CHAPTER 4

Agriculture and Irrigation*

Agriculture is the main occupation in Dharwad district. The district has varied geographical and climatic conditions and soils and contains three agricultural zones. *The Northern Dry Agricultural Zone* consisting of Navalgund, Ron, Gadag, Nargund and Mundargi taluks forms 80 per cent black soil and gets an average rainfall of 564.2 mm. It is the main *Rabi Zone* area. *The Central Transition Zone* area consists of Byadgi, Dharwad, Haveri, Hirekerur, Hubli, Kundgol, Ranibennur, Savanur, Shiggaon and Shirhatti taluks. In this zone, red soil covers an area of 70 per cent and the average rainfall is 696 mm. This is an area where rainfall is certain and it is mainly a kharif zone. Due to the favourable climatic conditions in this zone, there is abundant scope to undertake varied cropping pattern under rainfed conditions. Kalghatgi and Hangal taluks come under the *hilly zone*. In this zone about 85 per cent of the soil is sandy clay in nature, with an average rainfall of 909 mm. The rainfed Paddy is grown in about 60 per cent of the area. After the harvest of Paddy crop, short term pulse crops are grown. As per the statistics available from 1901 to 1970, the annual normal rainfall in the district is 717 mm., out of which 422 mm comes from the South-West monsoon (*Mungari*) and 169 mm from the North-East monsoon (*Hingari*). It is found that 126 mm of rain comes before the monsoon season (pre-monsoon).

The population living in rural areas of the district was 7,35,170 in 1881 (83.2 per cent of the total population), 8,15,569 (77.5%) in 1891; 8,87,697 (79.7 per cent) in 1901; 8,23,750 (80.2%) in 1911; 7,97,120 (76.7%) in 1921; 8,20,312 (74.3%) in 1931; 9,07,228 (75.5%) in 1941 and 10,82,582 (68.6%) in 1951. The number of persons residing in the rural areas has increased by 6,82,497 during the period from 1881 to 1951. This increase is also due to the increase in area of the district by the merger of some small princely States in 1949. The number of persons living in the States merged with the district was about 1,50,000. In 1961, the rural population was 14,25,738; in 1971 it was 16,04,240; in 1981 it was 19,07,229 and in 1991 it was 22,79,259. The number of persons, residing in the rural areas has increased by 11,96,677 between the period from 1951 to 1991.

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* In this chapter, Horticulture, Animal Husbandry and Veterinary Services and Fisheries sections are also included.

As per the 1991 Census Report, there were 22,79,259 persons in rural areas of which the number of males was 11,71,200. According to 1971 census, there were 2,49,756 cultivators and 3,20,187 agricultural labourers, out of the total workers. Out of the total agricultural labourers 1,93,658 persons were males and 2,07,249 persons were males out of the cultivators. It would be noted that nearly 73.1 per cent of the total population in 1961 comprised of the rural population. This figure fell to 68.5 per cent in 1971, 64.7 in 1981 and rose marginally to 65.1 in 1991.

According to the 1951 Census report, there were 6,50,698 cultivators (38.5% of the total population) who themselves owned the land; 1,42,306 tenants (9%); 2,85,227 (18.1%) agricultural labourers and 55,081(3.5%) land lords, who did not themselves cultivate the land. The total number of persons engaged in agriculture was 10,88,312 (69.1%). In 1961, cultivators constituted 3,69,174 and agricultural labourers numbered 2,30,285. Out of 8,31,478 total main workers (those who have worked for a major part of the year *i.e.,* not less than 183 days) in 1971; 2,49,756 persons were cultivators and agricultural labourers formed 3,20,187 while the remaining belonged to other occupations. The number of cultivators living in rural areas was 2,26,665 and the number of agricultural labourers was 2,81,430. According to the census of 1981, out of the total workers (11,18,666); 3,48,038 persons were cultivators and 4,29,349 persons were agricultural labourers. Out of the cultivators, 2,97,631 persons were males. Of the total of 4,29,349 farm labourers 2,27,187 were males. According to census Report of 1991; 9,75,260 persons out of the total workers of 13,49,492 lived in rural areas. Out of them 6,48,748 were males. Out of the total cultivators (4,05,028); 3,66,377 persons lived in rural areas, of which 2,93,027 were males and 31,874 were females. Out of the total agricultural labourers (5,27,619), 4,64,757 persons belonged to rural areas, of which 2,33,011 were males and 2,31,746 were females. The total number of workers engaged in Animal Husbandry, Forestry, Fisheries and Plantations was 18,445. Of them, 13,186 persons belonged to rural areas and 12,131 persons were males. The percentage of main workers to total workers is given in the table below.

Details of Cultivators and Agricultural workers
(in percentage terms to the main workers in 1981 and 1991).

		Cultivators		Agricultural labourers	
		1981	1991	1981	1991
District Total	Males	36.30	34.18	27.77	28.19
	Females	16.87	20.26	66.66	64.89
	Total	31.11	30.04	38.38	39.10
Rural Area	Males	47.66	45.33	34.85	35.96
	Females	19.35	22.58	73.84	70.70
	Total	39.20	37.65	46.49	47.69
Urban Area	Males	11.96	10.40	12.42	11.62
	Females	7.12	9.60	43.40	38.27
	Total	11.05	10.25	18.26	16.73

Out of the total female main workers it can be observed that more than 70% them were agricultural labourers. The talukwise details of rural agricultural labourers are given in Table 4.1. The percentage of agricultural workers out of the total workers has decreased from 72.71 in 1961 to 68.55 in 1971 and 66.81 in 1981. It rose marginally to 69.09 in 1991. The percentage of urban workers to total population was 34.73 in 1961; 30.35 in 1971. It rose to 32.41 in 1981 and 30.61 in 1991.

Table 4.1 : Talukwise details of Agricultural workers – Rural Area – 1991.

Sl.No	Taluk	Rural Population	Cultivators	Agricultural labourers	Forest Animal Husbandry & Plantation workers
1.	Byadgi	91,361	15,605	20,647	399
2.	Dharwad	1,78,358	30,989	34,037	1,043
3.	Gadag	1,40,093	19,909	27,106	1,112
4.	Hangal	1,83,502	29,429	35,469	628
5.	Haveri	1,75,181	23,904	39,718	1,442
6.	Hirekerur	1,91,956	31,302	29,084	701
7.	Hubli	1,13,085	18,478	23,304	585
8.	Kalgatgi	1,21,248	27,052	17,727	743
9.	Kundagol	1,23,241	20,705	30,381	204
10.	Mundargi	85,252	15,144	18,801	715
11.	Nargund	56,747	13,022	10,818	357
12.	Navalgund	1,16,794	23,982	23,510	705
13.	Ranibennur	2,01,823	25,081	38,185	1,469
14.	Ron	1,63,081	23,768	36,877	912
15.	Savanur	93,935	12,432	22,554	659
16.	Shiggaon	1,27,690	19,081	27,810	602
17.	Shirhatti	1,15,912	16,494	28,729	910
	Total	22,79,259	3,66,377	4,64,757	13,186

The Cultivators were concentrated in large numbers in Hirekerur, Dharwad, Hangal, Kalghatgi and Ranibennur taluks. While agricultural labourers were found in large numbers in Ranibennur, Ron, Hangal, Dharwad, Kundgol, Hirekerur, Shirhatti and Shiggaon taluks.

Agricultural Land Holdings

The details of agricultural land holdings as per agricultural census reports in the district are given in the statement on page number 232.

Year of Agricultural census	No. of land holdings (in lakhs)	Percentage of the district out of the State Total	Area of the land holdings (in lakh ha.)	Percentage of the district out of the State Total	Average size of land holdings (in ha.)
1955-56	2.55	10.34	11.05	10.19	4.34
1970-71	2.68	7.5	11.29	9.9	4.20
1976-77	2.76	7.2	10.90	9.6	3.95
1980-81	2.92	6.8	10.51	9.0	3.60
1985-86	3.53	7.2	11.11	9.4	3.14
1990-91	3.92	6.8	11.36	9.2	2.90

In 1947-48, 1,66,171 persons held a total of 76,97,218 ha *Khalsa* and *Inam* land holdings of which 1,07,603 were own cultivators having ownership of 5,14,429 ha of land, 9,321 persons who were only supervising cultivation had 49,517 ha of land ownership and 49,247 persons who neither cultivated nor supervised held ownership of 2,06,151 ha. of land area. 72,035 persons had less than two hectares of land, 60,489 persons had holdings ranging from two to six hectares and the remaining had more than six hectares of land holdings. The average size of land holding was 4.6 hectares. In 1955-56 there were 2,54,950 land holdings in the district with a total area of 11,05,245 ha. The average size of land holding was 4.34 hectares. In most of the taluks the average area of land holding was less. When the families got separated, the land holdings were scattered in the villages, some were spread in two taluks and some others were spread over two districts. In 1955-56 the number of land holdings less than two hectares was 1,13,600, their area was 1,12,185 hectares. The number of land holdings between 2-4 ha was 60,600 and the corresponding area was 1,73,340 ha. The number of land holdings between 4-6 ha was 29,800; its extent was 1,49,040 ha; The number of land holdings between 6-12 ha, were 34,300, its relative extent was 2,90,385 ha. It is to be noted that there were 12,900 holdings of the extent between 12-24 ha and its corresponding area was 2,11,815 ha. There were 2,600 holdings of an extent of 20-40 ha; accounting to 80,595 ha. There were fewer landholdings of higher extents. While there were 900 holdings of 40 to 80 ha extending to an area of 49,815 ha, there were only 250 holdings, comprising of each holding ranging over 80 ha of land and the corresponding total area was 38,070 ha.

The district has witnessed a gradual increase in the number of land owners from one Agricultural census to the other, while compared to the 1970-71 census, the 1990-91 census revealed the fact of phenomenal increase in the number by as much as 46 per cent. However in contrast the increase in the area as per the 1991 census vis-a-vis the 1970-71 census is just of the order of 0.6 per cent only. All the census figures have thrown upon an interesting picture in the district, indicating that while the average land holding is consistently getting reduced, the average extent of the land holdings in the district has grown larger than the average area of the land holdings at the State level. According to the Agricultural census in 1990-91, out of the 3.92 lakh land owners, there were 24,000 Scheduled Caste, 15,000 Scheduled Tribes and others constituted 3.54 lakh. Their corresponding area of land holding being 47,000 ha; 34,000 ha. and 10.54 lakh hectares respectively. The average size of land holding was 1.99; 2.30 and 2.98 hectares respectively.

The average size of various land holdings in the district is as follows:

(Figures in hectares)

Sl.No.	Categories of Holding	1980-81	1985-86	1990-91
1.	Very Small (< 1 ha)	0.58	0.58	0.58
2.	Small (1-2 ha)	1.50	1.50	1.50
3.	Semi-Medium (2-4 ha)	2.83	2.80	2.70
4.	Medium (4-10 ha)	6.13	6.05	5.98
5.	Large (> 10 ha)	14.14	14.37	14.22

In 1990-91 there were 3,91,000 individual holdings in the district and it was 99.7 per cent of the total holdings. The number of holdings belonging to joint holdings and Institutional holdings was one thousand (0.2%) and less than one thousand (0.1%) respectively. Their total area was 11.92 lakh ha (99.5%), two thousand ha (0.2%) and four thousand ha (0.3%) respectively. The categorywise details of 1985-86 and 1990-91 Agricultural Census are given in the ensuing table 4.2

Table 4.2 : Distribution of number and area of operational holdings according to Social groups for major size classes 1985-86 and 1990-91

(Area in hectares)

Sl No		Land holdings					
		Marginal	Small	Semi Medium	Medium	Large	Total
1	2	3	4	5	6	7	8
1. Scheduled Caste							
1	No. of land holdings						
	1. 1985-86	4,460	6,998	4,493	1,587	160	17,698
	2. 1990-91	5,927	9,560	5,944	1,880	195	23,506
2	Area of land holdings (ha)						
	1. 1985-86	2,489	10,236	11,969	9,103	2,069	35,866
	2. 1990-91	3,267	14,005	15,728	10,866	2,957	46,823
3	Average size of land holdings (ha)						
	1. 1985-86	0.56	1.46	2.66	5.74	12.93	2.03
	2. 1990-91	0.55	1.46	2.65	5.78	15.16	1.99
II	**Scheduled Tribes**						
1	No. of land holdings						
	1. 1985-86	1,427	2,871	2,341	1,302	218	8,159
	2. 1990-91	3,336	5,564	4,121	1,725	191	14,937
2	Area of land holdings (ha)						
	1. 1985-86	840	4,334	6,533	7,697	2,965	22,369

1	2	3	4	5	6	7	8
	2. 1990-91	1,827	8,235	11,383	10,134	2,705	34,284
3	Average size of land holdings (ha)						
	1. 1985-86	0.59	1.51	2.79	5.91	13.60	2.74
	2. 1990-91	0.55	1.48	2.76	5.87	14.16	2.30
III	**Others**						
1	No. of land holdings						
	1. 1985-86	46,786	1,02,304	98,489	66,511	13,355	3,27,445
	2. 1990-91	51,065	1,20,312	1,07,459	63,253	11,656	3,53,745
2	Area of land holdings (ha)						
	1. 1985-86	27,280	1,53,418	2,76,310	4,03,091	1,92,368	10,52,467
	2. 1990-91	29,841	1,80,879	2,99,190	3,78,957	1,65,547	10,54,414
3	Average size of land holdings (ha)						
	1. 1985-86	0.58	1.50	2.81	6.06	14.40	3.21
	2. 1990-91	0.58	1.50	2.78	5.99	14.20	2.98
IV	**Total**						
1	No. of land holdings						
	1. 1985-86	52,673	1,12,173	1,05,323	69,400	13,733	3,53,302
	2. 1990-91	60,328	1,35,436	1,17,524	66,858	12,042	3,92,188
2	Area of land holdings (ha)						
	1. 1985-86	30,609	1,67,988	2,94,812	4,19,891	1,97,402	11,10,702
	2. 1990-91	34,935	2,03,119	3,26,301	3,99,957	1,71,209	11,35,521
3	Average size of land holdings (ha)						
	1. 1985-86	0.58	1.50	2.80	6.05	14.37	3.14
	2. 1990-91	0.58	1.50	2.76	5.98	14.22	2.90

Source: Agricultural Census Report, 1990-91, Part I, D.E.S. 34 of 1993
Commissioner of State Agricultural Census, Bangalore – 1993

Land Utilization

The total geographical area in the district was 11,95,980 ha in 1880-81, 11,95,883 ha in 1947-48; 13,80,686 ha in 1949-50 and 13,78,304 ha in 1950-51. The merger of minor principalities into unified Mysore State led to the increase in the area of the district from 12,023 sq km (1881) to 13,687 sq km (1951). According to village records, the total geographical area of the district was 13,78,304 ha in 1950-51. Out of this, the land available for cultivation was 11,27,246 ha; Forest area 1,09,050 ha; barren land 34,892 ha; pastures and grazing lands 40,398 ha and land used for non-agricultural purpose 40,699 ha. In 1955-56, according to village records, the total geographical area of the district was 13,77,100 ha, out of which forest area constituted 1,11,800 ha; land not available for cultivation amounted to 64,100 ha; land meant for non-agricultural purposes 7,000 ha; barren land 57,100 ha; other lands not cultivated 58,600 ha; permanent pastures 34,000 ha; Trees and groves 4,400 ha; barren land not fit for cultivation 20,200 ha; current fallow land 7,400 ha; other fallow land 32,100 ha, total fallow land 39,500 ha; net area sown 11,03,100 ha and gross area sown 11,26,600 ha. The details of land utilization from 1955-56 to 1991-92 according to annual season and crop reports are given in Table 4.4.

Table 4.3 : Taluk-wise distribution of number and area of operational holdings according to major size classes - 1985-86

(No. of holdings in 1000s
Area in thousand Hectares)

Sl. No.	Taluk	Marginal Less than 1 ha		Small (1-2 ha)		Semi Medium (2-4 ha)		Medium (4-10 ha)		Large (More than 10 ha)		Total	
		No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1.	Byadgi	2.8	1.5	5.4	8.0	4.4	12.0	1.9	10.7	0.2	2.6	14.6	34.5
2.	Dharwad	4.1	2.5	6.4	9.5	6.3	17.6	4.7	28.7	1.0	14.9	22.5	73.2
3.	Gadag	2.2	1.3	8.4	12.8	8.5	23.7	5.9	36.2	1.5	21.2	26.3	95.2
4.	Hangal	6.7	4.0	8.1	11.8	6.0	16.8	3.2	18.7	0.4	5.2	24.4	56.6
5.	Haveri	2.9	1.6	7.1	10.6	6.6	18.3	4.0	34.2	0.9	15.4	21.5	70.1
6.	Hirekerur	6.6	3.5	9.3	13.7	7.1	19.8	3.5	20.1	0.3	4.3	26.9	61.4
7.	Hubli	2.6	1.6	4.9	7.4	5.1	14.7	4.3	26.6	0.9	13.5	17.9	63.6
8.	Kalghatgi	3.2	1.9	4.6	6.8	4.6	12.8	2.7	15.8	0.4	5.2	15.4	42.5
9.	Kundgol	1.9	1.2	5.1	7.7	4.9	13.8	4.0	24.5	1.0	14.4	16.9	61.6
10.	Mundargi	1.5	0.9	6.0	9.1	6.0	17.0	4.3	25.9	0.9	12.1	18.6	65.0
11.	Nargund	1.5	1.0	3.9	5.9	3.8	10.6	2.9	19.5	0.4	5.8	12.2	40.9
12.	Navalgund	1.5	0.9	6.0	9.3	7.2	20.8	6.9	42.9	1.9	27.2	23.6	101.2
13.	Ranibennur	3.9	2.0	8.9	13.3	8.0	21.9	3.9	22.9	0.5	7.0	25.1	67.1
14.	Ron	4.6	2.8	11.4	17.3	10.9	30.5	7.0	42.3	1.4	19.2	35.3	112.0
15.	Savanur	1.7	0.9	5.0	7.5	4.5	12.6	2.8	16.7	0.5	7.2	14.5	44.8
16.	Shiggaon	2.9	1.7	5.2	7.6	4.4	12.0	2.5	14.8	0.5	6.7	13.8	43.0
17.	Shirhatti	2.2	1.2	6.4	9.7	7.1	20.0	5.2	31.3	11.1	15.5	21.9	77.7
	District Total	**52.7**	**30.6**	**112.2**	**168.0**	**105.3**	**294.9**	**69.4**	**419.9**	**13.7**	**197.4**	**353.3**	**1,110.4**

Table 4.4 : Details of Land utilization according to annual season and crop reports in Dharwad district

(Area in thousand Hectares)

Sl. No.	Particulars	1955-56	1965-66	1979-80	1988-89	1990-91	1991-92
1.	Total Geographical area						
1.1	According to Survey Department	1,376.8	1,376.9	1,378.0	1,378	1,378	1,378
1.2	According to village records	1,377.1	1,376.9	1,378.0	1,378	1,378	1,378
2.	Forest Area	111.8	110.9	113.0	115	115	115
3.	Land not available for cultivation						
3.1.	Barren and uncultivable land	57.1	57.9	31.1	22	22	21
3.2.	Land under non-agricultural use	7.0	12.3	28.9	61	61	63
4.	Land not available for cultivation other than fallow land:						
4.1.	Permanent pastures and other grazing lands	34.0	26.5	36.9	19	19	19
4.2.	Miscellaneous trees, crops and groves not included in the net sown area	4.4	9.6	4.2	2	2	2
4.3.	Cultivable Waste land	20.2	7.4	9.7	7	7	7
5.	Fallow Land						
5.1.	Current fallow land	7.4	23.5	21.3	101	169	37
5.2.	Other fallow land	32.1	20.4	11.5	11	11	11
6.	Net area sown	1,103.1	1,108.4	1,121.5	1,040	972	1,103
7.	Area sown more than once	23.5	30.2	26.7	141	156	276
8.	Total cropped area	1,126.6	1,138.6	1,148.2	1,181	1,128	1,379

During the year 1990-91 the total geographical area of the district was 13.78 lakh ha out of which forest area constituted 1.15 lakh ha (8.3%). The land not available for cultivation comprised 0.83 lakh ha (6.9%), land not cultivated other than the follow land amounted to 0.28 lakh ha (2.3%) and fallow land formed 0.9 lakh ha (7.1%) . The land available for cultivation in the district formed 11.59 lakh ha out of which 9.72 lakh ha was sown. The area sown more than once included 1.56 lakh ha. According to the report of 1991-92, the forest area in the district included 1,15,303 ha; land not available for cultivation comprised 84,081 ha; other fallow land not cultivated formed 27,797 ha; fallow land contained 48,242 ha; Net sown area comprised 11,02,777 ha and area sown more than once formed 2,76,161 ha. Talukwise *Net Area Sown* (ha) is as follows: - Byadgi – 30,521, Dharwad – 79,365, Gadag-1, 04,494, Hangal – 48,678, Kalghatgi – 40,648, Kundgol – 61,104, Mundargi – 57,428, Nargund – 41,387, Navalgund – 1,04,831, Ranibennur – 66,822, Ron – 1,16,980, Savanur – 48,924, Shiggoan- 43,814 and Shirhatti – 73,863.

Based on *the annual season and crop report* in the district, the talukwise details of land utilization are given in tables from 4.5 to 4.7.

SOILS

The soils of Dharwad district may be generally classified into black soil, red soil and laterite soils.

Black Soil: The greater part of Dharwad district (about 11.9 lakh ha) is covered by black soil. Black soil is found in the *maidan* area of Navalgund, Ron, Gadag, eastern portion of Hubli taluk, western portion of Shirhatti taluk, eastern portion of Kundgol Taluk, northern portion of Mundargi and Nargund taluks. The medium black soil is formed by the Deccan volcanic rock, schist and limestone. This type of soil can be seen in areas where there are granite, feldspar, mica and schist rocks with granite. The deep black soil is formed by the Deccan Volcanic rock, schist, lime stone etc. This type of soil can be seen in areas where there are granite, feldspar, mica and schist rocks with granite. The deep black soil is formed by gneiss rock, schist and mixture of schist and gneissic rock. Normally this soil is made of natural erosion and mostly found in river valleys. These soils are found with Brown mixed black colour, black and brown mixed grey colour, pure black colour and pure brown colour. Deep black soil types can be seen in places like western parts of Hubli, eastern parts of Dharwad, eastern parts of Shiggaon, southern and eastern parts of Hirekerur and in the taluks of the Haveri and Ranibennur in Dharwad district. In Dharwad district black soil is called as *Ere* soil and the brown soil as *Hulakeri* soil. These soils are known to be fertile soils.

Medium black soils are medium in depth, and are of deep, brown mixed black colour soils. These soils contain lime stone mixed clay. On high elevation, these soils are 180-210 cm deep. Powdering basic materials, lime crystals and in all the portions of soils profile it contains loose calcium carbonate in various proportions of dissoluble salts. For the black colour of the soil probably humus or the plant portions that has given into the soil and decomposed and the residual black or brown coloured shapeless bursting material may be the cause. In black soil, the clay factor is more than the red soil. The clay in the black soil contains montmorrillonite mineral. This clay is more sticky, the pH of this soil ranges from 7 to 8.5. In alkaline condition it goes upto 10 . In this soil calcium, magnesium and potassium are found at satisfactory levels. The ion exchange capacity of black soil is twice that of red soil. When black soil absorbs water, it expands and contracts when dry. When there is no moisture this contraction will be excessive. Therefore. during the summer, deep crevices can be seen in this soil. The top soil gets into these crevices. As the soil becomes topsy-turvy the fertility will not be lost.

Table 4.5 : Taluk-wise details of Land utilization for 1990-91 (According to Annual Season and Crop Reports)

(Area in hundred hectares)

Sl.	Taluk	Geographical area according to village records	Forest	Land not available for cultivation		Other fallow land			Fallow La nd		Area Sown	
				Land used for non-agricultural purposes	Barren and uncultivable land	Cultivable Waste land	Permanent pasture	Trees and Groves	Current	Other	Net	More than once
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Byadgi	437	49	20	5	3	12	-	42	14	303	122
2.	Dharwad	1,118	136	67	16	21	19	-	5	15	840	188
3.	Gadag	1,098	17	6	13	3	11	2	417	1	616	43
4.	Hangal	775	85	65	19	7	21	13	37	8	521	52
5.	Haveri	800	38	50	5	12	19	-	37	5	633	140
6.	Hirekerur	807	89	61	7	-	27	3	30	33	557	213
7.	Hubli	737	20	49	10	1	6	-	12	1	637	86
8.	Kalghatgi	688	195	37	10	8	7	-	9	5	417	32
9.	Kundgol	649	1	14	7	2	3	1	14	-	608	51
10.	Mundargi	884	176	30	14	2	3	-	267	10	382	20
11.	Nargund	436	-	14	7	-	1	-	62	-	352	12
12.	Navalgund	1,082	-	27	6	1	-	-	241	-	807	83
13.	Ranibennur	905	106	58	8	8	24	1	80	6	616	52
14.	Ron	1,291	3	23	51	4	4	-	400	-	806	187
15.	Savanur	539	8	25	6	-	7	2	8	-	482	151
16.	Shiggaon	589	100	33	7	3	14	-	12	-	419	21
17.	Shirhatti	949	129	29	31	2	8	1	17	6	727	109
		13,782	**1,152**	**608**	**223**	**74**	**186**	**23**	**1,692**	**104**	**9,721**	**1,563**

NB : As the total figures of the taluks are given in hundred hectares, it will not tally with the district total

Table 4.6 : Details of Talukwise Land Utilization of the Geographical area and Crop intensity (1990-91)

(Area in hectares)

Sl.No.	Taluk	Forest area	Land not available for cultivation	Other fallow land not cultivated	Fallow Land	Net area Sown	Area sown more than once	Total area sown	Crop intensity (%)
1.	Byadgi	4,889	2,536	1,588	5,563	30,280	12,199	42,479	140.20
2.	Dharwad	13,554	8,279	3,984	2,025	83,946	18,946	1,02,715	122.36
3.	Gadag	1,749	1,895	1,513	41,775	61,619	4,346	65,965	107.05
4.	Hangal	8,474	8,364	4,138	4,498	52,051	5,240	57,291	110.07
5.	Haveri	3,849	5,461	3,118	4,221	63,336	13,999	77,335	122.10
6.	Hirekerur	8,876	6,856	2,999	6,279	55,684	21,283	76,967	138.22
7.	Hubli	2,033	5,939	732	1,431	63,662	8,586	72,248	113.49
8.	Kalghatgi	19,526	4,634	1,494	1,408	41,695	3,230	44,925	107.75
9.	Kundgol	-	2,066	584	1,435	60,774	5,119	65,893	108.42
10.	Mundargi	17,646	4,411	445	27,685	38,211	1,992	40,203	105.21
11.	Nargund	-	2,117	58	6,210	35,177	1,230	36,407	103.50
12.	Navalgund	-	3,318	69	24,131	80,700	8,343	89,043	110.34
13.	Ranibennur	10,614	6,605	3,066	8,591	61,599	5,162	66,761	108.30
14.	Ron	276	7,421	806	39,994	80,594	18,692	99,286	123.19
15.	Savanur	801	3,167	895	859	48,179	15,125	63,304	131.39
16.	Shiggaon	9,951	4,048	1,780	1,224	41,917	2,100	44,017	105.01
17.	Shirhatti	12,943	5,997	1,015	2,305	72,653	10,854	83,507	115.94
		1,15,181	83,114	28,284	1,79,634	9,72,077	1,56,446	11,28,346	116.06

Table 4.7 : Talukwise details on land fit for cultivation out of geographical area - 1991-92

(Area in hectares)

Sl.No.	Taluk	Geographical Area	Net Area sown	Percentage of net area sown in relation to total geographical area	Total area sown	Area sown more than once	Percentage of area sown more than once out of the net area sown	Fallow land	Net Culti-vable land fit for cultivation	Percentage of land fit for cultivation out of total geographical area
1.	Byadgi	43,656	30,280	69.36	42,476	12,199	40.29	5,563	35,843	82.10
2.	Dharwad	1,11,788	83,946	75.09	1,02,715	18,769	22.36	2,025	85,971	76.91
3.	Gadag	1,09,751	61,619	56.14	65,965	4,346	7.05	41,775	1,03,394	94.21
4.	Hangal	77,525	52,051	67.14	57,291	5,240	10.07	4,498	56,549	72.94
5.	Haveri	79,985	63,336	79.18	77,335	13,999	22.10	4,221	67,557	84.46
6.	Hirekerur	80,694	55,684	69.01	76,967	21,283	38.22	6,279	61,963	76.79
7.	Hubli	73,707	63,662	86.37	72,248	8,586	13.49	1,431	65,093	88.31
8.	Kalghatgi	68,757	41,695	60.64	44,925	3,230	7.75	1,408	43,103	62.29
9.	Kundgol	64,859	60,774	93.70	65,893	5,119	8.42	1,435	62,209	95.91
10.	Mundargi	88,398	39,211	43.23	40,203	1,992	5.21	27,685	65,896	74.54
11.	Nargund	43,562	35,177	80.75	36,407	1,230	3.50	6,210	41,387	95.01
12.	Navalgund	1,08,218	80,700	74.57	89,043	8,343	10.34	24,131	1,04,831	96.87
13.	Ranibennur	90,475	61,599	68.08	66,761	5,162	8.38	8,591	70,190	77.58
14.	Ron	1,29,091	80,594	62.43	99,286	18,692	23.19	39,994	1,20,588	93.41
15.	Savanur	53,901	48,179	89.38	63,304	15,125	31.39	859	49,035	90.98
16.	Shiggaon	58,920	41,917	71.14	44,017	2,100	5.01	1,224	43,141	73.22
17.	Shirhatti	94,913	72,653	76.65	83,507	10,854	14.94	2,305	74,958	78.98
	District Total	**13,78,200**	**9,73,077**	**70.53**	**11,28,343**	**1,56,269**	**16.08**	**1,79,634**	**11,51,708**	**83.57**

These soils are subject to soil erosion to some extent. As these soils expand and contract, deep crevices are formed and the top soil falls into these crevices and the movement of the soil takes place on its own accord and this is called self-movement or self-covering. Jowar, Wheat, other minor cereals, Cotton, Safflower, Groundnut, Maize, Sesamum, Dry Chillies, Tur, Gram and other pulses grow well in this soil. Under irrigation, Paddy, Sugarcane, Vegetables, Cotton, Tobacco, Plantain etc., are the important crops that are cultivated.

The amount of water soaking/draining in black soil is very less. Due to this factor, major portion of the rain water not only flows out of the land but also the top fertile soil gets washed out. In the black soil where soil conservation methods are not adopted, about 15 to 20% of the annual rainfall flows out of the land. It is found that about 12 to 43 tonnes of soil per hectare is washed away annually due to the water flow in this manner. In dry farming it is important that the major portion of rain water falling on the soil should be drained and it should be ensured that room is made for the excess water to flow out safely in order to grow crops successfully. To achieve this objective, construction of bunds proper management of the soil in between the bunds, and to store the excess water in farm ponds and reuse are some of the soil and water conservation methods recommended.

Red Soil : The sand mixed red soil can be seen in more than 40,000 hectares in the eastern parts of the district and northern portion of Ron, Gadag, Shirhatti and Mundargi taluks of the district. This soil is formed from gneiss rock and granite and granulite stones. This soil has the capacity to drain the water. In rainfed farming Jowar, Cotton, Groundnut, pulses and oil seeds are the important crops. Under irrigation Paddy, Sugarcane, Cotton, Groundnut, Chillies and vegetables are the chief crops. The red mixed black soil is generally found in undulated places and gneiss rock or schist areas in the district. There are places where red and black soils are found side by side. The black soils are found in low lying area and the red soil in elevated areas.

Laterite Soil: Laterite soil is found in hilly areas where undulated rocks are found with gneiss rock and in plain (*Maidan*) areas. On the western side of Dharwad district, this type of soil is found. The laterite soil is formed due to excessive rain and excessive temperature and the main elements are drained due to these factors and silica, iron and aluminium oxide have more influence on the soil. The laterite soil of *Malnad* is recently formed and so the layers of the soil can be seen evenly to a greater depth. These are found to be yellow mixed red to black mixed red colour. The main crops are Paddy, Sugarcane, Coconut, Plantain, Areca, Cardamom, Cashew and Pepper.

Soil Health Centre, Gadag: In the Soil Health Centre, Gadag,soil samples are analysed and recommendations are made about the application of correct quantity of fertilisers to the crops. The details of water and soil samples analysed recently in this centre are as follows : 1982-83 : 113 and 30,010; 1984-85 : 62 and 30,013; 1986-87 : 50 and 25,486; 1988-89 : 143 and 28,408; 1989-90 : 447 and 28,013; 1990-91 : 207 and 30,720 and 1991-92 : 213 and 22,723. (The first figure refers to water samples and the second to soil).

The soil samples are analysed in this centre and technical guidance is given as to the quantity of fertilisers to be applied, the soil minerals required and the fertility (pH) level that is essential for the crops are also provided. The items analysed in the soil samples at this centre are, pH, organic carbon, sulphur, nitrogen and potash. In addition to this, electrical conductivity will also be determined which will be helpful to know the alkaline content in that soil. Based on these factors the quantity of gypsum, salt or calcium to be added to the soil will be determined depending on the crops grown.

In addition to this the quantity of plant nutrients to be provided for each crop to be grown are given. On the basis of the results of soil testing, separate talukwise maps are prepared for the rainfed and irrigated areas. Information concerning the crops grown in the area, their yield level, relation between the crops and soils of the respective areas are collected.

If the soil is alkaline or saline, the growth of the plants will be stunted. To reduce alkaline content, the area is to be divided into small plots and bunds are to be constructed so that water can stagnate. By frequently making the water to stagnate in those plots, the alkaline content can be reduced by draining. In saline soils, gypsum salt is added and exchangeable sodium is reduced and thus the soil can be corrected. By applying farm yard manure to the soil or by growing a green manure crop like *Diancha*, the saline soil can be corrected quickly. In the soils receiving heavy rainfall the acid content will be more. The soil can be corrected by adding calcium oxide and calcium carbonate to the acid soils. The quantity of gypsum and calcium required per hectare will be determined on the basis of soil test results.

Cropping Pattern: The area under various types of crops grown(in hundred hectares) in the district are as follows:

Sl.No.	Particulars	1955-56	1966-67	1979-80	1983-84	1988-89
1.	Cereals	5,323	5,433	5,122	5,203	4,265
2.	Pulses	1,282	1,238	1,111	1,305	1,503
3.	Total food crops	6,605	7,085	7,137	7,537	7,124
4.	Oilseed crops	1,188	1,722	1,550	1,930	2,447
5.	Total non-food crops	NA	4,436	4,347	4,307	4,683
6.	Total cropped area	11,266	11,522	11,484	11,844	11,807

The area covered by cereals (Jowar, Paddy, Wheat, Maize, etc.) was 5.32 lakhs ha in 1955-56 and it rose to 5.35 lakh ha in 1991-92. The area sown under pulses (Gram, Tur, Horsegram, Blackgram, Green Gram, *Avare* etc.) which was 1.28 lakh hectares (1955-56), reached 1.68 lakh hectares in 1991-92. The total area of the food crops was 6.6 lakh ha in 1955-56 and it has risen to 8.68 lakh hectares in 1991-92. The area under non-food crops has gone up from 4.43 lakh ha (1966-67) to 4.93 lakh ha in (1991-92). The area of Groundnut crop has risen from 0.89 lakh hectares (1955-56) to 1.68 lakh hectares (1991-92). The Sunflower crop was grown in 81 thousand hectares (1991-92). It is newly introduced crop from 1980. The area of Cotton crop has gone down from 2.73 lakh hectares. (1955-56) to 1.96 lakh hectares; The area of Sugarcane crop has gone up from 900 hectares to 6,000 hectares. Though the hectare-wise yield of cotton has gone up due to the introduction of new varieties like *varalaxmi* etc., the area sown under Cotton has come down substantially.

The details of area (ha) and production (tonnes) of various crops grown in 1955-56 are as follows : Paddy, 83,452 (82,950), Jowar – 2,88,620 (1,03,852), Ragi – 11,279 (11,469) Maize -,17 (11), Bajra – 3,700 (946), Wheat – 1,04,094, (23,268), minor Cereals – 41,133 (11,342), Total Cereals – 5,32,307 (2,34,148) Tur- 22,820 (7,444) Gram- 19,068 (5,749),Other Pulses – 86,812,(33,947), Total Pulses 1,28,187 (46,690), Groundnut-89,812, (1,17,477), Sesame – 6,906 (1,262), Safflower 13,911 (1,860). Total Oilseeds 1,18,763 (1,22,435), Cotton 2,72,660 (50,934) Bales(bale of 180 kg. weight) and Sugarcane – 888 (55,730).

Jowar, Paddy, Wheat and Maize crops are the main cereals. Out of the pulses Gram, Tur, Horsegram, Blackgram and Greengram are important crops. Groundnut, Sunflower, Safflower and Sesamum are important pulse crops among the oilseeds. According to *the annual seasonal and crop report* of 1990-91, different crops were grown in a total of 11.28 lakh hectares in the district. Out of the total area sown in the district, food crops were grown in 7.27 lakh ha (64.45%) and other non-food crops were grown in 4.01 lakh ha (35.55%). Out of the total area under cereals (4.39 lakh ha) Paddy was grown in 0.82 lakh ha (18.68%), Jowar in 2.33 lakh ha (52.86%), Bajra in 0.02 lakh ha (0.46%), Maize in 0.28 lakh ha (6.38%), Ragi in 0.12 lakh ha (2.73%), Wheat in 0.55 lakh ha (12.53%), Navane in 0.10 lakh ha (2.28%) and *Save* 0.18 lakh ha (4.10%). Out of the pulses, Gram was grown in 0.35 lakh ha, Tur in 0.16 lakh ha, Horsegram in 0.20 lakh ha, Blackgram in 0.02 lakh ha, Greengram in 0.33 lakh ha, Avare in 0.02 lakh ha and other pulses in 0.12 lakh ha. Among the Oil seed crops, Groundnut the main crop was grown in 1.35 lakh; Sunflower in 0.45 lakh ha, Safflower in 0.17 lakh ha, Sesamum in 0.16 lakh ha, Other oilseeds in 0.04 lakh ha, and Dry Chillies in 0.82 lakh ha; Cotton in 1.71 lakh ha, and Sugarcane crop is grown in 0.06 lakh hectares.

The details of the area, production and yield per hectare of the principal crops in the district for the year 1991-92 are given in table 4.8 and the area and production of the principal crops from 1960 to 1990 are given in table 4.9 and the talukwise area of the principal crops for the year 1992-93 is given in table 4.10

Table 4.8 : Fully Revised Estimates of Area (ha), Production (tonnes) and average yield (Kg/ha) of principal crops in Dharwad district for 1992-93

Sl.No.	Name of the crop	Season	Area in Hectares	Production in tonnes	Yield Kg/ha
1	2	3	4	5	6
1.	Paddy	Kharif	83,148	1,70,703	2,154
		Summer	2,311	10,009	4,559
		Total	86,459	1,80,712	2,219
		Irrigated	33,554	89,047	2,794
2.	Jowar	Kharif	1,27,290	1,68,099	1,390
		Rabi	1,50,552	84,162	588
		Summer	178	296	1,750
		Total	2,78,020	2,52,557	956
3.	Bajra	Total	2,032	834	432
4.	Maize	Kharif	35,620	98,578	2,913
		Rabi	666	2,013	3,182
		Summer	133	372	2,944
		Total	36,419	1,00,963	2,918
		Irrigated	22,911	71,623	3,291
5.	Ragi	Kharif	11,183	9,204	866
6.	Navane	Kharif	8,888	4,602	545
7.	Save	Kharif	18,716	19,380	1,090
8.	Total minor millets	Total	27,604	23,982	915

1	2	3	4	5	6
9.	Wheat	Rabi	75,747	44,280	615
10.	Total Cereals	Kharif	2,87,147	4,15,556	1,584
		Rabi	2,26,965	1,30,455	605
		Summer	2,622	7,345	2,949
		Total	5,16,734	5,53,356	1,125
		Irrigated	81,404	1,69,825	2,196
11.	Tur	Kharif	20,017	11,961	629
12.	Horsegram	Kharif	7,491	4,177	587
13.	Blackgram	Kharif	1,121	649	609
14.	Greengram	Kharif	1,07,155	36,683	380
15.	Avare	Kharif	1,170	236	202
16.	Other Pulses	Kharif	9,891	1,889	191
17.	Total pulses	Kharif	1,46,845	57,895	413
18.	Bengalgram	Rabi	45,637	19,250	444
19.	Horsegram	Rabi	12,617	3,824	319
20.	Total Pulses	Rabi	65,289	24,339	392
21.	Total Pulses	Kharif and Rabi	2,12,134	81,934	407
22.	Total food grains	Annual	7,28,868	6,34,290	916
23.	Groundnut	Annual	1,59,485	1,23,497	815
		Irrigated	23,073	36,930	1,685
24.	Gingelly	Annual	18,451	5,276	301
25.	Niger	Annual	2,906	706	243
26.	Safflower	Annual	732	716	1,030
27.	Castor	Annual	24,463	16,942	729
28.	Sunflower	Annual	90,898	39,723	460
29.	Total oil seeds	Annual	2,99,137	1,87,650	660
30.	Sugarcane	Annual	5,567	4,32,092	80
31.	Tobaco	Annual	232	226	1,027
32.	Cotton	Annual	1,97,615	2,60,026	235
		Irrigated	26,873	48,205	321

Paddy : Paddy is one of the chief food crops of this district. This crop was found to be spread in an extent of 85,700 ha of land with an annual production of 1.8 lakh tonnes. In respect of area the district ranked fifth in the year 1991-92 and sixth in production at the state level (4.27%). The yield per hectare was 22 quintals, which was less than the State average yield (35 quintals). Paddy was grown in about 33,554 hectares under irrigation and the yield per hectare worked out to 28 quintals, it was less-than the State average yield by 12 quintals, Jaya, Mandya vijaya varieties were recommended for the Kharif season. For the late Rabi season *I.R. 20, Mandya Vani, Pushpa* and *Karna* varieties were recommended and for the summer season, *Madhu, Rashi, Mangala* and *Jyoti* varieties were recommended. In some parts of the district, paddy is grown in rainfed condition in an area of about 52,000 hectares and the yield got was less than the State average by about seven quintals. For cultivating drill sown crops *Jaya* and *Abhilash* varieties in respect of low lying areas, *Avinash* variety for normal land, *Rashi* variety for high lands respectively were the recommended varieties. The irrigated crop is

Table 4.9 : Area and Production of Major Foodgrains and Oilseeds Crops and Percentage of Individual Crops to area and production in Dharwad District (1960-1990)

(Area in hectares ; Production in Tonnes)

Sl.No.	Crops	1960-61				1970-71				1980-81				1990-91			
		Area	%	Production	%	Area	%	Production	%	Area	%	Production	%	Area	%	Production	%
1.	Paddy	97,664	18	92,659	29	97,513	19	1,27,109	32	77,751	16	1,24,611	20	81,993	17	52,550	15
2.	Jowar	2,96,712	54	1,78,379	58	2,45,040	47	2,06,339	52	2,41,604	49	2,62,845	55	2,66,895	55	2,06,065	57
3.	Ragi	10,886	2	15,486	5	11,881	2	10,057	3	17,567	4	14,634	3	9,294	2	8,909	2
4.	Bajra	1,527	SQ	225	SQ	1,627	SQ	317	SQ	1,800	SQ	432	SQ	1,827	SQ	743	SQ
5.	Maize	-	-	-	-	206	SQ	685		7,695	2	16,841	4	22,220	5	47,472	13
6.	Wheat	1,10,120	20	22,514	7	1,22,716	23	33,792	8	1,10,724	22	41,014	9	80,729	17	28,057	8
	Total Cereals	5,48,951	100	3,21,677	100	5,23,618	100	3,99,501	100	4,97,813	100	4,78,222	100	4,87,714	100	3,62,091	100
	PULSES																
1.	Tur	21,649	18	7,999	22	16,254	15	9,126	27	18,419	15	5,967	15	19,385	14	5,433	12
2.	Bengalgram	15,688	13	5,930	16	13,803	12	5,389	16	17,427	14	8,559	22	48,647	34	13,402	29
	Total Pulses	1,22,026	100	36,329	100	1,10,923	100	33,839	100	1,25,634	100	38,551	100	1,41,038	100	46,197	100
	OIL SEEDS																
1.	Groundnut	1,29,872	82	48,262	90	1,54,732	87	1,04,647	95	1,12,853	79	68,150	89	1,45,326	62	83,846	69
2.	Sesamum	3,431	2	300	1	3,706	2	1,201	1	7,230	5	1,120	1	9,404	4	3,297	3
3.	Safflower	15,565	10	2,812	5	15,551	9	3,172	3	15,849	11	5,164	7	28,655	12	18,811	16
4.	Sunflower	-	-	-	-	-	-	-	-	2,323	2	561	1	44,465	19	13,560	11
	Total Oilseeds	1,59,076	100	53,892	100	1,78,697	100	1,10,395	100	1,42,570	100	76,345	100	2,32,587	100	1,20,366	00

Source : Trends in Area, yield and production of principal crops during 1960-90 DES.No.92 of 1992

Note: Total Cereals also includes other Cereal Crops. So the total does not tally. Like wise total pulses includes other pulse crops and Total oilseeds includes other oilseed crops.

SQ - Small quantity negligible

Table 4.10 :Talukwise area of principal crops (in hectares) - 1992-93

Sl.No .	Taluk	Paddy	Ragi	Jowar	Wheat	Bengalgram	Tur	Groundnut	Sugarcane	Cotton	Highyielding varieties
1.	Byadgi	4,158	1,660	8,772	22	455	982	1,882	400	7,369	12,472
2.	Dharwad	13,118	81	21,372	8,998	3,621	2,339	12,104	1,454	13,822	11,787
3.	Gadag	139	93	28,555	9,125	7,590	1,222	19,154	20	11,931	5,494
4.	Hangal	26,520	985	4,316	27	252	210	1,912	2,129	6,722	14,898
5.	Haveri	995	866	21,258	405	275	1,994	5,280	689	18,437	12,113
6.	Hirekerur	8,540	4,146	14,718	95	852	2,258	6,005	640	14,293	22,351
7.	Hubli	2,130	73	13,574	6,222	2,182	1,382	8,879	53	16,609	5,503
8.	Kalghatgi	20,678	-	4,401	116	147	346	1,461	163	9,060	10,907
9.	Kundgol	358	248	9,120	6,982	453	557	12,032	5	17,866	1,733
10.	Mundargi	240	-	16,554	2,989	1,650	549	10,826	5	3,512	6,510
11.	Nargund	103	-	10,409	7,459	3,250	121	1,502	40	7,374	15,208
12.	Navalgund	269	-	24,613	23,971	9,003	688	19,648	-	16,166	17,529
13.	Ranibennur	2,107	533	22,692	172	93	817	3,676	67	14,159	18,646
14.	Ron	121	-	37,709	12,194	7,144	1,189	23,702	4	6,623	17,501
15.	Savanur	139	277	15,369	439	103	1,561	9,383	39	14,354	8,280
16.	Shiggaon	9,738	547	8,276	625	165	745	4,254	244	9,175	10,089
17.	Shirhatti	198	22	23,066	1,664	489	899	27,077	5	8,807	9,608
	District Total	89,551	9,551	2,84,774	81,505	37,724	17,859	1,68,777	5,997	1,96,279	2,00,629

Source : Dharwad District at a glance, 1992-93 DES No.63:1993, Dharwad

sown in the months of June-July and the summer crop in January-February *Stem-borer, leaf hopper, paddy gall-midge, case worm, swarming catterpiller, grass hopper, mealy bug, thrips and paddy leaf roller* are the commonly known pests in this region and *blast, bacterial leaf alight and leafspot* disease are the diseases affecting paddy frequently.In the irrigated crop. An yield of 60-70 quintals per hectare can be obtained from short duration varieties and 75-80 quintals of yield can be obtained from medium-duration varieties. An yield of 35-40 quintals per hectare can be expected out of drill sowing. In Hangal (27,354 ha) Kalghatgi (20,186 ha). Dharwad (11,411 ha), Hirekerur (7,989 ha) and Shiggoan taluk (7,909 ha) of the district, Paddy is particularly grown.

Jowar : Jowar is the major crop of the district in addition to being the staple food of the people in the district. In 1991-92, Jowar crop was grown in an area of about 2,78,020 hectares and it is estimated that a total quantity of 2,52,557 tonnes was produced. In area and production, the district has secured the fourth and the first position respectively in the State. In the kharif season, Jowar was grown in 1,27,290 hectares and in Rabi season, it was grown in 1,50,552 hectares. Under irrigation, it was cultivated in 10,175 hectares of land. The average yield per hectare is 922 kg which was above the State average yield (822 Kg). Jowar was specially grown in Ron (35,032 ha), Gadag (27,674 ha), Navalgund (26,964 ha.), Haveri (24,629 ha), Shirhatti (23,354 ha), Ranibennur (21,145 ha), Dharwad (19,614 ha), and Savanur (15,963 ha) in the district. In Khariff season *CSH-1, CSH-5, CSH-6, CSH-9, CSH-10, CSH-11 Shaktiman, CSHV-4* improved variety for irrigated conditions are recommended. For rainfed conditions. *Shaktiman* and *CSV 4* improved variety and *SB 965, SB 1079 and D.S.* improved varieties along with the varieties recommended under irrigation conditions (except *CSH11*) are recommended. For the Rabi hybrid Jowar for irrigated areas *CSH 8R, CSH-5, CSH-12R* varieties and for rainfed Rabi crops *M.35-1, 5-4-1 (Muguti), CSH 12R and Annigeri-1* varieties are recommended.

The quantity of fertilizers will be decided on the basis of the results of soil testing. According to the type of soil and climate, water is provided to the irrigated crop. Especially at the time of sprouting, growth before the earhead appears and at the time of grain formation more water is required. The important pests affecting the Jowar crop are *shootfly, stem borer, earhead bug, earhead fly, shoot bug, Deccan wingless grass hopper and mite.* Among the diseases affecting the crop mention may be made of *grains smut, downy mildew, rust and sugary diseases.* The period between January 15 to June 30th is the ideal time for taking up sowing of Jowar in irrigated areas. The ideal time for sowing Rabi Crop is between September and October. Out of the crops raised by sowing Shaktiman jowar under the irrigated tracks during the kharif season, a yield of 40-50 quintals of grain per hectare and 8-10 tonnes of fodder is expected, while in the dry tracks, the expected yield is 30-38 quintals of grain and 10-15 tonnes of fodder per hectare. During the Rabi season, under the irrigated tracks a production level of 50-60 quintals of grain and 10-15 tonnes of fodder can be reaped. It is possible to grow 12-15 quintals of grain and 14 tonnes of fodder only in the dry tracts as revealed from the latest researches made in this field.

Maize: Maize is an important food crop introduced recently in the district and is grown in 22,911 hectares under irrigation and in 13,508 hectares as a dry crop in the year 1991. In respect of area this crop had the third place and in production, it had the fourth place in the State. It is mostly grown as a Kharif crop. The yield per hectare is 29 quintals and is less by three Kg than the State average yield. The yield per hectare is 32 quintals for an irrigated crop. Maize is especially grown in Nargund, Navalgund, Ranibennur and Bydagi taluks. This crop can be grown in all the three seasons. But, May-June, September-October and January-February months are very ideal for sowing. It is recommended

that, *Deccan-103, Vijaya-composite, Prabha (G-57) and Ganga-11* varieties may be grown in irrigated tracts, while *Deccan-103 and Vijaya composite* varieties are recommended for dry tracts. *Pink stem borer, cut worm, cob caterpillar and root grub* are the commonly found pest affecting crop, while *downy mildew, rust and leaf blight* are the diseases *affecting* the Maize crop in this region. It is learnt by research that 50-60 quintals of grain and 25 tonnes of fodder per hectare can be obtained under irrigated conditions and under dry tracts 30-37 quintals of grain and 12-18 tonnes of fodder per hectare may be obtained.

Wheat : Wheat is an important Rabi food crop in the districts. In 1991-92, it is estimated that from the crop grown in 75,747 hectares, a production 42,280 tonnes has been obtained. The yield per hectare was 615 kg and it is less than the State average yield of 743 Kgs. Under irrigation, Wheat was grown in 14,628 hectaress, and the yield was 1,053 kg per hectare. It is less than the State average (1,432 Kgs). Under irrigated conditions, it is recommended that *H.D. 2189. DWR 16, DWR 39 and HD 502* varieties and for rainfed crop *Bijaga yellow* and *DWR 137 (Kiran*) varieties can be grown. The suitable time for sowing is from the second week of October to the first week of November. *Pink stem borer, white ants, green plant bug and rootgrub* are the commonly known pests and *stem rust, leaf rust and stripe rust* are the major diseases affecting this crop. A total of 25-37 quintals of grain per hectare from irrigated tracts and a yield of 12-15 quintals of grain can be obtained from dry tracts as revealed from the researches conducted in this region.

Ragi : Ragi crop was grown in 11,183 hectares in the district in 1991-92 and 9,204 tonnes of Ragi was produced. The yield got was 866 kg per hectare and it is less than the State average yield (1,386 kg). Ragi is grown only as dry crop and *Indaf-8, Indaf-9, HR 911, Indaf-5, PR202 and Indaf–7* are the varieties recommended. This crop is restricted to parts of Hirekerur (4,420 ha), Byadgi (2,627 ha) and Hangal (1,061 ha) taluks. It is learnt by research that about 15 to 20 quintals of grain can be obtained per hectare.

Bajra : Though Bajra is one of the main food crops grown in the State. It is grown on a very limited extent in the district. This crop was grown in just about 2,032 hectares with a total production of 834 tonnes in the year 1991-92. The yield per hectare was 432 kg. It is less than the State average yield (501 kg). This crop was grown to a limited extent in Ranibennur (470 ha), Mundargi (47 ha) and Hirekerur (386 ha) taluks. While *HB 3* variety is recommended for dry tracts, *WCC-75* Hybrid Bajra variety is being grown under rainfed areas. Researches have revealed that about 15 quintals of grain and three tonnes of fodder can be obtained per hectare from this crop.

Other Minor Millets : Itallian Millet (*Navane),* Kodomillet *(Haraka),* Common Millet *(Baragu),* little millet *(Same)* and Barnyard millet *(Oodalu)* are the other crops which belong to the group of minor millets of the State. Though they are not prominent crops, these crops have the capacity to with stand the dry weather conditions and even so during scanty rainy conditions these are grown. During the year 1991-92, *Navane* crop was grown in 8,888 hectares and *same* (*save*) crop in 18,716 hectares in the district. The other minor millets are not cultivated in the district. *Same* crop not only comes to harvest in a short time but also can withstand very acute dry climatic conditions. This district stands first in area and production in the State and the district also has more than half the area under this crop in the State. The yield is 1,090 kg per hectare and is more than the State average yield (880kg). *P.M.2 and I.C.M. 1006* varieties are being developed. More research is yet to be done about the improvement of this crop. According to the nature of crop and the variety, this crop will be ready

for harvest in 90-100 days; It is learnt that 8-10 quintals of grain and one tonne of fodder can be expected from an hectare. *Navane* is an important foodgrain crop in low rainfall area. In area it has the fourth place in the State and it is estimated that the yield per hectare is 545 kg. It is more than the State yield (392 kg). *HK-289, H-1, H-2 and K-222-2* varieties are recommended. By adopting improved methods, of cultivation 8 to 10 quintals of grain and 500-600 kg of fodder per hectare can be obtained. Usually this crop is not infected by any insect or disease.

Pulses : Pulses fix atmospheric nitrogen with the help of the bacteria in the soil and store it in the roots. By this, it helps to increase the fertility of the soil. In traditional cultivation and also in the present modern cultivation, it is an important cropping practice to rotate pulse crops with cereal crops. In recent years pulses are grown in about 2.12 lakh hectares and annual production is about 89,934 tonnes. The details of major pulse crops are given hereunder.

Greengram : Greengram is one of the short duration pulse crop. During the year 1991-92, Greengram was grown on a maximum extent of 1,07,155 ha. among the districts in the State and it is estimated that 38,683 tonnes of Greengram is produced out of this area. The yield per hectare is 380 kg but it is less than the State average yield (425 kg). During summer it was grown in an area of 2,976 hectares with a production of 588 tonnes. *P.H-16, Pusa Bysaki, Jawahar-45, T.A.P-7 and China Mung* varieties are recommended for cultivation.June and July months are ideal time for sowing in Kharif season and February March for the summer crop. *Agromyzid fly, leaf eating caterpillars and pod borer* are the commonly known pests affecting the crop, while *mosaic, powdery mildew and leaf spot* are the diseases affecting the crop.

Bengal gram(Gram) : Gram is an important pulse crop of the district. During 1991-92 Gram was grown in 45,637 hectares and it is estimated that 19,250 tonnes of grain has been produced . It is grown in Ron (9,400 ha), Navalgund (9,329 ha), Gadag (8,738 ha), Dharwad (7,050 ha), Nargund (4,349 ha) and Hubli (2,965 ha) taluks. *Annigeri-1* variety is recommended for dry and irrigated areas. For sowing under dry conditions, second week of October and for irrigated crop, second week of November are ideal times. Gram caterpillar is a major pest affecting the crop, while wilt is the disease that affects it. *Annigeri-1* variety will be ready for harvest in about 95-100 days. *Gram caterpillar* is an important pest and *wilt* is an important disease of Gram. By adopting modern cultivation methods 10 quintals per hectare from dry crop and 20-25 quintals from the irrigated crop can be expected. When all the pods turn brown and get dried, the crop is ready for harvest. The usual practice is to cut the whole plant and then separate the grains.

Red Gram(Tur) : Tur (togari) is the third important pulse crop in the district. It is being used mostly in the form of dal /split bean. During 1991-92 it is estimated that this crop was grown in 20,017 hectares and 14,809 tonnes of grain was produced. The yield got per hectare was 629 kg and it is more than the State average yield 376 kg. It is generally grown in taluks of Ron (2,194 ha), Haveri (2,152 ha), Hirekerur (2,026 ha). Dharwad (1,867 ha), Shirhatti (1,544 ha) and Gadag (1,525 ha). This crop is also grown as a mixed crop with Jowar, Bajra, Groundnut and Ragi. *K.G.T-1 and A.C.P.L-87* varieties are recommended for this district. June and July months are ideal months for sowing . Early sowing gives higher yields. *Gram Caterpiller* (*pod borer) Plume moth, pod fly* and *blister beetle* are the pests affecting this crop and *wilt* and *mosaic* are the diseases commonly prevalent. When about 80-90% pods are dry the crop gets ready for harvest. One speciality of this crop is when the pods are dry, the pods will not burst and the grains will not come out. It is learnt from research that when this crop is

separately grown, it gives an yield of 15-20 quintals per hectare and 8-10 quintals of yield is obtained if it is grown as mixed crop.

Horsegram : During 1991-92, Horsegram was grown in 7,491 hectares in the Kharif season and in 12,617 ha during the *Rabi*. It is estimated that 4,177 tonnes of Horsegram from the Kharif crop and 3,824 tonnes from the rabi crop have been produced. From the Kharif crop 578 kg yield per hectare has been obtained and it is more than the State average yield (524 kg). It is grown both as an individual crop as well as mixed crop during kharif. It is drought resistant and definite crop. Local varieties will be ready for harvest within 90-100 days. This crop is grown as a late kharif crop in August or September or sown after the early sown kharif crops are harvested. If sown in the early parts of August yield will be more. Horsegram is considered as poor people's food. In addition it is grown in large quantities as a cattle feed.

Other Pulses : Among the other pulses, Blackgram was grown in about 1,121 hectares in Kharif, field bean (*Avare)* in 1,170 hectares in kharif and in 1,864 hectares in Rabi season during 1991-92. From the Kharif Blackgram (*uddu*) crop, yield of 609 kg per hectare and from the *Avare* crop 139 kg per hectare was obtained. The cowpea (*Alasande*) crop was grown in an area of 9,891 hectares. The varieties such as *C-152, TVX 944 and KBC-1* are the recommended varieties for cowpea, *Maniavare* variety for *avare* and *Karagao.3 and T-9* and *Manikya* varieties for Blackgram crop is recommended. It is known by research that an yield of 7-12 quintals of Blackgram per hectare, 10-12 quintals of cowpea per hectare and 10-12 quintals of Avare per hectare can be expected.

Oil Seeds

Groundnut *:* Among the oilseeds grown in the district, groundnut is the main crop. During 1991-92, groundnut was grown in an area of 1,59,485 ha. The district ranks third in the State in respect of area of cultivation. It was grown in 4,017 hectares under irrigated tracts during kharif, 1,36,412 hectares in dry tracts and in 19,056 hectares in *Rabi*/Summer under irrigation. The share of the district in terms of area of cultivation and the yield amounted to 11.97% and 11.46% respectively at the State level. The total Groundnut production in the district was 1,23,497 tonnes and the yield per hectare was 815 kg as estimated. It is less by 36 kg of the State average yield. The varieties recommended are *TMV-2, JL-24, DH 3-30 ICGS-11* (all *bunch varieties*) for irrigated crop, and *TMV -2, DH3-30 and JL-24 varieties* for dry crop. It is advised that the best season for sowing the Kharif crop is before the end of June under irrigation, and from the last week of December to the last week of January for summer crop and May and June months for dry crop.*Leafminor, plantlice, rootgrub and red headed hairy caterpillar* are the commonly found pests while *Tikka, rust and Collar and root rot* are some of the diseases affecting the crop. Under favourable conditions an yield of 25-30 quintals of Groundnut per hectare from irrigated crop and 10-12 quintals per hectare from rainfed crop can be obtained according to the varieties.The yield in the district under the irrigated tracts was 16.85 quintals per hectare and 6.68 quintals per hectare in dry tracts. This crop is extensively grown in the taluks of Ron (24,156 ha), Shirhatti (21,538 ha), Gadag (17,272 ha), Navalagund (12,722 ha), Dharwad (11,758 ha,), Kundgol (10,616 ha) Savanur (10,588 ha) and Mundargi (10,440 ha).

Sunflower : Sunflower is one of the important oilseed crops of the district. This crop was grown in 37,712 hectares in Kharif, 47,237 hectares in Rabi, and 5,949 hectares in summer during 1991-92. It is estimated that the total area of 90,898 hectares of the crop in the district produced a total tonnage of 38,723 tonnes. The yield of this crop in the district is 460 kg per hectare and it is about 11 kg more

than the State average yield. Among the districts of the State Dharwad district has secured the sixth place in area accounting for 7.66% of the State's area. *EC 68415 (Armawitsky). Morden, B.S.H.-1 (Hybrid)* varieties are recommended for irrigated crop and the same varieties can also be grown under rainfed conditions. It is recommended that the best season is the August month for Kharif crop, October-November months for Rabi crop and January-February months to commence the sowing for summer crop. The *corn ear worm, black headed hairy caterpillar and surface weavies* are the pests and *rust* is an important disease affecting Sunflower crop. An yield of 10-15 quintals per hectare can be got from an irrigated crop and 8-10 quintals from rainfed crop.

Safflower : Safflower *(kusube)* is an important oilseed crop of the district. This crop was grown in 24,463 hectares during 1991-92 and it is estimated that there was a production of 16,942 tonnes of Safflower seed. This district has got the third place in the State and it has 14.45% of the States area. The yield of this crop is 729 kg per hectare and it is more than the State average yield (498 kg). *Annigeri-2 and A-300* varieities are recommended and the ideal season for sowing is middle of October to middle of November. *Caterpillar* and *Aphids,* are the pests and *crownrot and seedling blight* are the important diseases affecting this crop. An yield of 15-20 quintals per hectare can be obtained in the irrigated tracts and 10-12 quintals of yield can be obtained under dry tracts. It is mostly grown in Gadag, Navalgund, Ron and Mundargi taluks.

Sesame: Sesame *(yallu)* is also one of the important oilseed crops of the district. and it is possible to grow this crop in different kinds of soil. In 1991-92, this crop was grown in 18,415 hectares in the district and 5,276 tonnes of sesame has been produced. This district ranks third in the State and has 6.17% of the State's area of sesame crop. The yield in this district is 301 kg per hectare and it is less than the State average yield (357 kg). *KDSC*-1 sesame variety of 100 days duration is recommended for dry cultivation and the appropriate time for sowing is April-May months. *Pod borer, cutworm* and *aphids* (*midate*) are the pests while leaf spots and powdery mildew are the diseases affecting this crop.An yield of 400-500 kg per hectare is expected and the present estimated yield is about 300 kg. This crop is mainly grown in Shirhatti, Shiggoan and Haveri taluks.

Linseed : Linseed (*Agasi*) crop is mainly grown as a Rabi crop in Ron, Hirekerur, Gadag and Navalgund taluks. Normally it is sown in the month of October and harvested in February. Oil and Oil-cake are produced from this crop.

Cotton : This district has the largest area in cotton crop in the State and occupies the first place in production. In 1991-92 cotton was grown in 1,97,615 hectares (33.72% of the State area) and the production was 2,60,026 bales of 170 kg each (27.25%) of the State Cotton production. The yield is 235 kg per hectare. It is less than the State average yield by 56kg. Cotton grown under irrigation is 26,873 hectares and the yield of irrigated crop is 321 kg per hectare. Dr.Katarki, an agricultural scientist had found out a long stapled hybrid *varalakshmi* variety (1972) in the district and had given a new dimension to cotton cultivation. The yield from the dry crop is estimated to be 222 kg. For the dry crop, *Jayadhar, Lakshmi, Sharada (CPD 8-1), Ajanta (DB 3-12), Abadhita (JK 276-4) and DDH – 2* varieties are recommended and for the irrigated crop *Sharada (CPD 8-1)* and *Arunabha (JK 119)* varieties are recommended. Suitable time for sowing is from June to the end of July. *Spotted boll worm, pink boll worm, American boll worm, Aphids, Mites, Jassids, Thrips, white flies, Red cotton bug and dusky cotton bug are the commonly found pests while Angular leaf spot or black-arm disease* and *anthracnose* are the diseases affecting the crop. According to the variety and climate, it is learnt that an yield of 625-1000 kg per hectare can be got from dry crop and 20-25 quintals per hectare can be got from an

irrigated crop. This cotton crop is extensively grown in Hangal, Hirekerur, Nargund, Ranibennur, Haveri, Navalgund, Ron, Shiggaon, Shirhatti, Byadgi and Dharwad taluks.

The Cotton Control Act, 1964, and then the Cotton Ginning and Pressing Act, 1925 (Central legislation), with State Amendments was enfoced in 1961. The Assistant Director of Agriculture will detect the cases of violation under the above Acts and they send the reports to the Assistant Director of Agriculture (Cotton Act), Hubli for further action. Under the centrally sponsored cotton Development Plan, the variety-wise area (ha) in 1992-93 is as follows :- *Jayadhar* 1,06,030, *Renuka* 1,233, *Lakshmi* 70, *Sharada* 171; *Abadhita* 1,655, J*K 119*43, *Jayalakshmi* 80-191; *Varalakshmi* 25 and other varieties 25. Totally 370 kg of breeders Cotton seeds were distributed. Under this plan, distribution of seeds for Cotton crop and fertilizers, Plant protection measures, demonstrations, classification of cotton lint are undertaken.

Sugarcane : Sugarcane is an important economic crop of the district. Totally it is grown in an area of 5,567 hectares and the production of Sugarcane from that area was 4,23,092 tonnes during 1991-92. The district has the seventh place in area in the State and ninth place in production. The district has 1.94% of area of the State. The yield is 80 tonnes per hectare and it is less than the State average yield by eight tonnes. *CO-419, CO-7219, CO-740 and CO-6415* varieties are recommended. For rainfed crop, January to March are the ideal months to start sowing of *CO 740* variety. *Seedling borer, Top shoot borer, Root grub, Termites, Sugarcane leaf hopper* and *Mealy bug are the commonly found pests and red rot, whipsmut, rust* and *helminthosporium blight* are the diseases affecting this crop. It is learnt that an yield of 80-100 tonnes per hectare can be obtained from the rainfed crop and 90 to 115 tonnes per hectare can be obtained from the irrigated crop. Under the Sugarcane Development Plan, for multiplication of seed material for sowing, the Sugarcane growers are given a grant of Rs.2,200 per hectare on the sowing cane cuttings and Rs.500 as Transport assistance grant per hectare. In 1992-93, 2280 tonnes of Sugarcane stalks were distributed. By March 1993, the new crop of Sugarcane was grown in 1973 hectares and the ratoon crop was grown in 2,187 hectares. Financial assistance is being given for the purchase of materials to fix the sprinkler irrigation system for Sugarcane crop. By 1993 March, Sprinkler irrigation materials were fitted in 16 hectares of land in the district for the Sugarcane crop. Parasites were released for an area of about 250 hectares.

Input Supply and Quality Control Programmes

The success of Agricultural Production mainly depends on the supply of quality inputs like seeds, fertilisers, Chemicals, Agricultural Implements, and credit. This is the major activity of the Agricultural department in colloboration with the Government and other input agencies, so as to ensure timely supply of these inputs to all categories of farmers easily and in required quantity at right times. The demand of the inputs are worked out well in advance and arrangements are made to store them in advance at different sale points so as to ensure timely supply. The department estimates each year the requirement of breeder, foundation and certified seeds for the State and arrange for their production. Two Agricultural Universities at Bangalore and Dharwad takeup breeder seed production whereas foundation seed production is organised by department, Karnataka State Seeds Corporation, Karnataka Oilseed Federation, National Seeds Corporation, and other leading private agencies. Certified seed production is organised by institutional agencies like Karnataka State Seeds Corporation, Karnataka Oilseed Federation, Central State Farm, Sindhanoor and also by private agencies like *Mahico, EID Parry, Sandoz etc.*. Karnataka State Seed Certification Agency undertakes certification of foundation and certified seeds. The department in accordance with the Central Government seed

transfer formula has taken steps to provide and undertake seed transfer programmes by providing the quality seeds, of 7 to 10% of grains out of the total seed demand, hybrid seeds 100%, Pulses 3 to 13% and oilseeds 5 to 10% quantity towards the seed transfer programme.

Quality Control of Seeds: The seeds play a prominent part in agricultural production. To maintain the quality of Seeds, Seed Act 1966 and Seed Rules 1968 are effectively in force in the district. The main object of the seed Act is to compulsorily put the label about the quality of sowing seeds sold to the farmers and also to maintain the quality by self certification. Therefore it is important to put a label, ensuring the minimum quality of sowing while distributing the registered variety sowing seeds to the farmers. The Seeds Inspector will inform the farmers not to use low quality seeds when he check seed samples and if they find fault with the quality, he will take action under the Seeds Act and the Seeds Rules. In 1992-93 under the service samples 2,204 and under the Seeds Act 1,050 seeds samples were collected and of them 873 samples were found to be of low quality. Showcause notices were issued to the traders who were selling low quality seeds, and by issuing stay order for sales, filing cases in the court, confiscation of the seed and such other similar actions the provision of the statutes were enforced. The seed Testing Laboratory at Dharwad has jurisdiction over Dharwad, Uttara Kannada, Belgaum, Bijapur, Raichur, Gulbarga and Bidar districts and the seed Act samples got from the respective districts were analysed and it helps in maintaining the quality of seeds.

Soil Fertility and Manures: The capacity of the soil to give crops or productivity depends on its water retaining capacity, soil porosity, the supply of nutrients by dissolving the decomposed organic matter like leaves, twigs, the remains of animals and minerals. Basic elements like Carbon, Hydrogen, Calcium, Nitrogen, Oxygen, Sulphur, Magnesium, Phosphorus, Iron, Copper, Manganese, Zinc, Boran, Molybdenum and Chlorine are essential for the growth of plants. Of these Carbon, Hydrogen, Oxygen are got from air and water. Some plants can obtain Nitrogen from air. Excluding these all other plants nutrients are absorbed from soil . When these are not present in the required quantity in the soil it becomes inevitable to add to the soil, cow dung and urine, leaves, twigs, ash etc. which contain these nutrients to make way for growing a satisfactory crop or by adding chemical fertilizers.

The important among the Plant-Animal origin manures are a) Plant origin -manurial raw materials remains of leftout grass in farm yard, dung, urine etc. the faces of goats and sheeps etc. b) Plant remnants, c) Green manures – Sun hemp, Diancha, Cowpea, Horsegram, Bersem etc. d) Green manuring trees – *Honge* , Gyricidia, Lucenna etc. e) Town and Rural compost and f) Sub products of agriculture and industry-Oil seed cake, vegetable refuse, Cotton and silk wastes, Paddy husk, Sugar factory by products, fish powder and weeds available from sea. In recent times the method of preparation of farm yard manure in an improved way (Trench or valley method, Plaster Heap or Smeared heap method) is being practiced. Compost means putting the Farm yard waste, dry leaves, grass waste, ash, lime, chemicals in a pit or in heap and getting them decomposed.

Among the nitrogenous fertilisers, Ammonium Sulphate (21% N), Calcium Ammonium Nitrate (21%) Urea (46%), Liquid Ammonia (82.4%) and Ammonium Chloride (25%) are important. Among the phosphorus fertilizers, Super phosphate (Phosphorous content dissolvable in water 16-18%) Di-calcium phosphate 35-40% phosphorus content dissolvable in Citrate), Rock phosphate (30-38% phosphorous content) are important. Among the Potash fertilisers Muriate of Potash or Potassium Chloride (60% potash) and Sulphate of Potash (50.53% potash) are important. Among the compound fertilisers, potassium Nitrate, Mono or Di-Ammonium Phosphate, Ammonium Phosphate, Sulphate, Ammonium Sulphate Phosphate, Urea Ammonium Phosphate, Nitro phosphate are important.

Many plant nutrients can be provided to the crops through leaves and stems. On the basis of research so far conducted, it is learnt that when all the important nutrients and minor nutrients are provided to the annual and fruit crops it is possible to get good results as well as good yield. As per the studies conducted in our State it is found that Zinc, Iron and Manganese are deficient in Black soils. On the basis of soil tests chemical fertilisers are used. On the basis of the quantity of plant nutrients used by the crops for production and the level of plant nutrients available in the soil and the soil fertility, chemical fertilisers are used for different crops. In recent times Gobar Gas Plant or Bio-gas units are being established in large numbers. The manure that comes out after the biogas produced is completely decomposed and it is rich with protein and humus. The manure that comes from the gobar gas plant is filled with nutrients and by using such a manure soil structure is improved and thus the yield also improves.

The bio fertilizers prepared by the micro organisms will provide plant nutrients especially Nitrogen. These micro organisms belong to Azola, Blue green algae and Rhizobium, Azola is a plant that floats on water and grows. It has got the capacity to absorb nitrogen found in the atmosphere. The Blue green algae by name '*Anabina'* found in it helps in this process. In *azola* there is 4 to 6 % nitrogen. In addition there are many minor nutrients required for plant growth. Rhizobium is a single celled bacteria which causes nodules in roots and stems of pulse crops. When the pulse seeds are treated with suitable rhizobium bacteria, they absorb nitrogen from the atmosphere directly and provide it to the plants. The blue/green Algae absorb nitrogen in the atmosphere and provide it to the crops. In wetlands this grows profusely.

There are two types in green manure. The first type are the crops that produces leaves and stems in plenty and comes to harvest in a period of 6-8 weeks prior to the main crops like Sugarcane, Paddy or other irrigated crops grown in wet lands. The second one is trees and plants that give more leaves and stems and when they are cut during seasons they bloom profusely. These trees and plants belong to the Leguminaceae group. They absorb directly the nitrogen in the air by the action of bacteria living in the nodules of their roots. Sun hemp, Horsegram and cowpea may be cited as examples for the first category while examples for second group may be made of Subabul, Glyricidia and others.

In the organic manure division, the establishment of biogas units, blue green algae production, popularising plan of Azola bio manures, rhizobium production and green leaf resources plan are being implemented in the district. In the seed testing laboratory in Dharwad, Rhizobium bio manures are being produced from 1993-94. The rhizobium bio-manures are distributed to the farmers free of cost.

Details	1989-90	1990-91	1991-92	1992-93
Rural compost production in 1,000 tonnes	1,197	936	1,208	1,288
City compost production in 1,000 tonnes	205	146	116	121
Green leaf manure in 100 hectares	730	790	805	854
Biogas Units (no.)	425	212	307	875

In 1993-94 there were totally 3,662 biogas units in the district (for details see chapter –5)

The organic manure is added to the soil in four different ways. Sheep and goats are flocked in dry lands during nights and make them urinate and put dung and when they are mixed to the soil, the soil fertility increases. Sheep and goats eat the remnants of crops, fallen leaves and weed and

convert them in to manure. Before growing Save and Sesame crops, the crop portion that are left in the land are burnt and they are added to the soil. Thirdly in some places the black sesame crop is grown and after it flowers it is ploughed into the soil or the practice of giving green leaf manure is in vogue. Preparation of compost manure is the fourth. In 1945-56, after the 'grow more food' programme, the preparation of compost from urban waste also came into practice. In the compost preparation, waste materials, green leaf and soil etc. are collected and put in the pit and made to decompose and in this way the compost manure is prepared. During 1949-50, 5,48,000 tonnes of compost were produced in the district. During the same year 16,580 tonnes of compost were prepared from urban wastes. The use of organic manure varies from crop to crop and place to place. Usually ten cortloads of organic manure are put to one acre of kharif Jowar crop. It is learnt that in some parts of Gadag and Ron taluks, 20 to 25 cart loads of organic manure are put once in three to four years before the cotton crop is grown.

Quality Control of Chemical Fertilisers: Orders regulating production of Chemical Fertilisers, quality, sale, distribution and price control was issued in 1957. To take action on the quality control of chemical fertilisers and to take action on quality, the earlier order was amended. The Chemical Fertiliser (Control) order was issued in 1985, In the said Act certain previous definitions concerning adulterated fertilisers, origin of certificate, mixtures in the form of tablets, useful nutrients of plants, wholesale business organisations, Advisory Committee, restriction of time for analysis etc. have been modified. All subject experts of the office of the principal Agricultural Officer, Assistant Directors of Agriculture, all Assistant Directors of the taluk, all agricultural officers of the cluster taluk, and the Deputy /Director of Agriculture of soil conservation division and Agricultural officer of the Sub-division, have been appointed as Fertiliser Inspectors. They have to visit the marketing centres of fertilisers and take samples of fertilisers and send them to Fertiliser Quality Control Laboratory to know their quality. Action will be taken on the sellers and manufacturers of low quality samples.

In Dharwad the Chemical Fertiliser Quality Control Laboratory was set up in 1979. The jurisdiction of this laboratory extends over Dharwad, Uttar Karnataka, Belgaum, Bijapur, Raichur, Bellary, Gulbarga and Bidar Districts. Gypsum samples are not analysed in this laboratory. The number of fertiliser samples collected and the number of low quality samples (in brackets) from 1982-83 to 1991-92 are as follows :1982-83 – 1,317 (61), 1983-84 – 2,300 (162), 1984-85 – 2,487 (82), 1985-86 – 2,294 (130), 1986-87–2,096 (132), 1987-88 – 2,125 (122), 1988-89 – 1,931 (101), 1989-90 - 1,882 (125), 1990-91 – 1,651 (54), 1991-92 – 1,934 (113) and in 1992-93, 436 samples were collected in the district and out of them 12 were of low quality samples.

Use of Fertilisers: In 1984-85, 24,372 tonnes of nitrogen, 17,519 tonnes of phosphorous and 8,912 tonnes of potash fertilisers were used in the district. This quantity increased in 1992-93 as follows. Use of nitrogen fertiliser to 27,072 tonnes, Phosphorous quantity to 18,308 tonnes, Potash quantity to 17,880 tonnes. The talukwise progress of fertiliser use for 1992-93 is given in table 4.11

In 1983-84, 20.46 kg of nitrogen, 12.89 kg of phosphorous, 8.59 kg of potash fertilisers per hectare were used for the total cropped area. In 1984-85 this quantity stood at 20.58 kg of nitrogen, 14.79 kg of phosphorous and 7.52 kg of potash. In 1970-71 the total use of chemical fertiliser per hectare of cropped area worked out to 5.7 kg and even in 1990-91 it was only 5.6 kg.

Table 4.11 : Taluk wise details of Fertilizers use (in Tonnes) 1992-93

Sl.	Taluk	Nitrogen	Phosphorus	Potash	Total
1.	Byadgi	1,185	945	880	3,010
2.	Dharwad	1,530	1,020	1,040	3,590
3.	Gadag	130	1,064	995	3,361
4.	Hangal	1,535	1,180	1,035	3,750
5.	Haveri	1,690	1,085	1,080	3,855
6.	Hirekerur	1,610	1,170	1,090	3,870
7.	Hubli	1,813	965	995	3,773
8.	Kalghatgi	1,760	970	1,030	3,760
9.	Kundgol	1,282	1,080	990	3,352
10.	Mundargi	998	1,002	590	2,590
11.	Nargund	1,900	1,280	1,255	4,435
12.	Navalgund	1,985	1,295	1,330	4,610
13.	Ranibennur	2,392	1,188	1,370	4,950
14.	Ron	1,860	1,084	1,060	4,004
15.	Savanur	1,640	1,040	1,050	3,730
16.	Shiggaon	1,010	910	1,050	2,930
17.	Shirhatti	1,500	1,030	1,040	3,650
	Total	27,072	18,308	17,880	63,260

Plant Protection: As the technologies in agriculture have increased the importance of plant protection has also kept pace with it. Greater attention is to be paid to plant protection while growing more commercial crops like cotton, Paddy, vegetables and seed production crops. To control many seed borne diseases, it is an important practice to do seed treatment before sowing. After the harvest of the crop, attention has to be paid to store the grains without being exposed to pests and diseases. Usually it can be said that there will be rat menace to all crops. Their trouble will be there from the day of sowing uptill the day of harvest. To control rats, rat catch, poisonous food and fumigation are the important measures required to be taken. Weed control is an important aspect of plant protection. Weed is an unwanted plant in the crop field. By using chemicals, the growth of weed before sprouting can be checked and thereby competition of the weed with the main crop is avoided. Also weeds can be controlled by spraying weedicides. Nowadays different weedicides have been identified for different crops. It is very essential that the right quantity of weedicides is applied to a particular crop at the appropriate time.

Out of the 24 species of weeds that belong to the family of *Bilikasa*, the *Striga asiatica* is a root parasite which grows with Jowar, Bajra, Sugarcane, Paddy, Maize and some grasses. From one plant, about four lakh seeds are produced. The seeds of *Bilikasa* will be dormant for about 20 years. This can be controlled by spraying 2-4-D sodium salt. Parthenium is a poisonous weed. It flowers and produces seeds in all seasons. This weed can be controlled by spraying 2-4-D sodium salt or Ansar solution. The insects and diseases that appear every year are as follows : the *blast* disease on Paddy appear in all the areas of the district, grass hopper menace for Jowar in Haveri and Savanur taluks, the insect attack for Jowar crop in all over the district, the insect attack for Safflower and the pod borer for cotton are important. The progress of plant protection work in the district are as follows :

Particulars	1990-91	1991-92	1992-93
Seed Treatment ('000 ha)	265.5	319.5	215.6
Rat Control in dry lands (ha)	700	1,870	22,180
Insect control of soil and mixed crops ('000 ha)	198.5	207	206.3
Intensive control of pests and diseases (ha)	216.8	173.6	148.2
Weed control by weedicide (ha)	3,280	11,195	6,600
Integrated pest control (ha)	3,122	6,880	15,000
Total ('000 ha)	697.4	717.9	614.9

The use of pesticides in the district is as follows :

Details		1989-90	1990-91	1991-92	1992-93
Insecticide	Dust (Kg.)	4,195	4,375	4,836	5,345
	Liquid (litre)	4,81,600	4,68,350	57,960	68,940
Fungicide	Dust	12	8	10	16
	Liquid	850	910	1,210	1,033
Nutrients	Dust	1	1	2	3
	Liquid	3	4	6	9
Weedicide	Dust	1	1	4	6
	Liquids	15	18	560	840

Seed Farms : There are several hybrid varieties grown in the district. There is a distinct method adopted in the production of hybrid variety sowing as well as in seed production. There are many organisations established for seed production which are functioning under the provisions of Acts and Rules. National Seeds Corporation, State Seeds Corporation and Seed Ceritification Agency are the organisations connected with it. There are many private agencies which have obtained the approval of these organisations. These private agencies have their own production and cleaning system. The total quantity of seeds to be produced will be distributed among National Seeds Corporation, State Seeds Corporation, Agricultural Universities and Agriculture department, Hybrid seeds producers and processed Seed Producers. The State Seeds Corporation has made agreement with some selected farmers and is undertaking hybrid seed production. The Community Development Centres undertake processed seed production through some farmers. The Seed Quality Certifying Agency has taken up the work of supervision of this seed production work and it does the work of issuing certificates.

To support the initiatives taken up for producing good quality, improved high yielding and hybrid crops seeds in all the seasons, seed farms have been established. There are four seed farms in the district. Seed farm has been established in Hombala of Gadag Taluk in 1963-64 with an area of 20.81 hectares, the total cultivated area is 20.23 hectares. A seed farm was established in 1961-62 in Rattihalli of Hirekerur taluk with an area of 18.51 hectares, of which dry land of 17.54 hectares and 0.20 hectares of wet land are being cultivated. In Havangi of Hangal taluk a seed farm was established in 1959-60 and 9.11 hectares of wet land is being cultivated. In Annigeri of Navalgund taluk a seed farm

has been established in 1957-58 and the area of 14.16 hectares cultivated here is dry land. As already stated many private organisations are doing this work.

High Yielding Varieties : From the year 1965-66, the development programme of high yielding varieties is in operation. Among the high yielding varieties, mainly Paddy, Wheat, ragi, Maize were grown in an area of 1.79 lakh ha in 1990-91. There is about 0.91 lakh hectares area under the high yielding Jowar variety in the district. The high yielding Paddy area is 0.36 lakh ha, Wheat area 0.13 lakh ha and the area of Maize is 0.13 lakh hectares. In 1966-67 the area of high yielding varieties was as follows (ha). Paddy-328, Jowar- 11,391, Maize – 368 and Wheat-132. In 1983-84 the area of Paddy reached 49,578 ha; Jowar area to 1,29,840 ha; area of Maize to 15,874 ha; area Wheat 13,520 ha and area of ragi to 19,836 ha. According to the report of 1992-93, the talukwise (ha) of high yielding crops is as follows ; Byadgi – 12,472, Dharwad 11,787, Gadag – 5,494, Hangal – 14,898, Haveri – 12,113, Hirekerur – 22,351, Hubli – 5,503, Kalghatgi – 10,907, Kundgol – 1,733, Mundargi – 6,510, Nargund – 15,208, Navalgund – 17,529, Ranibennur – 18,646, Ron – 17,501 Savanur – 8,280, Shiggaon – 10,089 and Shirhatti – 9,608 total area being 2,08,877 ha

Soil Conservation: Soil Conservation is an important factor in dry and rainfed cultivation. Protecting soil from erosion, conservation of water and constructing bunds against the slope and making the required moisture to stay longer in the soil and to make the crops use them, are the main responsibilities of the Agriculture department. According to the Karnataka Land Reforms Act the Soil Conservation work is undertaken by the Agriculture department through the workers directly without the involvement of middlemen. Of the extent of 11.36 lakh hectares in the district, soil conservation work has to be taken up in 8.90 lakh hectares of land. Of this bund construction was completed in 3.42 lakh hectares at a total cost of Rs.17.36 crores. There are eight soil conservation sub-divisions, in the district covering all the 17 taluks. In Dharwad sub-division, Dharwad. Hubli, and Navalgund, in Haveri sub-division, Haveri, and Byadgi; in Ranibennur sub-division, Ranibennur and Hirekerur; in Shirhatti sub-division Shirhatti and Kundgol; in Savanur Sub-division, Savanur and Shiggaon; in Gadag sub-division , Gadag and Mundargi; and in Ron sub-division, Ron and Navalgund, and in Khalghatgi sub-division, Kalghatgi and Hangal taluks are included. The total talukwise area for which soil conservation work has to be undertaken (ha) and the total area for which bund construction work completed so far in hectares, since 1988-89 are as follows ; Dharwad – 71,890 and 8,962, Hubli – 61,936 and 4,180, Shiggaon – 38,125 and 8,367, Kalghatgi – 35,270 and 2,150 , Kundgol – 62,165 and 17,643, Hangal – 37,874 and 1,109, Shirhatti – 68,800 and 38,387, Savanur – 50,200 and 34,593, Haveri – 60,703 and 30,864, Byadgi – 20,233 and 17,032, Hirekerur- 32,376 and 7,726, Ranibennur- 80,940 and 25,171, Gadag-80,940 and 35,306, Navalgund – 60,705 and 5,714, Mundargi – 54,287 and 49,246, Ron-78,806 and 55,044 and Nargund – 14,530 and 655.

National Watershed Development Project for rainfed lands started in 1986-87 in the district. Upto the end of 1990-91 works have been undertaken in Gadag, Ron, Kundgol, Kalghatgi, Shirhatti, and Haveri taluks under this programme. In 1992-93 the programme was undertaken in Doddahalli Command area of Kundgol taluk (4,725 ha), Kanavihosur command area of Gadag taluk (4,482 Ha), Maidur command area of Herikerur taluk (4,860 ha), Kadakol command area of Savanur taluk (4,215 ha), Hammigi Command area of Mundargi taluk (4,796 ha) and Lendihalli command area of Navalgund taluk (4,108 ha) with a financial grant of Rs.150 lakhs. Under this programme special attention is being paid to soil conservation methods by using plants and management of inter bunds, programmes like

crop production, horticulture, forest development to give knowledge to farmers and women farmers in rural areas about the improved cultivation practices and on rural industries are being undertaken.

Drought Prone Area Development Programme is in operation in Dharwad, Hubli, Kalghatgi, Kundgol, Shiggaon, Haveri, Byadgi, Hirekerur, Ranibennur, Savanur, Shirhatti, Mundargi, Gadag and Ron taluks, in 1992-93 and construction of bunds, prevention of erosion by planting. trees on bunds across slopes, canal bunds, check dam, farm ponds, Paddy strip, cross drainage etc. have been programmed to be undertaken in an area of 4,725 hectares in the above taluks by spending Rs.105 lakhs.

Western Ghat Development Plan is in operation in Dharwad taluk. The Karnataka Command area Development Plan under DANIDA Aid is in operation in Dharwad (Harobelavadi watershed), Hubli (Bommanasamudra command area), Shiggaon (Shishuvinahala Command area), Hangal (Hirehalla Command area), Haveri (Edagoor command area), and Byadgi (Motebennur command area) taluks. Under the million well programme, soil conservation work is being undertaken with a grant of Rs.32 lakhs in14 taluks of the district for the small and marginal farmers of schedules castes and scheduled tribes.

In 1993-94 the command areas selected for development are as follows : Byadgi taluk – Motebennur, Kalledevaru, Kotenahalli and Gundenahalli; Dharwad taluk – Harobelavadi, Veerapura, Kallekabbenur and Kanavihonnapur; Gadag taluk – Kanavihosur, Eachalahalli, Kurtakoti, Haveri taluk – Didagur and Hombaradi ; Hirekerur taluk – Mydur and Mavinatopu, Hangal taluk- Hirehulyala; Hubli taluk – Bommasamudra, Kolivada and Mantur; Kalghatgi taluk – Mukkala, Kundgol taluk – Doddahalli, Samshi, Yareboodihal and Ingalgi; Mundargi taluk – Hammigi, Shingatarayanakere and Dambala; Navalgund taluk – Lendihalli; Ranibennur taluk – Makanur ; Ron taluk – Itagi ; Naregal and Jigeni; Savanur taluk – Kadakola and Madapura, Shiggaon taluk – Shishuvinal, Belagali and Hanakanahalli and Shirhatti taluk – Madalli.

Agricultural University, Dharwad

The Agricultural University at Dharwad came into existence in October 1986. Prior to this the Agricultural College here was under the jurisdiction of the University of Agricultural Sciences, Bangalore, established in 1964. Even prior to this, the Agricultural College, Dharwad established in 1947 at Dharwad, was under the Karnataka University. This college is imparting degree education in Agriculture, Agricultural Marketing, Animal Husbandry, Cooperation and Forest Science subjects. Along with this post graduate education in twelve divisions are being given. The Rural Home Science College at Dharwad is giving degree in Home Science. Here food and nutrition, child growth, clothes and dress, Home management and Home extension subjects are taught. The Veterinary college at Bidar is giving degree education in Veterinary Science since 1984-85. The Agricultural Engineering College at Raichur is imparting a four-year degree courses in Agricultural Engineering. The National Service Scheme was started in the Agricultural University in 1987. It has undertaken service like planting trees in the yard of the schools, digging drains, conducting camps for the health of people and animals in the adopted villages throughout the year. In addition they do conduct demonstrations for digging ditches for green manure, bio-gas system, sprinkler irrigation, method of giving fertilisers and medicines etc.

The Extension Directorate of the University has under its control two extension education units, two agricultural science centres, one National Demonstration plan, and one bakery training unit.

Besides it has National Agricultural Extension project phase II. On first and on the third Sunday of every month broadcasts will be made on various agricultural matters through the radio. Various trainings are arranged to the Officers of the Agricultural department and Horticultural department. Under the plan of adopting villages in Farm experiment, holding demonstratioins, on the use of Chemical fertiliser based on the soil tests, plant protection and nutrients in dairying and such other enterprise activities, field demonstration and cattle health camps, planting seedlings, film shows etc., are undertaken.

In order to respond to the problems of the farmers two Krishi Vignana Kendras are functioning at Hanumanahatti and Bidar. These centres are conducting training to farmers and farm women in crop production, poultry, sheep, rabbit rearing, silk farming, bee keeping, bio-gas production. Sprinkler irrigation, Home science, water management and other topics both in house as well as outside the house trainings. One bakery training centre is at Dharwad and in that in-house training is organised and women are given training. Outside camp training is also arranged.

In recent years, the University of Agricultural Sciences, Dharwad has released three Jowar varieties (S.B.-1066, S.B.-1079, S.B.-905) and one Kharif hybrid Jowar variety (D.S. H. 1). It has released R.S.H.1 and S.P.H.-318 Rabi Hybrid Jowar varieties and I.S.-8283 improved Jowar variety. In cotton hybrid varieties, this University has released *Varalaxmi, Jayalaxmi*, mixed (J.K.176-4) varieties and has improved the local hybrid cotton variety (D.D.H.-2). The improved Wheat varieties *CWR-19* and *DWR-39* are improved by this University. The only Dry Paddy Research Centre in the State is in Mugud and it has improved A-67, A-200, Vanara, Grama-318 (Avinash) and *IET 5882* (Abhilash) varieties and released them.

Rural Development Training Centre, Dharwad

The Rural Development Training Centre was established in October 1952 as Grama Sevak Training Centre under Community Development Plan. This Centre was started to give training to the Grama Sevaks in modern agricultural technology, Animal husbandry etc., in the Social Extension Plan areas. Out of the five Rural Development and Training Centres in the State, this is one. The main objectives of this are to give education in pre-occupation and reorientation education to Agricultural Assistants and farmers and welfare of the women and children. It is also conducting training for the staff of command Area Development Authority and other Departments. In 1962 Gram Sevaks who had put in three or more years of service were given reorientation training in working capacity in technical knowledge about research in agriculture and the methods of increasing work efficiency. In the same way in 1963 Cooperative Farming Division Training was started and in this division training is given to the Secretaries of Agricultural Cooperative Societies, members of the Managing Committee in Co-operative farming. In 1971, because of the various training programmes and educational activities it was conducting, this centre was named as Rural Development Training Centre. From 1975 onwards training is given to Anganawadi Workers and Assistants of the Women and Children Welfare department on various aspects like care of children, rearing Children, food and health of children, pre-primary education and health of mothers. During the period, training is given like "do and learn, see and learn, hear and learn" in various aspects like agriculture extension, social extension, Panchayat Raj, Animal Husbandry, Horticulture and Public health. As per the National Agricultural Extension Plan (II stage) Re-orientation training is given to Agricultural Assistants and Assistant Agricultural Officers and for Agricultural Assistant who are in service for three years and more (for two months and one month) on the recent agricultural research, technically and increasing the working capacity and efficieny.

In 1982 DANIDA WYTEP plan was started in the Rural Development Training Centre with the assistance of International Development Agency of Denmark. Under this plan training is given for 10 days to women farmers and for 14 days to young Yuvak farmers in the modern agriculture technology and other agriculture based subjects such as Animal Husbandry, Horticulture, Sericulture etc. In the second stage of this plan Link Workers Training Programme for women farmers and two days training workshop in rural areas and seminar for women farmers in Animal Husbandry, Fisheries, Sericulture sectors are arranged.

With the collaboration of Malaprabha Command Area Authority, training is given to farmers for seven days and five days training to women farmers and also training is given in water management. The training programmes of this centre is not limited in this centre and several mobile Agricultural training programmes are also conducted. This training is conducted for a day at the village level to farmers and women farmers by giving guidance to them on existing problems on framing and guide them on resolving these problems.

The agricultural farm of the Rural Development Training Centre is having a cultivable area of 152 hectares of which irrigation facility is provided for only 1.2 hectares. This agricultural land which belonged to the Agricultural University, Dharwad was transferred to this centre in 1970. The soil of this farm is sandy and stone mixed red soil and hence the water retention capacity is very low. The agricultural farm is used for demonstration of modern agricultural practices to the trainees who come to this centre. Seed productioin work is also undertaken. In 1991-92, 81.9 quintals of Maize, 116 quintals of Groundnut and 10.4 quintals of Soya bean seeds were produced. Also production of seeds of Greengram, Jowar, Sunflower, Cowpea, Tur, Safflower, Horsegram is also taken up.

The number of beneficiaries who were benefited by the various programmes sponsored by the Rural Development Training Centre from 1982-83 to 1991-92 are as follows :- Pre-service training to Agricultural Assistants of one year duration – 437, Reorientation training of Agricultural Assistants of two months duration – 446 (This programme ceased to be in operation since in 1984-85); Reorientation training of one month duration to Agricultural Assistants – 873, Reorientation training to Assistant Agricultural Officers – 95, Introductory training to Agricultural Assistants – 37, Experimental Efficiently training to Assistant Agricultural Officer – 47, Training on soil and water management to farmers of Malaprabha cammand Area – 1,437; Mobile Training Camps to the members of the Co-operative Agricultural Societies – 2,370, Training to farmers on dry farming – 148, Agricultural Mobile camps to farmers on bio fertilizers – 14,038, Training to Schedule Tribes under the special Unit Plan – 260, Training in Poultry farming – 298, Training in Dairying and Poultry farming to small and marginal land holders – 343, Training to women farmers of Malaprabha Command Area- 133; Training to Women Farmers on High-yielding Varieties – 272; Agricultural Mobile Camps for women farmers – 8,623, Training to women users of Gober Gas Plant- 1,509, Training Anganawadi workers-926; training to Anganawadi Assistants – 82; Training to Young farmers under DANIDA plan – 4,336, Training to women Farmers – 4,374, Training for the entire season to women farmers at village level – 1,455; Training to Link workers (Assistant Workers) – 310, Special Training to women farmers – Dairying-161, Horticulture – 88, and Sericulture – 157.

Agricultural Development Centres

Out of the four Agricultural Development Centres situated in various agricultural zones of the State, two centres are situated at Konnur (Nargund Taluk) of Dharwad District and the other at

Dharwad. The main objectives of these centres are production and multiplication of improved and hybrid seeds, finding out suitable varieties for different areas, finding suitable irrigation practices, undertaking farm experiments and to work as advisory centres to the farmers of the command area.

An Agricultural Development centre is functioning in Belleri Farm in Konnur of Dharwad district. It is situated on the road side of Belleri village on the road going to Ramdurg at a distance of three km. to the west of Konnur of Nargund taluk. This centre was started as an Experimental – cum-Demonstration Farm in 1971 at first and in 1978 it was converted as an Agricultural Development Centre. The total area of this Centre is 38 ha, of which 29.7 ha is under cultivation. Water is provided to this centre through a D-6 sub canal of Kolchi canal and water facility is provided to a total area of 27.6 ha. The main objectives of this centre are to find out suitable cropping pattern to the areas coming under Malaprabha irrigation project, to conduct experiments on the main irrigated crop and to provide information for implementation to the farmers of the Malaprabha irrigation area, to demonstrate to the farmers experimentally by growing successfully suitable crops and to provide information to the farmers of Malaprabha Irrigation area, to arrange demonstration of the use of good seeds. Also to conduct experiments on the use of chemical fertilisers to irrigated crops and production of Hybrid varieties and other varieties (original and certified) and to provide complete and detailed information about them. The annual average rainfall at this farm is 489 mm. In this centre seed production is being made on cowpea (*C.152)*, Green Gram (*P.S.16* and *China Mung)*. Sunflower (*EC-68415, B.S. H* and *Morden)*, Hybrid Maize (*Deccan*), Soya Bean (*H.,S.B. and Hardi)*, Sesam *(E-8),* Cotton *(D.C.H.32),* Tur (*I.C.P.L.16),* Safflower (*A-100 and A-1),* Bengalgram *(A-1)*, Jowar (*5-4-1* and *M-35-1).* Wheat *(H.D.2189, Keerti, Dharwad –39, U.P. 301* and *Beejagow)* and cotton *(Sharada)* varieties. In 1990-91 Seed production was undertaken in 2.5 ha in Kharif and 18 ha in Rabi seasons. During the current year expenditure of Rs. 1.51 lakhs was incurred and the yield fetched a revenue of Rs. 2.70 lakhs which resulted in a profit of Rs.1.29 lakhs.

The second Agricultural Development centre in Dharwad district is situated in the compus of Rural Development Training Centre and its details are included in the Rural Development Training Centre, Dharwad

Agricultural Research Station, Dharwad Farm

The Agricultural Research Station Dharwad was established in 1904 and it is one of the oldest research centres in India. This is the main research centre on cotton cultivation in Karnataka State. This centre is at a distance of about four km in Dharwad-Navalgund Road, east of Dharwad city and this centre has a total area of 33 ha out of which the cultivated area is 28.75 ha. Cotton crop research is conducted and many important varieties are released from this centre. In 1951 *Jayadhar* and *Lakshmi* cotton varieties were developed and released. In 1972 *Varalaxmi* Hybrid cotton variety and *Bhagya* varieties were released. *Sharada* in 1980, in 1981 *DB-3-12*, in 1982 *Soubhagya*. In 1981, *D.C.H.32* hybrid variety, in 1988 *Abhadita (G.K.-276-4)*, *J.K.-119* and *D.D.H.-12*, local hybrid varieties and in 1993 *D.H.B.-105* varieties were released. Research is carried on varietal improvement finding out improved agricultural practices and finding out methods of pests and diseases control. Also to find out resistant varieties to *pod borer* and *sucking insects*, intensive research is being done. Not only the cotton varieties but also *Nandyal* and *Bilichigan* Jowar varieties and *Spanish Improved* Groundnut varieties were also released from this centre. The ordinary cotton variety (original), hybrid cotton (original) seed and cowpea, *mung*, Blackgram, Soya bean, Safflower, Wheat and Bengal Gram seeds are produced in this centre.

Agricultural Research Station, Prabhunagar : The main objective of the Agricultural Research Station at Prabhunagar in Dharwad is to give technical training in Agriculture forestry and forest farms to the workers of the development departments, and farmers and also to conduct research in Agricultural forestry and forestry division. This centre was started in 1976. Out of the total area of 213.6 hectares of the centre only five hectares have the facility for irrigation. Out of the total plantations the natural forest raised in an extent of 98.5 ha and forest plantation in 80 ha and horticultural crops are grown in nine hectares.

Main Research Station : The main Research Station situated in Krishinagar, Dharwad, was established in 1947 and it was transferred to Dharwad Agricultural University in 1986. It has a total area of 441 ha of which irrigation facility is provided only to 90 hectares. The seed production programme is undertaken in a total area of 50 hectares. The objectives of establishing this station are as follows :- 1) To conduct research in development of varieties in Agricultural Science, Horticulture and Dairying, Entomology, Pathology and Microbiology, Agronomy Agricultural Engineering etc. 2) To undertake production of seeds of various crops and seedlings. 3) To grow profitably the commercial crops by adopting modern agricultural practices and to show to the farmers by arranging field days and to encourage them to grow commercial crops. 4) To take up extension work, by arranging demonstrations and field days to the farmers on the modern technology in crop production. 5) To give training to farmers, departmental officers and other concerned institutions, seed production of Jowar, Gram Cowpea, Soyabean, Cotton, Wheat and other crops are undertaken.

Agricultural Research Station, Mugad : The Agricultural Research Station in Mugad was established in 1923 and was transferred to the University of Agricultural Sciences , Dharwad in 1986. The total area of this station is 14 hectares and only an area of two hectares is provided with irrigation facility. The main objectives of establishing this station are : 1) To develop suitable drill sowing varieties for Paddy to high altitude lands in valleys, middle land and shallow lands of the low lying areas of agricultural zones 8,9 and 10 ; 2)To undertake evaluation work of agricultural practices.; 3) To evolve cropping patterns based on Paddy; 4) Research on weed control and management practices in drill sown Paddy.; 5) Developing the disease resistant varieties and to conduct studies on plant protection methods.; 6) To undertake seed production work of Paddy, Maize, Jowar, Safflower and Pulses.

Agricultural Research Station, Hanumanamatti: The agricultural Research Station was established in Hanumanamatti in 1974 and the total area of this station is 108 hectares, of which only four hectares have irrigation facility. The objectives of establishing this station are as follows :- 1. To introduce modern high yielding varieties of cereals, pulses, oilseeds, commercial crops like chilly, and cotton ; 2. Production of breeder seeds and to distribute them through various seed production institutions.; 3. To conduct research on agricultural practices which are economically profitable to this zone and 4. To arrange cultivation and demonstration of improved crop varieties. Training is given in this centre to the farmers who visit this centre about dairying, poultry farming, sheep and goat rearing, rabbit rearing, apiculture and other agricultural related acttivities.

Agricultural Research Station, Gadag : Agricultural Research Station was established in Gadag in 1906. This station is having an area of 1.78 hectares.

Agricultural Research Station, Annigeri : The Agricultural Research Station at Annigeri was established in 1947 and was transferred to the University of Agricultural Sciences Dharwad in1986. The total area of this station is 22 hectares. There is no irrigation facility in this station. The main

objectives of this station are to develop improved and hybrid varieties in the Rabi season under dry farming and to undertake seed production for kharif and rabi crops. Seed production of Groundnut, Mung, Soyabean, Blackgram, Gram, Sesame, Cotton and other crops is undertaken.

Water Management Research Station, Belavatagi

The water Management Research Station was established in 1974 in Belavatagi of Navalgund taluk in the year 1974. The total area of this centre is 18.84 hectares. Out of this, there is canal irrigation facility covering four hectares. Seed production is undertaken for cotton, Gram, Greengram, other crops. The main objectives of establishing this station are :- 1. To conduct research on water requirement and water management practices on crops like Cotton, Safflower, Wheat, Gram, Greengram, Safflower, Jowar, Maize, onion, chillies and other crops.; 2. To undertake studies on such issues as, water contents in moisture, the relation between the various crops and the need for water, the quality of water supply neded, and the methods to be adopted to provide waterings under irrigation, to sustain the above mentioned crops.; 3. To conduct research to find out suitable cropping patterns to Malaprabha Command area ; 4. Evaluation of chemical fertilisers and irrigation practices with respect to the yield of crops.; 5. Studies on dissolving and distribution of salts, the ups and downs of water level, quality of underground water and the use of drained water and the short term and long term effect of irrigation on the above ; 6. Weed management and 7. To take up studies on suitable irrigation practices especially of black soil.

Agricultural School, Devihosur

The Agricultural School at Devihosur in Haveri taluk was established in 1914. As S.J. Desai of Shirasangi donated the land required for it, it was named as Shirasangikar Memorial Agricultural School. Programmes like giving training to disseminate modern agricultural practices to the farmers and to arrange demonstration were taken up by this school. This school has lands of an extent of 68.8 hectares, Jowar, Groundnut, Paddy, Cotton, Chillies, minor grains, pulses, Sugarcane, Betel leaves, Banana and other crops are grown. Training is being given to about 40 students every year through the medium of Kannada. Now the main objective of this school is to attract youth who intend to become good farmers and after they are given training in modern agricultural methods, they are to return to rural areas as good farmers. Training is given for one year on modern agricultural methods. The short term (three months) training programme is also conducted. Under the short term training programme, 62 persons were trained in '1991-1992 and 72 persons in 1992-93. Seed production programme is undertaken in the land belonging to the Agricultural school. During 1992-93 original sowing seeds of *Indaf-8* ragi variety. *J.L.2* Groundnut variety, *Deccan 103,* Maize variety, *Morden* Safflower variety, Moneta and *Hardi* Soya bean varieties, *C.S.H.9* hybrid Jowar variety, local chillies variety, *I.C.P.L.-88631*, Tur variety and Horsegram for Kharif and for Rabi season, *M-35-1* Rabi Jowar variety, *A-1* Gram variety, *A-2* Safflower variety, *H.B. 2186* Wheat variety, *I.C.C.V.2* Gram variety, local Rabi Jowar and in summer *C-152* cowpea variety, *C.M.S.-234*, Sunflower variety and *Mandya Vijaya* Paddy variety were produced and distributed to Karnataka State Seeds Corporation and to be sold to farmers and Agricultural Producers Marketing Organisation.

Agricultural Management Studies

The objects and purposes of Agricultural Mangement studies are the following : 1. To find out the expenditure to be incurred for the cultivation of different crops and also to find out the expenditure

incurred for the production of every quintal of crops.; 2. To study the use of various inputs for various crops and find out the relation between production and expenditure.; 3. To undertake scientifc studies such as, investments made on cultivation of various crops, and their production level, and based on such factors, work out the support prices, payable to farmers in respect of all these crops, with the ultimate object of sending these details to Government of India, through the State Government, for enabling the Government of India to determine and announce the support prices payable to the farmers. 4. To determine the profit earned after taking into consideration the expenditure incurred on cultivation on various crops and their production, under the new minor irrigation and lift irrigation projects undertaken by the Irrigation department. The information on the crop cultivation expenditure will be useful to decide the quantity of crop loan. In 1992-93 Kodikoppa of Navalgund taluk, Nidagundi of Ron taluk, Gadag of Dharwad taluk, Kolur of Haveri taluk and Masanakatte village of Hangal taluk were selected for agricultural management studies and Greengram, Tur, Paddy, hybrid Cotton crops were included in the studies.

Agricultural Implements

In Dharwad district locally manufactured agricultural implements and recently improved implements are put into use. The agricultural implements required for various agricultural operation are as follows :-

1. To plough-Balarama plough which is an improved local plough made out of iron with a system of changing the worn-out shares and it is useful in ploughing of medium depth to low depth and the wear and tear is less and can be used for ploughing deep also. The iron plough turns and mixes the soil better than the wooden plough and can crush the clods. In one plough no unploughed area will be leftout.; 2. To plough deep, the iron plough which ploughs deep is suitable to plough in summer in black soils. Generally, it is used once in three years, in black soil after the harvest of rabi crop. It is useful in the control of Hariyali grass and retaining more water. Grubber is suitable for all types of soil and it is an useful implement instead of a plough for all seasons.; 3. Foot cultivator used in the black soil and it puts soil in an undulating like manner on the bunds and is useful to conserve moisture; 4. Log to break clods – it is a swadeshi implement made out of wood to crush clods; 5. Harrow for harrowing – It is suited for all types of soils. Usually after the plough is used it is used to make the soil better and to remove weeds and other waste material; 6. Ridger is used in all types of soils to make furrows and ridges. In a properly prepared field, it is used to make ridges and furrows of various measurements. The soil can be raised with the help of ridger; 7. Bund former is an implement to form bunds for irrigation and conserve soil moisture in properly prepared soils. It is a useful implement in line crops having more distance.

Adjustable seed cum fertilizer drills are used for sowing Safflower, Redgram, Jowar, Bajra crops. There are improved desi drills and it is possible to adjust the sowing distance and the seed and fertilizer placement in different lines, In red and black soils and the drill to sow Groundnut is in use and it has four pipes and two seed cups. With this, it is advantageous to sow seed in more areas in a short time. Crop line harrow is in use to cover the seeds for all types of soils and this harrow has a long light log. The following implements are in use for intercultivation. *Ede Kunte* (Harrow) where blades can be adjusted, is used for all line crops and in red and black soils. In this *Edekunte* blades of various measurements can be joined in only one log. The *edekunte* mouth will remove the weeds near the plants of row crops. The shovel type *edekunte* will be more advantageous than the ordinary *edekunte.* The edekunte of the shape of duck foot will go deep into the soil and loosen the soil

effectively. Also it is very effective in weed control. In row crops it is useful to raise the level of soil. In Groundnut crop four lines are cultivated with the intercultivation implement where labour and expenditure can be saved. With the top dressing seed drill it is possible to put fertilizer deep and very near to the crop in all types of soils. The improved sickle is in use to harvest hollow stem crops like Paddy, Wheat and it has a special quality handle and the crop can be cut very close to the bottom of the crop without injury to the workers . As it has got toothed blade and the blade can be adjusted, it need not be sharpened frequently.

The tube like Maize grains removal implement can be used to remove the grains easily and better than by hand. In Sunflower crop there is a knife to thresh Sunflower. Manually operated Maize grain removal machine is in use and with that more grain can be separated in short time and with less labour. From the Groundnut removing machine more pods can be removed per unit time. The power driven Groundnut removing machine has one horse power motor and cleans pods and half pods with the blower. For all harvested crops Tungabhadra pedal and power driven winnowing machine is in use. For all types of loosened soils the *haragu kunte* with (Harrow) levelling equipment is used to level the land. The long handle soil transporting implement is useful to transport soil to the required place. The top soil can be removed and spread with buckscraper with the front implement. The small ditches can be levelled in a levelled hand. Implement for dehusking Groundnut and Castor pods, thristing machine for threshing many crops, power driven fodder cutting machine and other implements are in use in the district. From the Seed cum fertilizer drill, the fertiliser can be sown 5 cm. deep. Puddler is in use to puddle in wet lands. Japan type sickle is prepared out of spring steel and it is useful to harvest Paddy, Ragi, Wheat and hybrid grass. In the grain storage barns designed by the Agricultural University, it is possible to protect grains from moisture, heat, rats and insects. It can be built by using the locally available bricks, stone slabs, kadapa stone. At the bottom, a slope is given as outlet and with that the grains easily slide and flow out.

Agricultural Implements*:* As per the Livestock census of 1983 the district had 1,46,600 wooden ploughs, 19,500 iron ploughs, 87,300 bullock carts, 5,000 Sugarcane crushing machines/*ganas* 11,000 diesel driven pumpsets, 1,500 persian wheels, 5,300 tractors and 7,71,400 other implements totalling 10,35,000 agricultural implements. As per the Livestock census of 1990 the details of agricultural implements recorded in the district are as follows : **Manually operated Agricultural implements** 1) Seed drill (seed and fertilizer)-4,411; 2. Seed drill – 9,705; 3. Chaff cutter – 55,875; 4. Wheel hoe – 12,278; 5. Sprayer and duster – 23,317; 6. Rice Planter – 1,134; **Animal drawn Agricultural implements** – 1. Wooden ploughes – 1,51,610; 2. Iron ploughs – 41,321; 3. Cultivators – 80,623; 4. Disc Harrow – 1,23, 576; 5. Seed and manure sowing drill – 22,286; 6. Seed drill – 98,160; 7. Leveller – 32,907; 8. Wetland Puddler – 6,945; 9. Harvesting machine 21,435; 10. Bullock Carts 91,217; 11. Sugarcane crushing machine – 1009; **plant protection equipments** – Electrically driven. Sprayers and dusters – 5,136; 2) Diesel driven pumpsets – 2,508; 3) Electrical driven pumpsets – 17,426; 4) Tractors – Agriculture power tiller – 1,199; 5) Agricultural Tractors – 4,990, 6) Mould Board plough – 2,165, Disc Harrow – 2,000 and Tractor Trailers – 3,882.

IRRIGATION

In Ancient Karnataka irrigation was an inseparable part of agriculture. There are many references available in inscriptions about tanks, *katte*, ponds, *kunte*, '*done*'. *Hokkarane*, (*Pushkarane*) etc., There is a chapter in "*Lokopakara*" a kannada Encyclopaedia of Chamundaraya II, about the methods adopted by the ancient people to find out the source of water. It has a list of various types of plants, trees,

vines, snakes mound etc. types of conditions indicating the source of water. It was considered a sacred thing. Kings, queens, king's officers and other rich people were constructing tanks and reservoirs with the same veneration as they constructed temples. There are a lot of inscriptions giving information about irrigation practices. In one of the inscriptions of Hampi there is a reference to a song in which a mother, while feeding her child with her milk was singing like *"Kereyam Kattisu, Baviyam savesu, Daivagarangalam Madisu"*, meaning construct tanks, dig wells, construct temples. In the Shiggaon inscription of Badami Chalukyas it is mentioned that there were 14 tanks in the surroundings of Gudageri. There is a mention of a tank constructed in Kurtukoti during Rashtrakuta times and a tank repaired in Dandapura near Nargund. A Chalukya inscription states that there was a *Sethu (Katte*) in Asundi. Facilities were made to repair and desilt the tanks and to undertake other works to provide irrigation facilities. In some villages some lands were reserved as a *"Bithuvatta"*. The persons who were enjoying this land were given the responsibility of repairing them. In 1125 A.D.land was given by Bommadeva on lease for repair of Honavvas tank of Mugad in the district. For the same purpose, water ways cess called (Neera Coolie) on tanks, *katte*, canal, were levied. As per 1052 inscription the entire income of house tax was utilised for keeping *Piriyagere* in good condition in Niralagi of the district. Even a better arrangement can be seen to have been made in 929 by the Alur Village near Nargund about the *Kantamagere*. A fund was made by collecting money while performing marriage, Upanayanam and other auspicious functions. Also the fines levied on offences were included to this fund and the funds were made to grow. As per the decision of the Gram Sabha of Umachagi of the district in 1102, the fund raised by fines, levied on criminals of Deyimagere was used for the repair of tanks.

Badami Chalukyas constructed many tanks. In the Alampura inscription of Vijayaditya it is stated that he constructed many tanks (*tatakas*) in his Kingdom. In his Shiggaon inscription there are names of 14 tanks around Gudigeri. In the Shiggaon inscription while naming the boundaries of Guddigere (now Gudagere) it is stated that there were *Venna* (*Venne*) lake, in the South, *Kuvera* lake in the west, *kodi* lake to the north-west, *Pulivara* lake in the north, *Matkere* (Matkuna) and *Arasal* (*Arasi*) lakes in the north-east. It is mentioned in the inscription that there were lake *Kurulehalla* near Kapatti village, *Mahishavata* lake to the north of Kanpura village and Puli lake to the north-east. From this it can be understood that there were many tanks in the southern portion of Dharwad in the beginning of the eighth century. It is recorded in the Chinchili inscription of Gadag taluk that during the reign of Rashtrakuta a private person donated the tank. In this inscription there is a reference to water cess. From about the 10th century to the 14th century innumerable tanks were constructed. It is learnt that Someshwara, the first of Chalukyas (C 1068-76) had concentrated on construction of tanks and canals in Dharwad district.

According the Moraba Inscription of Navalgund taluk, during the period of the Kalyana Chalukya's Nolambavadi king Jayasingha Raja named the local tank as Nolamba Samudra and reserved land for its repairs. During the period of Someswara, the fourth (1184) a cess by name *"Pannaya cess"* was levied for the valve of Gonasamudra of Dambala and its repair. This cess was entrusted to the 16 traders (*Shetti*) of the place for tank repairs. Even today this tank is a very big tank in use. Many tanks like this are referred to in the inscriptions of Chalukyas. According to 1242 inscription there is a reference that Yadava Singha of the district constructed a new tank. In another inscription of Yadava Singha the boundary of the village is described this way, Herur village is in the left bank of Venna or Bennehalla. For the management of Herur tank the lands reserved were in the south of Kusugala, north of Kundgol, west of Hubli and west of Bennehalla. All the place names still exist, but the tanks

are not there. The water crisis in Kusugala might have been very acute and it may be the reason for the disappearance of tank. After the 12 years continuous famine that occurred during the end of 14th century the Vijayanagar Kings gave special attention to the repairs of tanks in the district and construction of new tanks. Their provincial kings also did the same work. *"Krishnaraya Samudra", "Sadashiva Samudra", "Rayapurakere"* are some of the examples for the construction of their times. In Dharwad itself, there are even new *Sadoonakere (Sadhanakeri), Kempugere, Yemmekere, Kelagere, (Kelageri), Attikolla* and other reservoirs. In Hubli the *Gulakavavva* tank has now become Nehru Maidan. *Thimmasagara* of Dharwad and *Unakal* tank are famous. The names of places like *Chikkerur*, *Hirekerur*, *Nuggikeri*, *Kerewada*, *Kerikoppa*, *Kerimallapura*, *Kerimathihalli*, *Gudageri*, *Musigeri*, *Thavarageri*, (derived from the word tank) *Amaragola*, *Shirakola*, *Gummagola*, , (derived from the word pond), *Haveri*, *Medleri*, (derived from the word bund) indicate that there existed reservoirs from the ancient times. The details of tanks which were irrigating more than 200 hectares are as follows: 1) Doddakere – near B.Konanakere 260 hectares, 2) Heggere near Haveri – 206 ha 3) Doddakere near Hirekerur – 306 ha, 4) Devikoppa"s Doddakere of Kalghatgi taluk – 173 ha, 5) *Honnavvanakere* of Mugad – 241 ha, 6) Anikere near Holekote (Hangal taluk)-214 ha, 7) Hirekere near Naregal – 241 ha and Hirekere near Tilavalli (Hangal tq.)-344 hectares. In addition, Halekere of Dambala of Gadag taluk and the Doddakere near Masur of Hirekerur taluk were irrigating more than 200 hectares. In 1884 there were 2,979 tanks in the district and they were providing water facility for an area of 37,492 hectares. In 1901 the number of tanks were only, 2,404 and they were irrigating 32,736 hectares. Alongwith this number of *kuntes* (small tanks) were also good and their use was to provide drinking water to animals. There seems to be more dependence on tank irrigation in Hangal. Hirekerur, Kalghatgi and Kundgol taluks.

Madag – Masur Tank : The Madag dam was constructed in about 16th Century during the time of Vijayanagar Kings across the Kumudvati river, a tributory of Tungabhadra river. It is at a distance of 6.5 km from Masur village of Hirekerur taluk. The bottom width of the dam is 1,048 to 1,248 feet. and on top its width is 400 to 600 feet and it has a height 140 feet from the bottom of the river. The original tank breached and it was repaired during the time of Adil Shahis and again later in 1889-90. Both the left and right bank canals carry water to a total distance of 15 km when the tank is full it has an water spread area of 144 hectares. The valve (*Kodi*) is on the side and the total length of the mud dam is 1,850 ft. The total *Atchkat* area of this dam is 1,130 ha and irrigation facility can be provided to 535 hectares. The useful water storage of this dam is 567 million cubic feet. In 1950-51 irrigation facility was provided to 255 hectares. Irrigation facility was provided very near to Madag tank from Anjanapura dam (at a distance of the 36th km on the upper canal flow of the Madag tank) constructed in 1938. Between these two dams there are many small tanks.

Dambal Tank : Dambala Tank near Gadag was constructed 450 years ago during the Viajayanagara period. The length of the bund of this mud tank is 4,000 feet and it has a 25 feet high mud dam. Silt has accumulated in this tank and in 1824, 1849, 1860 and 1877 silt was removed and repaired. In 1877 the water storage capacity was increased to 108 million cubic feet. Now the length of the dam is 6,000 feet. and the width at the top of the dam is six feet. and its height is 48 feet. The water storage capacity is 96.7 million cubic feet. The length of the water canal is 5 km and provides irrigation facility to about 1,000 hectares.

Medaleri Tank : The Medaleri tank was constructed 1886-87 and an expenditure of Rs.81,392 was incurred. The length of the tank bund is 2,250 feet and the width of the bund at the top is six feet and the height of the dam is 41 feet. when the tank is full, its water spread area is 67 hectares.

The water storage capacity of the thank is 57.6 million cubic feet. The left bank canal runs up to four km and the right bank runs up to 4.5 km. The total area irrigated from this tank is about 240 ha

Asundi Tank *:* The Asundi tank was constructed in 1889 at a cost of Rs.74,995. The bund of the tank is of mud and it is 4,767 feet. long. The width at the top of the bund is six feet. and it is 34 feet. in height. When the tank is full with water its spread is 418 hectares in extent and the total water storage capacity is 74 million cubic feet. There are two water distribution canals and the right bank canal runs up to seven km and the left bank canal runs up to a km.

In 1936 irrigation facility was available to 36,136 hectares from 2,348 tanks in the district. During 1955-56 the area irrigated from tanks was 43,296 hectares and the area irrigated from river canals was 3,174 hectares. In 1950-51 water was utilised for 37,151 hectares from 2,912 tanks and it was 81.2 percent of the total irrigated area. The average irrigated area from each tank was 13 hectares. Of these, most of the tanks are very small tanks. Only 28 tanks had an *atchkat* area of more than 40 hectares. Big tanks can be seen in Dharwad, Hirekerur, Byadgi and Mundargi taluks. There were no big tanks in Nargund, Navalgund and Gadag taluks. Out of the total 2,912 tanks there were 678 tanks in Kalghatgi taluk, 605 in Hirekerur taluk, 492 in Bankapura taluk, 359 in Dharwad taluk, 355 in Ron taluk, 268 in Byadgi taluk and the remaining were spread over in other taluks. In 1992-93 there were 276 tanks having an achkat of more than 40 hectares and there were 2,800 tanks having less than 40 hectares of *achkat.*

As per the agricultural census of 1950-51, there were 4,300 wells in the district and of them Hirekerur taluk had 1,333, Ranibennur taluk 911, the then Bankapur Taluk 617, Shirhatti taluk 456, Gadag taluk 452, Ron taluk 293, Dharwad taluk 117 and the rest of the wells were spread over in other taluks. There were no wells useful for irrigation in Nargund, Haveri and Mundargi taluks. An area of 2,587 hectares were irrigated from 4,320 wells and it amounted to 5.6 percent of the total irrigated area. Irrigation facility was available to only half an hectare area from each well. If there was water in the nearby reservoirs the quantity of water available in wells will also be more. The depth of wells was 120 to 130 feet in *Malnad* area and in border areas 35 to 60 feet and in *maidan* areas it was 80 to 120 feet. According to the report of census of wells of 1972 there were 9,455 irrigation wells in the district. According to the 1974 census, the irrigation wells had reached 10,038. In 1984-85 there were totally, 16,653 wells and irrigation facility was available to about 16,653 hectares. In 1992-93 there were 13,764 tube wells and 13,071 other wells and out of them 7,399 were for household use.

Dharma Reservoir Project: A small reservoir was constructed in 1911 at Sringeri (Shiggaon tq.) across the Dharma river a main tributary of Varada river in the net work of Krishna river valley. Another reservoir was constructed in mud dam near Yamagalli village of Mundgod taluk of Uttara Kannada district. Commenced in 1957, the project work was completed in 1964. The command area of Dharma reservoir is 98 sq.km. and the water yield is 64.20 million cubic metres annually. The total height of the mud dam is 24.12 metres. Its total length of 1,448 metres. The total water storage capacity is 23 million cubic metres. Irrigation is provided to 6,482 hectare area of land in Hangal taluk of Dharwad district. The left bank canal is six km. in length and the length of the right bank canal is 27.4 km, and the length of the upper canal is 1.6 km.

Malaprabha Project : Under the Malaprabha Irrigation Project a dam was constructed at Naviluthirtha of Belgaum District and 37.73 TMC water is collected and canals are constructed and it is planned to provide irrigation facility to about 2,18,191 hectares of land in Belgaum. Bijapur and

Dharwad districts. All works of the dam is completed. Water is being stored since 1974. The Malaprabha right bank canal starting from the Malaprabha reservoir is 138 km. long and it has one sub main canal. The sub main canal or Nargund canal is totally 42 km. In length. It is planned to finally irrigate from the right bank canal an extent of 30,601 ha in Nargund taluk, 38,790 ha in Navalgund taluk, 40,728 ha in Ron taluk, 4,744 ha in Hubli taluk and 1,570 ha in Gadag taluk. From the Kolachi right bank canal irrigation facility is available to an area of 1,514 ha in Nargund taluk and 4,585 ha in Ron taluk, Irrigation facility is available totally to 1,22,532 ha in Dharwad district from this project. By March 1986 irrigation facility was provided to 27,416 ha in Navalgund taluk, 27,416 ha in Nargund taluk, 3,727 in Ron taluk and 4,744 ha in Hubli taluk. In 1991-92 the taluk wise area irrigated from canal irrigation was as follows :- Hangal 5,070 ha, Hubli 2,006 ha Nargund –30,819 ha, Navalgund 15,326 ha and Ron – 3,078 ha. In 1985-86 the net sown area out of the geographical area of the district was 81 percent and out of the net sown area, the net irrigated area was 14 per cent. Out of the total irrigated area 47% was from large and medium irrigation project. Upto April 1986 under the minor irrigation scheme, area of 62,469 ha from 2,021 tanks, 10,481 ha from 26 picottah irrigation. 821 ha from 8 *Bhandaras* and 7,568 ha from six small works were benefited by irrigation.

Details of irrigation in the district is as follows :

		1970-71	1975-76	1980-81	1985-86	1990-91
1.	Percentage net irrigated area out of the net sown area	5.8	7.0	8.0	8.9	14.8
2.	Percentage of total irrigated area out of the Gross sown area	5.7	NA	8.8	NA	13.9

In table 4.12 details of Talukwise net irrigated area (ha) are given and in table 4.13 details of minor irrigation census (1986-87) in the district are given.

Problem of Water Logging

As the irrigation facility has increased in the district, the problem of water logging in cultivated lands is becoming serious. In the black soil clay content is more and so draining of water is difficult. As irrigation facility is increasing, if artificial drainage system is not there, the ground water level comes up. If the underground water level is lessthan 1.2 metres below the ground it means that salts have accumulated. With the ground water at this level the dissolved salts come up through the capillary pores. Even if the water evaporates to the atmosphere the salts remain in the soil. In this way as the water logging increases the salt content and alkaline chemical content in the soil go on increasing. In the irrigated soils even though water logging is not more the alkaline salts may also increase. Though the source of irrigation may be well or reservoir the salts dissolved in it remain. When the irrigated water evaporates salts only remain. It is said that about 16,000 ha of land in the district are water logged and they are facing the problem of salts and alkalies. According to the 1984 report of the Agriculture department the details of water logged land are as follows :- Land having very high salt content 7,578 ha, Lands having very high alkali content 6,422 ha and heavily water logged land – 2,000ha

If water logging is accumulated in cultivated lands it requires a long duration of time and expenditure for its repairs. Not only the canals are to be constructed in land and deep from the land,

Table 4.12 :Talukwise net irrigated area (in hectares) in 1990-91

Sl.No.	Taluk	Canals (Rivers)	Tanks	Wells	Tube Wells	Others	Net total irrigated area	Net sown area	Percentage of irriga ted area to net sown area
1.	Byadgi	-	30	590	2,050	-	2,670	30,280	8.82
2.	Dharwad	-	678	1,247	1,976	170	4,071	83,946	4.85
3.	Gadag	-	-	1,088	160	-	1,248	61,619	2.03
4.	Hangal	5,070	9,676	68	2,710	1,489	19,013	52,051	36.53
5.	Haveri	-	-	-	2,931	4,863	7,794	63,336	12.31
6.	Hirekerur	-	2,690	3,088	3,624	1,263	10,665	55,684	19.15
7.	Hubli	2,006	146	160	318	333	2,963	63,662	4.65
8.	Kalghatgi	-	2,405	145	1,211	-	3,771	41,695	9.04
9.	Kundgol	-	20	-	18	-	38	60,774	0.06
10.	Mundargi	-	-	2,414	898	2,477	5,789	38,211	15.15
11.	Nargund	30,819	-	311	63	460	31,653	35,177	89.98
12.	Navalgund	15,326	-	1,784	-	5,503	22,613	80,700	28.02
13.	Ranibennur	-	-	517	2,978	6,722	10,217	61,599	16.59
14.	Ron	3,078	364	4,571	4,416	556	13,165	80,594	16.33
15.	Savanur	-	-	323	1,671	846	2,840	48,179	5.89
16.	Shiggaon	-	26	-	982	-	1,008	41,917	2.40
17.	Shirhatti	-	119	2,016	1,849	781	4,765	72,653	6.56
	District Total	56,299	16,154	18,322	27,865	25,643	1,44,283	9,72,077	14.85

Source : Dharwad District at a glance, 1991-92

Table 4.13 : Minor irrigation census in Dharwad District 1986-87

Sl.No.	Taluk	Wells					Shallow Tube wells			
		in use	Not in use	Fitted Electric pump	Total Irrigated area	Net irrigated area in ha.	in use	Not in use	Total irrigated area in ha.	Net irrigated area in ha.
1.	Byadgi	226	235	235	440	440	557	27	1,547	1,224
2.	Dharwad	378	37	240	741	681	111	6	316	316
3.	Gadag	1,023	2	981	1377	1,170	71	-	170	171
4.	Hangal	192	109	93	277	176	505	-	1,393	1,299
5.	Haveri	307	30	298	755	726	549	10	1,899	1,899
6.	Hirekerur	398	343	402	1,194	926	1,000	52	3,500	3,490
7.	Hubli	352	103	281	670	598	77	9	179	162
8.	Kalghatgi	31	1	27	57	49	198	-	556	535
9.	Kundgol	34	-	23	29	29	6	-	13	13
10.	Mundargi	911	12	919	2,415	2,415	67	18	214	214
11.	Nargund	100	-	93	203	203	8	-	24	25
12.	Navalgund	94	-	64	224	220	4	-	7	7
13.	Ranibennur	626	1,072	651	1,704	1,773	585	136	1,943	1,943
14.	Ron	1,332	204	1,410	3,591	3,215	569	27	2,434	2,409
15.	Savanur	350	87	348	671	456	201	16	545	447
16.	Shiggaon	336	157	200	494	420	162	-	394	393
17.	Shirhatti	1,016	94	944	2,119	2,067	26	-	104	103
	Total	7,706	2,486	7,209	16,961	15,564	4,695	301	15,218	14,650

Table 4.13 : Minor Irrigation Census (Cont'd)

Sl.No	Taluk	deep tube wells				Canal Irrigation Schemes			Lift irrigation schemes		
		in use	Not in use	Total irrigation capacity in ha	Net irrigated area	Total no. of schemes	Total irrigation capacity	Net irrigated area in ha	Total no. of schemes	total irrigation capacity	Net irrigated area in ha
1.	Byadgi	81	17	309	309	182	3,448	966	-	-	-
2.	Dharwad	14	-	79	79	61	10,261	298	88	238	96
3.	Gadag	1	-	2	2	3	98	18	5	7	-
4.	Hangal	62	-	146	144	517	19,382	1,921	421	1,559	1,384
5.	Haveri	26	-	89	89	44	3,374	1,018	882	4,187	3,622
6.	Hirekerur	-	-	-	-	12	12,574	985	340	2,735	2,004
7.	Hubli	21	-	52	52	12	549	28	121	385	300
8.	Kalghatgi	18	6	34	34	464	14,218	1,892	65	212	214
9.	Kundgol	1	1	2	2	-	284	-	-	-	-
10.	Mundargi	-	-	-	-	218	4,237	3,298	9	2,436	1,372
11.	Nargund	-	-	-	-	-	-	-	146	342	342
12.	Navalgund	11	-	36	36	-	-	-	189	477	477
13.	Ranibennur	340	65	695	695	3	2,200	308	851	6,074	7,300
14.	Ron	-	-	-	-	45	977	83	116	400	388
15.	Savanur	41	6	125	93	-	1,442	-	141	1,189	284
16.	Shiggaon	38	-	114	114	255	7,404	775	-	-	-
17.	Shirhatti	20	-	157	157	23	1,651	1,122	99	948	513
	Total	674	95	1,840	1,806	1,839	82,099	12,712	3,473	21,189	18,296

water has to be pumped out often to throw the water out and reduce the level of underground water. If salts and alkalies are accumulated land has to be left barren for some time. Water has to be let into the land often to wash off the chemicals gradually. By artificial methods of adding gypsum and sulphur to the soil relief works have to be undertaken. Realising the seriousness of this problem the Government of Karnataka has taken up reclamation of land through soil conservation division of the Agriculture Department as per Karnataka Land Reforms Act. As per this Act, farmers can avail 25 per cent concession out of the expenditure of removing water logging and the rest will have to be paid in 15 annual installments. An integrated programme for improvement of salts. alkali and water logged land is planned and some of the main objectives are as follows :1) To remove the obstacles in the natural way of draining water; 2)To construct main and subsidiary canals ; 3)Adding chemicals to the soil; 4) Washing off the salts by flooding the land with water; 5) Suitable demonstration is to be arranged to provide education, to the farmers and 6) Popularising green leaf manuring.

HORTICULTURE

Flower gardens particularly in temples and cities and the *pushpavathikas* are mentioned in ancient inscription. Jasmine, *Kedage*, *Sampige*, *Kanigala*, *Davana, Maruga* and other flower crops were grown in Hangal, Lakshmeshwara, Gadag, Kalghatgi, Dambala and Mundargi in the district. Flowers were not only essential for worshipping in temples, it was a part of social life. Fruit gardens were also raised. Records of growing mango,jack, lemon, *jambunerale*, Coconut, and betel leaf gardens have been found. The betel leaf gardens were very common. The inscriptions mention places like *Eleya poorballi* (the present Hubli), *Eleya Siruvara(Eleshirur)* and other places. Because of the betel leaf gardens they were given that name. In the inscriptions there are mentions of *gathriga, Thambuligar* meaning sellers of betel leaves, '*Ugura – Munnoorvaru* ' meaning the pluckers of leaves and *Galemunnoorvaru* meaning pluckers of fruits from the fruit plantations. Out of the spices, Chillies, Coriander, Garlic, Arecanut and out of fruits, Plantain, Mango, Lime, Guava, and of vegetables, Potato, Sweet potato, Raddish, carrot, Brinjal, Lady's finger, Tomato crops are mainly grown in the district. Onion, Tomato, Potato, Chillies are the vegetables brought by the portuguese (17-18 the century)

After a separate Horticultural directorate was established in 1963, better attention is being paid to Horticulture. Due to this development in 1974, the area of Plantation and Spice crops was 42,108 ha, area of Fruit crops was 3,178 ha, area of Vegetable crops was 7,192 ha and the area of Commercial crops was 27 hactares in the district. The area under the main horticultural crops during 1977-78 was as follows : (area in hectares)

Arecanut – 214, Coconut-2,400, Cashew – 194, Betel Leaf – 1,829, Chillies – 36,334, Onions – 8,832, Coriander – 2,006, Garlic – 915, Potato – 1,931, Tomato – 2,661, Brinjal – 2,994, Beans – 1,856, Lady's finger – 857, Greens – 1,468, Gourds like Pumpkin, *sore* etc – 836, Mango – 1,810, Plantain – 1,530, Lemon – 438, Guava – 585 and Sapota–577 and total area of commercial flowers - 347, out of which the area under *Savantige* (chrysanthemum) was 274 hectares. In 1990-91, the area of the main horticultural crops in hectares was as follows : Mango – 3,226, Plantain – 638, Lemon spp. - 338, Guava – 1,000, sapota – 1,082, Grapes – 24, Pomegranate – 145, Jack – 181, Papaya–182, *Seethaphal* – 96, Total fruit crops – 7,251, Potato-3,983, Tomato – 2,548, Brinjal – 2,992, Cole crops – 650, Peas – 359, Beans – 1,997, Lady's finger – 1,594, Radish – 905, Beetroot – 159, Carrot – 214, Greens – 1,338, Capsicum 397, Pumpkin variety – 699, total vegetable crops – 20,598, Arecanut – 258, Coconut – 4,829, Cashew – 88, Betel leaves – 2,203, Chillies – 96,600, Onion – 18,758, Coriander – 2,297, Garlic – 1,250, Tamarind – 594, total area of Plantation and Spices: 1,27,143. The total area under commercial flowers

was 1,132 comprising Rose – 60, Chrysanthemum – 619, (Tube rose – 48, Aster – 3, Jasmine – 154, *Kanakambara* – 51, Marigold – 21, *sampige* – 123 and area of other flower crops being 23 hectares. The taluk wise details of the main horticultural crops grown in the district in 1992-93 are given in table 4.14 to 4.16

Main Horticultural Crops

Mango : Mango is one of the important fruit crops. In 1992-93 this crop was grown in a total area of 4,591 hectares and it is estimated that the average production per hectare was 8.6 tonnes. Dharwad taluk (1,918 ha) had the highest area under this crop and mango is cultivated in Kalghatgi (640 ha), Hirekerur (296 ha) Hubli (294 ha), Hangal (276 ha), and Haveri (273 ha) taluks. *Badami (alphanso), Rasapuri – (Pairi), Totapuri (Bangalore), Malgoba, Neelam, Bangarpalli, Mallika, Neelagoa and dashehari* varieties are recommended for cultivation. Four years old seedling starts bearing fruit. After 10 years there will be heavy yield. From a ten years old plant about 50 to 500 fruits per year, can be reaped from 11 to 20 years plant 500 to 1500 fruits per tree can be repeaded from more than 20 years old plant, the yield will be more than 1,500 fruits per year.

Plantain : During 1992-93, *Cavendish* Banana was grown in 378 hectares in the district and other varieties were grown in 263 hectares and it is estimated that on an average, the yield per hectare was 60 tonnes of fruits in Shiggaon (62 ha), Hangal (54 ha), Ranibennur (52 ha) and Nargund (51 ha) taluks and other banana varieties were grown in Ranibennur taluk (112 ha) and Haveri taluk (62 ha). *Poovan, Dwarf cavendish, rasabale, robust and nendra* banana varieties are recommended. *Puttabale Yalakkibale, Boodabale, Gujarati and Rajapuri* varieties are also grown. The main crop comes to harvest in 12 to 14 months and the ratoon crop in 6 to 8 months.

Citrus Varieties :In 1992-93 lime was grown in 363 hectares and it is estimated that the average yield is nine tonnes per hectare. It is mainly grown in Dharwad (51 ha), Hirekerur (51 ha), Hubli (50 ha) Nargund (49 ha), and Haveri (43 ha) taluks. *Kagzi lime, seedless time, Italian Lemon, Lishon lemon* and *Sivelli lemon* varieties are recommended to be grown. The crop can be harvested twice a year and an eight year old lime tree yields 1,000 to 1,200 fruits per year. Other varieties yield 600 to 800 fruits.

Grapes : In 1992-93 *Anab-E-Shahi* grape variety was grown in five ha and other varieties in 11 hectares. It is estimated that 44 tonnes of grapes have been produced. Grape is grown in Gadag, Mundargi, Ron, and Haveri taluks.

Guava : Guava was grown in 1,022 hectares in the district during 1992-93 and it is estimated that an average of 13 tonnes of fruit per hectare has been produced. This crop is mainly grown in Hubli (240 ha) Dharwad (178 ha) Kalghatgi (100 ha) and Haveri (80 ha) taluks. *Allahabad safed, Sardar (Lucknow-49) and Navaloor* varieties are recommended to be grown. Economically the yield after five years is good and an average 1,000 to 1,500 fruits can be got annually from a plants of more than 10 years.

Sapota : Sapota crop was grown in an area of 1,454 ha in the district and it is estimated that an average yield of 18 tonnes of fruit per hectare is obtained. It is grown mostly in Hubli (345 ha), Dharwad (160 ha), Kalghatgi (186 ha), Nargund (120 ha) and Shiggaon (111 ha) taluks. Out of the Sapota varieties, *Kalipathi, Cricket ball and 'Calcutta round'* varieties are recommended to be grown. It is learnt that from a plant of 10 years and above an average 1,000 to 1,500 fruits can be obtained.

Table 4.14 : Talukwise area of Spices and Plantation crops in Dharwad District in 1992-93 (In hectares)

Sl.No.	Taluk	Coconut	Chillies	Onion	Coriander	Garlic	Tamarind	Arecanut	Cashew	Betel Vines	Total spices & plantation crops
1.	Byadgi	171	3,260	37	41	130	16	-	-	34	3,687
2.	Dharwad	478	1,700	665	240	76	56	-	19	-	3,254
3.	Gadag	517	7,374	3,228	735	63	120	-	-	9	12,212
4.	Hangal	583	4,336	11	53	-	23	148	30	87	5,342
5.	Haveri	328	15,000	850	225	10	110	10	5	86	16,636
6.	Hirekerur	430	15,000	150	143	420	77	33	9	120	16,403
7.	Hubli	262	5,500	805	125	15	50	-	3	-	6,760
8.	Kalghatgi	312	20	18	5	-	5	-	-	-	36
9.	Kundgol	35	26,021	508	279	368	10	-	-	-	27,221
10.	Mundargi	150	123	264	23	5	7	-	-	3	577
11.	Nargund	248	300	350	-	-	-	-	-	-	908
12.	Navalgund	1	250	600	10	-	5	-	-	-	867
13.	Ranibennur	19	329	1,615	315	450	80	4	4	15	2,847
14.	Ron	192	25	50	5	-	55	-	-	39	366
15.	Savanur	123	9,981	244	163	4	9	17	1	98	10,657
16.	Shiggaon	61	800	300	20	5	3	7	17	10	1,243
17.	Shirhatti	324	3,872	1,500	300	208	32	-	-	8	6,246
	Total Area	4,234	93,891	11,195	2,682	1,754	658	219	88	509	1,15,262
	Average Production per hectare in tonnes	-	2.5	16	1	8	1	1	-	-	-

Source : Office of the Deputy Director of Horticulture, Dharwad

Note: Total Spices and Commercial crops column includes remaining crops apart from the above mentioned crops.

Table 4.15 : Talukwise area of Vegetable Crops in Dharwad District for 1992-93 (Ha.)

Sl.No.	Taluk	Greens	Potato	Tomato	Brinjal	Cabbage	Peas	Avare	Ladies finger	Raddish	Sweet potato	Tapioca
1.	Byadgi	14	-	14	18	11	21	6	6	5	2	-
2.	Dharwad	275	3,274	470	201	95	305	320	250	150	50	10
3.	Gadag	545	-	224	945	85	-	1,350	400	315	-	25
4.	Hangal	20	5	50	30	10	-	25	10	5	-	2
5.	Haveri	100	300	250	20	22	-	130	160	120	80	5
6.	Hirekerur	200	300	800	575	175	20	750	525	90	45	40
7.	Hubli	140	400	300	100	13	-	30	50	32	-	-
8.	Kalghatgi	25	350	150	500	-	-	100	100	50	-	-
9.	Kundgol	20	1	30	35	-	6	18	12	4	2	7
10.	Mundargi	63	-	95	94	-	-	-	53	12	15	-
11.	Nargund	-	-	65	70	-	-	-	45	60	-	-
12.	Navalgund	5	-	45	32	-	-	-	2	2	-	-
13.	Ranibennur	220	-	436	374	35	-	70	98	46	20	7
14.	Ron	15	2	20	25	-	-	10	15	15	2	10
15.	Savanur	16	2	90	82	2	3	10	8	7	5	15
16.	Shiggaon	20	183	32	20	4	2	491	21	23	7	3
17.	Shirhatti	16	2	62	35	1	-	6	8	11	2	8
	Total Area	1,694	4,819	3,133	3,156	453	357	3,316	1,763	947	230	132
	Average Yield per hectare in tonnes	11	18	19	8	18	12	12	7	6	15	13

Source : Office of the Deputy Director of Horticulture, Dharwad

Table 4.16 : Talukwise area of Fruit Crops in Dharwad District for 1992-93 (Ha.)

Sl.No.	Taluk	Mango	Plantain		Lime	Grapes	Guava	Sapota	Pomegra-nate	Jack	Ber	Papaya	Total fruit crops
			Cavandish	Others									
1.	Byadgi	26	1	2	16	-	5	17	2	1	20	1	163
2.	Dharwad	1,919	12	5	51	-	178	160	17	11	17	13	2,481
3.	Gadag	165	30	-	6	5	8	46	27	1	63	5	368
4.	Hangal	276	54	21	20	-	20	60	8	71	-	30	658
5.	Haveri	273	28	62	43	2	80	107	12	20	18	6	674
6.	Hirekerur	296	30	39	51	-	50	53	14	40	10	18	669
7.	Hubli	294	8	2	50	-	240	345	50	2	2	4	1,014
8.	Kalghatgi	640	9	-	11	-	100	186	-	1	8	5	960
9.	Kundgol	51	7	-	1	-	-	12	2	1	5	3	85
10.	Mundargi	43	6	1	3	6	55	48	23	-	12	-	213
11.	Nargund	80	51	-	49	-	50	120	43	-	30	8	444
12.	Navalgund	4	-	-	4	-	5	4	12	-	12	-	41
13.	Ranibennur	158	52	113	26	-	59	70	19	13	10	5	563
14.	Ron	81	-	-	14	4	35	53	14	-	6	-	218
15.	Savanur	46	18	18	12	-	20	40	112	5	12	12	219
16.	Shiggaon	181	62	-	1	-	7	111	28	20	24	8	476
17.	Shirhatti	60	9	2	5	-	11	22	7	-	15	1	143
	Total Area	4,593	377	265	363	17	923	1,454	390	186	264	119	9,389
	Average Yield per hectare in tonnes	8	30	30	9	22	13	18	10	24	8	42	-

Source : Office of the Deputy Director of Horticulture, Dharwad

Note: Total fruit crops includes other fruit crops apart from the above mentioned crops.

Table 4.17 : Talukwise area of Vegetable Crops in Dharwad District for 1992-93 (Ha.)

Sl.No.	Taluk	Capsicum	Pumpkin	Cauli flower	Root crops	Beetroot	Cluster beans	Cucumber	Ridge gourd	Bitter gourd	Drum stick	Other Vegetables	Total vegetables
1.	Byadgi	20	3	-	-	-	3	5	2	2	2	41	172
2.	Dharwad	-	165	55	60	64	10	200	20	-	-	-	5,974
3.	Gadag	-	70	35	35	-	300	460	380	120	5	420	5,714
4.	Hangal	5	-	1	5	5	5	5	10	15	2	-	209
5.	Haveri	70	140	5	2	5	20	20	30	10	-	50	1,539
6.	Hirekerur	106	200	50	40	43	-	-	-	-	-	-	3,689
7.	Hubli	-	-	-	-	5	20	-	-	-	-	-	1,090
8.	Kalghatgi	5	25	-	-	-	-	-	-	-	-	25	1,300
9.	Kundgol	2	3	-	-	-	5	6	3	12	-	-	1,587
10.	Mundargi	90	-	-	-	-	18	31	15	10	5	65	566
11.	Nargund	-	18	-	-	-	-	-	-	-	-	32	290
12.	Navalgund	-	5	-	-	-	2	4	2	-	-	6	105
13.	Ranibennur	130	30	4	6	12	35	28	40	10	30	15	1,646
14.	Ron	5	5	-	-	-	20	15	50	2	2	20	234
15.	Savanur	6	12	2	3	1	5	3	2	1	5	2	283
16.	Shiggaon	12	4	-	3	3	-	-	-	-	-	-	827
17.	Shirhatti	2	4	-	-	-	4	5	3	2	-	7	178
	Total Area	453	684	152	154	138	447	782	557	184	51	683	25,403
	Average Yield per hectare in tonnes	7	18	18	18	15	8	10	12	8	-	16	-

Source : Office of the Deputy Director of Horticulture, Dharwad

Pomegranate: Pomegranate crop was grown in an area of 290 hectares during 1992-93 and it is estimated that the average production per hectare was 10 tonnes. It is mostly grown in Hubli (50 ha), Nargund (43 ha), Shiggaon (28 ha) and Gadag (27 ha) taluks. *Basin seedless, Jyothi (GKVK I) and Ganesh (GBG-1)* varieties are recommended. After 10 years from planting, 200 to 250 fruits can be obtained on an average per year per tree.

The area (ha) and average production (in tonnes per hectare given in brackets) of the other fruit crops grown in the district are as follows : *Jack* 185 (24), *Ber* 261 (18) *Ramphal* 29 (9), *Seethaphal* (66), Papaya 110 (42), other citrus var 139 (39), Fig 6 (74) Pineapple 2 (9) and other fruits 181(9).

Potato : Potato is a popular vegetable crop. It is grown mostly as a dry crop in the district. In 1992-93, it was grown in about 4,050 hectares and it is estimated that the average production per hectare was 18 tonnes. In Dharwad taluk. It is grown in about 3,274 hectares. Potato is grown in Haveri, Hubli and Kalghatgi taluks. *Kufri chandramukhi, Kufri Badshaw, Kufri Jyoti and Kufri Kubera* varieties are recommended. It is learnt that 10 to 13 tonnes of yield can be obtained per hectare.

Tomato : Tomato is another popular vegetable crop. During 1992-93 it was grown in 3,133 hectares and it is estimated that a production of 119 tonnes per hectare was obtained. It is mainly grown in Hirekerur (800 ha), Dharwad (470 ha), Ranibennur (436 ha) and Hubli (300 ha) taluks. *Pusa Ruby, Siax , L-15, NTDR 1, Roma, Arka Sourabha and Arka Vikasa* varieties are recommended. It is learnt that an yield of 20 to 25 tonnes can be obtained.

Brinjal : The Brinjal crop was grown in 3,156 hectares in the district during 1992-93 and it is estimated that production of eight tonnes per hectare was obtained. It is chiefly grown in Gadag (945 ha), Hirekerur (575 ha), Kalghatgi (500 ha) and Ranibennur taluks. *Mallapura, Pusakranti, Composite 1 and 2, Arka Navaneetha* varieties are recommended. It is learnt that an yield of 25 to 40 tonnes can be obtained per hectare .

Lady's Finger : Lady's finger is one of the popular vegetable crop and during 1992-93, it was grown in 1,762 ha. It is estimated that an average yield of seven tonnes per hectare was obtained. *Pusa Sawani and white velvet* varieties are recommended to be grown. It is mostly grown in Hirekerur (525 ha), Gadag (400 ha) and Dharwad (250 ha) taluks.

The area (ha) and yield (tonnes per hectare given in brackets) of the other vegetable crops grown in the district are as follows : Cabbage 453 (18), Peas 357 (12), Avare 3,316 (12), Raddish 946(6), Sweet potato 233 (15), Tapioca 125 (13), Capsicum 453 (7), Gourd variety 681 (18), Cauliflower 152 (18), Knol Khol 154 (18), Beetroot 138 (15), Cucumber 783 (10), Ridge gourd 558 (12), Bitter gourd 184(8), Drumstick 52, Greens 1,694 (11) and other vegetables 682 (17).

Of the flower crops, Rose was grown in 85 hectares, Crysanthemum in 721 hectares, Tuberose in 57 hectares, Aster in 50 ha, Jasmine 203 ha, Crossandra in 93 hectares and Marigold in 223 hectares. *Champak* in 22 hectares and other flowers are grown in 45 hectares. An average of three to eight tonnes of flowers are produced per hectare.

Chillies : In respect of area under Chillies, this district has got the first place in the State, In 1992-93 this crop was grown in 93,882 hectares and it is estimated that the production was 2.5 tonnes per hectare from this crop. It is mostly grown in Kundgol (26,021 ha) Hirekerur (15,000 ha), Haveri

(15,000 ha), Savanur (9,981 ha) and Gadag (7,374) taluks. If it is grown as an irrigated crop it is suitable to sow in October-November and January-February and if it is a dry crop May-June months are suitable for sowing. Byadgi Chilli variety is gown in large area in the district and when it is dried , it will get deep red colour. The fruit is about 12 to 15 cm. long and it is less pungent and it is suitable for dry areas. Among the other improved varieties *NP 46 A, G-3, Pusa Jwala, G-4* and *D.H. 7-6-6* are important. To sow one hectare of area 1,250 gm of sowing seeds are required. Seedlings are raised in nurseries and then it is transplanted in dry lands. The fruits are available after 70 to 80 days of transplanting. If it is green chillies it is learnt that an yield of 7 to 10 tonnes for hectare can be obtained and if it is dry chillies 750 to 1000 kg of yield can be obtained. From an irrigated crop 2 to 2 1/2 tonnes of yield can be obtained.

Byadgi chillies have got special characteristics. It is long and has beautiful attractive colour and even if it is stored for a long time it will not be spoiled. There are two types, one being *stick* and the other being *Dabbi* chillies . The *'stick'* chillies are about 7.5 to 25 cm long and it has less seeds. It is more pungent. The *'Dabbi'* chillies are 5 to 15 cms long. Its outer cover is very thick and it will have lot of seeds. The improved *Jwala* variety is just like *Guntur* chillies and it can compete with *Guntur* variety. Byadgi chilli is not grown only in Byadgi but also in Gadag, Dharwad, Hubli, Kundgol, Shiggaon and Hirekerur taluks. Chillies are also brought from Chitradurga, Shimoga and Chikmagalur districts. Byadgi chillies are famous even in foreign countries. It was chiefly exported from Kumta port in the olden days. Usually the trade activities will be very brisk during November to February every year. For the past one or two years the disease of dropping of the pods has commenced and there are signs that the crop may have a setback.

Onion : Onion crop was grown in 11,200 hectares in 1992-93 and it is estimated that the average yield per hectare was 16 tonnes. In area the district has got the first place in the State. It is mostly grown in Gadag (3,228 ha), Ranibennur (1,615 ha), Shirhatti (1,500 ha) Hubli (805 ha) and Haveri (850 ha) taluks. The onion crop can be grown in all the seasons. *Bellary* Red, *Pusa Red, Arka Pragati, Arka Niketana, Arka Kalyana, Duliya (Bombay), N-53, Telagi Red and Telagi white* varieties are recommended . The onion crop can be grown by growing the seedlings in the nursery and then transplanting or sown using seed drills or planting the tubers by hand or even by sowing seeds by hand. When the leaves of the plant turn yellow the crop is ready for harvest. It is learnt that an yield of 20 quintals on an average can be obtained.

Garlic : Garlic crop was grown in 1,754 hectares (12992-93) and it is estimated that the yield got per hectare was eight tonnes. It is mainly grown in Ranibennur (450 ha), Hirekerur (420 ha), Kundgol (368 ha) and Shirhatti (208 ha) taluks. It is recommended to grow high yielding varieties, of *fouri* and *Rajallegaddi*. About eight tonnes of yield per hectare can be expected. More than half the area in the State is in this district.

Coriander : Coriander crop was grown in 2,681 hectares in 1992-93 and it is estimated that the yield per hectare was one tonne. It is grown in Gadag (735 ha). Ron (300 ha), Ranibennur (315 ha), Kundgol (279 ha), Dharwad (240 ha), and Haveri (225 ha) taluks.

Betel Leaves : Betel leaves are grown in about 500 hectares in the district. The important places from where *'beeda'* leaves are exported are Ranibennur and Savanur of this district and Channarayapatna of Hassan district. It is learnt that in Ranibennur this enterprise will be going on briskly throughout the year. These leaves have always got heavy demand . The beautiful, medium sized betel leaves of

this place are very tasty. *Black* leaves and *Ambadi* leaves are available and if the regularly habituated pan lovers eat the black leaves, others who eat rarely only eat *Ambadi* leaves. The exporting of leaves to other places has given jobs to hundreds of people here. The transactions will be very brisk from March to June. In these months, more than 2,000 baskets are transported to various parts of the Country from Ranibennur. As the leaf gardens of this taluk cannot comply with the demand, leaves are got from Harihara and Honnavar also. Beetel leaves are transported to foreign countries especially to Karachi in Pakistan.

The area of other spices and plaintain crops of the district is as follows : Arecanut– 218, Coconut – 4,254, Cashew – 88, Tamarind – 657, Curry leaves – 133, Ginger – 59, Turmeric- 25, Cocoa-4 and other crops 127 hectares.

Horticultural Farms and Nurseries

Multipurpose horticultural farms were started to impart knowledge to the people on horticultural crops. Identifying original plants that suit the soil, to satisfy the needs of the cultivators, regarding all horticultural crops, seedlings to be produced and providing training to the farmers children, demonstration about the improved horticultural practices to the horticulturists and to provide them knowledge through farms, are the main objectives behind the establishment of these farms and nurseries. By 1967 an office nursery of one hectare area in Dharwad city, horticultural farms at Kanavi Honnapura (1.2 ha), Dhummawada (3.2 ha), Hubli (0.8 ha), Shiggaon (0.2 ha), Haveri (0.08 ha), Hangal (4.8 ha)Ranibennur (0.08 ha), Rattihalli (0.04 ha) , Hamsabhavi (2.8 ha) and Byadgi (0.08 ha) in the district were established. The details of horticultural farms in the district during the year 1992-93 are given in the following table.

	Particulars of Nurseries	Area (ha)	Year of Commencement
	1	2	3
1.	Kanavi Honnapura Horti cultural Farm	1.84	1965-66
2.	Bengeri Horticultural Farm	2.57	1969-70
3.	Dastikoppa Horticultural Farm	1.22	1969-70
4.	Kundgol Nursery	0.02	-
5.	Shiggaon Nursery	0.05	1972-73
6.	Karjagi Horticultural Farm	10.13	1976-77
7.	Hansabhavi Horticultural Farm	2.57	1965-66
8.	Elivala Horticultural Farm	8.10	1976-77
9.	Chowdadanapura Horticultural Farm	4.46	1972-73
10.	Hanumanamatti Horticultural Farm	11.75	1974-75
11.	Nargund Nursery	0.83	1974-75
12.	Konnur Horticultural Farm	7.09	1974-75
13.	Belavatagi Horticultural Farm	2.27	1986-87
14.	Navalgund Nursery	1.03	1981-82
15.	Shirhatti Nursery	0.41	1975-76
16.	Hangal Horticultural Farm	7.02	1968-69
17.	Byalavadagi Horticultural Farm, Mundargi	11.67	1972-73

1		2	3
18.	Ron Nursery	0.12	1975-76
19.	Rattihalli Horticultural Farm	3.18	1972-73
20.	District Nursery, Dharwad	0.68	1961-62
21.	Dhummavada Horticultural Farm	4.05	1967-68
22.	Savanur Horticultural Farm	5.33	1982-83
23.	Office Nursery, Savanur	0.03	1988-89
24.	Horticultural Farm, Yettinahalli	10.59	1986-87
25.	Horticultural Farm, Lakshmeshwar	1.22	1982-83
26.	Horticultural Farm, Byadgi	2.68	1968-69
27.	Office Nursery, Hirekerur	0.16	1980-81
28.	Office Nursery, Hubli	0.06	1969-70
29.	Office nursery, Haveri	0.18	1962-63
30.	Office Nursery, Mundargi	0.49	1986-87
31.	M.P.O. Nursery, Gadag	11.02	1981-82
32.	Office Nursery, Gadag	2.03	1971-72
33.	Horticultural Farm, Jagalur	7.38	1974-75

There is a capacity to produce 61,300 grafted and 3,48,200 non-grafted seedlings out of the total horticultural farms and nurseries. During 1990-91, 60,127 Coconut seedlings, 2,22,822 other seedlings and 2,100 kg of vegetable seeds were produced and distributed to the cultivators.

Developing of good quality plants, distribution of good quality grafted seedlings, giving technical guidance to extend the horticultural area, extending the area by getting loan facilities from the Primary Land Development Banks to the farmers, promoting horticultural crops giving practical training in following plant protection measures for horticultural crops and providing appropriate technical guidance and establishing good market and processing units to horticultural produces, farming plans to implement programmes for horticultural development in specific areas etc. are the major programmes of the Horticulture department. As heavy initial capital is required for the cultivation of horticultural crops arrangements are made to provide loan facilities to the farmers under "NABARD" to help the small and marginal farmers. Loans are given to 14 horticultural crops. They are Mango, Grapes, Sapota, Pineapple, Pomegranate, '*Elache*', Coconut, Cardamom, Cashew, Pepper, Betel leaf, Arecanut, vegetable and Rose crops. Short duration training of one to five days duration is given to selected farmers every year. Scientific cultivation of horticultural crops, different plant production methods and the associated technology will be made known to the farmers. The children of the farmers will be made proficient in horticulture and they will be encouraged to start their own horticulture occupation. To make the farmers to be aware of the latest development in horticulture, exhibitions, seminars and many other programmes are conducted. The District Horticultural Produce Marketing and Processing Co-operative Society has been established. These societies arrange horticultural exhibitions and in addition they are rendering service by implementing many useful programmes.

ANIMAL HUSBANDRY AND VETERINARY SERVICES

Besides crop husbandry, trade and *handicrafts*, animal husbandry was also a main occupation in the district. In olden days elephants and horses were used in army. A division of training elephants and horses is found in the M*anasollasa*.This book makes a mention of such interesting events such as fight among the domestic animals like Ram and Fowl. Kirtivarma, King of Kalyani Chalukya (c 1100) has written a Kannada book by name "*Govaidya* " about veterinary science. In every village a *Basava* or a bull would be there, under the protection of the main temples of the village and there was no obstacles for these bulls to graze in any dry land. In many temples cows were reared. As lands were gifted for the service of Gods, It was common to give cows and sheep as grants for specific expenses. Cattle were used not only in transport but also for ploughing the land and other works. Bullocks and buffaloes were used as animals carrying heavy cargos and also to draw carts and to plough the land. Donkeys and horses were used as load carrying animals. The merchants who were travelling in hilly areas were using bullocks and donkeys to transport their trade articles. During cart festival aand cattle fairs, trading of cattle was in practice. Valuable Milk and Milk products were available from some animals. Separate grassland and tanks were reserved for cattle. More attention was also paid towards the health of cattle.

It is very common to find beautiful sculptures like Bison's head in many villages of Dharwad district. By this it can be presumed that buffalo rearing was common in the district in the past. In the herostones of *Turugol,* there are sculptural carvings in many places depicting that protecting buffaloes instead of cows was preferable. There are *Gosasa* stones testifying that '*Gosahasradana'* was common in many places in the district under the Badami Chalukyas and even more, during the reign of the Rashtrakutas. There are hundreds of Gosasa stones in the district to give evidence that thousands of *Gosasa* gifts were given and there are inscriptions to say that *Gosahasradanas* were made in places like *Devagiri*, *Gudigeri*, *Annigeri*, *Assoti* etc., of the Badami Chalukyas and *Hiremaganur*, *Hoolihalli*, *Hirekerur*, *Holabikonda*, *Sathenahalli*, *Soratooru*, *Belahoda*, *Haleritti*, *Sangoor* etc. Therefore it may be surmised that importance for giving more attention to cattle rearing must have come only from this period. It is seen from these gifts that persons who received *godana* should give ghee as a levy to temples and Governments. The old ghee was collected and was used as medicine to those injured in war and in all the forts there were such stores.

The Animal Husbandry and Veterinary Services department has undertaken the following programmes *viz.*, To provide improved bullocks to agriculturists, increasing the quantity of milk from every milch animal, to provide good poultry. In increasing the quantity of eggs per fowl, to provide better veterinary help, increasing the nutrition of cattle through taking up fodder production and other programmes. These activities aim at providing health care and maximising the production of milk, eggs, wool and meat.Development of cattle is an integrated part of agriculture. *Amrithmahal*, *Amritmahal-Killar*, *Krishna Valley* and *Malnad Gidda* cow breeds are famous in the district, *Killar* breed is suitable to draw heavy loads. The buffaloes of the district are superior in the production of milk.

Amritmahal cows are famous for withstanding harsh conditions for their endurance. These bullocks adjust themselves to galloping and quick transport. Generally these animals are brown in colour. It is not uncommon to find white coloured cows. It has a good stature, small head., forehead with rows and deep folds, flashing red coloured eyes, long legs of equal proportion and length and small teethed animals. But they give low milk yield.

In the '*malnad*' parts the cows and bulls are mostly small sized with stunted growth and there are no definite characteristics for these breeds. So they are called `*Malnad Giddas which are* without any definite characteristics. Most of the cattle have black hairs. Though they are small in size they are mostly disease resistant and are enduring and have a good stamina. As the *Malnad Gidda* variety are not superior, their milk yielding period is only from six to seven months. These are reared for agricultural purposes, milk and getting manure.

Livestock Census

The details of livestock census conducted in the district are seen in Tables 4.18 and 4.19

Table 4.18 - Details of various Livestock census conducted in the district

Sl.	Particulars	Livestock census				
		1966	1972	1977	1983	1990
1.	Cattle per sq. km	63	68	73	76	79
2.	Cattle for every lakh of population	39,540	38,911	37,281	33,716	27,047
3.	Available for one lakh population					
	3.1 Milching cows	3,369	3,177	3,302	3,150	2,600
	3.2 Milching buffaloes	3,828	3,524	3,593	3,250	2,800
	3.3 Sheep	9,577	9,496	8,017	6,690	7,250
	3.4 Goats	8,505	12,403	11,109	10,160	8,900
	3.5 Pigs	143	162	164	200	230
	3.6 Poultry	12,756	15,391	10,286	11,600	17,980
4.	Livestock per veterinary Institution	24,859	20,137	16,710	16,205	8,232

Table 4.19 : Details of Livestock Census (Numbers in lakhs)

Sl.No.	Particulars	1956	1961	1960	1972	1977	1983
1.	Cows	231	241	238	268	294	310
2.	Bulls	355	378	372	396	425	436
	Total	586	619	610	664	719	746
3.	He-Buffaloes	36	35	41	42	44	48
	She-Buffaloes	203	216	218	228	244	251
	Total	239	251	259	270	288	299
5.	Sheep	172	154	205	229	218	206
6.	Goats	122	165	183	299	303	312
7.	Horses and Donkeys	6	7	7	5	5	3
8.	Pigs	4	13	3	4	4	6
9.	Total Livestock	1079	1209	1267	1462	1587	1572
10.	Poultry	186	238	279	371	282	361

The main objectives of the livestock farms are (a) to provide bulls of outstanding merit for the artificial in semi nation programme, (b) to maintain the purity of the indigenous breeds like Amrithmahal, Deoni, Khillar, Krishna valley and Hallikar, (c) to conduct studies on cross breeding of local cattle with exotic breeds like Jercy and Holstein – Friesian, (d) to supply fodder seeds, cuttings and rootslips (e) training farmers and beneficiaries in improved dairy husbandry practices, (f) production of buffaloe bull-calves of Surti breed for breeding purpose.

The taluk wise Livestock in the district is given in table 4.20 and details of veterinary institutions and fisheries are given in table 4.21.

The important factor in the improvement of cattle breed is to develop mixed breeds from the semen of good quality bulls of foreign countries in large numbers. By this milk yield can be increased in a very short period. There are two key village schemes in the district and 16 sub-centres are established and through them encouragement is given to the improvement of breeds throughout the district. There are two artificial insemination centres and 77 artificial insemination sub-centres. The semen collected in these centres is processed and used for artificial insemination.

The cattle Breeding station at Bankapura (for improvement of breeds) is doing the work of producing improved bulls to improvise the local cattle. Chiefly *Killari* breed is being improved. Experiments are being conducted here with the purpose of improving the calving regularly by the cows, to come to maturity early and to improve the quality of milk yield., 28 hectares are being cultivated in this centre. There is a Rabbit breed improvement centre and good breeds are made available to rabbit rearers. Here *Ambura* of America, *Chinchira* of Russia and other rabbit breeds are developed. The buffalo breeding centre at Tegur is having an objective to bring the local buffaloes to the level of Amritmahal Cattle. In this centre 28 hectares of land are cultivated.

Sl.No.	Name of the Centre	Area in acres	No.of cattle 1987-88	1990-91	1993-94
1	Cattle breeding and Training centre Dharwad	63	131	112	97
2.	Killari Cattle breeding centre, Bankapura	139	73	56	150
3.	Baffalo Breeding and Training Centre, Tegur	314	144	141	198

The Intensive cattle Development scheme is being implemented in the district and it has been started with the objective of producing mixed breeds by artificially inseminating the local cattle with foreign breeds through which higher milk yield is be obtained. In this scheme Artificial insemination centres are established in Dharwad. The centralised semen collection and Bulls centre is established in Dharwad. Semen is supplied from this centre to Artificial insemination centres. The semen of draught breeds like Hallikar, Amritmahal, Khiller and Deoni is being used for selective breeding of draught animals. Semen from exotic breeds like Holstein Friesian and Jercy are being used to increase milk production through cross breeding. Semen from Murrah and Surti breeds are beeing used to increase productivity among buffaloes.

The special Livestock production programme is in operation and the main objectives of this programme are :1. To increase the production of livestock.; 2. To assist the farmers by giving grants for their feed till the mixed breed heifers come to maturity.; 3.To assist the farmers to rear a unit of

Table 4.20 : Talukwise Details of livestock, as per 1990 Livestock census (Numbers in Hundreds)

Sl.No.	Taluks	Cattle	Buffaloes	Sheep	Goats	Pigs	Dogs	Other Livestock	Total Livestock	Poultry
1.	Byadgi	293	124	50	127	3	43	1	641	287
2.	Dharwad	479	237	64	216	1	68	1	1,012	440
3.	Gadag	338	171	165	236	21	72	2	1,005	259
4.	Hangal	638	171	54	153	6	64	1	1,087	424
5.	Haveri	427	190	245	253	5	77	3	1,200	661
6.	Hirekerur	632	288	167	262	1	76	-	1,426	463
7.	Hubli	238	117	25	91	-	36	-	507	324
8.	Kalghatgi	522	136	8	81	1	47	-	795	220
9.	Kundgol	271	124	72	97	-	46	1	611	203
10.	Mundargi	295	80	210	217	2	42	1	847	220
11.	Nargund	162	75	68	78	4	25	-	412	81
12.	Navalgund	367	159	89	183	7	60	2	867	119
13.	Ranibennur	402	265	591	282	6	89	4	1,639	569
14.	Ron	411	210	245	314	12	80	2	1,274	600
15.	Savanur	275	97	82	172	-	40	-	667	258
16.	Shiggaon	407	119	66	102	2	52	-	749	241
17.	Shirhatti	382	132	351	289	3	61	2	1,226	328
18.	Hubli-Dharwad Corporation	139	97	5	41	8	41	1	332	673
	District Total	6,678	2,792	2,557	3,194	82	1,019	21	16,297	6,370

Source :Livestock Census, 1990 HDMC - Hubli, Dharwad Municipal Corporation

Table 4.21 : Talukwise Details of Veterinary Institutions (1993-94) and Fisheries (1992-93)

Sl.No.	Taluks	Veterinary Hospitals	Veterinary Dispensaries	Primary Veterinary Clinics	Mobile Dispensaries	Artificial insemination Centres	Fish caught in tonnes	Refrigeration centres (Cold storage)	Ice Factories
1.	Byadgi	1	3	7	1	-	25	-	-
2.	Dharwad	1	4	10	1	16	560	1	4
3.	Gadag	1	3	10	1	5	54	-	-
4.	Hangal	1	2	11	1	1	273	-	-
5.	Haveri	1	6	7	1	6	150	-	-
6.	Hirekerur	2	6	11	1	9	58	-	-
7.	Hubli	1	4	9	1	8	34	1	5
8.	Kalghatgi	1	1	6	1	7	72	-	-
9.	Kundgol	1	4	5	1	8	4	-	-
10.	Mundargi	1	2	7	1	1	60	-	-
11.	Nargund	1	-	5	1	-	5	-	-
12.	Navalgund	1	2	7	1	5	2	-	-
13.	Ranibennur	1	4	7	1	5	38	-	-
14.	Ron	1	3	9	1	3	35	-	-
15.	Savanur	1	1	5	1	-	35	-	-
16.	Shiggaon	2	2	6	1	5	102	-	-
17.	Shirhatti	2	-	6	1	1	30	-	-
	District Total	20	47	128	17	80	1,537	2	9

Source : Dharwad District at a Glance, Dharwad District

20 of sheep and one ram.; 4. To help the farmers to establish a 50 bird poultry farming unit and to establish poultry rearing co-operative societies. ; 5.To give aid to selected farmers to establish a pig rearing unit (3 pigs). To assist small and medium farmers and landless labourers to establish sheep, pig and poultry rearing centres and grants will be given to the calves of mixed breed she-calves of 4 to 29 months for their feed. The large scale production programme, is aimed 1) To increase the production of animal based foods like milk, meat, eggs etc. 2) To provide subsidiary occupation to the farmers throughout the year and 3) to improve the economic position of farmers.

Integrated Rural Development Programme, Integrated Development of Western Ghats, Fodder Development, Draught Prone Area Programme, Special Component Programme, Special livestock Breeding Programmes are being taken up under special economic programmes and under these schemes sheep rearing, Pig rearing, mixed breed calf rearing, rabbit rearings and other schemes are being implemented in the district.

Dairy Development

The milk distribution centres in the district, by purchasing milk throughout the year from the rural milk producers, ensure and enable them to market and also ensure to provide pure and healthy milk to the milk consumers in the city. The Dairy in Dharwad collects the milk available with the milk producers and after processing it, distributes to the consumers. There is a milk producers co-operative Societies Federation in the district and in this limited company, there are 424 co-operative societies and 51,000 members. About 233 milk distribution centres are working in the district and 167 are in Hubli and 66 are in Dharwad, Dharwad Dairy which is in *Rayapura* near Dharwad has a milk processing capacity of 10,000 litres per day. Under its jurisdiction three Rural Milk Centres are working, Gadag (2,000 litres daily). *Mundgod* (4000 litres daily) and Kiruvatti (4,000 litres daily). The last two are in Uttara Kannada district and cold storage facility is also provided to them. By providing cold storage facilities the spoilage of milk is avoided . There is a milk extension centre in the district and its functions are 1) forming milk producers co-operative society, 2) to get financial aid to dairy farms from different organisations 3) to protect the health of livestock to facilitate successful rearing 4) to give guidance to milk producing farmers about the methods of marketing, 5) to suggest sources of balanced food required for cattle, 6) to help the farmers to grow green grass required by the farmers in their lands etc. These centres do preliminary work at the rural level and by developing the milk industry, they are made to involve in the activities of the development of Dairy and their welfare is looked after. In Dharwad Dairy 47 lakh litres of milk was collected during 1979-80 and during 1990-91, 130.89 lakh litres of milk were collected. As per the Milk and Milk Products order 1992, any firm or individual who procures, processes, stores, or markets in excess of 10,000 litres of milk per day or 500 metric tonnes of milk products per annum, needs to cmpulsorily obtain a registration certificate from either state Registering Authority or the Central Registering Authority.

Sheep Development : Sheep rearing is providing extensive employment and earns foreign exchange. Therefore more encouragement is given to sheep rearing and wool processing. According to the livestock census of 1990, there were 2.56 lakhs sheep. A sheep Breeding Station has been established in 1947 at *Guttala* of Haveri taluk with an area of 118 hectares. The fine and good quality wool is obtained by cross breeding of local *Deccan* with *Merino* and *Ramboullet* breeds. At present the cross breed is continued on the same basis and Rams are provided to the different Central and State Sheep Development Centres.

In the sheep Breeding Station at Guttala, 395 sheep in 1992-93 and 427 sheep in 1993-94 were reared adopting scientific methods. 159 sheep were born in 1992-93 and 191 in 1993-94. In the same years 77 and 74 mixed breed sheep respectively are distributed to the farmers. Under the centrally sponsored scheme , a sheep Development Extension Centre has been established at Ranibennur with the object of crossing the foreign breeds which have abundant meat and wool. In this extension Centre the foreign pure breeds, *Ramboullet*, *Cloridale* and *Manlenave* are crossed with local breeds and the local breeds are improved. The various quality wool samples coming from sheep breeds from different parts of the State are examined under the wool development scheme. To decide the improvement of quality of wool by breeding sheep an analytical laboratory was established in 1960-61 at Ranibennur for the development of wool as per the sheep and wool development scheme. The items of work of this centre are(a) To review the statistics of research and extension and to evaluate them (b)to examine the quality of wool among the rural flock of sheep to identify good breeds to use them as source material (c) To study the quality of wool that has developed hereditarily in the selected flocks of different villages and evaluation of improvement and to process wool as required by the processing machine or manual *charakas* by cutting wool. There is a wool uitlization centre attached to the laboratory and actual experiments are demonstrated about the weaving of different kinds of wool and produce the readymade *rugs*, carpets, *waist belts* and other attractive articles. In the sheep wool processing centre at Ranibennur 415 kg of wool valued at Rs.3,320 was produced in 1993-94 and by using 1,509 kg of wool 458 kg of wool thread were produced. These threads are utilised for manufacturing wool products. Wood products worth Rs.1.15 lakhs were produced and products worth Rs.1.04 lakhs were sold. In the month of March 1994 there was a store of 8,446 kg of wool in the centre and its value was assessed at Rs. 1.67 lakhs.

During 1991-92 the details of inoculation done to livestock at veterinary institutions of the district are as follows : a) No.of livestock treated – 6,51,290, b) No.of bulls castrated – 22,994, c) Innoculation for throat disease – 2,67,841, d) Inoculation for black quarter disease – 2,e) Innoculation for intestinal disease – 2,68,369, f) Innoculation for foot and mouth disease – 18,792, , g) Innoculation for Rabies – 494, h) Innoculation for sheep and goat pox – 7,463, i) Innoculation for Anthrax disease – 10,893 and j) Making the sheep to drink worm medicine – 1,12, 670.

Poultry Rearing : The conditions for poultry rearing activities in the district are favourable. Many schemes to provide sufficient chicks for breeding poultry in the district and health protection for poultry in private poultry farms are implemented in the district. The Regional Poultry Rearing Farm at Dharwad is involved in providing the required help and service to the poultry farms already started and also the farms to be started by the farmers. These farmers in addition to multi plying fowls, also provide good chicks to the farmers who rear poultry and are also engaged in the food production required for the concerned programme. These farms will also help in such other facilities like markets, health protection, inter-organisational finance, establishment of poultry rearing co-operative societies and to determine the required cattle feed and also provide life saving drugs to the farmers. There is the Poultry Food Quality Control Act in force to provide good poultry feed. For those who are possessing poultry rearing units training is given in the nearby Government farm about poultry feed, disease control and supervision of hatching fowls.

Fodder Development: In *the Intensive Cattle Development Programme*, Key village Scheme and Sheep farms fodder development activities are in progress. These farmers are made to take up fodder cultivation under the technical guidance and improved fodder seeds and cuttings and legumes are

provided from the Bankapura and Tegur Cattle rearing Farms and sheep farm at Guttala. The grass roots of hybrid *Poona Napier, Giant Napier, Rhodes grass,. Guinea gross* etc., and fodder seeds of Maize, Bajra, Cowpea etc. are distributed. In addition to these fodder Development activities Red Dane scheme officers are giving training programmes to farmers at Dharwad centre.

The University of Agricultural Sciences, Karnataka Milk Development Corporation and Fodder Scheme Centres at Hebbal are jointly conducting research about grass and legumes and also distributing grass and grass seeds in large quantities from the Fodder Research Station centre at Dharwad.

Under the *Drought Prone Area Programme*, the development of grass and grass lands is taken up. This activity is generally conducted by the Forest department, under the *Western Ghat Area Development Programme*. The *Malaprabha Command Area Development Authority* is arranging Demonstration Plots in Farmers lands for the development of Fodder

FISHERIES

Irrigation tanks, reservoirs and rivers are the resources for the development of fisheries In Dharwad district, . The tanks having an area of ten hectares of water spread area and more are classified as Major tanks and tanks having less than ten hectares are classified as minor tanks. Dharwad district has 250 major tanks with a water spreading area of 4,496 hectares, 2,054 minor tanks with a water spread area of 4,655 hectares and there are two reservoirs with a water spread area of 7,644 hectares provide the necessary facilities for fisheries to develop in the districts and the district has a total of 16,795 hectares of inland water resources. Out of the total tanks 100 major tanks (10,000 ha) and 500 minor tanks (1,500 ha) are considered suitable for fisheries. The Senior Assistant Director of Fisheries is giving the major tanks on lease to the co-operative Societies. Mandal Panchayats and Yuvak Mandals through the Zilla Panchayat for the development of fisheries . If there is no demand from these organisations it will be auctioned in Public. The small tanks are given for a long lease of four to five years to the fisherman after giving training to individual beneficiaries. Tungabhadra, Varada and Kumudvati rivers are flowing in the district and their total length is about 150 kms. A portion of the river is disposed of by lease to the societies and organisations and auctioned for a living to the fisherman.

There are 12,700 fishermen engaged in fishing in tanks and rivers in the district and of them 3,000 fishermen are engaged in full time fishing. Co-operative societies are started for the fishermen to continue their profession, to improve their financial position, to solve the problem of unemployment of rural fisherman and to supply healthy fish at a reasonable cost to the rural people. Under the plans of the Fisheries department, they are given loan for purchasing fishing equipments, share capital loan and the working expenses,. Also the societies and organisations are given portions of tanks and rivers on annual lease and the department is providing supply of fishing and technical guidance etc. The talukwise fisheries co-operative societies and the number of members are as follows : Dharwad – 4, (154), Hubli –1 (30), Mundargi – 1 (401), Ron-1 (15), Shiggaon – 1(52), Savanur 3 (134), Haveri 3 (218), Byadgi (52), Hangal –8 (605), Ranibennur –2 (290), Hirekerur –3 (200), Kalghatgi –1 (77), and Dharwad district – 29 (2,228 members).During the year 1992-93, 83 tanks were given on lease to Fisheries Co-operative Societies, 53 tanks to Mandal Panchayats and Yuvak Mandals, totaling 136 tanks were given on lease and 39 tanks was auctioned in publics. The total income obtained in 1992-93 was Rs.4.15 lakhs.

Fish breeds and Fish Rearing Farms : *Katla, Rahu*, Mrigal of North India, and foreign breeds like *common carp*. '*Gross Carp*' and '*Silver crops*' brought from outside the country considered as very good for fish rearing are utilised for higher fish production. These fish breeds were brought every year from outside the State. Recently in the fishseed production centre established in the State the Fish seeds of these breeds are being produced more and more. In Dharwad, *Neerasagar* Fishing Production Centre has been established and during 1986-87 to 1990-91 thirteen, thirteen, eleven and one lakh fishseeds have been produced respectively. This Centre is managed by Fishermen Development Organisation.

In order to meet the increased demand for fisheries in the State, it is planned to take up Inland Fisheries Development Plan at a total cost of 906 lakhs with the help of *European Economic Community* in Shimoga, Dharwad and Raichur districts. This plan has been sanctioned by *European Economic Community* in April 1989. This plan has not only a programme of Fishseed production but also inland fisheries in tank and reservoirs through Fisheries Co-operative Societies.