owned mares and five private mares owned by the Bangalore and Calcutta Turf Clubs.

There are also three thorough-bred stallions of outstanding quality and pedigree in the farm. Thus, there are, in all, 55 horses in the Stud Farm including yearlings and other young stock of good quality. The yearlings are auctioned at Bombay annually under the Royal Western India Turf Club rules. The receipts and expenditure of the farm for the year 1960-61 was Rs. 1.64 lakhs and Rs. 1.40 lakhs respectively. As against this, a budget provision of Rs. 2.53 lakhs has been made for meeting the expenditure on this farm during 1968-69. The Government have recently decided to entrust the management of the farm to the Bangalore Turf Club on a lease-rent of Rs. 55,000 per annum, for a period of five years, with the object of encouraging breeding of race horses.

FISHERIES

The tanks in the district are divided into major and minor tanks and the approximate water-spread of the major tanks is 84,402 acres and that of minor tanks is 28,035 acres. In addition to this, there are big reservoirs like Marconahalli and Boranakarive which have a water-spread capacity of 8,890 and 3,682 units respectively. Among the major tanks, Kadaba, Mallaghatta, Chandrashekarapur, Kallur, Nitur, Maidala, Thumbadi, Mavathur, Turvekere and Kunigal-doddakere are perennial tanks which have good potentialities for development of fisheries.

A list of important fishes found in the district with their scientific and common names are furnished below:—

<i>Scientific name</i>	<i>Kannada name</i>
Barbus carnaticus	Gende
Barbus sarana	Hetteparki
Cirrhina fulungi	Arya
Chela spp	Bilchi
Catla catla	Katla
Cat Fishes	
Calliichrous bimaculatus	Godhle
Wallago attu	Bale-meenu
Mystus vittatus	Meesegritu
Murels	
Ophiocephalus marulius	Hoomneenu
Ophiocephalus striatus	Kutehu
Ophiocephalus punctatus	Korava
Miscellaneous	
Mastacembelus armatus	Havu-meenu
Notopterus notopterus	Chavale
Basbora spp	Sastu
Palaemon serratus (Prawns)	Seegadi

Fishing methods

Water areas suitable for fish culture are being stocked with quick-growing varieties of fishes, *i.e.*, Catla, Rohu and Mrigal. Fishing is done by means of drag nets, gill nets, prawn nets, long line and plunge baskets. Fishing with improved gears is demonstrated by departmental fishing units.

Drag nets.—These nets are used in tanks. The net is rectangular in shape and mostly made of cotton. The mesh size of the net varies from $\frac{1}{4}$ inch to 1 inch and the length of the net from 80 feet to 100 feet and breadth from 8 feet to 10 feet.

Gill nets.—These are commonly used for fishing in the reservoirs and tanks. In the gill net, the fish gets gilled in the mesh of the net when trying to swim through. The nets are rectangular in shape and they are made of hemp or cotton yarn. The length of the net varies from 100 feet to 200 feet and depth from 10 to 15 feet with floats and sinkers. The mesh size varies from 2 inches to 5 inches (stretched). The nets are laid either in the night or early hours of the morning for being collected after sun rise. Most of the bigger fishes such as carps and cat fishes are caught in these nets.

Prawn nets.—In shape, a prawn net is more or less like a cone. The wider end is opened and kept in position by a set of three poles, of which one is about six feet in length and the second is slightly longer than 6 feet, the extra length serving as a handle. The third is at the base and is about four feet in length. At the apex of the cone is an opening, which leads into a long cylindrical linen bag. The net is pushed in shallow water with the wide mouth directed forwards. The water is filtered through the net and the prawns and small size fish are driven into the linen bag, the fish being removed now and then by detaching the bag from the net. The weeds are prevented from entering the net by a triangular and wide meshed screen tied to the mouth of the net.

Long line.—The line consists of a coir cord, varying from 200 feet to 300 feet in length; short and strong cotton threads, to the free ends of which hooks are tied, are attached to the coir cord at intervals of about 2 feet to 3 feet. The baits offered are mostly frogs, small live fish and earthworms. The long lines are operated both in shallow and deeper waters.

Conservation

The auction sale of fishery rights of tanks and issue of licences to exploit fisheries of reservoirs are regulated by the Fisheries Department so as to conserve the fishery in the various water-spreads of the district.

The most important fishing community in the district is that of Besthas, who live in villages situated around big tanks and reservoirs. A fairly good population of fishermen is found at

Gubbi, Chandrashekharapur, Kunigal, Amruthur, Kadaba, Kallur, Belavate and Nitur. Generally, as fishing in this district cannot be done throughout the year, fishermen do not entirely depend upon fishing for their livelihood. Many of them have taken to agriculture and some also work as labourers.

In the Marconahalli reservoir, which has a water-spread of 8,890 units, fingerlings of quick-growing food fishes such as Catla, Rohu and Mrigal are being stocked every year. A deep water fishing unit is operating in the reservoir for demonstration in the use of improved gear. Here, nylon gill nets with a mesh size varying from 2½ inches to 4 inches and each net having a length of 120 feet and a breadth of about 100 feet are being operated.

In order to develop the fisheries in a phased manner, the Directorate of Fisheries in Mysore has created two separate divisions in the district with headquarters at Tumkur and Gubbi.

The former division was established in 1957-58 and the latter in 1959-60. Under the technical guidance of these divisions, the major tanks and reservoirs in the district are being exploited by improved methods of fishing. The principles of co-operative effort have been also applied in the sphere of fisheries by the establishment of a Fishermen's Co-operative Society at Gubbi. This Society has been formed to encourage and augment fishery activities and also to improve the socio-economic conditions of the fishermen. Financial help, in the form of short-term and long-term loans, is provided to fishermen to clear off their old debts and to buy their own crafts and tackles.

During the Third Five-Year Plan period, a total outlay of Rs. 1.76 lakhs had been fixed for fisheries development in the district. The development schemes included supply of fishery requisites to fishermen, fish-seed production, rearing and distribution, fisheries education and training and assistance to private fish farmers. An intensive development scheme was also introduced in the Turuvekere Community Development Block during the period in order to exploit fully the fisheries resources in the tanks of the area. Carp fry was imported from outside and stocked in several selected watersheds in the block. Fishery requisites were also supplied to fishermen on subsidised basis.

In addition to this intensification scheme, an Applied Nutrition Programme has also been introduced in the district for bringing about 150 acres of more water area under fish-culture by intensive stocking of quick-growing varieties like major as well as common carps, for exploiting selected tanks in each established feeding centre, for helping the supply of fish food to nursing mothers and school-going children and for granting subsidies to village panchayats for proper renovation of tanks. The total fish-catch in the district in 1965-66 was estimated at 3,810 metric tonnes.

**List of Animal Husbandry and Veterinary Institutions in Tumkur district
as on 31st August 1968.**

<i>Sl. No.</i>	<i>Name of town or village where located</i>	<i>Name of taluk</i>	<i>Type of institution</i>
1	2	3	4
1.	Tumkur town	.. District head-quarters.	Veterinary Hospital and A.I. Main Centre.
2.	Nagavalli	.. Tumkur	R.V.D. and A.I. Sub-Centre
3.	Seethakal	.. do	R.V.D.
4.	Siddhaganga Matha	.. do	R.V.D. and A.I. Sub-Centre
5.	Urdagere	.. do	R.V.D.
6.	Tumkur town	.. do	Poultry Extension Centre
7.	Tumkur town	.. do	Sheep Breeders' Association
8.	Gubbi town	.. Gubbi	Vety. Dis. and A.I. Sub-Centre
9.	Hagalvadi	.. do	R.V.D.
10.	Kadaba	.. do	R.V.D.
11.	Mavinahalli	.. do	R.V.D.
12.	Hosakere	.. do	R.V.D.
13.	Bidare	.. do	R.V.D.
14.	Chiknayakanahalli town	Chiknayakanahalli.	Vety. Dis. and A.I. Sub-Centre
15.	Huliyar	.. do	R.V.D.
16.	Thimmanahalli	.. do	R.V.D. and A.I. Sub-Centre
17.	Mathighatta	.. do	R.V.D.
18.	Handanakere	.. do	R.V.D.
19.	Tiptur town	.. Tiptur	Vety. Dis. and A.I. Sub-Centre
20.	Nonavinakere	.. do	R.V.D.
21.	Biligere	.. do	Vety. Dis. and A.I. Sub-Centre
22.	Turuvekere town	.. Turuvekere	Vety. Dis. and A.I. Sub-Centre
23.	Mayasandra	.. do	R.V.D. and A.I. Sub-Centre
24.	Thandaga	.. do	R.V.D.
25.	Dandinashivara	.. do	R.V.D. and A.I. Sub-Centre
26.	Kunigal town	.. Kunigal	Vety. Dis. and K.V.S. Centre
27.	Huliyurdurga	.. do	R.V.D.
28.	Ujjani	.. do	R.V.D.
29.	Yedeyur	.. do	R.V.D. and A.I. Sub-Centre
30.	Kunigal town	.. do	K.V.S. Main Centre
31.	Yeliyur	.. do	A.I. Sub-Centre
32.	Kaggere	.. do	A.I. Sub-Centre
33.	Santhemavathur	.. do	A.I. Sub-Centre

1	2	3	4
34.	Santhepet	.. do	A.I. Sub-Centre
35.	Yediyur	.. do	A.I. Sub-Centre
36.	Amruthur	.. do	Vety. Dis. and A.I. Sub-Centre
37.	Koratagere town	.. Koratagere	Vety. Dis. and A.I. Sub-Centre
38.	Thovinakere	.. do	R.V.D. and A.I. Sub-Centre
39.	Kyamenahalli	.. do	R.V.D.
40.	Theetha	.. do	R.V.D.
41.	Madhugiri town	.. Madhugiri	Vety. Dis. and A.I. Sub-Centre
42.	Byalya	.. do	R.V.D.
43.	Kodigenahalli	.. do	R.V.D. and A.I. Sub-Centre
44.	Badavanahalli	.. do	R.V.D. and A.I. Sub-Centre
45.	Neralekere	.. do	R.V.D.
46.	Sira town	.. Sira	Vety. Dis. and A.I. Sub-Centre
47.	Kallambella	.. do	R.V.D.
48.	Tavarekere	.. do	R.V.D.
49.	Bargur	.. do	R.V.D.
50.	Bukapatna	.. do	R.V.D. and A.I. Sub-Centre
51.	Pavagada	.. Pavagada	Vety. Dis. and A.I. Sub-Centre
52.	Y. N. Hoskote	.. do	R.V.D.
53.	Kondethimmanahalli	.. do	R.V.D.

A.I. Sub-Centre=Artificial Insemination Sub-Centre.

R.V.D.=Rural Veterinary Dispensary.

K.V.S.=Key Village Scheme.

Vety. Dis.=Veterinary Dispensary.