

## CHAPTER IV

### AGRICULTURE AND IRRIGATION\*

That agriculture flourished right from the Ganga dynasty times (4th century onwards) and much attention was paid to create and maintain irrigational facilities in the Bangalore district area, is clearly vouched by some stray references in inscriptions. A record dated 870 A.D. of the Gangas speaks of building of tank and its being provided with a sluice by a Ganga feudatory with reference to the tank at Agara (near Bangalore) and the record also speaks of three tanks of the neighbourhood and *bittuvatta* grant, *bittuvatta* standing for a land grant, the recipient of which was charged with the responsibilities of the upkeep of the said tanks (and other irrigation facilities). The importance of agriculture and irrigational facilities is clearly stressed in many records. The Allalasaandra inscription of 1544 (Bn 30) speaks of the *kere-kunte* (water sources like tanks), *gadde-beddalu* (wet and dry lands), *gude-guyilu* (huts and plots?), *tota-tudike* (orchards and flower gardens), *kadaramba-neeraramba* (land cultivated by rain water and irrigation water) in the village. This gives an idea of the clear recognition of agricultural potential of the village. A record from Tippasaandra (An 47) from Anekal taluk dated 1614 similarly speaks of not only *kere-kunte*, and *tota-tudike* but also of *ane* (bund), *accukattu* (irrigated land) and *phalavriksha* (fruit-bearing trees). Raising a bund Devara Ane across the Arkavati and creating reservoir called Shivasamudra at Hesaraghatta in 1533 is also mentioned in a record (NI 31). Reclaiming land for agriculture by clearing the forests, constructing a tank by removing sand to irrigate the lands and creating a new village named Vaccidevapuram is mentioned in a record of 1307. This was for the merit of Vallappa Dannayaka, nephew of Hoysala Ballala III. Instances of individuals honoured by grant of land for constructing tanks are numerous, as in the case of land grant at Maysaandra in 1274 (An 45), Jigani in 1302

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\* This chapter also includes Horticulture, Animal Husbandry, Veterinary Services, and Fisheries.

An 80), Tirumalapura in 1766 (Nl 21) or at Mattikere as late as in 1834 (Bn 160). In the village Kallukere the tank was damaged (its bank broken) in the days of Ballala III, and the state not only built two bunds to protect it, but also made a grant of land (*kerekodige*) to an individual for its up-keep (Bn 166). The Nayaka of Kukkalanadu spent 3,000 *honnu* (a gold coin) to construct a tank at Ramasamudra in 1340 (Bn 111). Providing a cart for desilting a tank (to carry silt) is mentioned in a record of 1515 (Bn 80). Many of these tanks created then are in use even today as at Jigani, Hesaraghatta, Agara, Biduragere, etc. The tanks in Bangalore city like Kempambudhi and Dharmambudhi were in use even during this century. The Kottanur record of 1705 (Bn 118) speaks of lifting devices like *yata* (piccota) and *kapile*.

The crops grown in ancient times were the same as now, paddy, *ragi* and jowar being the cereals. Sugar cane, cotton, oil seeds like gingelly and castor, and vegetables like brinjal, ladies finger and gourds and fruits like mango and guava were also raised. After the advent of the Portuguese, mainly during 18th century cultivation of maize, chillies, groundnut, potato, tomato, etc. became popular. Mulberry came to be cultivated on a wider scale from the 19th century. Bangalore district was known for its orchards and coconut gardens. Buchanan states that garbage from Bangalore city was being used as manure by villagers around Bangalore. Tipu had introduced many exotic *flora* including eucalyptus in the Lalbag garden. While speaking of this garden (created by Haider and Tipu) Buchanan says that "They are extensive and divided into square plots prepared by walks, the sides of which are ornamented with fine cypress trees. The plots are filled with fruit trees, and pot-herb". He says that water is supplied to this garden from three wells. Water was raised by 'capily' *ie* "leather-bag fastened to a cord passing over a pulley, and wrought by a pair of bullocks, which descent on an inclined plane". He says that in the climate of Bangalore cypress and vine "grow luxuriantly", and so did apple and peach. Some pine and oak trees, later introduced from the Cape of Good Hope, "seem to be thriving here" he adds and also feels that "in this country all the valuable plants of Levant could succeed". Agara had mango gardens, and fruits from these were taken to Bangalore market, he informs. Haider is said to have encouraged the migration of skilled gardeners called *Thigalas* to Bangalore from Tamil Nadu.

The establishment of the Agricultural School in 1912 at Hebbal, the Agricultural College in 1946 and the University of Agricultural Sciences at the same place in 1964-65 helped the development of agriculture in the district. An Agricultural School at Ramakrishnapura in Anekal taluk was founded in 1930.

### **Agricultural population**

The highly urbanised Bangalore district contains relatively low proportions of main and marginal workers and a correspondingly high component of non-workers. Main workers are those who have engaged themselves in economically productive work for a period of 183 days or more during the year. While those who

have worked for a lesser period are classified as marginal workers, those who have not at all participated in any economically productive activity are grouped under non-workers. The proportions of main workers in the total population of different taluks of the district ranges between 29.85 per cent and 34.55 per cent. The rural component in the total population of Bangalore North taluk is quite low and, evidently the places which have managed to retain their basic rural character are somewhat at the interior and are beyond the pale of the influence of the city. The work participation rates for males and females vary considerably and it is also observed that as a general rule, the male segment of the population contains a much higher proportions of main workers in it than its female counterpart. The predominantly non-agricultural nature of the economy of Bangalore district can be visualised when it is known that nearly two-thirds of the total number of workers are engaged in other than agricultural activities. In the urban areas of Bangalore district 97 per cent of the workers are engaged in non-agricultural activities. The taluk-wise figures of total number of workers, cultivators and agricultural labourers during 1981 are given in the table hereunder.

Taluk	Main workers	Cultivators	Agricultural labourers	Marginal workers
<b>Total</b>				
Anekal	57,190	25,071	14,774	3,434
Bangalore North	1,02,453	13,488	9,002	2,444
Bangalore South	1,21,080	22,275	17,087	5,493
<b>Rural</b>				
Anekal	50,910	24,417	14,405	3,095
Bangalore North	36,180	11,173	6,570	1,013
Bangalore South	53,581	18,647	12,963	4,503
<b>Urban</b>				
Anekal	6,280	654	369	339
Bangalore North	66,273	2,315	2,432	1,431
Bangalore South	67,499	3,628	4,124	990
Bangalore City & Bangalore Development Authority	7,34,684	1,903	1,158	12,208

This data does not include the four hoblis transferred to the Bangalore North and South taluks.

**Land utilization**

As per the land utilization data for the year 1987-88, the net area sown stood at 1,02,331 ha and constituted 47.07 per cent of the total reported area of the district. The position regarding the other types of land use stood as follows: forest 1.52 per cent, barren and uncultivable land 4.02 per cent, land put to non-agricultural uses 21.73 per cent, permanent pastures 4.7 per cent, land under miscellaneous tree crops and groves 3.66 per cent, cultivable waste 1.83 per cent and fallow lands 15.48 per cent (including current fallows). The gross area sown is seen to be 49.48 per cent of the total area and this indicates that about 5.13 per cent of the net sown area is more intensively utilized and is sown more than once. The fallow lands also represent the lands that have been brought under cultivation and when these are also taken into consideration, the proportion of cultivated land to the total reported area moves upto 62.55 per cent. The following statement provides particulars of taluk-wise land utilization of Bangalore district for the year 1987-88.

**Land utilization data for the year 1987-88 in hectares**

Sl. no.	Particulars	Anekal	Bangalore North	Bangalore South	District (Total)
1.	Geographical area according to village papers	53,518	78,411	85,481	2,17,410
2.	Forests	463	1,145	1,695	3,303
3.	Area under non-agricultural use	6,566	22,328	18,350	47,244
4.	Barren and uncultivable land	1,362	2,898	4,475	8,735
5.	Cultivable waste land	763	1,907	1,300	3,970
6.	Permanent pastures and other grazing lands	4,860	2,145	3,212	10,217
7.	Land under miscellaneous tree crops and groves	3,207	3,611	1,143	7,961
8.	Fallow lands including current fallows	4,145	13,625	15,879	33,649
9.	Net area sown	32,152	30,752	39,427	1,02,331
10.	Area sown more than once	1,698	1,109	2,446	5,253

**Land holdings**

As per the agricultural census of 1976-77, the holdings with an extent of less than two hectares each constituted as much as 73.6 per cent of the total number of

holdings. Large holdings with an extent of 20 hectares and more each formed just 0.2 per cent of the total number of holdings. As between 1971 and 1976, there has been a slight increase in the number of land holdings and a simultaneous decrease in the total area held. As a result, the average size of a holding has moved down from 1.86 to 1.75 hectares. It is seen that the process of fragmentation of agricultural holdings is continuing without any check and that what was once an agricultural holding has ceased to be so either in part or full having been transferred to the non-agricultural category. Conceivably, this phenomenon is more in evidence in the villages that are located around the Bangalore City Corporation and its satellite towns mainly on account of the tremendous rate at which the city is expanding. Thus in Bangalore district, marginal and small farmers constitute the bulk of the cultivating classes and together with medium farmers (20 per cent) form the real backbone of the agricultural economy. Taluk-wise distribution of land holdings by size in hectares during 1980-81 is given here.

**Distribution of land holdings in Bangalore district (1980-81):**

Particulars		Anekal	B'lore North	B'lore South	District (total)
0.5 ha	No	4,921	4,043	5,079	14,043
	Area	1,298	1,071	1,296	3,665
0.5-1.0	No	4,274	3,314	4,422	12,010
	Area	3,192	2,443	3,299	8,934
1.0-2.0	No	4,610	3,249	4,717	12,576
	Area	6,711	4,635	6,775	18,121
2.0-3.0	No	2,143	1,429	2,164	5,736
	Area	5,198	3,446	5,228	13,872
3.0-4.0	No	1,090	723	1,112	2,925
	Area	3,740	2,487	3,834	10,061
4.0-5.0	No	673	357	639	1,669
	Area	2,985	1,585	2,827	7,397
5.0-7.5	No.	772	436	642	1,850
	Area	4,641	2,637	3,881	11,159
7.5-10	No	318	158	261	737
	Area	2,716	1,359	2,234	6,309
Above 10	No	253	183	270	706
	Area	3,869	3,057	4,201	11,127
Total	No	19,054	13,892	19,306	52,252
	Area	34,350	22,720	33,575	90,645

This does not include the figures of the four hoblis transferred.

## Soils

The soils of Bangalore district consist of red laterite and red fine loamy to clayey soils.

*Laterites:* The laterites occur in the district to a small extent over granites and gneisses. Laterites are derived from various parent materials principally igneous formations under peculiar climatic and local conditions such as high humidity, high temperature and alternate periods of drying and wetting. These soils are red to pale yellow in colour, friable and easy to cultivate when moist and have a very low base exchange capacity. The rain-fed crops grown in these soils include *ragi*, jowar, oilseeds and groundnut.

*Red loams:* The red loams occur in vast tracts in the district. They are derived from igneous rocks principally granites and gneisses. The red soils are characterised by their light texture, porous and friable nature, absence of lime kankar and free carbonates. The texture of the soils varies from gravelly to sandy loam to clay loam. The prominent feature about them is their bright colours which vary from bright brick red to brown, yellowish brown to yellow. The colour is due to the presence of large amount of hydrated oxides of iron like haematite and limonite in the soils. The colour frequently varies according to changes in the structure of the soil aggregates and the degree of hydration. The clay fractions of the red soils are rich in Kaolinitic type of minerals. The chief crops grown in these soils comprise *ragi*, paddy, millets, pulses, oilseeds, vegetables and fruit crops.

The depth of these soils varies from place to place from a few centimetres to several metres. The soils are generally low in plant nutrients. Soil reaction is chiefly neutral with a tendency to develop alkalinity in the low-lying and ill-drained areas. A few acid soils are found distributed here and there. Soluble salt content is low except in some low lying badly drained places. The organic matter content is low, the available Phosphorous content is deficient and the available Potassium is present in sufficient quantities. These soils are well drained, poor in lime and bases

*Agro-climatic Zones:* Bangalore district has been grouped under Eastern Dry Zone along with Kolar and parts of Tumkur districts. The annual rainfall ranges from 679.1 to 888.9 mm. in the zone; the rainfall is received in two peaks, one in May and the other in September-October. Kharif cropping is a major practice. Red loamy soils predominate in major areas and lateritic soils are found in the remaining areas. The soils are medium to deep in depth, but they are low in retentive capacity. *Ragi* occupies the major dry land area in the zone. About 10 to 12 per cent of the area is covered by groundnut crop. Kharif pulses like horsegram are used for sowing late in the season and this occupies about 10 per cent of the area in the zone. Under irrigated conditions, paddy, mulberry and sugarcane are raised.

## Soil conservation

Soil erosion is a serious manace confronting farmers. In nature, it takes 500 to 1,000 years for the formation of three centimetres thick layer of top soil through

the action of weathering agents. The surface 30 cm is the principal basis for crop growth. Mismanagement of soils might wash away this precious top soil in a couple of years and expose barren infertile sub-surface material incapable of either supplying moisture or nutrients to plants. Soil conservation is a means to prevent erosion of fertile top soil and to conserve the soil moisture which helps in maintaining the soil fertility. Lands unsuitable for cultivation either due to extreme slopes or easy erodibility or infertility owing to sandy nature are recommended to be used for forests or grasses. A systematically planned anti-erosion programmes such as terracing, contour bunding, contour tillage, strip cropping, crop rotation, mixed cropping and selection of suitable crops are taken up under soil conservation programmes. Coupled with these, the soil fertility has to be enhanced by the application of farm yard manure, composts, Phosphatic and other fertilizers. The soil conservation works are taken up in accordance with the provision made under the Karnataka Land Improvement Act 1961. At present, the stress is on the development of land on watershed basis.

To determine suitable cropping pattern of particular region, rainfall probabilities, estimation of soil moisture and actual evaporation losses have to be worked out in a systematic way. Based on the rainfall probabilities and moisture availability index with different degrees of waterstress and periods of droughts of various intensities, the periods and duration of crop growth have been worked out. In the district, the period of crop growth is 217 days *i.e* from 2nd May to 12th June and 27th June to 18th December. The drought period during the growing season is more in the district.

#### **Dryland/Rain-fed Farming**

Bangalore district has been grouped under Dry Zone and this zone has been found to be suitable for mixed cropping, since these are predominantly kharif areas. Sequential cropping for two crops is recommended in certain pockets of soil types having favourable moisture holding capacities. During 1983-84, all the three taluks of Bangalore district were selected for dry land farming project and an area of 1,000 ha in each taluk was demarked for the implementation of the project. A total area of 3,130 ha was included from 41 villages. The rainfall pattern in the district was analysed week-wise and the initial and conditional probabilities were worked out over a base period of 30 years and this data was utilised in suggesting suitable cropping systems. The dry farming practices include 1) fall ploughing, 2) construction of small section bunds across the main slope of the land at a spacing of 9 to 12 metres depending upon the slope percentage, 3) opening of ridges and furrows for redgram, 4) development of waste weirs and 5) opening of furrows at every three metres in *ragi* and groundnut crops which are aimed at conserving soil and moisture. Dry land/rain-fed farming in 100 ha block around raingauge stations is in operation in the district from 1985-86. It envisages the study and recommendations of location specific technology based on rainfall probability analysis and having contingent plans to meet out aberrant weather conditions. Successful crop

production in dry farming area contemplates soil and water conservation and change in the choice of crops, varieties and management practices based on yearly changes in rainfall pattern. In Bangalore district it is estimated that the total area needing soil conservation measures is about 33,000 ha. Till 1985-86, the area contour bunded was 1,885 ha and the area yet to be contour bunded is about 31,115 ha.

During 1984-85, Dry Land Development Board was constituted to concentrate on land development and cropping systems on integrated watershed approach on the line of the World Bank assisted rain-fed farming project. The main objective of the project is to develop over a period of seven years through the use and adoption of appropriate technology for increasing and establishing crops and forage yields and production of timber in selected rain-fed farming areas. It is also proposed to select a block of 200 to 250 ha per taluk for implementing dry land farming technology under model micro-watershed development. In this model micro-watershed all the land treatments like land smoothening, small section bunds, opening of dead furrows, strengthening of existing bunds, contour cultivation and sowing to improve *in-situ* moisture conservation are taken up besides constructing farm ponds as water harvesting measures. The blocks selected for dry land/rain-fed farming around 100 ha block include Anekal and Attibele in Anekal taluk, Soladevanahalli and Chikkajala in Bangalore North taluk and Tavarekere and Kadugodi in Bangalore South taluk. The progress achieved under model micro-watersheds during 1988-89 is as follows.

Sl. no.	Particulars	Anekal taluk Huli-mangala	B'lore North tq Singanai-kanahalli	B'lore South tq Tavarekere
1.	Area in sq km	250	250	260
2.	Total farmers involved	392	264	308
3.	Small and marginal farmers	250	234	248
4.	S.C. and S.T. farmers	98	32	62
5.	Contour ploughing (ha)	250	250	215
6.	Small section bunds (ha)	165	130	215
7.	Input kits distributed (no.)	399	190	380

### Soil Health Centre

Soil Health Centre at Hebbal helps in testing the soil samples for their pH level, organic carbon, Phosphorous and Potassium content. In special cases electric conductivity is also tested to measure the salt concentration. Based on these tests and in consistent with the cropping patterns, recommendations are made to apply



lime or gypsum as amendments and supply the required quantity of major nutrients. There is quality control programme in soil testing in the district, started during 1970-71, with a view to ensure that the results received from the Soil Health Centres are of rigid standard. The main objectives of the quality control in soil test are 1) to check the procedure and methods adopted for various estimations, 2) to assist the soil health centres to run effectively, and 3) to impart training. Training programmes in quality control are conducted every year. Water samples are collected from irrigation wells from November to January to analyse the water samples for their suitability for irrigation. There is central mobile soil health centre at Bangalore. The micro-nutrient laboratory at Bangalore estimates the micro-nutrient deficiencies and recommends the quantum of micro-nutrients required to get maximum production. The number of soil samples collected and analysed in the district during 1988-89 were as follows. Anekal 2,287; Bangalore North 3,938; Bangalore South 3,177; 3,141 and District's total 9,402; 9,334. During 1989-90, it is proposed to collect and analyse about 11,000 soil samples in the district.

#### **Local Manurial Resources**

In recent years, the development and the use of organic manures assume great importance in extension education programme to educate the farmers on scientific methods of compost making. This scheme is in operation in the district and the items of work undertaken are 1) intensification of urban and rural compost production, 2) intensification of green manuring in irrigated and assured rainfall areas, 3) training village leaders in better composting, 4) conservation of night soil, 5) improved cattle sheds and manure sheds, 6) intensification of gobargas plants, 7) setting up of mechanical compost plants, 8) intensification of blue green algae and azolla in wet lands, 9) utilisation of sewage water and 10) award of prizes to local bodies for preparation of good quality and quantity compost. Under local manurial resources programme, 2,89,650 tonnes of rural compost and 1,68,700 tonnes of urban compost were prepared during 1988-89 in the district.

#### **Input Supply, Monitoring and Quality Control Programme**

The Department of Agriculture has an onerous responsibility in planning, co-ordinating and monitoring the supply of inputs through various inputs supplying agencies to make available to farmers the required quantity of inputs at right time, at a reasonable price and at a nearest place possible. The three important inputs are seeds, fertilizers and plant protection chemicals. Seed is a vital input in production around which there is a rapid development of technology in recent years. The new hybrids and high-yielding varieties of seeds of different crops have contributed substantially for improving the production and productivity in several crops. Large scale varietal replacement of traditional varieties of paddy and *ragi* with high-yielding varieties has been accomplished. The Department of Agriculture estimates each year the requirement of quality seeds through the KSSC, NSC

and KSSCA. As part of seed production, there is a seed farm at Kittaganahalli in Anekal taluk. The farm was established during 1970-71 and it has an area of 17.47 ha out of which the net area cultivable is about 14.61 ha. This seed farm takes up the production of foundation seeds using the breeder seeds supplied by the UAS. Foundation seeds are further multiplied through the KSSC as certified seeds. Arrangements are being made to distribute the seeds by KSSC, NSC, KAIC, KOF and private seed dealers through the network of respective outlets.

The Seed Act 1966 and Seed Rules 1968 are being effectively enforced in the district to ensure the supply of quality seeds distributed to the farming community. Further, the seeds have now been brought under the Essential Commodities Act and a separate Seed Control Order has been issued from 30.12.1983 and is called as Seed (Control) Order 1983. The Seed Testing Laboratory situated at Hebbal lends support in the maintenance of quality of seeds under the Act. The laboratory at Hebbal has its jurisdiction over southern Karnataka including Bangalore Rural district. In addition, the Laboratory at Lalbagh under the Department of Horticulture has its jurisdiction over Bangalore, Tumkur, Kolar and Mandya districts and analyse seeds from these districts. The department is producing Foundation seeds in seed farms as well as Agricultural Development Centres and supply these foundation seeds to KSSC and private agencies for multiplication of certified seeds for further distribution to farmers. The number of seed samples collected and analysed during 1988-89 were as follows: Anekal 151, Bangalore North 180 and Bangalore South 217.

### **Fertilizers**

Since 1977-78, there has been an increasing trend in the consumption of fertilisers in the district due to large coverage of area under high-yielding varieties and also educating the farmers in the use of fertilizers for getting better yields by frequent training and demonstrations. As a result, farmers have started applying fertilizers to dry land crops like *ragi* and groundnut which has led to a greater off-take of fertilizers. Fertilizers are being distributed by the organisations like KAIC, KSCMF and private dealers. The villages which are at the interior and are in need of fertilizers were selected throughout the district to store the fertilizers well in advance of the kharif season involving both the institutional agencies and fertilizer manufacturing firms. They were asked to stock minimum of one truck load of different fertilizers in a specified time. Government have provided incentives for the movement of fertilizers to such areas well in advance of the kharif season.

The fertilizers manufactured by various firms are marketed through their authorised dealers. The quality of fertilizer supplied has to be maintained in accordance with the standard fixed by the government under Fertilizers (Control) Order 1985. About 240 fertilizers have been included under this Order. There is a Fertilizer Control Laboratory at Bangalore to analyse fertilizer samples.

## Consumption of fertilizers in tonnes

Year/taluk	Nitrogen	Phosphorous	Potassium	Total	kg/ ha
1981-82	2,760	709	869	4,338	51
1982-83	3,711	1,287	945	5,943	70
1983-84	4,167	1,358	701	6,226	76
1984-85	3,088	2,092	1,493	6,673	94
1985-86	3,729	1,992	1,212	6,933	90
<b>1985-86:</b>					
Anekal	1,353	918	637	2,908	91
B'lore North	991	711	266	1,968	129
B'lore South	1,385	363	309	2,057	69

The number of fertilizer samples collected and analysed in the district during 1988-89 were as follows. Anekal 20, Bangalore North 46, Bangalore South 29 and District total 79. It is proposed to collect and analyse about 120 fertilizer samples in the district during 1989-90.

### Plant protection

The new extension system provides for training of farmers and village-level workers in taking up timely plant protection measures for control of pests and diseases of crops. As a result, farmers are now more educated and conscious about taking up remedial measures against pest and disease out-break, and significant increase in the consumption of pesticides and coverage of crops under plant protection measures can be observed. In crops like paddy and groundnut, farmers are found readily taking up control measures in the village which was a rare thing in the past. Soil pests are those which generally live in soil or hide themselves beneath the soil surface and feed on plant material like roots, stem, etc. e.g. root-grubs, cutworms, termites, etc. Polyphagous pests are those which have more than one host plant as a rule. They feed and breed on many host plants. Hence, they are more successful in thriving against natural odds. Many of the soil insect pests are also polyphagous in habit. e.g. pod-bores, catter-pillars, stem-borers, grass-hoppers, aphids, mites, etc. Plant protection chemicals are subsidised by the government to enhance the consumption of plant protection chemicals which result in the increased yield of crops. The KAIC and KSCMF have the stocks of chemicals besides private dealers. The plant protection equipment of the farmers which require repairs are repaired by the Plant Protection Mechanic of the department and only the cost of the spare parts is being collected from the farmers. Plant protection equipments are supplied to the farmers on subsidised rates, subsidy being limited to Rs. 300 per equipment. The number of pesticide samples collected

and analysed during 1988-89 in the district were as follows: Anekal 11, Bangalore North 19 and Bangalore South 9.

*The Central Biological Control Station and Parasite Multiplication Unit, Bangalore, was established in June 1976 at Ganganagar, Bangalore with the main objective of promoting and implementing the control of insect pests and weeds by biological means. This station has been assigned with integrated pest management programme in Karnataka, Kerala and Tamil Nadu, survey of storage commodities, pests and pesticides, price monitoring etc. This station has mass multiplied eleven host insects and 29 natural enemies during 1988-89. The parasite multiplication unit was established in January 1983 with the objective of mass multiplication of natural enemies and their supply to farmers, biological workers and organisations in India. This unit has been entrusted with the field activities such as augmentation and conservation of natural enemies. This unit has multiplied four host insects and 15 natural enemies during 1988-89.*

#### **National Bureau of Soil Survey**

An all-India soil survey scheme was started in 1956 as a division of the Indian Agricultural Research Institute to conduct progressive soil survey in the country. Four regional soil correlation centres were started at New Delhi, Calcutta, Nagpur and Bangalore. In 1958, the scheme was integrated with the Land use survey scheme and was renamed as All India Soil and Land Use Survey. In 1976, it was designated as National Bureau of Soil Survey and Land use Planning (NBSS & LUP). The major responsibility of the organisation is to conduct progressive soil survey of the country at the State and District levels and emphasis is laid on the preparation of soil map of India. The Bangalore Centre is having jurisdiction over southern states to carry out soil survey, preparation of land resources maps and interpretative maps, research programmes for characterisation and classification of bench mark soils and correlation and co-ordination of soil survey work carried out by the State departments, aerial photo-interpretation, remote sensing work and interpretation of satellite imagery. The centre has conducted reconnaissance soil surveys and detailed soil surveys in an area of about 1,16,400 sq. km. in Karnataka. From 1979, a training centre is functioning at the centre and offers training courses in soil survey, pedology, soil taxonomy, geomorphology and cartography. The Bangalore Chapter of the Indian Society of Soil Science was formed in order to create a forum for Soil Scientists in various departments and organisations.

#### **Save Grain Campaign**

Save Grain Campaign was launched by the Government of India as a Pilot Project during 1965-66 and was elevated to a country-wide programme during 1969-70. The main objective of this scheme is to educate, motivate and persuade the farmers, traders and others involved in the storage of food grains to adopt scientific methods of grain storage by trainings, demonstrations and publicity. The regional office of Save Grain Campaign was set up in Bangalore headed by a Deputy

Director in August 1978. Three types of training programmes are arranged by this office. A three-week stipendiary training programme is meant for literate farmers. A non-stipendiary training course of 5 to 7 days duration is arranged for extension workers and other officials of Government departments. For volunteers two to three days training is arranged. The trainee farmers were motivated to buy or construct modern storage structures or improve upon their indigenous structures. Since inception of this office, 1,025 courses were conducted and 21,392 persons were trained under this scheme. Save Grain Campaign office is conducting demonstrations in selected villages. Disinfestation of storage premises, grain fumigations, rat burrow fumigations and rat control measures in houses are demonstrated using storage pesticides such as Malathion, Ethylene-di-bromide, Aluminium phosphide, Zinc phosphide and Anti Coagulants. This office is also popularising modern scientific storage structures such as *pucca kothis*, *pusa bins* in addition to improving the traditional storage structures to make them rat and moisture proof. An incentive in the form of materials worth Rs. 150 and technical guidance are provided free of cost to the farmers coming forward for the construction of improved storage structures. Since inception of this office, 459 *pucca kothis*, 10 RB/RCC *bins* were constructed by the Regional office in the adopted villages in Karnataka. In SGC Regional office, Bangalore, 5 Sub-teams each consisting of a Technical Assistant and a Technical operator are constituted to visit villages and carry out regular trainings, demonstrations and publicity activities. The overall guidance and supervision of the Technical Assistants and Technical operators are carried out by Technical Officers, Assistant Director and Deputy Director.

### **Agricultural crops**

*Ragi*: *Ragi* is an important grain crop of Bangalore district. It occupies an area of about 54,824 ha *ie.* 54 per cent of the net area sown during 1987-88. Bangalore South taluk ranks first in *ragi* cultivated area followed by Bangalore North and Anekal taluks. *Ragi* is mostly a rain-fed crop and high yields are obtained when grown under irrigated conditions. Of the many important irrigated *ragi* varieties, Purna, Shakti, Indaf-5 and Indaf-7 are the high-yielders. Purna, Indaf-5 and Indaf-7 are suitable for growing throughout the year except during the winter months, while Shakti is recommended for sowing between May and second week of August. Purna can yield 35-50 quintals, whereas Shakti, Indaf-5 and Indaf-7 can yield 50 to 60 quintals grain per hectare under irrigated conditions. Indaf-1, Indaf-3, Indaf-8, ES-11 and PR-202 *ragi* varieties are recommended for monsoon cultivation under rain-fed conditions. About 20 quintals of grain per hectare can be obtained from a rain-fed crop. Double cropping of cowpea and *ragi* is in practice when the early rains are received in April and May. By rotating cowpea with *ragi*, the soil fertility is likely to be increased. Mixed cropping is very general and pulse crops like field bean, cowpea, niger and fodder jowar are raised as mixed crops in *ragi* field.

**Paddy:** Paddy is the next important cereal crop of the district. It is cultivated in an area of 8,185 ha forming about eight per cent of net sown area during 1987-88. Bulk of the area is under assured rainfall under canals and tanks. It is grown during kharif and summer seasons. Several paddy varieties are grown all over the district. The important paddy varieties cultivated in the district comprise Jaya, Vani, Sona, Prakash (IET-2254), IR- 20, Pushpa, Madhu, Mangala, Pragathi (MR-292), Raasi and Mandya Vani. A grain yield of 75 to 90 quintals from Jaya, 60 to 70 quintals from IR-20, Sona, Vani, Prakash and Raasi and 50 to 60 quintals from Madhu, Pushpa, Mangala, Pragathi and Mandya Vani can be obtained from one hectare under good management.

**Hybrid Maize:** Hybrid maize has been a minor food crop of the district. The total area under maize crop is about 2,115 ha *ie.* 2.07 per cent of the net sown area during 1987-88. The crop is suitable for cultivation throughout the year. Deccan and Deccan- 101 are the important hybrid maize varieties of the district and their duration is about 110 to 120 days. An yield of 50 to 60 quintals of grain and 25 tonnes of fodder can be obtained from one hectare maize crop with good management. Other cereal crops cultivated in the district include wheat 34 ha and minor millets 499 ha.

**Redgram:** Redgram or *togari* is the most important pulse crop of the district. It is cultivated over an area of 1,398 ha in the district, *i.e.* 1.37 per cent of net sown area during 1987-88. Anekal taluk ranks first in redgram cultivation followed by Bangalore North and Bangalore South taluks. It is also grown as a mixed crop with groundnut and *rugi*. Hyd-3c is an important redgram variety cultivated in the district and the crop yields 15 to 20 quintals per hectare from the main crop and 7 to 10 quintals per hectare in case of mixed crop.

Other pulse crops cultivated in the district include bengalgram, field-bean, greengram, blackgram, cowpea and horsegram, mostly raised as mixed crops.

**Groundnut:** Groundnut is an important oilseed crop of the district grown over an area of 587 ha during 1987-88. Spanish Improved and TMV-2 groundnut varieties are raised under irrigated conditions while only TMV-2 groundnut variety is cultivated under rain-fed conditions. Irrigated groundnut crop yields about 35 quintals of pods per hectare while the rain-fed groundnut crop yields about 15 quintals of pods per hectare.

Other oilseed crops cultivated in the district include castor, niger, sunflower and mustard.

**Area and production of principal agricultural crops  
in Bangalore district during 1988-89**

Area in hectares:

Production in tonnes:

Sl. no.	Particulars		Production in tonnes:			District (total)
			Anekal	B'lore North	B'lore South	
1)	Paddy	A	1,836	3,448	4,085	9,369
		P	2,360	7,531	9,070	18,961
2)	Ragi	A	14,395	20,498	21,959	56,852
		P	5,692	10,750	12,196	28,639
3)	Hybrid Maize	A	451	636	880	1,967
		P	1,350	1,949	2,684	5,983
4)	Wheat	A	7	10	12	29
		P	15	21	25	61
5)	Redgram	A	268	341	460	1,069
		P	67	85	115	267
6)	Field-bean (avare)	A	1,262	1,610	2,200	5,072
		P	94	120	165	380
7)	Cowpea	A	356	486	533	1,255
		P	64	116	133	313
8)	Greengram	A	26	35	126	187
		P	4	5	18	27
9)	Horsegram	A	2,208	1,844	2,800	5,852
		P	220	184	280	585
10)	Bengalgram	A	100	19	160	179
		P	25	5	15	45
11)	Blackgram	A	54	50	127	231
		P	8	8	19	35
12)	Groundnut	A	293	375	595	1,263
		P	147	188	298	633
13)	Sunflower	A	143	61	86	287
		P	72	31	43	146
14)	Castor	A	84	150	492	726
		P	21	38	123	182
15)	Sesamum	A	366	53	430	849
		P	22	3	26	51

Sl. no.	Particulars		Anekal	B'lore North	B'lore South	District (total)
16)	Niger	A	173	166	230	569
		P	10	10	14	34
17)	Mustard	A	113	98	170	381
		P	7	6	10	23

### High-yielding varieties programme

High-yielding varieties programme was commenced in the district during 1966-67. There is a continuous increase in the distribution of quality seeds after the introduction of high-yielding varieties. It is proposed to cover all the rain-fed areas of the district with hybrids and high-yielding varieties with more stress on production and productivity by the timely supply of inputs such as quality seeds, fertilizers, plant protection chemicals, required credit, etc. During the year 1987-88, an area of 51,958 ha was covered under the programme. The taluk-wise distribution of area under high-yielding varieties programme during 1987-88 was as follows: Anekal 13,507, Bangalore North 16,397 and Bangalore South 20,054 ha.

*Mini-kit demonstrations* are organised to identify and popularise the promising pre-release or newly released varieties or hybrids through farmers participation. These demonstrations help the extension workers to acquaint with the new varieties/hybrids before they are actually released and feed back information to the researchers for further improvement of the varieties. These demonstrations also help in bringing more areas under cash crops or multiple cropping or inter-cropping and crop substitution. During 1988-89, it was proposed to organise 1,780 mini-kit demonstrations by incurring an expenditure of Rs. 15,385.

*The Farm trial* is a process of testing the suitability and profitability of a new technology under local conditions. The programme is a new system of extension through which the new technology evolved at research stations is being transmitted to the field. These farm trials are identified by the district-level technical committee of departmental officers and University of Agricultural Sciences' scientists at different National Agricultural Research Project (NARP) Regional workshops. About 30 to 40 farm trials are laid-out in five to ten locations each per annum and these trials are of varietal, agronomical, insecticidal, etc.

*The Hasiru Kirana Project* was in operation during 1988-89 and 1989-90 in Anekal taluk of Bangalore district with the main objective of increasing the production in the low production taluks. Anekal taluk was identified as low productivity taluk in the district and the principal kharif crop selected for monitoring and evaluation is *ragi*. To ensure timely availability of fertilizer in the interior and inaccessible areas, the Government of India have given approval to implement



the scheme of opening of additional retail outlets in eight selected districts including Bangalore. The scheme has one component of opening additional retail outlets at the rate of 100 outlets per district. Under this programme, preference for opening of sale points is given to low consumption areas where the outlets do not exist within a reasonable range and will result in additional food production. The retail outlets are being opened through co-operatives or Agro Industries by providing a subsidy limited to Rs. 1,200 per outlet per annum for advance stocking and transportation beyond taluk headquarters. Rs. 1.2 lakhs has been provided for the district during 1988-89.

### **Agricultural Extension Project**

The extension service in the Department of Agriculture has undergone re-organisation, once during 1967 and the second time during 1978. Earlier to 1967, the extension system adopted the old production technology with the community development approach and after 1967, with the advent of high-yielding varieties, the new technology was started but with the old extension system, again under the community development set up. At the village level, the agricultural extension was entrusted to the multi-purpose extension worker. The district had the experience of Intensive Agricultural Area Programme and Intensive Agricultural District Programme earlier to 1978. During 1978, the extension system was further reorganised and it was known as training and visit system. Under the T & V system, the primary level workers were brought under the fold of the Agricultural Department under a system of hierarchy. The Primary level worker called Agricultural Assistant would himself visit the farmers through contact farmers in a regular schedule of 15 days on a fixed day and take all extension steps to see that the messages of improved agriculture are delivered to the farmer and he is persuaded to adopt them. The world bank aided Agricultural Extension Project (AEP) which has completed the extended period of one year by 31st March 1985 in the district is being extended for another period of five years under National Agricultural Extension Project (NAEP). The World Bank assisted NAEP which was introduced in the district as a second phase of the Composite Agricultural Extension Project under the T & V system of agricultural extension during 1985 is in its fourth year of operation in the district during 1988-89. The NAEP II has been introduced in the district in order to consolidate the gains of AEP by way of providing subject matter specialists (SMS) in the areas of soil and water management, inputs, farm management, farm implements, strengthening the trainings, organising farm trials, etc. under the department. The University of Agricultural Sciences components include providing extension coordinators, construction of seminar halls and provision of transport.

The second phase of NAEP began with a new thrust to improve the conducting of monthly and fortnightly workshops in order to make them skill oriented. During 1988-89, the Minimum Technology Package Approach (MTPA) has been introduced under NAEP and this is insisted on all contact farmers to an extent of 50

per cent in the case of small farmers, 25 per cent in case of medium farmers and 10 per cent in case of big farmers. The packages of technology is to be adopted under SMS verification (Farm Trials) programmes at one plot of 0.1 ha for paddy under different situations and 0.2 ha for other crops under rain-fed farming situations. Under NAEP, contact Block Demonstration Programme is also organised to demonstrate all package of practices and to serve as a meeting point when Agricultural Assistant and other extension personnel visit the village to meet the contact or fellow farmers. One day exhibition in a year is organised in every Assistant Agricultural Officers range by making use of locally available materials in order to educate the farmers on various aspects of modern agricultural technology.

The farm information unit set up under the department has undergone a big change after the introduction of AEP. The extension literature consists of all printed materials like hand-bills, posters, leaf-lets, pamphlets, booklets etc., to provide information support to the various extension programmes of the department. Daily press columns are written on the topics of the current interest for the farmers. Daily tips to farmers (*Raitharige Salahe*) are sent to Akashavani (AIR) for arranging broadcast and these tips are on current topics, useful to farmers. The departmental staff also helps the Akashavani staff for recording interviews of progressive farmers for broadcast. Cassette tapes are also utilised for recording the farmers' opinion, experiences on their adoption of new technology and interview with contact farmers etc. and they are played back during group meetings of farmers and other functions.

The University of Agricultural Sciences has a statutory responsibility to provide extension education to the entire State of Karnataka. There is an Extension Education Unit of the University around the Main Research Station, Hebbal. The Unit consists of a team of Extension Guides—one Guide located in each taluk and provided with a motor-cycle, supported by a small band of Subject Matter Specialists located at the headquarters. The work of the Guides is supervised by the Extension Leader who is provided with a jeep and who operates under the over-all guidance of the Director of Extension.

*Karnataka Pradesh Krishik Samaj*: The Mysore Agricultural and Experimental Union served as farmers organisation before independence. Many progressive farmers were members of this Union. The union published a monthly journal in Kannada and a quarterly journal in English aimed at disseminating the improvements in agriculture. After Independence, the union was renamed as Krishik Samaj (Farmers Forum) and was affiliated to the National Krishik Samaj. Young Farmers Association was also organised on the youth wing, during that time. The monthly journal was continued as *Vyavasaya Patrike* (Agricultural journal) in Kannada. The Krishik Samaj and the Young Farmers' Association have sponsored many progressive farmers and young farmers under an exchange programme with foreign countries.

**The Karnataka Agro Industries Corporation**

The Agro Industries Corporation Ltd. was incorporated on 1.9.1967 under the Companies Act, 1956 with the following objectives: To work towards the development of agriculture and agro-based industries; to assist the farmers in the improved farming methods by supply of agricultural inputs, agricultural equipments, machineries, spares and accessories, etc., veterinary medicines, services of agricultural machinery for land and water development and tillage operations and such other activities in promoting modern agriculture. The Agro Engineering Services Department renders a) services by supplying tractors, bulldozers, power tillers etc., for land development and ploughing, and b) services of rigs and rock-blasting units for borewells and revitalising open wells. The Corporation has a workshop in Bangalore which undertakes the reconditioning works of custom hiring machinery and its components. The workshop also manufactures agricultural implements and there is a separate wing for spares, equipment and animal health. The Agro-Fruits Unit which was commissioned in 1975, has an installed capacity of 1,000 tonnes of manufactured fruit products per year. It processes and cans pineapple, mango products, jams, jellies, processed peas, tomato products etc. and squashes. The unit has also taken up export of the finished products.

**Karnataka State Co-operative Marketing Federation Ltd.**

The Karnataka State Co-operative Marketing Federation (KSCMF) which was established during the year 1943, took up the distribution of fertilizers from the Agricultural Department since 1960. At present, the Federation is an Apex body of the Taluka Marketing Societies (TAPCMS) and occupies a premier position in the distribution of agricultural inputs in the State and ensures the farmers remunerative prices for their produce through market intervention operations. The Federation operates through the co-operative network and supplies fertilizers to village level societies. The Federation is also supplying other pesticides in addition to Sahakar products. The Federation established the Pesticides Formulation Unit at Yeshwanthapur during 1975-76 at a cost of Rs. 2.75 lakhs. It was shifted to Peenya at a cost of Rs. 30 lakhs and went into production in 1984. The chemicals formulated in the above unit comprise BHC, Carbaryl, DDT, Malathion, Quinolphos, Endosulfan, Dimethoate, Monocrotophos, Chloropyriphos, Phosphomidon and Methyl Parathion. The Federation's net profit as at the end of 1987-88 amounts to Rs. 51.92 lakhs after deducting the entire accumulation losses of the previous years. The Regional Marketing Manager, Bangalore Division has the jurisdiction over eight branch offices of KSCMF including Bangalore branch. The Federation undertakes marketing activities on a commercial basis both on a joint venture with the National Agricultural Co-operative Marketing Federation of India Ltd. (NAFED) and as independent purchaser through TAPCMS and SCS or in Regulated Markets.

**Karnataka Co-operative Oilseeds Growers' Federation Ltd.**

The Karnataka Co-operative Oilseeds Growers' Federation Ltd. (KOF), Bangalore, the agency entrusted with the implementation of the project 'Restructuring edible oil and oilseeds production and marketing', was registered during 1984. At present, the project consists of 32 tq in the districts of Dharwar, Raichur, Bijapur, Gulbarga, Bellary and Chitradurga. The implementation of the project is being carried out through the co-operative structures consisting of Oilseeds Growers Co-operative Societies (OGCS) at the village level and Oilseeds Growers Federation at the State level. The project is designed to create an integrated co-operative system of production, procurement and processing of oilseeds and marketing of oil and by-products. The Federation (Apex Body) arranges for the supply of inputs to the member growers through the societies and also organises demonstrations and gives technical advice to the growers. Procurement of the farm produce is done through OGCS. The farmers get a remunerative price from the Federation. The oilseeds are processed in the Federation's own processing plant and the final products are marketed by the Federation. The OGCS members earn dividends and bonuses on the profits made by the Federation. The Federation has an oil packaging plant at Bangalore where oil is packed in plastic sachets and bottles. 'Safal' brand groundnut oil has been introduced in Bangalore. KOF's sales turnover went upto Rs. 442 million during the year ending 31.3.89 from Rs. 220 millions during the year 1986-87.

*Institution of Agricultural Technologists:* The Institution of Agricultural Technologists (IAT) was established during 1960 with the main objective of bringing together all technical persons interested in agricultural development, providing a forum for discussion, exchange and dissemination of scientific and technological matters pertaining to agricultural development and stimulating scientific and technological research on various aspects of agricultural development. It is an active branch of 'Indian Institution of Agricultural Technologists' (IIAT). The total number of members in the institution as on 31st March 1989 is 422 out of which, 337 are life members. The Institutions' Newsletter 'Krishi Tantrajnya', a quarterly journal, is being circulated among members. There are various sub-committees including programme, seminar, education, enrollment, building project and news letter committees, each headed by an elected Chairman.

**Agricultural Implements**

A majority of the farming community mostly uses only bullock drawn and hand operated implements. New implements have been developed for various farm practices like tillage, sowing, inter-cultivation, levelling and harvesting which are mostly bullock drawn except harvesting. In recent years, plant protection has become one of the important cultivation practices. Various types of hand operated sprayers and dusters are in use. About power operated implements, tractors, power

tillers, power sprayers and electric pumpsets are important. The following table gives the taluk-wise number of different agricultural implements and machinery used in the district as per 1983 livestock census.

Sl. No.	Particulars	Anekal	B'lore North	B'lore South	District (total)
1)	Seed-cum-fertilizer drills	540	285	1,806	2,631
2)	Seed drills	1,786	817	1,338	3,941
3)	Sprayers	615	144	498	1,257
4)	Wooden ploughs	8,318	4,761	3,939	17,018
5)	Steel ploughs	9,672	1,717	4,978	16,367
6)	Blade harrows	15,788	3,308	7,240	26,336
7)	Disc harrows	8,826	3,798	6,000	18,624
8)	Cultivators	4,045	777	1,822	6,644
9)	Animal carts	4,641	1,230	3,115	8,986
10)	Diesel engine pumpsets	147	57	143	347
11)	Electric pumpsets	2,539	719	1,308	4,566
12)	Power tillers	42	51	45	138
13)	Tractors	117	55	143	315

### IRRIGATION

The irrigation potential is quite low in the district as there are no major rivers flowing in the district. Bangalore (Urban) district has about 461 tanks and most of these have been providing irrigation facilities to small patches of land that come under their respective *atchkats*. These tanks are widely dispersed and are of various dimensions. The usefulness of these tanks depends largely on the adequacy of rainfall in the catchment area of each tank. Consequently, the area actually irrigated varies from year to year. The total irrigable area under the tanks adds upto about 11,000 ha. In Bangalore district, well irrigation is also quite popular since quite a long time. In recent years, there has been a remarkable increase in the number of irrigation wells. The traditional devices such as *yeta* and *kapile* for lifting water from the wells as also the more recent device of diesel engine pumps have, during the past couple of decades, yielded place to electrically operated pumpsets. The production of vegetables and flowers in the garden lands that are being irrigated by wells and tanks has now become a characteristic feature of this district. A few particulars about wells are given here.

Wells	Total number	Gross potential created	Net area irrigated during 1986-87
		(ha)	(ha)
Dug wells	9,355	9,521	8,600
Shallow tube wells	3,841	6,097	5,997
Deep tube wells	296	720	694

A classification of irrigation area by sources of irrigation shows that tanks and wells account for 39 per cent and 44.7 per cent respectively, borewells account for 15.6 per cent of the total area under irrigation and the irrigated area amounts to about 18.5 per cent of the net area sown, the total irrigated area being 18,928 ha during 1987-88. The following table gives the taluk-wise particulars of irrigation during 1987-88.

Particulars	Anekal	B'lore North	B'lore South	District (total)
Surface irrigation potential (ha)	4,601	2,330	5,610	12,541
Ground water potential (ha)	3,248	3,412	4,078	11,738
No. of tanks	197	98	166	461
Potential created (ha)	4,502	2,142	4,447	11,091
Area irrigated (ha)	2,552	2,142	2,691	7,385
No. of anecuts	1	9	9	19
Atchkats (ha)	6	45	366	417
No. of lift irrigation schemes	1	-	4	5
Atchkats (ha)	121	-	707	828
No. of other minor irrigation works	2	1	-	3
Atchkats (ha)	15	10	-	25

As per the Minor Irrigation Census 1986-87, there were 464 surface flow irrigation schemes with a gross irrigation potential of 9,753 ha. During 1986-87, 9,189 hectares were provided with irrigation by surface flow irrigation schemes. There were 14 lift irrigation schemes (13 from rivers and one from tank) with a

gross irrigation potential of 958 ha of which 828 hectares were provided with irrigation by lift irrigation during 1986-87. About 36 per cent of the area in Anekal taluk and 58 per cent of the area in Bangalore North and Bangalore South taluks is situated in Cauvery basin area. Remaining area is distributed in Dakshina Pinakini basin area.

### HORTICULTURE

Horticulture means cultivation of the garden or plantation *ie.* enclosed cultivation. The credit of horticultural development in the district goes entirely to the Lalbagh. Lalbagh has been the nucleus of all the horticultural activities in the princely Mysore state from its inception. Before Reorganisation, besides introduction, acclimatisation, propagation and popularisation of exotic ornamental plants, fruits and vegetables of various kinds, reputable work has been done in introduction and experimentation of number of economic and industrially important plants such as those yielding fibres, rubber, drugs, essential oils, dyes, tans, gums, resins, etc. At present, the department deals with various multi-aspects of the Horticultural Science dealing with the extension, research and technology connected to the cultivation of horticultural crops. The department also undertakes the development and maintenance of parks and gardens, hill-stations, development of organised nurseries and nursery trade, organising horticultural societies, etc. The unusually large concentration of population in Bangalore city has created a very good and perennial demand for vegetables and fruits. As a result, production of vegetables in the garden lands that are being irrigated by wells and tanks has now become a characteristic feature of Bangalore district. This is so particularly due to the relative ease with which these perishable items can be transported to the city for quick disposal. The major activities of the department in the district are grouped under three categories *viz.* the development of horticultural gardens, horticultural wealth of the district and its development and other development programmes.

#### Lalbagh-the State Botanical Garden

Hyder Ali, having imbibed the Mughul taste regarding gardens, planned Lalbagh at Bangalore principally on the model of that at Sira. Hyder Ali, during 1760, selected the spot about a kilometre east from the Fort and a few hundred metres west of the watch-tower to have a garden of an extent of 16 ha. The name was originally given to the garden by Hyder Ali due to its profusion of roses and other red flowers. Hyder Ali imported plants from Delhi, Lahore and Multan for the ornamentation of his garden. The garden was divided into square plots separated by drives and paths, along the sides of which fine cypress trees were planted. Separate plots were set apart for different fruit plants like the pomegranate and the fig and flowers like roses. The small tank at the south end of the Lalbagh was the main source of water, which was conveyed to the garden by an open ditch, and the plots were irrigated by open channels. After Hyder Ali, Lalbagh continued to be the pleasure garden of his son, Tipu Sultan. He improved the

garden and maintained a good collection of mango trees. Three old mango trees said to have been planted during his time are still flourishing in the garden. Tipu Sultan enriched the garden by the addition of varieties of flower plants by procuring seeds and plants from Kabul, Persia, Mauritius and Turkey. The tank water was not sufficient for the improved and expanded garden and was supplemented with well water, which was lifted by means of a *kapile*. Lalbagh grew to be a treasure house of rare and valuable collection of tropical and sub-tropical plants and indigenous and foreign fruit trees.

Lalbagh was taken over by the British in 1799 after Tipu's fall and it was owned by a military botanist, Major Waugh and remained in his possession until 1819. He showed great zeal in the improvement of the garden and introducing foreign plants. In 1819, Major Waugh gave the garden as a gift to the Governor-General, Marquess of Hastings.

Dr. Wallich, the Superintendent of the Royal Botanical Gardens, Calcutta recommended acceptance of this garden as a branch of Bengal Presidency Botanic Garden, and accordingly it remained as its branch from 1819 to 31. On the British assumption of the province of Mysore in 1831, Lalbagh passed into the hands of Sir Mark Cubbon, the Chief Commissioner and remained so until 1839. Sir Mark Cubbon founded an Agri-Horticultural Society of India in 1839 and handed over Lalbagh to the Society. He helped the Society by providing convicts to work in the garden. The Society ceased to exist in 1842 and the garden once again came under the management of the Commissioner and remained so upto 1856. In August 1856, this garden was made the Government Botanical Gardens, entirely a Government establishment to carry out the higher objects of horticultural pursuits designed for the improvement of indigenous plants and for the introduction of exotic plants of economic importance. This was due to the efforts of Dr. Cleghorn, an Imperial Forest Officer. A committee consisting of the Secretary to the Commissioner, the Superintendent, Bangalore Division and Dr. Kirckpatrick was set up to take measures to preserve all the interesting botanical specimens and to make the ground attractive. During this time, the office of the Superintendent was constructed and the garden wall was also established.

William New assumed the charge of Lalbagh in April 1858 and in his superintendence, each succeeding year witnessed improvements; the collection of indigenous and exotic plants was expanded and this garden became one of the greatest attractions in Bangalore. The office of the Director of Government Gardens in Bangalore (from 1856 to 1881) was purely honorary. Colonel Puckle, I.D. Gordon and Col. W.R. Johnson succesively held the office. The Superintendent was incharge of the gardens. William New exchanged plants with other botanical institutions in India and abroad. To conserve water, the open channels for conveying water from the tank to the lower parts of the garden were brick-lined in 1859.



As the tank used to dry up in summer, New sunk three more additional wells to supplement the water supply to the garden. He prepared a complete list of plants in the garden and it was published in the *Journal of the Botanical Society of Edinburgh*, on 11th July 1861. The Lalbagh improved very much under the charge of New with a varied collection of Ferns, Cycades, Ardisias etc. brought from Coorg, the Nilgiris and Nagar. In 1862-63, through the sale of seeds, plants and other produce, the Lalbagh had earned Rs. 1,770. A. Black took charge of the garden in 1864.

John Cameron took charge of the garden in 1874 and expansion of the garden took place in his time. Vigorous and systematic introduction of new plants took place. Cameron also collected animals for the garden and Lalbagh was also zoo for some years but all the animals were later transferred to the Mysore Zoo. In 1889, five hectares of ground including *mantapam* (watchtower) were added. In the same year, sufficient land outside the main entrance gates was acquired for the frontage and new and elegant gates were erected. In 1894, four more hectares were acquired for the extension of botanical gardens and thus the area of the garden at the close of the 19th century was over 40 hectares. On November 28, 1889, Prince Albert Victor of Wales was given a reception in the garden by Chamaraja Wodeyar. The Prince of Wales laid the foundation of the Glasshouse on 30th November 1889. Built at a cost of Rs. 75,000, the Glasshouse called the Albert Victor Conservatory, is designed on the lines of the Crystal palace. Another important event in the annals of the Lalbagh has been the erection of the Equestrian statue of the late Maharaja of Mysore Sri Chamarajendra Wodeyar in 1908. This statue was transferred from the Curzon Park at Mysore. The statue was wrought by noted English sculptor Onslow Ford at the Royal Academy of Arts, Astor.

G.H. Krumbiegel assumed charge of Lalbagh in 1908. A reservoir and the pumphouse were erected in 1919. After Krumbiegel, Rao Bahadur H.C. Javaraya, Dr. M.H. Marigowda, M.C. Maste Gowda, K.T. Krishnappa, Yeshwanth Ail and B.K. Bhattacharya took charge of the garden and improved it. The Glasshouse was extended towards eastern side during the year 1935. At present, the total area governed by the Glasshouse is 2,180 square metres. Now, Lalbagh has an area of about 97 hectares and it has become the guiding centre for research, extension and developmental activities of horticulture.

The famous horticultural shows, one on the Republic Day and other for the Independence Day are being conducted in the Glasshouse. The list of plants in the garden covers 127 families, 673 generas, 1,854 species and about 890 cultivars. Regarding Zoological species, an aquarium, deer, pigeon, parrots, rabbits and guinea pigs are maintained. Except in monsoon season, the average number of visitors are approximately 4,000 to 5,000 per day. The average number of visitors on Sundays and on special occasions like Ramzan, Bakrid, Pongal etc. goes upto 10,000. A well maintained library in the garden has got large collection of books, journals, magazines and research papers on horticultural and related subjects.

## Cubbon Park

Sri Chamarajendra Park, popularly known as Cubbon Park is about 120 ha in area. It was created by the efforts of Col. Meade, who was the Commissioner (1870-75), though work had been initiated in 1864. Many government offices are situated in this Park including the High Court building (former Secretariat or the Athara Cutchery). The special features of the park are, the Public Library with blazing cannas intercepted by the tall Aracarias, and expansive lawns on either side, the picturesque avenues, shrubberies, clipped plants and hedges, the well distributed ornamental flowering and foliage trees, the beautiful annual garden in front of the statue of late Sri Chamarajendra Wodeyar and fairy fountain opposite to it. In 1866, an equestrian statue of Mark Cubbon, a work by Baron Marochetts had been unveiled here. There is also 11 feet tall marble statue of Queen Victoria unveiled in 1906. It is the replica of a similar statue at Worcester in England and was wrought by Sir Thomas Brock. Dewan Rangacharlu's statue in front of the Library here was unveiled by Lord Hardinge in 1913. Lord Chelmsford unveiled the statue of King Edward in 1919.

## Horticultural plants

### I. Fruit Crops

*Grapes (Vitis vinifera)* occupy an area of 1,234 ha in the district. Bangalore blue variety of grapes are cultivated over an area of 950 ha. The fruit has round berry with thick skin. The thick skin easily slips from the pulp. The juice is thick, purple in colour and is good for bottling. The bunch is medium sized and compact. Anab-e-shahi variety is cultivated over an area of 175 ha. The fruit is white, oval, thick skinned, sweet and of excellent eating quality. The bunch is medium to large and moderately compact. Grape bunches do not ripe after harvest. The white varieties get golden colour when ripened and the black varieties get dark and uniform colour. The area under other grape varieties like Thompson seedless is about 100 ha in the district. The yield depends on the variety, age of vine and cultural practices adopted. The average yield per hectare is as follows. Bangalore Blue 20,000 to 25,000 kg per ha, Anab-e-Shahi 30,000 to 40,000 kg per ha and Thompson seedless 15,000 to 20,000 kg per ha.

*Mango (Mangifera indica)* is an important fruit crop, cultivated in an area of 715 ha in the district. There are number of mango varieties in the district like Totapari, Raspuri, Badami etc. Fruits are eaten, canned and pickled. The number of fruits harvested varies with the age of the tree. A tree aged between 11 to 20 years, yields about 500 to 1,500 fruits and older trees beyond 20 years yield 1,500 fruits per plant and more.

*Guava (Psidium gujava)* is generally found all over the district in orchards and also in the backyards. It is cultivated over an area of 141 ha in the district. Allahabad Safeda variety is very common. Local varieties are Bangalore Guava and Candra

Seebe. The economic yields are obtained from 7 to 8 years and onwards from planting. The tree flowers in three flushes during February, June and October. So, the harvest may overlap. The number of fruits depend on the age of the plant. On an average, a ten-year old tree may yield upto 1,500 fruits per year.

*Sapota (Achras sapota)* is one of the important tropical fruits and is becoming more popular in the district. It is grown in an area of about 600 ha. Cricket ball and Kalipatti with round and oval fruits respectively are popular sapota varieties. The economic yields from sapota can be obtained only from 7th year onwards. It flowers throughout the year. March to May and September to October are distinct periods. Fruits are harvested when they attain dull brown colour and become smooth on the surface. Average yield from a ten year old tree is around 1,000 to 1,500 fruits per plant.

*Banana (Musa paradisiaca)* is cultivated over an area of 260 ha. in the district. More popular banana varieties are *pacchabale*, *rasabale*, *yelakkibale*, *puttabale*, *chandrabale* and *boodabale*. The bunches come to harvest in 12 to 14 months after planting, depending upon the variety. Ratoon crop comes to harvest quickly in about 6 to 8 months. The average yield varies from 20,000 to 40,000 kg per hectare.

*Papaya (Carica papaya)* is a quick growing fruit crop and it is cultivated over an area of 175 ha. Papaya fruits are ready for harvest by about 9 to 10 months after planting. Fruits are borne throughout the year. The plants can be retained for three years for getting fruits. Average yield varies from 75 to 100 tonnes per ha. If it is grown for papain, annual yield of papain varies from 500 to 700 grams per plant per year. Papain is obtained from the latex of raw fruits, a valuable enzyme used in several medicinal and industrial preparations.

Other fruit crops cultivated in the district are lime and lemons (*Citrus spp*) 190 ha, pomegranate (*Punica granatum*) 50 ha and water melon (*Citrullus vulgaris*) 56 ha.

## II. Vegetables

*Tomato (Lycopersicum esculentum)* is a popular vegetable extensively cultivated over the district in an area of 690 ha. Tomato varieties suitable for the district are Pusa Ruby, Sioux, Hybrid Karnataka, NTDR-1, Roma, Manipa, Selection-4 and Selection- 22. Harvesting starts from 10 to 12 weeks after transplanting and continues for six to eight weeks depending upon the variety and season. The ideal months for planting tomato are October and November. About 20,000 to 25,000 kg fruits can be obtained per ha. Hybrid variety may yield upto 50,000 kg per ha.

*Potato (Solanum tuberosum)* is another popular vegetable grown over an area of 400 ha in the district. This is essentially a winter crop and thrives well in cool climate. Kufri Jyoti, Kufri Kuber, Kufri Chandramukhi and Up-to-date are the important varieties of potato. The crop can be harvested when the aerial stems and foliage turn yellowish brown and start drying up. An average irrigated crop yields about 15,000 to 20,000 kg per ha. Tubers should be cured for 10 to 15 days in a well ventilated place after harvesting.

*French bean (Phaseolus vulgaris)* is a popular leguminous vegetable grown in the district in an area of about 400 ha. It is a short duration crop and can be harvested within 60 days. The important varieties are Bangalore local, Contender, Selection-2 and Selection-5. Best crop can be harvested from the crop grown during monsoon and early summer. Three to four pickings are made in case of bush bean. About 6,250 kg green pods can be obtained per hectare. In case of pole bean (Kentucky wonder), the number of pickings are more and yield from pole bean is about 12,500 kg per ha crop.

*Brinjal (Solanum melongena)* is a vegetable commonly grown throughout the year. It is cultivated in an area of about 300 ha and the important varieties grown are Erengere, Kengeri and Arka Sheel. About 30,000 to 50,000 kg brinjals can be obtained from one ha crop.

*Cabbage (Brassica oleracea var capitata)* is another major vegetable grown over an area of 300 ha in the district. The important varieties cultivated are Pride of India, Golden Acre, Early drum head, Late drum head and Danish ball head. An average cabbage crop yields about 20,000 to 25,000 kg per hectare.

Other vegetable crops cultivated in the district include carrot (*Daucus carota*) 78 ha, beetroot (*Beta vulgaris*) 36 ha, *bhendi (Hibiscus esculentus)* 200 ha, cucumber (*Cucumis sativus*) 80 ha, knolkhol (*Brassica oleracea var caulorapa*) 51 ha, radish (*Raphanus sativus*) 64 ha, peas (*Pisum sativum*) 42 ha, gourd varieties 116 ha and leafy vegetables 241 ha. Leafy vegetables include *menthya*, *dantu (Amaranthus sp)* *chakkotha*, *sabsigesoppu*, *harivesoppu* apart from coriander and *karibevu (Murraya koinigii)*.

### III. Floriculture

*Bougainvillia: Bougainvillia marypalmer* and *Bougainvillia mahra* are the outstanding introduced varieties. *B. thimma*, *B. rao*, *B. velayani* *B. laxminarayana*, *B. sharma* etc. are the chief variegated varieties produced and named at Lalbagh. All these varieties have acclaimed as the best for their extremely beautiful variegated flowers. Lalbagh is said to be the finest comprehensive collection of bougainvillias from all parts of the world. *Hibiscus rosasinensis* or *dasavala* is another flower cultivated in the district. There are about 30 varieties and the size of these flowers varies from 3 cm to 20 cm across having different colour shades.

*Crotons:* The crotons are popular as '*Pride of Bangalore*'. A largest comprehensive collection of crotons with crazy colours and dancing colours are being maintained at Lalbagh. The cherished and illustrious names of almost all the top world personalities find a noble place along with a new croton seedling developed and maintained at Lalbagh gardens. There are about 132 varieties of bougainvillias, 134 varieties of hibiscus and 236 varieties of crotons at the Lalbagh gardens.

*Jasmine: Jasminum spp* or *mallige* is an important commercial flower crop grown for its attractive and scented flowers. The different varieties of Jasmine grown are *Jasmine arborescens (navamallige)*, *J. auriculatum (sujimallige)* and *J.*

*officinata* (*sannajaji mallige*). All these varieties are perennial creepers and climbers. All are known for their sweet fragrance. *Kakada* (*Jasminum pubescens*) or *kadumallige* yields flowers throughout the year except from March to May and *gundumallige* (*Jasminum sambae*) variety flowers from March to October. The economic yield of Jasmine is generally obtained for about 10 to 15 years under usual management. An average crop of Jasmine produces about 10,000 to 15,000 kg flowers per ha.

*Chrysanthemum indicum* or *shavantige* is cultivated over an area of 120 ha in the district. The other variety commonly cultivated is *Chrysanthemum frutescens*. These flowers attract a remunerative market. The average crop yields about 15,000 kg flowers per hectare. Marygold (*Tagetes erecta*) or *chandumallige* is another popular flower crop, cultivated over an area of 60 ha in the district. The crop is grown throughout the year and the orange and the white coloured are the commercial varieties. Tuberose (*Polianthus tuberosa*) or *sugandaraja* is another important flower crop, grown in an area of about 25 ha. The flowers have a lucrative market. About eight tonnes of flowers can be obtained per ha from a well maintained garden.

Roses (*Rosa indica*) are grown for their cut flowers and they occupy an area of about 70 ha in the district. As many as 500 varieties are found in the district. *Rosa damascena*, *Rosa centifolia*, *Rosa maschata*, and *R. invalucrata* are cultivated as ornamental plants. All the cultivated multi-flowered roses are the hybrids of crossing *R. gallica* with *R. damascena*, *R. centifolia* and *R. indica*. The flowers are available in the market throughout the year. About two to two-and-a-half lakh flowers per hectare can be obtained from a well maintained rose garden.

A number of trees, shrubs, creepers and bulbs are cultivated in home gardens, orchards and gardens, for their flowers which are used for worshipping, preparing garlands, bouquets, etc. Among them, the following are worth mentioning. 1) *Passiflora caerulea* (*neeli jumuki huvu*), 2) *Thunbergia mysorensis* (*kamanabillu balli*), 3) *Barleria cristata* (*spatika*), 4) *Bauhinia tomentosa* (*vanasampige*), 5) *Cestrum auranticum* (*Queen of the Night*), 6) *Crossandra* sp (*kanakambara*), 7) *Hibiscus mutabilis* (*bettadavare*), 8) *Nerium odorum* (*kanigalu*), 9) *Nyctanthes arbortristis* (*parijata*), 10) *Lagerstroemia flos-reginae* (*Pride of India*), 11) *Lagerstroemia roseus* (*Queen of flowers or holedasavala*), 12) *Plumeria acuminata* (*Temple tree or devaganigalu*), 13) *Aster* spp., 14) *Canna aurea*, 15) *Dahlia cactus* and 16) *Nelumbium speciosum* (*kendavare*). Different varieties of several flowering plants both cultivated and wild are being collected and maintained at Lalbagh and other gardens for breeding work. The department also helps the cultivators by providing facilities like distribution of seedlings, planting materials and loans.

#### IV Plantation and spices crops

Coconut (*Cocos nucifera*) is one of the important commercial crops of the district and the total area under this crop is more than 2,700 ha. Two varieties,

namely, tall and dwarf are extensively cultivated in the district. The tall ones start yielding from 5 to 10 years and produces good quality nuts, copra and oil. The dwarf variety grows slowly and starts bearing within three or four years after planting and yields good tender nuts. It is revealed by experiments that hybrid palms bred by the crossing of these two varieties yield quality nuts. This encouraging fact has given an impetus to take up hybridization work of coconut palms. Coconuts are harvested throughout the year as and when they mature. The main harvesting season is summer. Average yield is about 80 to 100 nuts per plant per year. Proper fertilization and plant protection measures help in the increased yields of the palm. The *anabe roga* (*Ganoderma lucidium*) is a detrimental disease to this crop. A scheme to control this disease is put into operation and since then, the disease is kept under check. Cereal crops, leguminous crops or pineapple or banana are grown as inter-crops in the initial years and afterwards, mulberry, banana or pine-apple are suitable as inter-crops. Fodder grasses such as hybrid napier or Guinea grass along with the leguminous fodder crops are also raised in coconut gardens to overcome the scarcity of fodder. It has been found that raising these crops in one hectare of coconut garden can support four dairy animals.

*Arecanut* (*Areca catechu*) is cultivated over an area of 90 ha in the district. Raising of betel vines (*Piper betel*) always goes with areca. All the cultivators who cultivate areca will take up betel vine cultivation as an inter-crop. Banana, pineapple and guinea grass are also suitable as inter-crops. It is estimated that the yield of betel vine is between 10 to 30 lakhs of leaves per ha. *Mysore ele* is the popular local variety grown in the district besides *kareballi* and *ambadiballi*. The *ambadi* variety leaves are light green in colour, sweet in taste while *kareballi* bears leaves with dark green colour, thicker than *ambadi* and bitter in taste. *Kareballi* variety is comparatively hardy and partially resistant to pests and diseases and yields more than that of *ambadi*.

*Chillies* (*Capsicum annum*) represents the important spice crops of the district and is grown both under rain-fed and irrigated conditions. It is cultivated in an area of 180 ha in the district.

Other plantation and spices crops of the district are Cashew (*Anacardium occidentale*) 40 ha, Coriander (*Coriandrum sativum*) 33 ha, Ginger (*Zingiber officinale*) 49 ha, Garlic (*Allivum sativum*) 13 ha and Tamarind (*Tamarindus indica*) 284 ha.

### Horticultural Farms and Nurseries

Horticultural farms have taken up scientific methods of cultivation of fruits and vegetables of exotic and indigenous varieties besides maintaining the varietal collection of fruits and vegetables, introduction and acclimatisation work. These farms have succeeded in meeting the horticultural needs of the cultivators of that area. The nurseries at the taluk levels have taken up the task of raising the fruit

seedlings, rooted cuttings and seedlings of plantation and spices crops, grafts, bud-plants etc. in order to distribute them to the cultivators. These farms also serve as the centres of learning improved techniques of the cultivational aspects of various horticultural crops and also to supply the seedlings and rooted cuttings of fruits, plantation and spices crops to the local cultivators. The following statement provides the particulars of Horticultural farms/Nurseries in the district.

Sl. no.	Name of the Farm/Nursery	Extent of Farm in ha	Year of establishment	Important plants in the farm	
1)	Hulimavu Horticultural Farm, Bannerghatta Rd	17.33	1966-67	Sapota	825
				Coconut	218
				Pomegranate	92
				Guava	852
				Mango	172
				Others	174
2)	Indiranagar Horticultural Farm, Old Madras Road	3.28	1973-74	Sapota	152
				Mango	100
				Guava	150
				Pomegranate	65
				Coconut	30
				Others	66
3)	Kengeri Nursery	0.30	1966-67	Coconut	16
4)	Anekal Nursery	0.20	1966-67	Pomegranate	8
5)	Sirjakanahalli Horticultural Farm, Anekal	6.1	1966-67	Mango	155
				Cashew	280
				Others	233
6)	Kannamangala Improved Coconut Nursery	34.00	1971-72	Coconut seedlings	4,179
				Cashew	570

The details of seedlings raised in these farms (upto 1986-87) were as follows: Mango 5,230, Mango grafts 3,650, Pomegranate 1,850, Guava 6,500, Sapota 200, Vegetable seedlings 40,000 and others 19,000.

### **Export Oriented Farms**

Growing vegetables and flowers for export is a specialised job where one has to be familiar with scientific methods of cultivation, hybrids, lesser known varieties and improved management techniques. Both activities have now assumed increased economic importance and many individuals and organisations have taken them in a big way. The All India Scheduled Caste Development Co-operative Society (ASCOS) is one such organisation which has embarked on an ambitious project to develop export-oriented vegetable-cum-flower farms. The Government have given 28 ha of land at Kannamangala in Bangalore South taluk and 200 ha in Kunigal taluk of Tumkur district to a Society on a 99 year lease. Out of the total area of 228 ha, ASCOS plans to utilize 120 ha for growing flowers and 100 ha for growing vegetables. Cultivation of vegetables is an important source of farm income because it yields a higher tonnage per unit area within the shortest possible time. The Production of ornamental foliage plants has also gained importance in recent years. Foliage plants are in great demand for indoor decoration in homes, offices, hotels, shops and other establishments. In addition, there is a good scope for exporting them. The farm, in addition to earning a large quantum of foreign exchange, will provide employment to a large number of landless labourers belonging to the poorer sections of the society.

*The Mysore Horticultural Society:* The Society was started in 1912 at Lalbagh and is working as an adjunct of the Department of Horticulture. It commands a wide membership. The famous horticultural shows and the garden competitions are held twice a year under the auspices of the society to encourage gardening, vegetable and fruit growing among the city dwellers. The society publishes quarterly magazines 'Lalbagh Journal' and 'Totagara' (in Kannada). Till 1952, the activities of the society were restricted to Bangalore city only. Branches of the society have been started in all the taluk headquarters.

*Grape Growers Marketing and Processing Cooperative Society:* The increased interest of the cultivators to take up grape cultivation in wider areas and consequent increased production of grape fruits every year have necessitated the starting of the above Society. The Society started functioning during the year 1959. The Society aims mainly in coming to the rescue and help of the grape cultivators by way of extending them all the facilities for taking up grape cultivation and also to organise marketing facilities to assure the grower a good price for his produce. The Society also helps the cultivators by way of organising supply of fruit plants.

### **Indian Institute of Horticultural Research**

The Indian Institute of Horticultural Research (IIHR), Hesaraghatta, was established by the Indian Council of Agricultural Research (ICAR) to conduct research on all aspects of horticultural crops such as fruits, vegetables, ornamental and medicinal and aromatic crops in order to improve their productivity, quality and utility. Though, the Institute started functioning with effect from September 5,



1967 at the ICAR headquarters, New Delhi, the main station was established on February, 1968 at Bangalore with its office at 255, Upper Palace Orchards, Bangalore City and the experiment station of 266 ha at Hessaraghatta, located about 25 km from the city. In order to effectively tackle a wide range of problems in the major horticultural crops, the Institute is organised into thirteen divisions. Institute is one of the main centres for conducting research under the All India Coordinated Improvement Project on the following crops/insects viz. fruits, vegetables, floriculture, medicinal and aromatic crops, betelvine, mushroom, post-harvest technology, weed control, pesticide residue and honey bee research. The Institute has been recognised as a centre of Advanced Studies in Tropical Horticulture under the UNDP Project in collaboration with the University of Agricultural Sciences. The Institute has also been recognised for post-graduate research by many universities including the Indian Agricultural Research Institute, New Delhi.

A Trainer's Training Centre which was established initially at Central Horticultural Experiment Station, Chethalli in Kodagu district on December 1, 1976, was shifted to Hessaraghatta from November 1, 1979. The training is imparted to Horticultural Teachers of Krishi Vijnyana Kendras and Officers of the Department of Horticulture and Agriculture. The trainees are selected from different States and Union Territories. Besides, trainees from Nepal, Sri Lanka, Malaysia and Sudan have also received the training. The Institute has 266 ha of farm for undertaking research work on horticultural crops. The Institute has been providing nucleus planting seed materials of improved varieties of horticultural crops evolved at the Institute to interested farmers and to private and government agencies.

The Information Centre for Horticultural Sciences is a non-profit organisation and the library of this information centre came into existence in 1968, renamed as Nehru Library in 1988. About 58 new varieties of horticultural crops have been released by the Institute. Earlier, the Institute was releasing new varieties through its own variety release committee. At present, the release of varieties is being made through the State Variety Release Committee. The prefix Area with several varieties signifies Arkavati river on the bank of which the institute is located. The varieties released are as follows: A decade of research work on grape breeding at Bangalore has resulted in release of the following four promising hybrids viz. Arkavati (Black Champa X Thompson Seedless) during 1980, Arka Kanchan (Anab-e-Shahi X Queen of the Vineyards) 1980, Arka Shyam (Bangalore Blue X Black Champa) 1980 and Arka Hans (Bangalore Blue X Anab-e-Shahi) 1980. Mango breeding work carried out at Bangalore have yielded on promising hybrid No. 10 (Banganapalli X Alphonso). Intensive breeding work undertaken in the division of vegetable crops has resulted in the evolution and the release of the following high-yielding and good quality varieties of vegetable crops. Bitter gourd - Arka Harit (1972), Bottle gourd - Arka Bahar (1984), Brinjal - Arka Sheel (1972), Arka Shirish (1972), Arka Kusumakar (1972) and Arka Navneet (1975), Beans - Arka Komal (1984), Capsicum - Arka Basant (1984), Arka Gaurav (1984) and Arka

Mohini (1984), Longmelon-Arka Sheetal (1984), Musk melon- Arka Jeet (1970) and Arka Rajhans (1970), Onion-Arka Pragati (1984), Arka Kalyan (1984) and Arka Niketan (1984), Pumpkin-Arka Suryamukhi (1970), and Arka Chandan (1972), Radish-Arka Nishant (1980), Round melon-Arka Tinda (1970), Squash-Patty pan (1972), Tomato-Arka Saurabh (1984) and Arka Vikas (1984), Watermelon-Arka Manik (1980) and Arka Jyoti (1971). Among Ornamentals, Bougainvillea-Chitravati (Lalbagh x Red glory) 1979, Dr. H.B. Singh (Trinidad x Formosa) 1977, Jawaharlal Nehru (1975), Purple wonder (Formosa x Trinidad) 1979, Sholay (1977) and Usha 1977; Chrysanthemum-Indira 1980, Red gold (Flirt x Valentine) 1980, Rakhee 1980, Shoba 1980 and Apsara (1980); Gladiolus-Nazrana (Black Jack x Friendship) 1979, Sapna (Queen Woodpecker x Friendship) 1979, Poonam (1979) and Meera (1979); Hibiscus-Aikta (1976), Anuradha (1978), Ashirwad (1978), Bharat Sundari (1976), Chitralkha (1976), Dilruba (1976), Geetanjali (1972), Ratna (1979), Red Saturn (1978), Phulkari (1976), Smt Indira Gandhi (1974) and Tribal Queen (1972). Research conducted at Bangalore since 1968 has resulted in the release of Arka Upkar, a high- yielding clone of dioscorea (*Dioscorea floribunda*) during 1980 among medicinal crops.

#### ANIMAL HUSBANDRY AND VETERINARY SERVICES

Animal husbandry is being practised as an adjunct to agriculture since generations. Livestock development has been undergoing revolutionary changes in recent years. In recent decades, dairying and poultry keeping has assumed considerable economic importance. Since the agricultural holdings are small and mechanization has not made much headway, even now agriculture is largely dependent upon the draught power of the bullocks. The value of the farmyard manure consisting mainly of the animal refuse is also very much appreciated by the farmers even though they are by now quite familiar with the use of chemical fertilizers. Thus possession of land and livestock are very much interlinked and one hardly finds a land holder of any substance without a pair of bullocks and at least one or two cows and buffaloes. The adoption of modern techniques of breeding, feeding, management and disease control has contributed to the enhancement of the productivity of livestock. The approach to cattle development is intensive cross breeding of indigenous cattle, using superior germplasm of exotic sires to bring about improvement in genetic potential for increasing milk production and for draught purposes. The district is quite advanced in raising poultry, having the fourth place in the state in poultry wealth.

#### Livestock wealth

The cattle found in the district are mainly of the popular Hallikar breed. Animals of Amrut Mahal breed are also found in substantial numbers. The Hallikar cattle formed the nucleus of famous breeds of draught cattle. The breeding of this type is undertaken throughout the district by individuals on a small scale from early times. These are good draught cattle but poor milkers. The Amrut Mahal

breed is very active and famous for their power of endurance. These bullocks are specially suited for trotting and quick transport. This breed is generally poor in milk yields. Murrah buffalo breed is massive, black with infrequent white markings. Surri buffalo breed is medium sized, well shaped, with straight back and sickle shaped horns. These breeds are used as milch animals in the district. Improved breeds of cattle like Holstein Friesian, Jersey and Reddane are quite popular in the district. The taluk-wise figures (1988) of various species is give below.

#### Livestock statistics 1988

Particulars	Anekal	B'lore		B'lore City
		North	South	
Cows	56,128	50,395	66,040	32,995
Buffaloes	11,121	13,237	12,612	6,634
Sheep	32,266	23,427	33,699	2,357
Goats	11,993	14,033	13,098	1,751
Pigs	232	2,177	1,567	527
Poultry	5,01,472	1,21,287	2,33,331	60,550

#### Veterinary services

In order to protect the livestock population against contagious and non-contagious diseases, there are about 70 veterinary institutions during 1987-88. There are two veterinary hospitals in the district, one at Cantonment area in Bangalore North taluk and the other at City in Bangalore South taluk. There are 25 veterinary dispensaries in the district at Anekal, Attibele, Sarjapur, Dommasandra, Bannerghatta and Maranur in Anekal taluk; Malleswaram, Ulsoor, Byata, Jalahalli, Yeshwantapur, Byadarahalli and Sondekoppa in Bangalore North taluk; and Jayanagar, Kengeri, Shoolay, Gavipura Guttaalli, Thyagarajanagara, Gunjur, Krishnarajapur, Dommasandra, Madivala, Rajajinagar, Kadugodi and Tavarekere in Bangalore South taluk. There are eleven Rural Veterinary Dispensaries in the district at Hulimangala in Anekal taluk; Harohalli, Doddanekkundi, Kakolu, Gantiganahalli, Makali and Jeevanahalli in Bangalore North taluk and Kaggalipura, Ramohalli, Panathur and Medihalli in Bangalore South taluk. There are 31 Artificial Insemination Units in the district at Samandur, Mayasandra, Haragadde, Guddahatti, Magalur, B. Hosahalli, Handenahalli, Muttanallur, Huskur, Jigani, Chandapura and Hebbagodi in Anekal taluk; Kavalbyrasandra, Hennur, Jakkur Civil Station, Malleswaram, Singanaikanahalli, Nadagowdara Golahalli, Doddabommasandra, Byrali, Dasanapura, Chikkajala and Bagalur in Bangalore North taluk; and City hospital, Bidarahalli, Dommaluru, Madivala,

Gavipura Guttahalli and Immadihalli in Bangalore South taluk. There are two Artificial Insemination Sub-centres at Kengeri in Bangalore South taluk and Sarjapur in Anekal taluk. The objectives of these institutions are to provide veterinary aid, health coverage and breeding facilities to livestock population. The biologicals required for the control of contagious diseases are being produced at the Institute of Animal Health and Biologicals, Hebbal. Other types of vaccines are being purchased from outside. During 1986-87, the number of in-patients and out-patients treated was 2,59,406, castrations performed 1,896, artificial inseminations 98,186, calves born 12,721 and number of inoculations given against Rinderpest 61,097, Black quarter 12,625, Foot and mouth 7,909 and Rabies 1,509 respectively.

*The Key village scheme:* The Key village centre at Hesaraghatta serves a group of six villages viz. Hesaraghatta, Gollahalli, Shivakote, Chikbanavar, Bettahalasur and Marasandra by taking up intensive animal husbandry activities. The activities include artificial insemination of cows and buffaloes, castration of scrub bulls, prevention and control of animal disease, treatment of sterility and minor ailments. The progress achieved under the scheme during 1985-86 and 1986-87 is as follows: artificial insemination, cows 5,278/5,746, buffaloes 441/546, calves born, cows 645/947, buffaloes 17/33, castrations performed 1,397/1,436, animals vaccinated against Haemorrhagic septicaemia-1,618, black quarters 8,447/5,248, Rinderpest 878/178 and Foot and mouth 1,965/450.

*Cattle fairs:* The cattle fairs are held almost invariably as adjuncts to the annual festivities connected with various local deities, from 8 to 10 days duration. Facilities for drinking water and veterinary aid are provided at these fairs. Further, to encourage the best animals to gather, medals and certificates are awarded at these shows on the day the religious festivities come to close. The incentives offered during cattle fairs have succeeded in producing a large class of professional cattle breeders. It is a pleasant sight to watch the breeders tending their cattle with utmost care and tenderness. Three cattle fairs are held in Anekal taluk viz. the Yellamma Devaru fair at Hennagara, Jigani hobli is of 10 days duration in January and about 20,000 cattle are gathered, the Madduramma Devaru fair at Huskur, Sarjapur hobli is of 8 days duration in March and about 5,000 cattle are gathered and the Byataraya Swamy fair at Mugalur, Sarjapur hobli is of 8 days duration in December and about 10,000 cattle are gathered. In Bangalore North taluk, the Bheemeshwara Swamy fair at Makali, Dasanapura hobli is of 8 days duration in January and about 10,000 cattle are gathered.

### **Dairy Development**

The integrated dairy development based on the Anand pattern was initiated in Karnataka under the Karnataka dairy development project. The world bank aided project with an outlay of Rs. 51 crores and an aid component of 30 million dollars was initiated in 1974. A new organisation, Karnataka dairy development corporation came into existence to implement the project and the actual field work

was taken up in 1975. The project was implemented in eight southern districts of Karnataka including Bangalore. The aim of the project was to increase milk production by providing technical inputs at village level institutions and develop facilities for milk collecting, processing and marketing. The project originally to complete within eight years by the end of September 1982 was closed in September 1984 after extending the project period twice each time by one year. As the World Bank aided project came to an end, extending dairy development project to the entire state under operation Flood II including expanding the activities already established under the World Bank project was taken up. The implementing organisation was also converted from KDDC to KMF (Karnataka Co-operative Milk Producers Federation Limited) to complete three-tier system as proposed under Anand Pattern. Under the World Bank aided project, the following achievements were accomplished: establishment of Mother Dairy at Bangalore (2 lakh litres per day capacity), expansion of existing Bangalore dairy to a capacity of 1.5 lakh litres per day and the establishment of cattle feed mill at Bangalore to produce about 100 tonnes of cattle feed per day.

The objective of Rs. 82.61 crores operation Flood II project is to extend the dairy development activities on the Anand pattern to the entire state. The programme was implemented in a phased manner in the district by the expansion of World Bank assisted programme under operation Flood II. Bangalore union was bifurcated on 25.8.1987 as Bangalore and Kolar unions. As National Dairy Programme II is being launched throughout the country as OF III, the ongoing activities taken up under OF II will be continued under OF III. It is also proposed to take up the left over activities under OF II as part of OF III. Thus, the project proposal incorporating the unimplemented part of OF II and further requirement of dairy development has been prepared as individual sub-project proposals for each union and centralised activity. The proposals has been submitted to NDDB for appraisal during 1988. Mother dairy B'lore would be expanded to a capacity of about six lakh litres per day. Bangalore Urban and Rural District Co-operative Milk Producers Societies Union was started in 1976 and 563 dairy co-operative societies (DCS) were registered upto September 1988. About 91,000 members were enrolled and 37 milk routes were established. About 508 dairy co-operative societies were covered under Animal Health programme, 63 staff members were trained in artificial insemination and co-operation. The number of members per DCS were 172, quantity of milk procured per DCS per day was 246 kg and the milk procured per day was about 1,30,000 kg in Bangalore union.

The Bangalore Dairy, Bangalore and Mother Dairy, Yelahanka are meeting the demand for milk and milk products in Bangalore city and surrounding towns. Toned and standardised milk is sold in bulk to institutional consumers and in sachets of half litre and one litre to individual consumers.

*Cattle Feed Plants:* Two cattle feed plants have been established by KMF in the state and one plant is situated at Rajankunte, Yelahanka hobli in Bangalore

North taluk. It has a capacity of producing 10 tonnes cattle feed per day and the quality balanced cattle feed is supplied to milk producers at reasonable rates. Cattle feed is distributed to farmers through the Dairy Co-operative Societies. The plant at Rajankunte was commissioned during February 1983. About 78,200 tonnes of cattle feed was manufactured from April 1983 to September 1988 at the cattle feed plant, Rajankunte and about 77,300 tonnes was sold to milk producers.

*Liquid Nitrogen Plants* of 23 litres per hour capacity at Bangalore and 6 litres per hour capacity at Hessaraghatta have been commissioned during May 1987. About 13,780 litres of liquid Nitrogen has been produced at Hessaraghatta plant and 13,740 litres was sold during the quarter ending September 1988.

### Composite Livestock Farm and Research Station

The Composite Livestock Farm and Research Station was started at Hessaraghatta during 1947 with the main objectives to produce bulls of outstanding merit for artificial insemination programme, to maintain the purity of the indigenous breeds like Amrut Mahal and Hallikar, to conduct studies on cross breeding of local cattle with exotic breeds like Jersey, Holstien Friesian and Red Dane, to supply fodder seeds and cuttings, to train the farmers and beneficiaries in improved dairy husbandry practices and to undertake pig breeding programme. This station maintains a nucleus herd of Holstein Friesian for production of pedigreed bulls for distribution to various centres in the state for semen production. The area of this farm is about 440 hectares out of which, grassland comprises of 280 hectares. The station has also Rabbit rearing section. The total herd strength and other particulars are as follows.

Sl.no.	Particulars	1982-83	1983-84	1984-85	1985-86	1986-87
I.	Breeds:					
1)	H.F.	89	85	78	76	76
2)	Sindi: Jersey	53	50	48	47	37
3)	Sindi: RD	24	19	18	17	8
4)	Sindi: HF	25	27	26	22	20
5)	HK: JR	22	18	27	26	28
6)	HK: RD	23	25	16	4	1
7)	HK: HF	36	30	28	38	39
8)	AM:JR	8	12	30	19	19
9)	AM:HF	17	13	12	16	19
10)	AM:RD	6	-	-	-	-
11)	Amrutmahal (AM)	37	14	8	6	5
12)	Farm bulls	72	67	48	55	-
13)	Jersey (JR)	41	44	37	38	-
14)	CSB Bulls	-	47	30	51	-
15)	Hallikar (HK)	-	-	-	-	47
	Total	463	431	432	394	350

Sl.no.	Particulars	1982-83	1983-84	1984-85	1985-86
II.	No.of cows in milk	114	80	95	70
III.	Total quantity of milk produced (tonnes)	298	219	259	223
IV.	Quantity of milk per cow per day in kg	7.4	7.5	7.5	7.8
V.	Total expenditure in lakhs of Rs.	9.75	11.87	12.42	13.43
VI.	Income (in lakhs of Rs.)	8.89	8.90	13.65	10.48

*The Pig Breeding Station* at the Hesaraghatta farm is engaged in breeding pigs of exotic breeds and supplying them to the farmers and breeders. This centre also serves as a training centre in modern pig husbandry. The swine breeding policy aims at usage of the exotic breeds of pigs like the Land Race, the Large White or Yorkshire, Hampshire and Wessex Saddle back for the pure breeding and upgrading the local pigs. The progress achieved at pig breeding centre is as follows:

Sl.no.	Particulars	1983-84	1984-85	1985-86	1986-87	1987-88
1)	No. of piglings born	343	590	423	444	28
2)	No. of pigs distributed	154	367	316	220	27
3)	Income from the sale of piglings, pork etc '000 Rs.	93	239	171	245	-
4)	Income from the sale of pig manure '000 Rs.	35	35	35	35	41

### National Dairy Development Board

The National Dairy Development Board was constituted in September 1965 to replicate the Anand Pattern dairy co-operatives in other parts of India in an effort to improve the income of the rural milk producers. The Board is providing guidance to Central and State Governments, Corporations or local bodies in setting up dairies, milk product factories, dairy extension, rural milk creameries, cattlefeed compounding factories and other allied plants or industries. The responsibility for implementation of Operation Flood rests largely on the NDDB's regional offices in New Delhi, Calcutta, Bombay, Bangalore and Anand. Operation Flood is now 19 years old and has entered its third phase. Operation Flood's mandate is to replicate Anand in other milksheds by (1) organising milk procurement at remunerative prices through economically viable village cooperatives, (2) providing efficient marketing of rurally produced milk and milk products by building dairy plants to process all the milk offered by producers and to provide an adequate supply of milk to consumers (3) developing a transportation and storage network and (4) increasing the productivity of cattle and buffaloes through better feeding,

breeding and management practices. The NDDB'S assistance was mainly in the form of advice on all technical matters and procurement of equipment for field artificial insemination programmes and frozen semen production stations. The NDDB is helping the State Dairy Federations to build up their own capabilities for cooperative organisation at the village level and provides extension material to intensify the extension work.

### **National Dairy Research Institute**

The Imperial Institute of Animal Husbandry and Dairying established in 1923 came to be known later as Indian Dairy Research Institute and subsequently as Southern Regional Station while the main National Dairy Research Institute was shifted to Karnal, Haryana. The Institute is located on a 62.4 hectares of land at Adugodi, about seven km. from the city. The objectives of the Institute are (1) education and training in the field of dairy science at undergraduate and post-graduate levels (2) to carry out research in different disciplines of dairy science (3) extension and advisory work and to render consultancy in the area of dairy farming and industry and (4) to undertake collaborative programme both at national and international levels. The station has a herd strength of 400 cross-bred cattle and buffaloes with a forage production farm and an experimental dairy with a capacity to process 2,000 litres of milk and for manufacturing milk products. The station has 38 scientists supported by 81 technical and 244 supporting staff. The areas of specialisation available are in Animal Reproduction, Animal Nutrition and Physiology, Dairy Chemistry, Dairy Bacteriology, Dairy Technology, Economics and Management and Extension. Considerable amount of research work has been carried out on various aspects of production and processing and number of candidates have obtained their M.Sc. and Ph.D in several disciplines. The station has till now trained candidates for different courses, I.D.D.- 1,800, short course-2,000 and Post-graduate-150. Apart from this, about 15,000 candidates have also been exposed to other short courses, since inception. The proven technology is continuously transferred to the cattle owners and farmers in rural areas. Artificial insemination for impregnation of cows with superior germ-plasm has been undertaken in the villages around the station for increasing the number of improved dairy animals. A progeny testing programme is also in operation. Assistance to farmers through lab to land programme for increasing crop production, dairy animal keeping, piggery, poultry and sericulture have been extended by the Institute.

### **BBF and FSB, Hessaraghatta**

An Integrated Bull Breeding Farm and Frozen Semen Bank was established during 1985 with a total outlay of Rs. 113 lakhs as a part of the World Bank aided Karnataka Dairy Development Project. The primary aim of the BBF & FSB is to provide superior quality bulls and also quality semen for supply to all the dairy farmers through Dairy Co-operative Societies. The surplus bull mothers and bulls produced are being sold to other interested organisations. The French Technology



of cassou method of freezing is adopted in the frozen semen bank. The farm was established on 100 ha of land at Hessaraghatta. The foundation stock of exotic pure bred cattle was imported, consisting of 89 heifers and 30 bulls of proven pedigree. Out of 100 ha, fodder development works are taken up in 40 ha. The present herd strength of the farm is 189 and the details are as follows (as on March 1989).

Sl.no.	Particulars	Holstein Friesien	Jercy	Buffaloes	Crossbred	Total
	Total no. of:					
a)	cows	10	24	-	-	34
b)	bulls	32	28	23	21	104
c)	heifers	6	10	-	-	16
d)	calves	11	20	-	-	31
2)	No. of Hallikar bullocks	-	-	-	-	4

**Production and stock of frozen semen straws from April 1985 to March 1989  
(in '000 numbers)**

Sl. no.	Particulars	Holstein Friesien	Jercy	Cross bred	Buffaloes
1)	Production of straws	554	654	521	171
2)	Purchase	195	60	5.00	271
3)	Sale	719	689	16	430
4)	Discard of straws	15	11	0.19	7.31

Under Fodder Production programme, about 6,500 tonnes of fodder was produced from April 1985 to March 1989. During the same period, 635 tonnes of fodder was purchased and 1,379 tonnes of green fodder was converted into silage. About 6,800 kg of fodder seed and 21 lakhs perennial fodder seedlings were supplied to milk unions.

The Composite Livestock Farm and Research Station at Hessaraghatta also undertakes production of fodder seeds and root slips for distribution to dairy farmers. During 1986-87, about eight lakhs fodder seedlings were distributed to dairy farmers. Besides the station has produced 188 tonnes of dry fodder and 1,848 tonnes of green fodder.

**Central Training Institute, Bangalore**

The Central Training Institute was established under training and extension scheme of International Development Agency. The Agency assisted Karnataka

Dairy Development Project and the Institute came into independent existence towards the end of the project *ie.* during 1985. The Institute is a self-contained unit with all the facilities for conducting residential training courses and is fully equipped with modern teaching aids and equipments, hostel facilities, well furnished classrooms, various models, videos and charts. The following programmes are being conducted and regulated by the Institute at present. a) *Lay Inseminators Programme* is being conducted for Dairy Co-operative Societies, Secretaries or Testers for a duration of 30 days with 10 days slaughter house programme and 20 days hospital practice training. The average batch strength is 20 trainees. Trainees are taught about giving first aid to animals and taken to field visits to various units of KMF such as BBF & FSB, cattle feed plant, one model DCS and National Dairy Research Institute before conducting examinations. b) *P and I Wing training*: This programme conducted for extension officers, Mobile Veterinary Clinic Officers, Agricultural and Artificial Inseminator Officers for 60 days with a batch strength of 20, trains the personnel in milk procurement and technical input activities. Also organisation, supervision and extension activities including accounts at DCS level and co-operation activities are taught. Two weeks of practical training and 10 days of DCS organisational work are held. The programme concludes with a week's visit to National Dairy Development Board, Anand. c) *Management Committee training*: The DCS management committee members attend this programme for a duration of three days. Lectures about day-to-day DCS business, conducting meetings regarding bye-laws and co-operation are arranged in addition to their visit to NDRI and BBF, cattle feed plant and dairy plants. The average batch strength is 20. d) *Womens Training Programme*: Those women who are immensely interested in dairying and other technical know-how attend this programme for a day. Lectures on animal husbandry, dairying and allied subjects, emphasising on feeding, breeding, management of dairy cattle and role of women in dairying and visit to several dairy plants are arranged. The average batch strength is 20. The total number of trainees from January 1985 to March 1989 under different programmes at Bangalore are as follows. 1) Orientation programme for DCS management 2,041, 2) Orientation programme for women in animal husbandry practices 1,066, 3) Orientation programme for extension officers 85, 4) DCS staff training in artificial insemination and veterinary first aid 751, 5) Refresher course in artificial insemination 109, 6) P and I wing training programme 288, 7) Orientation programme in handling of frozen semen 23, 8) Technical training programme 18, 9) VDC one-day training programme 176, Tester training programme 140 and Secretaries training programme 149, 10) Union Board of Directors 79, 11) Primary animal husbandry programme 33 and Unemployed graduates training 9.

#### **Red Dane Project, Main Station, Hessaraghatta**

The Red Dane Project was started during the year 1964 as Indo- Danish Project with the collaboration of the Government of Denmark with the following objectives: 1) Demonstration of modern methods of dairy farming with high-yielding exotic animals, 2) Upgrading of local cows through semen of pedigreed bulls and distribution of pure-bred exotic bulls produced in the farm throughout the

country, and 3) Training of farmers, village level workers etc. in the improved methods of dairying, fodder production, preservation and utilisation and extension work in selected taluks. The main centre at Hessaraghatta was started with a batch of 50 Red Dane Heifers and five young bulls. During 1966, 40 Heifers and 6 bulls were added. The dairy at the main centre consists of pure Red Dane herd maintained under ideal conditions for demonstration to farmers and also for the production of pedigreed bulls for distribution within and outside the state through artificial insemination. The cross-bred Heifer project was started in 1976 with the objectives of providing inputs to the small and marginal farmers and landless agricultural labourers and to provide them with the necessary inputs in the form of loan and subsidy. The local breeds like Hallikar, Deoni, Krishna Valley and Malnad Giddas were crossed with Red Dane bulls. During the year 1986-87, 13 calves were born and 16 pregnant Heifers were sold to the beneficiaries.

#### **Veterinary Research Institute**

The Indian Veterinary Research Institute, B'lore was started during 1972 with the objectives of establishing a unit for production of foot and mouth disease vaccine in collaboration with the Government of Denmark and for attending to regional problems in animal health and allied areas. The Government of Karnataka has provided free of cost 4.5 ha of land at Hebbal for the Institute and 44 ha of land at Ramagondanahalli near Yelahanka for establishing the Isolation Unit. The Institute at Bangalore is having three wings *viz.* Research and development wing for the development and constant improvement of foot and mouth disease vaccine, vaccine production unit for producing the vaccine using BHK 21 suspension cell culture technology and regional research wing for studying the animal health problems, particularly of the southern region. The research wing undertakes the study of animal health problems including diagnosis and control methods, development of facilities for work on contagious animal disease, research on exotic and emerging diseases as and when required using high disease security system, rearing of specific disease free animals, potency testing of FMD vaccine, extension of results of laboratory research to the farmers through State or Central Government agencies and post-graduate teaching and research in the subjects of animal health. The main work at the campus is concerned with the foot and mouth disease which is considered as number one enemy of the livestock, particularly the dairy cattle.

This Campus is headed by Joint Director and has three research laboratories, out of which one is confirmed to P3 requirements of bio-safety where FMD vaccination production and research on FMD Virus are carried out. The other two laboratories are used for field isolates and monitoring, surveillance and disease diagnosis purposes. In addition, an animal experimentation station about 20 km. away from the campus has been developed for laboratory animal facilities and animal sheds for safety test of FMD vaccine. The campus is supported by auxillary services *e.g.* Engineering, Medical, Library and Administrative. A total of about 245 lakhs monovalent doses of FMD vaccine have been produced and about 235

lakhs of monovalent doses have been distributed on demand all over the country and a revenue of Rs. 240 lakhs has been realised from the sale of vaccine from 1972. The Bangalore campus of the Institute has been awarded 14th International Gold Star Award for quality of work during 1989 by Business Initiative Directions, Madrid, Spain. Two international collaborative research projects with Government of Switzerland and USSR, have been initiated during 1989 for the development of better immunogen and immunodiagnostics for foot and mouth disease. Regular courses are being conducted each of about a month's duration for officers being deputed from State departments, institutions and universities. The short term courses being conducted are the following: animal cell culture technology, animal virus vaccine production technology, ELISA techniques, hybridoma techniques for monoclonals and recombinant DNA technology for virus. In addition, short term training programmes for specialists within or outside the country are also being provided.

#### **Institute of Animal Health and Veterinary Biologicals**

The Institute of Animal Health and Veterinary Biologicals was established in 1926 as the Mysore Serum Institute at Hebbal, Bangalore. In the earlier years, the Institute used to produce anti-rinderpest serum to control rinderpest disease. Production of bacterial vaccines commenced in 1929 and in 1932, the disease investigation sections were established to provide sufficient health coverage of livestock. After 1935, anti-rabic vaccine and anthrax saporin vaccine were produced. In 1943, the Institute produced the rinderpest goat tissue vaccine. In 1945, the Stockman Training School was started by the Institute. Freeze dried raniket vaccine was produced in 1956 and in 1963, 'F' vaccines were produced. The production of Entero-Toxaemia vaccine was started in 1966. Rinderpest Eradication scheme was transferred to the Institute from the Centrally-sponsored schemes during 1972 and in 1974, the name of the Institute was changed from the "Mysore Serum Institute" to the present name in view of multi-faceted activities undertaken by the Institute in the production of different veterinary biologicals and problem-oriented research on existing, exotic and emerging diseases of livestock. The B'lore Centre for all-India co-ordinated research project for epidemiological studies on foot and mouth disease was started during 1976. Various research schemes and programmes besides the production of biologicals have also been undertaken. The Institute is also manufacturing different types of vaccines.

*Bangalore Military Dairy Farm* is situated adjacent to the Hebbal tank. The farm has an area of about 68 ha. The farm supplied daily about 5,000 litres of milk to the defence personnel in Bangalore by 1979. The farm with a staff of about 200, is regarded as a model farm for its maintenance. There are comfortable paddocks for animals and for those about to calve separate quarters. Young calves have a separate enclosure for their quick and unhampered growth. The animals are washed daily. The cattle were divided into groups of 14 with one man responsible for them. Maize and Napier grass are grown in the farm for the supply of fodder.

Meticulous records are kept of each animal, its parentage, grand parentage, birth, calving and average yield of milk per day and any other statistical data needed and produces dossiers on each animal. The farm had the herd strength of about 1300 during 1990. The Farm was established in 1955.

### Poultry Development

The State Poultry Farm, Hessaraghatta is one of the pioneer institutions in the country started in 1948 which is fully engaged in the scientific poultry breeding operations. This had helped this small district to take rapid strides in poultry farming. It has evolved a high yielding egg strain called the 'MYCHIX' from white leghorn. This strain has proved to be the best egg-yielding strain from the random sample laying test conducted by the Government of India. In addition, this institution has also taken up the production of day old commercial broiler chicks. The Government of India has identified the State Poultry Farm as one of the pioneer institutes in breeding operations and national co-ordinated poultry breeding programme is in operation to further strengthen the breeding programme and to evolve new strains of eggers and broilers. The Poultry Training Institute at Hessaraghatta is a National Centre for training experts particularly in priority areas of poultry genetics, cross breeding, mixing, feeding management and marketing. The progress achieved by the State Poultry Farm, Hessaraghatta is as follows.

Sl.no.	Particulars	1983-84	1984-85	1985-86	1986-87	1987-88
1)	No. of chicks reared	6,993	9,383	5,188	4,957	4,313
2)	Eggs produced (in '000s)	1,529	1,794	1,211	1,123	807
3)	Chicks produced (in '000s)	320	268	152	115	54
4)	No. of persons trained	215	291	428	513	455

### Central Poultry Training Institute, Hessaraghatta

Central Poultry Training Institute, with its present name, is the premier institute of its kind, located at Animal Husbandry Complex, Hessaraghatta under the Government of India, Ministry of Agriculture. This was established during 1972, with name High Level Inservice (Poultry) Training Institute. During 1975, this name was changed to "Central Training Institute for Poultry Production and Management". Again the present name is adopted since July 1986 with an idea to have a simpler name. The Institute is headed by a Director. The Institute works with the following objectives (1) to impart advanced and specialised training to the technical officers of the Central or State Government Organisations, Agricultural Universities, Poultry and Meat Corporations and Private sector poultry organisations and from developing foreign countries, in different disciplines of

poultry production (2) to organise specialised courses on poultry production for financial institutions such as NABARD, General Insurance Corporation, Grameena Banks, etc., (3) to provide technical assistance and expertise in the area of poultry production to the public and private sector poultry farms, hatcheries, central poultry organisations and compound Livestock and poultry feed manufacturers (4) to provide feed analytical and quality control service facilities to the Central and State Poultry farms, public and private sector poultry and livestock entrepreneurs and compound feed manufacturers (5) to conduct biological studies in the area of poultry management and nutrition for application under field conditions and (6) to develop and standardise egg and poultry products and to keep in touch with the marketing trends of chicken and eggs.

Mycotoxin centre of this Institute, which was established with the assistance of Overseas Development Natural Resources Institute (ODNRI), London, with its unique functioning and latest quantification techniques played important role not only in poultry production but also in other livestock production programmes. The Central Duck Breeding Farm, Hessarghatta which is one of its kind in South Asia avails the facilities of this Centre apart from all Central Cattle/Poultry breeding farms of Government of India. Ammoniation plant designed and fabricated by ODNRI, London is working to detoxify the mold infested feeds which are harmful for livestock. This is the only plant in India and second in the world. Nutrition service and technical laboratories are equipped with modern analytical equipments carrying, catering to public and private sectors. The Institute has a small but well stocked library. The different training courses offered are (a) Advanced Courses-Poultry Genetics and Breeding (8 weeks), Poultry Management and Farm Economics (8 weeks), Poultry Nutrition and Feeding (8 weeks), Poultry Processing and Technology (6 weeks), Marketing of Poultry and Poultry products (6 weeks), Duck Production and Management (8 weeks), (b) Laboratory Courses-Feed Analytical Techniques (8 weeks), Mycotoxin Assay (6 weeks), Chick Sexing (12 weeks), Artificial Insemination and Hatchery Management (6 weeks) and (c) Specialised Courses-Poultry Husbandry practices for Insurance and Bank Officers (2 weeks), Re-orientation Training in Poultry Production for Field Officers (1 week) and Basic Course in Poultry and Duckery for Executives (1 week).

The steady increase in the number of poultry farmers necessitated to assure the availability of quality feed, to ensure the optimum production in the flock, and thus came the innovative measure "the Quality Control Act for Poultry Feed". Under Quality Control Programme, 45 feed samples were collected for analysis and 52 feed manufacturers were given licences during 1987-88 in the district. The intensive poultry development project is engaged in providing health coverage to the poultry.

*Applied Nutrition Programme* was introduced during 1963-64 in Anekal tq and 1972-73 in Bangalore South tq with the objectives to develop progressively a

co-ordinated and comprehensive National Programme of Education and Training in modern poultry farming to promote through demonstration and education among the village communities sound and hygienic practices for production, preservation and use of eggs and to provide facilities to train in modern poultry farming various personnel including farmers involved in the implementation of the programme.

The Poultry Science Department of the University of Agricultural Sciences, Bangalore has evolved and developed a new breed of fowl 'Giri Raja'. It combines the majestic appearance and varied colours of the indigenous jungle fowl with the higher production of eggs and meat content of exotic breeds. Giri Raja has been evolved by pooling germplasms of the principal exotic broiler breeds. The breed is named as Giri Raja as it resembles the jungle fowl which is the father of modern exotic birds. Giri Raja thrives well even without scientifically formulated feed under scavenging conditions. It is larger in size than the indigenous fowl and produces three times more eggs than the local breeds.

*The Karnataka Sheep and Sheep Products Development Board* was established during 1975 as per Karnataka Act No.12 of 1974 with the main objective to establish and maintain sheep development farms, to promote the development of activities relating to sheep wool, meat and other matters and to organise the shearing, processing and marketing of wool. The sheep breeding stations viz. Guttal and Suttatti were transferred to the Sheep Board during 1984-85. During 1986-87, about 66,600 rupees worth wool products was produced and rupees 44,000 worth wool was marketed. Extension centres have been started to provide breeding facilities, health coverage and extension services to the flock owners. The head office of the Board is situated at Bangalore.

*The Bangalore Animal Food Corporation Limited* was established during 1973-74. The authorised share capital of the company is Rs.150 lakhs. The slaughter houses which were under the control of the Bangalore City Corporation until 24th December 1975 have continued to be under the Corporation. The revenue from these slaughter houses has increased from Rs.22 lakhs to Rs.24 lakhs during 1986-87 when compared with the revenue for the year 1985-86. The number of animals slaughtered during the year 1986-87 and the previous year 1985-86 were (given in brackets) as follows. Sheep and goat-4,86,003 (4,88,205), cattle 55,961 (50,950), and pigs 6,895 (5,149). A vigilance squad with qualified Veterinary Assistant Surgeons are assisting the Health Officer and his staff of the Corporation of the City of Bangalore to detect unauthorised slaughter and sale of such meat and initiate appropriate action against the offenders. The company has taken possession of the land at Kancharakanahalli measuring 27 hectares during 1986. National Bank for Agriculture and Rural Development has approved the project of construction of modern abattoir and offices of the Corporation at an estimated cost of Rs. 306 lakhs excluding the value of the land. The project is yet to be taken up.

## FISHERIES

Bangalore district is not well developed in the field of fisheries. The district has about 183 major tanks of varying sizes suitable for fisheries with a waterspread area of 13,429 ha. There are two reservoirs in the district at Hesaraghatta and Tippagondanahalli with waterspread areas of 1,160 ha and 1,500 ha respectively. The inland fish seed produced by Fish Farmers Development Agency was 9 lakhs during 1987-88. The inland fish production was 4,296 tonnes during 1987-88. There is a fish seed production farm at Hesaraghatta with gross land area and net waterspread areas of 5.22 and 2.52 hectares respectively. Fish farm is a demarcated fertile plot situated nearby a perennial source of water on which are raised ponds or nurseries for production and rearing purpose. The object of establishing fish farm is to maintain the breeders, to undertake breeding programme and to rear the hatchings to fry and fingerlings stage before they are transported and planted in suitable body of waters. The main object of Fish Farmers Development Agency is to involve private agencies in intensive development of fisheries in their tanks by providing incentives like loan, subsidy, training, etc.

There are four Inland Fisheries Co-operative Societies in the district with the total membership of 946 and the total share capital is about 19,693 rupees. The activities of these co-operatives include taking leases of fisheries tanks, rivers and channels for exploitation, procurement and supply of fisheries requirement of members etc.

### Fish Fauna

Common carps are the important exotic fishes introduced in the district. The exotic carps include *Cyprinus carpio communis*, *Cyprinus specularis*, *Cyprinus nudus*, *Ospharionemus goramy*, *Tilapia mossambica*, *Carrasius carrasius*, *Ctenopharyngodon idella* and *Hypophthalmichthys molitrix*. The common carps are the most popular due to their easy acclimatization, fast growth, and self-sustenance in lentic environment. The indigenous species of fresh water fish were *bale minu*, *avu minu*, *korama*, *kuchchu minu*, *ane minu*, *marali minu*, *gende minu*, *gralu minu*, *pakke minu*, *handi gorava*, *hu minu*, *murave*, *domme*, *kallu*, *korava* etc.

The Karnataka Inland Fisheries Development Corporation Limited was established during 1984 with the main objectives of construction and maintenance of fish hatcheries, development of fisheries in selected tanks and reservoirs for maximum fish production, to supply quality fish seed to Fishermen Co-operative Society, local bodies, etc. and to organise fish marketing. Hesaraghatta Fish Farm was transferred to this Corporation on 1.2.1986. Rupees one lakh has been provided to improve the facilities and to increase fish production at Hesaraghatta Fish Farm during 1986-87. Six tanks in Bangalore district viz. Begur, Hebbal, Madivala, Nagavara, Hennur and Binaganahalli have been leased to the corporation for a period of five years from 1987 for taking up intensive development of fisheries and to produce maximum fish in these tanks. With the object of developing fisheries in



tanks around Bangalore and to supply fish to the residents of Bangalore city, Yediyur, Sankey and Ulsoor tanks of Bangalore City Corporation and Hebbal tank of fisheries department are stocked with fast growing fish seed and they are being managed by the Corporation. The exploitation of the fishery of these tanks is being taken up by the Corporation. It has been proposed to start fish canteens at Ulsoor, Sankey and Yediyur tanks immediately. It is also proposed to open 25 fish canteens at the strategic points at Bangalore.

The Ice Plant and Cold Storage at Bangalore was transferred to the Corporation on 7.11.1986. The plant which is in defunct condition is being repaired and likely to be commissioned during 1989. The Government Aquarium at Cubbon Park has continued to be the centre of attraction for tourists. The Mini Aquarium at Lalbagh which had been closed down several years ago was revived with a major face-lift during 1987-88.

*The Central Institute of Fresh Water Aquaculture* was established in October 1986, under the scheme of reorganisation of Fisheries Research Institutes in the country by ICAR. The Institute is primarily entrusted with the responsibility of conducting research and transfer of technology through extension and education. The headquarters of the institute is located at Kausalyagang in Orissa. Bangalore is one of the six research centres of this institute entrusted with the study of ecology and fisheries of peninsular tanks.

### **Drought**

Drought is a condition arising out of scarce rainfall. In earlier days, acute scarcity condition was referred to as famine. The proximate cause of a famine in time of peace is the failure of crops resulting from insufficient or untimely rainfall. Indian Meteorological Department defines 'drought' as a situation occurring in any area when the annual rainfall is less than 75 per cent of the normal rainfall. Famines resulting from widespread droughts though quite frequent in olden days are relatively less at present. However, insufficient rainfall leading to loss of crops over large extent may result in distress among the small holders and landless class such as agricultural labour and petty artisans who do not have the economic strength for storing the grains and are purely dependent on what they earn by labour. Failure of crops also leads to shortage of fodder which in turn affects the cattle population driving poorer sections of the people during such times towards distress sale of cattle. The objectives of the modern method of managing the drought are to generate enough purchasing power among the affected people by providing them suitable employment at reasonable wage level, enabling them to buy foodgrains and to provide drinking water which becomes scarce on account of scanty rains and fodder to the cattle to save cattle population.

During the period of inadequate rainfall, leading to conditions of scarcity, the drinking water problem is tackled by digging new open and bore wells, deepening of existing open wells, flushing or repairs to existing borewells, augmenting the

water supply of protected water supply schemes and by transporting water through tankers or other modes of conveyance to places where there is no water. Steps are also taken to provide fodder to the affected farmers and to arrest the distress sale of cattle by the weaker sections of the farmers as the livestock forms an invaluable asset to the marginal farmers and landless labourers. Fodder requirements are met by procuring dry fodder from the surplus pockets within the affected areas or the neighbouring areas and production of fodder in farmers' fields and Government farms. Cattle camps are also organised in the areas where distress is widespread and acute, at places where water resources are available. Soil conservation works are given special attention during a period of drought as the soil conservation works besides providing intensive employment would help better land use and better management of surplus water. Special attention is paid for the maintenance of public health during the period of drought since inadequate and impure drinking water and malnutrition may lead to epidemics and diseases. Maintenance of regular supply of essential commodities and strict watch over the price level are the most important in the modern concept of drought management.

Bangalore district has suffered from deficit and capricious rainfall conditions and the resultant phenomenon of crop failure. The information about famines due to drought previous to the year 1876-78 is very scanty, the district seems to have shared the sufferings in a more limited degree during the famines of 1824, 1833, 1866 and 1876-78. During 1876-77, though there was a fair average rainfall during June, it became capricious and most scanty as the year advanced. The north-east monsoon was a complete failure. The failure of north-east monsoon completed the destruction to the extent of 80 per cent of kharif crops in Bangalore district. During 1977-78, June, July and August passed away without the rain and distress increased rapidly and in alarming proportions. In September, rains came copiously and brought some relief to the people. During 1884, the south-west monsoon was a failure in the district resulting in the reduction of harvest which varied from a quarter to a half of the usual average. The Revenue Commissioner in his report on the administration of relief measures during 1908-09 has classified the years 1883-84, 1884-85, 1891-92, 1899-1900, 1904-05, 1907-08 and 1908-09 as bad years in which rainfall was on the whole defective and ill-distributed. Loans were sanctioned for digging of *kapile* and *yatam* wells and construction and repair of *saguvali kattes*. The south west monsoon of 1923 was very feeble and the north-east monsoon that followed was a complete failure. Some parts of the district suffered from drought and want of fodder for cattle. In recent years, due to improvements in transport and communications, sufferings from scarcity conditions have been lessened.

Scarcity conditions were prevalent in the district during 1970-71 and a substantial part of the district was affected by scarcity conditions. Several relief measures were taken in the affected areas. The district has experienced scarcity conditions from 1980-81 to 1985-86. During 1981 June, all the taluks recorded a

miserably low rainfall and in July the entire district except some parts in Bangalore North taluk, came under the grip of drought on account of inadequate rains ranging from 15 to 50 per cent of the normal rainfall. The shortage of rainfall during June and July coupled with long dry spells causing recession of water levels aggravated scarcity of drinking water and fodder. 1986-87 was a year of slow recovery from the trauma of severe droughts. During 1987-88, the hopes of complete recovery and satisfactory progress of development programmes was again jeopardised by persisting drought conditions. The rainfall conditions were characterised by scarce pre-monsoon showers, delayed onset of south-west monsoon and long dry spells during crucial periods of crop growth.