CHAPTER IV

AGRICULTURE AND IRRIGATION

Agriculture has been the mainstay of the district's economy from time immemorial. According to a legend, the mighty king Kuru once ploughed the fertile land of this region with his golden plough. The *Mahabharata* speaks highly about the material prosperity of the people of this region which is indicated by fertility of soil, abundance of water and vegetation[1]. The soil produced succulent grains, the rains were timely and trees were laden with fruits[2]. Growth of agriculture was facilitated in this region because its land was irrigated by river Saraswati and the *Rigveda* mentions the river Saraswati as the provider of grains and all sorts of riches.

During ancient times, the region was known as the land of plentiful grains and immense riches (Bahudhanadhanya). Number of Historians have testified this fact. According to Bana Bhat, the court poet of Harsa, the secret of the prosperity of the region was fertility of its soil, abundance of crops and vegetation and the cattle wealth. He described this region as "heaven descendent upon earth", full of lotuses and sugarcane enclosures, and on every side of it were seen corn heaps. Rice crops stretching over the land were watered by the 'pots of wheel.' On the uplands were seen wheat crops dense with ripe *rajamasha* patches[3].

Likewise, Hiuen Tsiang, a Chinese Traveller, who visited the district during 7th century, speaks of the rich and fertile soil and abundant crops in the Sthanvisvara country.

With the passage of time, the drying up of river Saraswati adversely affected the productivity of the soil. For centuries preceding independence and even a few years succeeding it, agriculture remained mostly neglected and bound within traditional moorings.

After Independence and particularly after the formation of Haryana in 1966, concerted efforts were made to harness the fertility

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[1] V.N.Datta & H.A.Phadke, History of Kurukshetra, 1984, p.31.
[2] Ibid, p.32
[3] H.A.Phadke, Haryana Ancient and Medieval, p.59.

of the soil to increase agricultural production. The high-yielding varieties of seeds alongwith modern input packages were introduced in the district in the late sixties. Schemes were undertaken to enhance irrigation facilities. New scientific research in the filed of agriculture and mechanization has played a pivotal role in agricultural development in the district. The district has made spectacular progress in the filed of agriculture and is now known as 'Wheat Bin' and 'Rice Bowl' of Haryana.

Land Utilization.- By and large, cultivated area of the district continued to be sown more than once annually. The land use statistics reveal that there is over-exploitation of land for crop-raising in the district.

The total area of the district according to village papers measured 168 thousand hectares in 2003-04. The broad use of the land in 2003-04 is shown below:-

Nature of land use	Area (000 Hectares)
Total area according to village papers	168
Area under forests	0.725
Land not available for cultivation	17.8
Other uncultivated land (including fallow land)	"a"
Fallow land	0.269
Net Area sown	149
Area sown more than once	121
Total cropped area	270

The cultivated area (net area sown) is 88.69 percent of the total area of the district as compared to the state average of 82.00 percent. Since 88.69 percent of the total area of the district is under cultivation, there is hardly any scope to bring more area under different crops. Steps have been taken to increase the agricultural productivity by adopting enhanced irrigation facilities, latest farm technology and multiple cropping.

"a" Less than 500 hectares.

Soil Classification.- During ancient times, soils were classified into two broad types, viz. *urvara* and *anurvara* or *usar*. In the 16th century, the agricultural land was divided into *barani*, *nehri*, *Sallabi* and *abi* depending on the suitability of soils for crops, as determined by sources of irrigation. Later on, when the State of Haryana was divided into Assessment Circles for revenue purposes on the eve of the first settlement in the 19th century, the division purely confirmed to the surface texture of soil and the availability of water and sources of irrigation which put together determined the land productivity. On the basis of such information the villages were grouped into *barani*, *nehri*, *khaddar*, *bangar*, *Chhachhra*, *naili*, *rohi*, *rangoi*, *bagar*, *tibba tal*, *bet* etc.

Assessment Reports reveal that Pipli Tehsil of the then Ambala district had a great variety of soils at the end of 19th century. Five Assessment Circles of the Tehsil formed the Khadir (new alluvium), the Ladwa Bangar (old alluvium in the plains), the Northern and Southern Chhachhras (abundant growth of *dhak* jungle) and the Markanda Bet[1] (low lying flood plains). The Pehowa tract, inundated by the capricious floods of the Saraswati and the Ghaggar was known as the Naili[2].

The district mainly has now three type of soils, (i) the medium soil, (ii) the moderately heavy soil and (iii) the heavy soil and very heavy soil. Medium soil embrace three sub-categories viz. (a) Light Loam, (*seoti*), (b) Coarse Loam (*dhar* and Chacknot) and (c) Loam (*bangar* and *nardak*). The Loam is found in the central parts of east of Thanesar Tehsil. The moderately heavy soil includes silty loam which is locally designated as *Khadar*. General alluvium of mixed origin is found along the major river course of the Yamuna. *Khadar* soil is very inferior, poor and grey-coloured sandy loam.

The heavy soil and very heavy soil are found along the Ghaggar and Markanda. The heavy soil is clayey silt which forms a good area of alluvium known as *bet*. The very heavy soil consists of silty clay or stiff loam or stiff clay which is confined to drainage lines and hollows. Hard clay (*sotar*) or loam prevails in Ghaggar valley in

[1] Ambala District Gazetteer, 1892-93, pp.124-25.
[2] Karnal District Gazetteer, 1892, pp.2-5.

Pehowa tehsil. A yet more stiff loam is found in the low lying areas of the district where the action of the water washes out the sandy particles. It is locally known as *Dakar* and characterized by its clods not crumbling in hands. Stiff clay is common in *Chhachhra* of Pehowa and Shahabad the area intersected by several hill streams. It is also found in some areas of Thanesar Tehsil.

SALINITY AND ALKALINITY PROBLEMS

The Haryana land Reclamation and Development Corporation (HLRDC) is engaged in the land reclamation and land levelling programmes in the district. A Soil Conservation Sub-Division was set up at Kurukshetra during 1968 to provide sufficient extension support to the land reclamation programme. For tackling the problem of alkali affected land in Kurukshetra district, the Corporation also set up the Managerial Circle during the year 1976 at Kaithal which covered the present Kuruksehtra district. According to Master Plan on soil conservation prepared by the Agriculture Department, about 57,000 hectares area is affected by the problem of alkali and salinity in the district of Kurukshetra, as a result of which, such lands are either lying barren or giving very poor yield. The Central Soil & Salinity Research Institute, Karnal development a viable technology, the application of Gypsum at the rate varying from 3 metric tones to 3.5 metric tones. The implementation of the Land Reclamation Programme required gypsum in bulk quantity and manpower for educating the farmers about the use of recommended technology. Since the Corporation was not having manpower to carry the message of technology to all the farmers in the villages, the work of extension was taken up by the Department of Agriculture and the work of stocking gypsum and other inputs like Ammonium Sulphate and Zinc Sulphate (which were also important components of the recommended technology) was taken up by the Haryana Land Reclamation and Development Corporation Limited. The State Government also provided subsidy to the farmers on the purchase of Gypsum at the rate varying from 50 percent to 75 percent at different times depending upon the size of holding of lands. With effect from April 1986, 75 percent subsidy on Gypsum is available to all the categories of the farmers irrespective of their size of holding. From September, 2002, 50 percent subsidy is also available under Land Reclamation Scheme.

The Corporation has established 7 Gypsum stockists in the district. Through these dealers, Gypsum powder is provided to the needy farmers to reclaim their alkali affected lands. The farmers are also provided loans through Primary Land Development Bank for reclaiming their lands. As a result of Joint efforts made by the Department of Agriculture, HLRDC and Primary Land Development Bank, an area of 46,023 hectares has been reclaimed upto March 31,2004 and such reclaimed areas are producing foodgrains to the tune of 40 to 50 quintals per hectare annually.

Kurukshetra district is one of the leading districts of the State in agricultural production. It contributed nearly 5.13 percent of wheat and 12.45 percent of paddy of the total production of the State of these crops during the year 2003-04.

Significantly, the district contributed about 843 thousand tones of the total foodgrains production in the State and ranked sixth during the year 2002-03.

The cultivation in the district, to a large extent was *do-falsi* during the last century where irrigation was available and was *ek-falsi* in the land mainly dependent on rains. The two crop system i.e. autumn and spring crops is still prevalent in the district but multiple cropping pattern is also practised.

The crops grown are divided into two main categories viz. Kharif and Rabi, locally called as *sawani* and *asadhi*. The former is the summer season harvest. Any crop which does not strictly fall within these two harvests is known as a *zaid* crop and its harvest is called the *zaid* Kharif or *zaid* Rabi, according to the harvest with which it is assessed.

The major Kharif crops are paddy and sugarcane, and the major Rabi crops are wheat and gram barley. *Toria* (an oilseed) is cultivated as *zaid* kharif in the district. Major foodgrain crops of the district are paddy and wheat and major cash crops are sugarcane and *toria*. On the whole, food crops dominate in both the harvests.

FOODGRAIN CROPS

Wheat.- It is the most important Rabi crop of the district and occupies 41.5 percent of the total cropped area. Areas under this crop and its

production have registered manifold increase since the district was reorganized in 1989. The average per hectare yield of wheat increased from 3,397 kg. in 1989-90 to 4,330 kg. in 2002-03, showing an increase of 27.47 percent over the period. In 2002-03, the district had 109 thousand hectares under wheat crop and its production was 472 thousand tones. The area under wheat in the district was 4.8 percent of the total area under this crop in the state and it produced 5.13 percent of the total wheat production in the State.

Significantly enough, 99 percent area of wheat crop is covered under high yielding varieties mainly PBW-343, HD-2687, WH-542, UP-2338, PBW-373, WM-711 and Raj-3765.

Rice.- It is an important Kharif crop of the district and also occupies 41.5 percent of the total cropped area. The area under this crop and its production has significantly increased since 1989 when the district was reorganized. In 2003-04, the district had 112 thousand hectares under rice cultivation and its production was 348 thousand tones. Its per hectare yield in the district was 3107 Kg. as against state average of 2,749 kg. Significantly, the area under rice in the district was 11 percent of the total area under this crop in the state and it produced 12.45 percent of the total rice production in the State.

Among the varieties being grown in the district, basmati is a fine variety which fetches huge amount of foreign exchange annually. A little more than 85 percent of rice crop in the district is covered under high yielding varieties mainly jaya, HKR-126, PR-113, PR-116, Pusa-44, Pioneer Hybrids PR-114.

Gram.- This is also a Rabi crop. The area under this crop has gradually declined and, with better irrigation facilities, the farmers have switched over to wheat cultivation. In 2003-04, the area under gram in the district was only 153 hectares and production was one thousand tones. Per hectare yield was 74.5 kg. The important varieties grown in the district are C-235, MC-I and MC-3.

Besides gram, other pulses grown in the district are *mash*, *moong* and *massar*. Of these, *massar* is most important as it covered an area of 2.1 thousand hectares of the total 2.3 thousand hectares under pulses in the district in 2003-04.

COMMERCIAL CROPS

Sugarcane.- It is the most important cash crop of the district and is grown in Ladwa, Thanesar and Shahabad blocks. Its cultivation is considered profitable owing to the readily available marketing facilities because of location of a Sugar Mill at Shahabad. In 2003-04, the area under sugarcane in the district was 15 thousand hectares and production was 105 thousand tones. Per hectare yield was 6,818 kg. as against state average of 5,802 kg. The area under sugarcane in the district was 9.3 percent of the total area under this crop in the state and it produced 10.9 percent of the total sugarcane production in the State. The main varieties of sugarcane grown in the district are, Co-8436, Coj-64, Co-7717, COS-767, COM-56 and COM-99.

Oil Seeds.- Production of oilseeds is not popular in the district. The area under oilseeds is very small and these are grown mainly for local consumption. The district had 7.3 thousand hectares under oilseeds in 2003-04 and production was 7.2 thousand tones.

FODDER CROPS

In 2003-04, 6.5 percent of the total cropped area of the district was under fodder crops. Apart from these crops, the stalks of *jawar* and maize and wheat *bhusa* are used as animal food. The forage crops are generally sown under irrigated conditions in the district. The important among fodder crops grown in the district are *chari* and *berseem.* In 2003-04, the area under *chari*, a kharif fodder, was 9,000 hectares and area under *berseem* a Rabi fodder, was also 9,000 hectares.

CROPPING PATTERN

There have been many significant changes in the cropping pattern in the area now comprising Kurukshetra district since the beginning of the 20th century. A broad idea about these changes can be had from comparing the cropping pattern in the present Kurukshetra district in 2003-04 with the cropping pattern in the then Thanesar Tehsil in 1900-01 and 1930-31, as the area then comprising Thanesar Tehsil now broadly comprise the present district.

The following table showing the percentage of area under principal crops in 1900-01, 1930-31 and 2003-04, clearly brings out

the changes in the cropping pattern of the district during the last hundred years:-

Crops	1900-01[1]	1930-31[2]	2003-04
Rice	10.60	10.18	41.48
Wheat	26.71	25.27	41.48
Barley	4.13	1.67	-
Gram	13.49	14.94	0.05
Total Foodgrains	88.81	92.74	82.96
Oilseeds	7.27	2.26	2.07
Sugarcane	1.19	1.48	5.05

(Note.- Figures are as percentage of total cropped area and the figures for the Years 1900-01 & 1930-31 pertain to the then Thanesar Tehsil)

An analysis of above table shows that between 1900-01 and 1930-31, the percentage area under rice, wheat and sugarcane increased, the decrease being sharper in case of Gram and oilseeds. On the other hand, the percentage area under barley, gram and oilseeds decreased, the decrease being only marginal in case of oil seeds. On the whole, foodgrain crops dominated the cropping pattern in 1900-01 and 1930-31 as 88.81 percent and 92.74 percent of the total cropped area of the then Thanesar Tehsil was under foodgrain crops in 1900-01 and 1930-31, respectively. Significantly, between 1900-01 to 1930-31, the percentage area under foodgrain crops increased.

The period between 1930-31 and 2003-04, witnessed important changes in the cropping pattern. The area under rice, wheat and sugarcane had considerably increased, the increase being much significant in case of rice and wheat. The percentage area under rice increased from 10.18 percent in 1930-31 to 41.48 percent in 2003-04 and that under wheat from 25.27 in 1930-31 to 41.48 in 2003-04. Significantly enough, the rice and wheat put together covered more than 82.96 percent of the total cropped area in 2003-04 as against little over 35 percent in 1930-31. On the other hand percentage area under

[1] Karnal District Gazetteer, Statistical Tables, 1904, Table 19.
[2] Ibid, 1935.

barley, *Jowar*, *bajra*, gram, oilseeds and cotton considerably decreased. The decrease was sharper in case of gram as the area under this crop fell from 14.94 percent in 1930-31 to merely 0.05 percent in 2003-04. Thus, among the foodgrain crops, the percentage area under coarse and low value crops decreased whereas the area under superior crops like rice and wheat increased significantly. However, on the whole, foodgrain crops still dominate the cropping pattern in the district as 82.96 percent of the total cropped area in 2003-04 was covered by foodgrain crops. Commercial crops like sugarcane, oilseeds etc. do not form important part of the cropping pattern in the district as in 2003-04, only 8.1 percent of total cropped area was under commercial crops.

HORTICULTURE

Fruits.- The climatic conditions and soil of the district are congenial for growing *ber*, guava, mango, citrus and peach. The Horticulture Department of Haryana has taken many steps to promote fruit cultivation in the district. It is educating the farmers to switch over to fruit cultivation for better return. The Department has one office each at Thanesar and Shahabad where Horticultural Development offices look after the horticultural activities.

During 2003-04, 1142 hectares of area was under fruit cultivation. The breakup of area was as under:-

Fruits	Area (hectares)
1. *Ber*	28
2. Peach	169
3. Mango	386
4. Guava	216
5. Citrus	69
6. Others	274

Vegitables.- Improvement in irrigation facilities, develop-ment of means of communications and growth of urban centres has boosted cultivation of vegetables in the district. Earlier, vegetables were not

important part of diet of the rural masses. But in the last few decades eating habits of rural people have undergone a change and gradually vegetables have become important part of their diet. This has greatly increased the demand for vegetables in the district. Consequently, area under vegetables has increased in response to growing demand for them in the expanding urban centres and villages in the district.

Recent research carried out by various agencies such as Indian Council of Agricultural Research, New Delhi and Haryana Agricultural University, Hisar has helped in increasing per hectare yield of vegetables. These institutes have introduced many new varieties, which not only gave higher yield but also improved their quality and nutritive value.

The vegetables grown in the district are potato, cauliflower, cabbage, carrot, radish, garlic, tomato, brinjal, lady finger and chilies. In 2003-04, the area under vegetables in the district was 14,741 hectares.

AGRICULTURAL IMPLEMENTS

The role of improved agricultural implements and machine is of great importance for increasing agricultural production. The farmers are gradually adopting machanised cultivation. The following agricultural implements/machines are used by the cultivators in this district:-

Plough.- The use of traditional plough made of wood is still in vogue. This is very much in use with small and marginal farmers.

Tractor.- There were 13,110 tractor in the district during the year 2003-04. Almost all types of tractors manufactured in the country are used in the district. The tractors are being used for multi-purpose, work viz. ploughing, puddling, transportation, threshing and running of pumping sets.

Threshers.- Use of threshers for wheat threshing has become very popular with the farmers of the district. This device has helped the farmers in finishing the threshing work timely and ultimately making enough time available for the preparation of land for next crop. Old models prone to accidents have been replaced by the improved models to minimise the risk of accidents. It is estimated that there were about 10,094 threshers in the district in the year 2003-04.

Zerotill Machine.- Use of Zerotill Machine has become very popular for souring of wheat and lentil crop. It is used for sowing of wheat in Taper fields (without ploughing). By this way, farmers can save Rs.800 to 1000 per acre. At present, there are 1,642 Zerotill machines in the district.

Potato Ridger.- The use of potato ridger has become very popular with the potato growers of the district. The farmers prefer modern type of implements than the conventional ones.

Jhota Buggies.- Traditional means of transportation of agricultural produce i.e. bullock cart is being rapidly replaced by *Jhota buggies*. This means of transportation is more familiar with sugarcane growers of the district and landless labourers for whom it has become a source of livelihood. There were about 14,986 *Jhota buggies* in the district during the year 2003-04.

Cane Crushers.--This device is used for crushing the sugarcane to make *gur* for domestic consumption.

With the increased popularity of modern agricultural tools, the traditional tools and implements have not lost their utility. The use of these implements is still in vogue and will remain continue as these are of daily use for various farm operations. The following traditional type agriculture tools are still used in the district:-

Kulhari	*Hatchet*
Kasola	Smaller mattock for weeding and hoeing
Dikri	Drag rake dragged by men for leveling high land
Jeli	Six-pronged fork
Jua	Yoke
Dranti	Sickle
Kassi	Large mattock spade
Santa	Ox goad
Sohaga	Flat clod crusher

Gandari	Long handled chopper used for cutting sugarcane, cotton sticks and bushes grass spade
Khurpa	Grass spade
Jandra	Used for *Wat bandi* in the irrigated areas
Gandasa	Fodder-cutter

SEEDS

The Department of Agriculture plays an important role in publicizing the use of improved seeds. The department also concentrates on multiplying and distributing improved seeds to the farmers. At present, the following high-yielding varieties of various crops are popular among the farmers:-

Kharif	**Varieties**
1. Paddy	MKR-126,PR-114,PR-113, PR-116, Pusa-44, CSR-30, HBC-19 and breeds
2. Moong	K-851, Asha
3. Sugarcane	COS-8436, CO-7717, COJ-64, COS-767, COH-56, COH-90
Rabi	
1. Wheat	PBW-343, PBW-373, HD-2687, WH-542, WH-711, UP-2338, Raj-3765
2. Gram	C-235, MC-I, MC-3
3. Sunflower	Pioneer-6460, 6449, 6360, Mahyco-8, Pro Agro
4. Toria	T-9, TH-68, TH-15
5. Barseem	Mascavi

The seed is procured from National Seeds Corporation, Haryana Seeds Development Corporation, CCS Haryana Agricultural University, Hisar and Government Seed Farms.

During 2003-04, 31,686 quintals of certified seed was distributed among farmers of the district.

MANURES AND FERTILIZERS

Different crops, while growing, remove various plant nutrients in substantial qualities from the soil. The continued deterioration of plant food elements from soil leads to low fertility and lower agricultural yields. It is, therefore, essential that plant nutrients are replenished through the increased use of manures and fertilizers so that crops continue to give food yields.

Compost Manure.- Farmland manure or cattle dung manure being good manure for the maintenance and improving the soil fertility has been in use since time immemorial. However, the farmland manure commonly used by the cultivators is poor both in quality and quantity. This is largely due to faulty method of its preparation and incomplete utilization of the useful ingredients contained in cattle dung. Department of Agriculture is promoting preparation of compost manure. The extension workers train the farmers in the technique of scientific composting.

Another important source for good quality manure is refuse of urban areas. The municipalities of Thanesar, Shahabad, Ladwa and Pehowa have taken up the work of preparing compost from urban wastes.

Green manuring.-It is very important for soil fertility as it directly adds nitrogen and organic matters to the soil. Experiments have showed it that an increase of about one quintal of foodgrains per acre results through green manuring. The addition of organic matter improves the soil's physical condition. Water holding capacity of the soil is also increased. Further, it creates better conditions for the increase of useful bacteria in the soil. The practice of green manuring with sun-hemp *gwara* and *dhaincha* is being steadily popularised.

Chemical fertilizers.-With the introduction of high-yielding varieties of various crops, the use of chemical fertilizers has increased manifold. Apart from green manuring, chemical fertilizers are also very essential for increasing yield various crops. Chemical fertilizers have become popular following a large number of field demonstrations arranged by Agriculture Department. In 2003-04, the consumption of all types of chemical fertilizers in the terms of nutrients in the district was 56,206 tones. Of this, the consumption of

Nitrogen (N), Phosphoras (P) and Potassium (K) was 40,650, 13,317 and 1,839 tones respectively.

Crop Rotation

Crop rotation has been a common practice of the farmers to recharge the fertility of the soil and make the land free from crop pests/insects.

The practice of leaving the land fallow is mostly not followed these days. The farmers now make optimum utilization of the available land. Rice followed by wheat is the most popular crop rotation in the district.

With the modern agricultural practices, however, the farmers sow two to three crops in the district. The following important crop rotation are in vogue in the district:-

Paddy-wheat

Moong-paddy-wheat

Sugarcane-wheat

Tomato – cauliflower – potato

Moong- mash – paddy – gram

Jowar – toria – wheat

Agricultural Pests and Diseases

With the adoption of high-yielding varieties and use of chemical fertilizers, the crops are occasionally exposed to the incidence of various insects, pests and diseases. Some insects/pests and diseases are listed below:-

(1) **Crop Pests and Diseases**

(a) Sugarcane top-borer

(b) Sugarcane Shoot borer

(c) Sugarcane pyrilla

(d) Sugarcane black bug

(e) Root weevil

(f) Plant hopper

(g) Red rot

(h) Painted bug and aphid

(2) **Fruit Pests and Diseases**

(a) Citrus pyrilla

(b) Mango hopper

(c) Mango mealy bug

(d) Citrus canker

(3) **Vegetable pests**

(a) Red pumpkin beetle

(b) Brinjal hadda

(c) Potato late blight

(d) Potato black scruff

(4) **Store Grains Pests**

(a) Khapra

(b) Dhora

(c) Susri

(5) **Miscellaneous Pests**

(a) Fields rats

The Agriculture Department is advocating control measure through intensive propaganda to reduce the damage. Fumigation work is being done on a large scale by the Department.

ACTIVITIES OF THE DEPARTMENT OF AGRICULTURE

A number of factors such as development-oriented agricultural policies, creation of necessary infrastructures, provision for various service facilities such as agricultural inputs, credit, marketing, storage, plant protection measures, training in the modern technique of agriculture and application of land reclamation technique for increased agricultural production are pursued by the Department of Agriculture, Haryana.

To achieve these goals, a new reorganized Extension System has been introduced throughout Haryana from April, 1979. As the main emphasis in this reorganized system of extension is on regular trainings of the workers and visit to the farmers group on fixed days,

this system is popularly known as 'Training & Visit System'. The key feature of this system is the close and regular links between the farmers, extension workers and the researchers. The district is divided into two Sub-Divisions, each headed by a Sub Divisional Agriculture Officer (SDAO). They are supported by 3 to 4 Subject Matter Specialists (SMS) in the disciplines of agronomy, plant protection and training. The district is headed by Deputy Director of Agriculture.

The Sub-Divisions are further divided into circles- each headed by a Circle Agricultural Officer. The circles of Circle Agricultural Officers are divided into eight village extension worker circles. Each village Extension Worker (V.E.W.) looks after the agricultural activities of 1,100 to 1,200 farming families. These 1,200 farming families are grouped into 8 units, each comprising of 140 to 150 farming families. The V.E.W. visits their all 8 group of farmers in a fortnight. Friday is fixed as training day.

At Sub Divisional level, the S.D.A.Os and S.M.Ss. hold fortnightly trainings on Friday in which the relevant technology as per stages of crop growth for the coming fortnight is passed on to the extension workers. The V.E.Ws. give the feed back of the problems faced by them and the solution is given by S.M.Ss. The unsolved problems are discussed by the S.D.A.Os/S.M.Ss. in monthly workshops held by the Haryana Agricultural University, Hisar at their research station, Karnal.

Laying out of Farm Trails.- To facilitate local adoption of research results that have been obtained at research stations, which can not adequately represent the range of situations encountered under specific conditions in farmers fields and farmers resource situations, are treated by laying out on farm trails. These farm trails help to evaluate and refine or modify if necessary the technologies developed at research stations to better fit a particular resource and risk situation and meet the needs of farmers.

Laying out of Minikit Demonstration.- The Department of Agriculture through its field staff arranges mini kit demonstration on the fields of small and marginal farmers for their benefit.

Soil Testing Service.- The Department of Agriculture provides the facility of testing of soil and water samples through its Soil Testing

Laboratories located at Kurukshetra and Pehowa. This facilitates the farmers to apply fertilizers to their crops as per recommendations given by the Laboratory to make the judicious use of fertilizers. The farmers are also advised to reclaim their soil if soil test reveals the alkalinity.

Sugarcane Development Work.- To look after the work of sugarcane development in particular, an Assistant Cane Development Officer is in position at Shahabad. He is assisted by Agricultural Development Officer (Sugarcane). This staff looks after the sugarcane development work only in mill zone area of the district. Seed nurseries are maintained on the farmers fields from where healthy disease-free seed is distributed to the sugarcane growers.

Soil Conservation Work.- The work of soil conservation is executed in the district by the Assistant Soil Conservation Officer posted at Kurukshetra. He is assisted by 4 Agricultural Development Officers and 16 Agricultural Inspectors posted under him. The reclamation of alkaline soils in the district is their main work.

Installation of Bio-Gas Plants.- The installation of bio-gas plants under 20-Point Programme is also one of the important activities of the Department of Agriculture. The plants provide fuel gas as well as rich farm yard manure to the beneficiaries. There were 3,546 bio-gas plants in the district as on March 31,2004.

KRISHI GYAN KENDRA

Krishi Gyan Kendra is the major wing and field arm of Directorate of Extension Education, Haryana Agricultural University, Hisar. It was established at Kurukshetra in 1974. It has its research farm at village Dhurala, 11 kms. away from Kurukshetra. The total area of the farm is 43 acres, 2 kanals, 10 marlas. It has 11 District Extension Specialists in the disciplines of Agronomy, Farm management, soil science, entomology, plant pathology, agricultural engineering, horticulture, vegetable crops, animal science, veterinary science and home science, besides coordinator. The specialists disseminate latest knowledge in crop production, farm machinery, soil and water management, child care and family resources and management and livestock care and management.

Dissemination of knowledge is done by holding farmers' fairs, training camps, demonstrations, campaigns, exhibitions, film shows etc. Field days on different crops in respect of different package of practices and cattle shows are arranged in the district. The farmers of the district are apprised of the results based on the latest agricultural technology developed by the University Scientists from time to time.

Besides contacting farmers on their farm and home, conducting demonstrations, organizing meetings, group discussions, training camps, campaigns, etc. the extension scientists also bring out subject matter enrichers.

Krishi Gyan Kendra also brings out a monthly circular known as Krishi Pramarsh Patra. Besides containing the salient recommendations and farm operations for the month, it also has monthly programme of including important activities to be undertaken by the Kendra. These circulars are sent to all the Agricultural Development Officers and other extension functionaries of the district as well as some progressive farmers.

AGRICULTURAL CO-OPERATIVES

Increased agricultural production depends upon a number of factors like provision for timely and adequate credit, use of inputs viz., chemical fertilizers, improved seeds and insecticides/pesticides and facilities for marketing of agricultural produce as well as storage arrangements. The agricultural service co-operatives are aimed at meeting these requirements. It is through co-operative farming that scanty resources of the agriculturists can be pooled thus bringing to them the gains of large-scale intensive farming. Through cooperative marketing, the enormous profits to middlemen can be checked and higher dividends ensured to the farmers.

In 2003-04, the total number of Co-operative Societies in the district excluding industrial co-operatives was 570 with a total membership of 2,17,502, Their share capital owned funds and working capital were amounting to Rs.4,431.36 lakhs, Rs. 60,135.52 lakhs and 72,194.10 lakhs respectively. Almost, all the inhabited villages of the district were covered with one type or the other of the co-operative society.

To meet the credit, fertilizers and consumer goods requirements, there were 111 Agricultural Credit & Service Societies with the total membership of 1,38,858 in June,2004. These Societies advanced short and medium-term loans to the extent of Rs.16,354.06 lakhs during 2003-04.

The other agricultural co-operatives in the field are Co-operatives Marketing Societies, Poultry Societies and Dairy & Milk Supply Societies. The number, membership, owned funds and working capital of these societies during the year 2003-04 are given below:-

Sr. No.	Type of society	Number	Member-ship	Owned Funds (Rs.in lakh)	Capital
1.	Marketing	5	6,296	123.90	321.96
2.	Poultry	6	77	-	3.57
3.	Dairy & Milk Supply	171	9,520	2.28	63.49
4.	Other Agri. Non-Credit	36	7,102	85.26	1,412.43

ANIMAL HUSBANDRY

The cattle farming is an age old profession and culturally linked with the way of life of the people of the district. At the close of the last century kine or *dhenu* consisting of buffaloes and cows were kept by almost all villagers and their milk furnished the only animal food which they, as a rule, enjoyed. Of the two kinds of kine, the buffalo was definitely more valuable. If a villager lost his cow, he only grumbled a little harder than usual; if he lost his buffalo, he sat down and cried.[1]

Livestock raising of quality animals is an important economic programme of the district and next to agriculture animal husbandry is popular and widely accepted profession of the ruralists . The district possesses fairly large number of livestock including cattle, buffalos, sheeps, goats and pigs. Healthy cows and buffaloes are common sight

[1] Karnal District Gazetteer, 1892,00.213-14.

here. The livestock population of the district as per 1997 Livestock Census was 3.70 lakh. The following figures show tehsil-wise break-up of livestock population:-

		Thanesar[1]	Pehowa	Shahabad	Total (In lakh)
1.	Cattle	0.65	0.39	0.14	1.18
2.	Buffaloes	0.66	0.37	0.29	1.32
3.	Horses & Pones	0.02	0.01	-	0.03
4.	Mules & donkey	0.01	0.01	-	0.02
5.	Sheep	0.22	0.08	0.08	0.38
6.	Goats	0.07	0.06	0.04	0.17
7.	Pigs	0.20	0.05	0.08	0.33
8.	Others	0.15	0.05	0.07	0.27
9.	Total	1.98	1.02	0.70	3.70
	Poultry	1.74	0.36	0.36	2.46

CATTLE AND BUFFALOES

Cattle and buffaloes play an important role in the economy of the district in different ways. Most of the farmers in the district have a pair of oxen for ploughing and to draw the cart. Although bullocks are being replaced by motor and electric power in some areas, yet the importance of cattle in the agricultural economy of the district remains unchanged. They rear cattle for milk production. With the passage of time, the number of cattle is increasing.

Cattle buffaloes population which numbered 2.5 lakh in 1997 accounted for 67.7 percent of the total livestock. Out of 1.18 lakh cattle and 1.32 lakh buffaloes, the breadable (i.e. female over 2 years) population of cows and buffaloes was 0.36 lakh and 0.57 lakh respectively.

Cattle Breeding.- At the close of the 19th century a buffalo gave 5 to 10 *seers* of milk daily for eight months and each seer made a *chhittank* of ghee, the yield of cow was 3 to 5 *seers* of milk per day for five or

[1] This includes figures for Shahabad and Ladwa Sub Tehsils.

six months but each *seer* produced half a *chhittank* of ghee[1]. The indiscriminate breeding over long time has resulted in a large number of non-descript cattle in the district.

The district has a large number of indigenous and of non-descript cattle which produce less quantity of milk as compared to cross-breed or exotic breeds. In order to increase the milk production, it was decided to resort to cross-breeding in cows and selective breeding in buffaloes. An Intensive Cattle Development Project for improved scientific breeding was launched in 1968-69 in the areas now comprising Kurukshetra district. The scheme envisaged systematic planned method for best utilization of superior germs plasma through proper distribution by adopting artificial insemination technique, disease control and fodder management to provide breeding facilities promptly and effectively. To penetrate the benefits of latest policy of breeding to interior rural areas of the district, 105 veterinary institutions were rendering breeding services in the district during 2003-04.

An evaluation study of the Haryana Intensive Cattle Development Scheme was carried out by Planning Department, Haryana during 1973 with a view to assess its performance and utility. The study revealed that the Cross-breeding Programme introduced by the Intensive Cattle Development Project, Kurukshetra had significantly increased the milk production. The sample study results showed that average daily milk yield of the Jersey cross-bred cows was 11 litres as compared to 3.95 litres of a local cow.[2]

The cattle breeders now prefer to keep high-yielding cross-breed cows. According to 1997 livestock census, there were 16,000 breedable cross-breed cows in the district. During 2003-04, on an average, the milk yield of buffalo was 5.606 kilograms per day. In case of cows, the daily milk yield was about 4.259 kilograms from indigenous breed and 6.605 kilogram per day from the cross-breed could be sold at between Rs. 12,000 to Rs.30,000 while the cross-breed cow is available in the range of Rs.11,000 to Rs.18,000 in the district.

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1 Karnal District Gazeteer, 1892, p. 214.

2 Evaluaion Study of the Haryana Intensive Cattle Development Scheme, Planning Department Haryana, 1974, p. 17.

GAUSHALAS

There is one *Gaushala* at Kurukshetra. This *Gaushala* was initially opened out of religious sentiments to house the unproductive cattle. This was maintained on charity alone. The Government later took steps to covert this *Gaushala* into breeding-cum-production centre. Apart from providing technical guidance and financial assistance, the animals kept here are provided proper health cover, vaccinations and disease control measures by the Animal Husbandry Department. The cows kept in the *Gaushala* have also been covered under Artificial Breeding Programme.

POULTRY FARMING

According to Livestock Census, 1997 there were 2.46 lakh poultry birds in the district.

One day old chicks are supplied to the breeders at subsidised rates. The field veterinary staff in the district also provides education to the poultry farmers about the latest techniques of poultry husbandry and also helps them in setting up poultry farms, mass-scale vaccination, debeaking and deworming are also carried out through veterinary hospitals and dispensaries.

Poultry farming under Special Livestock Production Programme was launched in the district in 1977-78 for improving economic condition of weaker sections. Under this programme, small/marginal farmers and landless labourers are given loan and subsidy to adopt poultry farming as a subsidiary occupation by setting up poultry unit of 100 birds for which an amount or Rs. 6,900 per unit is got advanced from commercial Banks. Under this programme, some units were set up in the district during 2003-04.

PIGGERY

The concentration on piggery is low or negligible in Kurukshetra district when compared with other livestock such as buffaloes and cattle. The district has 0.33 lakh pigs according to 1997 Livestock Census. Earlier, no improvement in the breed could be brought about since only a section of Scheduled Castes with limited resources keeping country pigs were engaged in pig breeding. With the introduction of exotic Yorkshire and Landrace breeds, pig breeding is getting popular. By crossing the country pigs with the

exotic boars, the indigenous pig stock is being gradually replaced by the exotic pure breeds or the cross-breed stock. The Department has encouraged pig breeders to take up the piggery on modern lines.

SHEEP FARMING

The sheep farming in the district is in the hands of the weaker sections of the society. The Animal Husbandry Department is encouraging the sheep breeders to rear quality sheep for making sheep farming a profitable profession. The average annual yield of wool per sheep in the district is about 1.874 kilograms. In order to avoid the exploitation by the middlemen, the wool is purchased by the Department directly from the sheep breeders.

LIVESTOCK DISEASES

Before the opening of the veterinary dispensaries in the district, the people depended upon various indigenous methods to cure the livestock from diseases. Even they had faith in some sort of *tona* for the treatment of ailing livestock. The fatal diseases like foot and mouth *galghotu*, *sitla* etc. were cured through herbs. These local treatment are still followed but, by and large, people consult the Veterinary Doctor to save their livestock from diseases.

The common diseases now prevalent in the district are hemorrhagic, septicemia, rinderpest, foot and mouth *surrah* black quarter, ranikhet and fowl pox. These diseases are controlled with prophylactic vaccination and curative measures. Regular campaigns of inoculation and vaccination against these diseases are conducted. In 2003-04, 1.83 lakhs animals were treated and 5.95 lakh vaccinations were done against various animal diseases in the district.

The CCS Haryana Agricultural University, Hisar also provides animal disease investigation and diagnostic services to the field veterinarians and livestock owners of Kurukshetra district. Normally, the field veterinarians carry out curative treatment of animal diseases but if they are unable to diagnose a disease outbreak in any species of livestock, including poultry, they refer to the disease investigation staff of the University. In addition to the usual disease affecting livestock such as foot and mouth, other diseases treated by the administration through suitable treatment methods worked out by the University Scientists.

Veterinary Institutions.- The district has well developed veterinary infrastructure. In March, 2004 there was a network of 30 Veterinary Hospitals/Hospitals-cum-Breeding Centres, 28 Veterinary Dispensaries, 2 Regional Artificial Insemination Centres, one semen bank and 491 stockman centres in the district. On an average, a Veterinarian covered 3,627 heads of livestock. The list of veterinary institutions functioning in the district as on March 31, 2004 is given in Table No.1.

MEAT HOUSE

To ensure the availability of hygienic and disease free meat for human consumption, the district has 4 recognized slaughter houses at Pehowa, Ladwa, Shahabad and Thanesar. About 13,000 animals were slaughters in the district during 2003-04.

Strong taboos exist against the eating of meat. By and large, people are vegetarian and the low intake of meat in the district hinders the development of meat producing livestock.

DAIRY FARMING

Dairy farming is the most subsidiary occupation of farmers in the district. From time immemorial, it has been quite common for farmers to maintain one or two milch animals for meeting their own requirement of milk and milk products. With advent to urbanization, the demand for milk and milk products has increased manifold. Increased demand for these products has boosted up the dairy farming in a big way. Apart from being subsidiary occupation for farmers it has become a full fledged profession for many. It has proved to be an effective instrument for improving economic conditions of the farmers and providing employment to weaker sections, particularly in rural areas. Therefore, considerable attention is being paid for keeping quality milch cattle and enhancing milk production in the district.

Mini Dairy Scheme.- The Dairy Development, Haryana is popularizing modern techniques dairying by setting up mini dairy units of 5 to 3 milch animals. The scheme was started during 1979-80. This scheme also aims at providing gainful self-employment opportunities to the rural educated/semi-educated young men and women.

The persons interested in setting up these mini-dairy units are imparted 11 days training in the field of dairying. After the completion of training, these persons are assisted in securing loan for the setting up of mini dairy units. The Department provides ample incentives in the form of subsidy, technical guidance etc. to the person. The following three types of mini-dairy units are being established:-

Sr. No.	Types of Unit	Loan to be given	Subsidy to be provided	Net admissi-ble concession in five years
1.	20 Milch animals mini dairy unit	Rs.3.58 Lakh for animals & Rs.2,000 for cattle-shed & 6,000 for Chall cutter & water pump.	Grant of Rs. 1000 per milch animal upto five milch animals only.	Rs. 5,000
2.	10 Milch animals mini Dairy Unit	Rs.1,92,000(Rs.1.66 lacs for animals, Rs. 20,000/-for shed and Rs. 6000/-for Chall cutter and water pump).	Grant @ Rs.1000/- per milch animal upto five milch animals only.	Rs. 5,000
3.	5 milch animals Mini Dairy Unit	Rs.93,000/-for animals and Rs. 10,000 for cattle shed	Rs.83,000/- for animals and Rs. 10,000 for cattle shed.	Rs. 5,000
4.	3 milch animals (General Category)	Rs.49800 for the cost of animal	(i) Grant of Rs.1000/- per milch animal only	Rs. 3,000
5.	3 Milch animal for Scheduled Castes	Rs.49,800/- for the cost of animals	(i) Rs.1,000 for the purchase of animals as margin money and Rs.2000 for shed renovation.	Rs. 3,000
6.	3 Milch animals Mini Dairy Unit (Widow)	Rs.49,800 for the cost of animals	(i) Rs.2,000/-for shed renovation. (ii) Rs.1000/- per milch animal only.	Rs. 5,000
			Total	**Rs.26,000/-**

By March 31, 2004, 2,459 mini dairy units had been established in the district. The scheme is very popular in the district.

To bring the dairy under the co-operative ambit, the milk cooperatives were set up in the district. The Kurukshetra District Co-operative Milk Producers Union Ltd. was registered on 27th May, 1974. The job of milk procurement and provision for technical inputs was being done by Haryana Dairy Development Co-operative Federation Ltd.

During the year 2000-01, 71 Milk Co-operative Societies with total membership of 9,000 were functioning in the district. The concerted and sincere efforts were made to extend the area of milk cooperative societies in 2004-05. As a result, 229 Milk Co-operative Societies with a total membership of 13,000 began to function in the milk trade.

The Haryana Dairy Development Cooperative Federation has set up a Milk Chilling Centre with the daily handling capacity of 20,000 litres at Kurukshetra.

Besides, Haryana Milk Foods, a public limited Company was set up at Pehowa in December, 1970. It manufactures whole/skimmed milk powder, condensed milk, *desi ghee,* butter etc. Its products have the trade mark of 'Madhu'. In 2003-04, the total capital investment of the plant was Rs.1880.15 lakhs. Its production increased from Rs.92.76 lakhs in 1971-72 to 2,447 lakhs in 2003-04.

FISHERIES

Seasonal streams, lakes and ponds provide national habitat for fish propagation. In the past, no efforts were made for exploiting these national water resources for fish farming on commercial lines.

The Government has taken a number of steps to popularize pisciculture in the district. A survey was conducted by the Fisheries Department, Haryana in 1994-95 on the basis of the survey, it was estimated that 440 hectares of water area is suitable for fish farming in the district. Out of this total area, the Fisheries Department harnessed about 251.41 hectares and individual farmers exploited nearly 22.6 hectares during 2003-04. The fish production from the notified water and the area harnessed by the Fisheries Department during 2003-04 was estimated at 767 tones.

Fishing rights in the district are with the District Fisheries Officer-cum-Chief Executive Officer, Fish Farmers Development Agency, Kurukshetra. During 2003-04, only 141 fishing licences were issued for 276.4 hectares fish stocked area. Total receipt from fisheries was Rs.82.92 lakh during the year.

The Department of Fisheries, established a seed farm at Jyotisar during the year 1977-78 which was later raised to national status under National Inland Fisheries Programme. The Fisheries Department provides technical advice to the fish farmers. The fish farmers are getting high fish yield from their fish ponds and making good amount of profits from this profession. The fish farming is now not confined to weaker sections only in the district.

FISH FARMERS DEVELOPMENT AGENCY

The objective of the scheme is to create a class of fish farmers by providing technical and financial assistance. This agency stared functioning in Kurukshetra during 1989-90. Under this agency 179.5 hectare water area has been brought under fish culture and 300 fish farmers have been benefited in the district by March 31, 2004. The fish production from the area harvested by fish farmers during the year was 368 tones.

The improved varieties of food fish available in the district are :-

1. **MAJOR CARPS**

LABEO ROHITA (ROHU) : It is column-bottom feeder and grows to three feet or more in length. It is a very popular variety.

LABEO CAIBESU (KAIBANS): It is relatively slow growing and attains a size of about three feet (0.9 metre).

CATLO-CATLA (THAILA) : It is surface feeder and the fastest growing carp fish. It is quite popular when not exceeding two feet (0.6 metre) in size. The large species, reaching up six feet (1.8 metres) are rare.

CIRRHINA MARIGALA (MORI) : It is a bottom feeder and grows to three feet (0.9 metre) or more.

2. CAT FISH

WALLAGE ATTU (MALLI) : It is a predacious and pisciverous fish and grows to a size of about six feet (1.8 metres). It is a good same fish.

MYSTUS SEENGHALA (SEENGHALA) : It attains a length of over four feet (1.2 metres).

NOTOPTERUS NOTOPTERUS (PARI) : Scales on sheeks much larger than on body, maxilla does not extend the hindagge of the body. It grows to two feet (0.6 metre) or more.

NOTOPTERUS CHITALA (MOH): It is a game fish growing to about 1¼ feet (0.4 metres) in size.

SILONIA SILONIA (SILOND) : It prefers strong stream and deep water. It grows to a size of six feet (1.8 metres) and is considered good for eating.

RITA RITA(KHAGGA) : It is a game fish. It is much esteemed as food but is a very foul feeder.

3. MINOR CARPS

LAEO CONIUS(SEARCHA): It attains nearly five feet (1.5 metres) in length with scale darkest at marginds, but many have red lunnules on them.

LABEO BATA(BATA): It attains two feet(0.6 metre) in length.

GIRRHANA REBA (REBA):A bony fish attains one feet (0.3 metres) in length and is foul feeder.

PANGASIUS PANGESIUS(PANGUS): It attains four feet (1.2 metre) length and is a foul feeder.

BAGARIUS BAGARIUS(GONCH): It grows up to six feet (1.8 metre) in size.

CHELLA BACCILA(CHILWA): It attains at least seven inches (0.2 metres) length. It is used as live bait for fishing with rod and line.

MASTACEMBLUC ARN ATUS (BAM): It prefers pond of places of water which abound in mud. It is an excellent food.

CALLICHROUS PABADEN(FABED): Its colour is silvery with a badly marked shoulder spot.

CALLICHROUS BIMAELATUS: It attains a length of one a half feet (0.4 metre). It is excellent as food and is called butter fish for its better quality.

HAMIRAMPHUS-SP (HALF BEAK): Its body is narrow and comprised. It attains a length of at least 10.5 inches (0.26 metre).

MUGIL CORSULA (HARD VICKU WAHRE): The fish of this variety swun with its eyes just above the surface of water giving appearance of a number of tadpoles. As soon as it is disturbed, it dives down with great speed. It attains a length of one and a half feet (0.4 metres).

FORESTRY

The district was known for its forests from time immemorial. Numerous references are found in Sanskrit literature about existence of forests in Kurukshetra region. According to *Vamana Purana*, this region was adorned with seven auspicious forests viz.Kamyaka, Aditi Vyas, Phalki, Surya, Madhu and Sita[1]. These forests were studded with numerous species of trees. The Vedic literature makes special mention about *Palasa*, *Peepal*, *Veta* (Banyan), *Bilya*, *Khadura*, *Udumbara* and *Palaksha.* Of these, *Palasa*, *Peepal* and *Veta* acquired enough importance to be raised to the level of divinities.

Even till close of the 19th century, the district had large stretch of forests. The *dhak* jungles of Pipli covered as area of more than 150 square miles. The trees constituted a valuable property in this poor tract. The supply and carriage of this fuel wood was a large source of income to the villagers of the then Pipli tehsil along the Grand Trunk Road[2].

Sufficient area of Pehowa was also under forest even after independence, which was later allotted for cultivation to the displaced persons. The forest wealth steadily continued to decrease as crop production got priority over forests. However later on, the importance of forests was realized and steps were taken to preserve the remaining

[1] S.S.Parui, Kurukshetra in the Vamana Purana, 1976,p.49.
[2] Ambala District Gazetteer,1892-93,p.17.

forests and grow more trees. The Forest Department intensified its efforts to bring more area under forest cover.

Kurukshetra Forest Division was created in 1974 after the formation of Kurukshetra district in 1973. The jurisdiction of Kurukshetra Forest Division is co-terminus with the district.

Total forest area of the district during 2002-03 was 45 square kilometers which is only 2.94 percent of the total geographical area. The following classes of forests existed in the district in 2002-03 :-

	(in sq.km)
Reserve Forests	18
Protected Forests	27
Private Forests	-
Total	**45**

Among the protected forests, there is no block of forests and the rest consisted along sides of roads, railway tracks, canals, drains, strips, bunds and escapes, generally called strip forests.

In addition to this, an area of 45 square kilometers of Panchayat lands had been brought under tree cover during the period from 1976-2000 in the district.

The total population of the district was 8,25,454 persons according to 2001 Census. The total fuel wood requirement at the rate of 0.40 tones per head per annum is estimated to be about 2.2 lakh tones. Against this requirement, total timber and firewood produced in the district is only 2,500 tones and 10,000 tones respectively. The vide gap between demand and production in firewood is presently met with the use of agricultural waste, cow dung and fossil fuels for cooking. Timber requirements are met with through import of timber from adjoining states.

Forest policy followed at present is based on the following objectives:-

(i) Increasing the tree cover by planting in all available waste lands so that the National minimum of 30 percent is approached.

(ii) Growing trees in marginal agricultural lands and farm boundaries to meet the fodder, fuel and small timber requirements, and thereby releasing the cow dung for agriculture.

(iii) Intensive management in Government-owned forests for production of timber and firewood.

(iv) Introducing modern methods of logging to prevent wastage of wood.

In order to achieve these objectives the following steps have been taken:-

1. Waste lands available with Panchayats are taken up for afforestation in a phased manner for production of fuel, fodder and firewood.

2. Seedlings of useful species of trees are distributed to the farmers for planting in marginal agricultural land and farm boundaries. This is supported by Extension services by Social Forestry Wing of the Forest Department. Main species used are eucalyptus, poplar, *shisham*, *jamun* and *subabul*.

Forest Produce.- Very little natural forests are available in the district. Natural forest consists of mainly species like Dhak (*Butea monosperma*), Jal (*Salvadora Olesides*), Lasura (*Cordia dichotema*), Kikar ((*Acacia nilotica*), Raru (*Acacia Loucophoea*) and Jand (*Prosppis cinerariea*). These have been gradually replaced by better timber species like Shisham (*Dalbergia sisoo*), Neem (*Azadirachta indica*), Siris (*Albizia lebbeck)*, Jamun (*Syzvgium cumini*), Arjun (*Terminalia arjuna*) and firewood species, industrial wood like eucalyptus, poplar, etc. Major forest produce in the district is timber and firewood. Timber is mainly available from Shisham, Neem, Kikar and Siris. In recent years, eucalyptus grown by farmers as well as Forest Department has found use as timber in construction of inexpensive house. Firewood is available from Kikar, Jand, Siris.

The important minor forest produce are grasses (both fodder as well as coarse), *kana* grass is used for *mudha* making as well as rope making. This grass is also being used for manufacturing paper.

There is no major wood using industry within the district. However, Paper Mill at Yamunanagar (Ballarpur Industries Ltd.) use eucalyptus wood and *kana* grass for paper making. About 3 percent of the raw material requirements are met with from the district. Eucalyptus grown by private cultivators has a ready market now.

In recent years, poplar cultivation has picked up in the district. Poplar wood is used for manufacture of safety matches, sports goods and plywood. Most of the poplar wood is purchased by WIMCO located at Bareilley (U.P.).

The annual income from the sale of dead, dry and diseased trees as also matured green trees from the forests as per Working Plan approved by the Govt. of India is between Rs. 3 to 5 crores.

Very little efforts have been made by the individuals to increase the forest area in the district. The meager forest area falls under state forests. It is highly forest-deficit district of the state. The forest area per lakh of population was 5.45 sq.Kms. in Kurkshetra district, 8.03 Sq.Km. in Kaithal, 5.96 Sq.Km. in Karnal and 4.54 KM. in Ambala during 2003-04.

Social Forestry has been implemented involving the masses all over the state. Its main purpose is to raise plantation in order to:-

(i) Generate employment for the rural people in the agricultural off seasons,

(ii) Supply of fuel wood and release cow dung for its use in the cultivated field,

(iii) Provide small timber and fodder in the rural areas.

SARASWATI PLANTATION WILD LIFE SANCTUARY

An area of 11,003 acres of Saraswati plantation, 10 kilometres from Pehowa, has been declared as wildlife sanctuary. Besides different kinds of wildlife, the area has been developed as thick forests by providing fencing.

NATURAL CALAMITIES

Occasionally, the district was affected by natural calamities. When the rains failed, the drought and famine conditions prevailed in

the district. On several occasions, the floods caused major devastation thereby bringing untold miseries for the people. The Government has taken several steps to tackle the natural calamities. Assured irrigation to the large chunk of the cultivated land had helped in avoiding the drought conditions. To a considerable extent, the floods menace has been tackled in the district. Even then the district has remained under constant threat of natural calamities and the government authorities always remain vigilant for such eventualities.

DROUGHTS AND FAMINES

There have been several famines, besides a large number of severe scarcities in the district in the past but no authentic account is available. The available record reveals that the famines which occurred in the later part of the 18th and 19th centuries were unexampled in extent and frequency.

The long series of famines led the British Government to evolve Famine Policy in the 19th century. The chief feature of that Policy was the codification of an approved system of relief which was to be put into operation in the event of a famine. The famine codes were drawn on the model provided by the Famine Commission of 1800. The system of modern relief organization was formulated for the first time in the year 1860. Since 1865, the Government adopted a policy of famine prevention and famine relief.

Including the Chalisa famine of 1782-83 (Samvat 1840), the district had been visited by famine thirteen times in 220 years, one of the most terrible perhaps being that of 1833. Relief works seemed to have been established for the first time in the famine of 1861. In 1869, the famine was more severe in Karnal than in any other part of Punjab and hundreds of people were reduced to semi-starvation. From 1875 to 1877, there was not even a single good harvest and though the scarcity hardly assumed proportions of a famine but the cattle terribly suffered. In 1899-1900, some parts of Thanesar tehsil were affected.

Several famines and scarcities of a local character occurred after 1900, those of 1906-07 and 1907-08 being the most important. In 1920-21, a famine visited some areas of the district and relief measures taken by the Government diluted the effect. The drought conditions did occur in the thirties also and the Government contained them to the extent that the people had to face lesser miseries.

After independence, the government took various measures to arrest famines and drought conditions. The famines never occurred in the district after that. However, failure of Monsoons sometimes affected the crops hence the yields. The district is otherwise not prone to such conditions. During eighties, some parts of the district had deficit rains, as a result of that the agricultural production was affected.

Floods.- In Thanesar Sub-Division floods are caused by rivers Markanda, Saraswati as well as from small rivers namely Rakshi, Chutang and Danda Nallah. All these rivers/nallahs enter Thanesar Sub Division from Ambala on both sides of the Yamuna and the Markanda. The Drainage Department has constructed *bundhs* on western side of the Yamuna. Stone ramps have been provided by Drainage Department. These bunds have been properly strengthened. Sometimes, during rainy season certain breaches are caused due to heavy rains and the flood waters enter the surrounding areas, namely, Lal Chapar, Karhera, Gumthala Rao, Sandhola, Sandholi etc. These villages are affected by Markanda and Saraswati rivers and Bhuni village is affected by Tangri river.

In some part of the district, damage is caused by floods on account of inundation of the Markanda and the Ghaggar river as well as by accumulation of rain water in low lying areas after rainfall. Flood waters of the Saraswati and the river Markanda are collected into Bibipur Lake(near Bibipur village) for irrigation. The Saraswati drain is an escape channel in which surplus water of Bibipur Lake is drained. The drain starts from the regulator made on Bibipur Lake near village Murtazapur and falls into Para river - a tributary of Ghaggar near village Pawal. The present capacity of the drain is 16,000 cusecs and it provides an effective drainage line for the area through which it passes. Bunds have been provided on both sides of the drain as a safeguard against overfilling during the peak discharge. The drain has eliminated the flood problem of its catchment area to a great extent. A *bund* has been built on the left bank of river Markanda for protecting the Bhakra Irrigation system. This *bund* is quite closed to river at a number of places. No doubt, there has been breach in the left marginal *bund* of this river during the last five or six years. However, protective of studs and stone pitching have been taken by the Drainage Department on the Ghaggar river and a *bund* has been

constructed on the left bank of the river to protect the Bhakra Irrigation system.

IRRIGATION

The average annual rainfall in the district is 41.7 cm and the district ranks 6th in all the districts of the State. There are very few years in which the rains fail altogether though the rainfall is irregular and the variations from year to year are considerable. This uncertainty of rainfall necessitates the development of artificial sources of irrigation to take advantage of richness of soil and to ensure against drought.

In the past, the agriculture in the district was mainly dependent upon vagaries of the Monsoons. Very negligible area of the district was irrigated through assured means of irrigation. An idea of the problem can be had from the fact that in 1892, in the then Pipli tehsil of the then Ambala district, only 13 percent of the cultivated area was classed as irrigated. Wells were the main source of irrigation. Some area of the district was also occasionally irrigated through *kacha* tanks[1]. Though canal irrigation was non-existent in most parts of the district in the beginning of the present century, however, some areas of the present Pehowa tehsil were irrigated by Saraswati canal system. It was a non-perennial canal and was constructed in 1895-96 by District Board, Karnal by constructing *bunds* on downstream side across the Bibipur lake through Saraswati river near village Murtazapur and Markanda river near village Jalbehra. The supply of water from this source was extremely uncertain and inadequate to meet the irrigation needs of the area. Thus, irrigation facilities were generally lacking in the district in pre-independence period.

In was only in post-Independence period that Government took various measures to improve means of irrigation. Commissioning of Bhakra Nangal Project in 1954-55 was a major step in this direction. Another landmark in the field of irrigation was introduction of tubewells and pumping sets. The pumping sets initially replaced the old traditional manual method of raising water from the walls. With the electrification of all villages of Haryana in 1971, Government encouraged electrically operated installation of tubewells by providing

[1] Ambala District Gazetteer, 1892-93,p.3.

loan on easy terms. It also took installation of deep tubewells through Haryana State Minor Irrigation and Tubewells Corporation for providing irrigation to the farmers. In March, 2002-03 there were 35,116 tubewells and pumping sets in the district. Of these, 34,075 were electric sets and 1,041 diesel sets.

There has been significant increase in the irrigation facilities in the district in the past few decades. The opening of Narwana Branch of Bhakra Canal System, installation of large number of tubewells and other minor irrigation schemes have led to increase in the irrigated area of the district. Consequently, in 2001-02, 100 percent of the net area sown in the district was irrigated through various sources as against state average of 81.3 percent.

SOURCES OF IRRIGATION

Major sources of irrigation in the district are tubewlls and canals. Of the 1,50,000 hectares area irrigated in the district in 2003-04, 1,23,000 hectares and 27,000 hectares respectively was irrigated through tubewells and canals[1]. Tubewells are principal source of irrigation in the district as 85 percent of the net area irrigated in the district during 2001-02 was irrigated through tubewells. As against this, only 15 percent of the area was irrigated by canals. Thus, tubewells have played a major role in the development of irrigation facilities in the district.

CANAL SYSTEM

Narwana Branch.- After commissioning of the Bhakra Nangal Project/Narwana Branch during 1954-55, there has been significant improvement in the irrigation. Narwana Branch off takes up RD158230 from Bhakra Main Line and its reach from RD 197000 to RD 320398 passes through this district. In 1954-55, the Saraswati Canal system also began to be fed by Narwana Branch of the Bhakra Canal and became a perennial one.

After formation of Haryana State, the following schemes in this district were executed:-

Silpani Kalan Lift Irrigation Scheme.- The work of constructing Silpani Kalan lift irrigation scheme, taken up in 1981, started

[1] Statistical Abstract,Haryana, 2003-04,p.267.

functioning from April, 1987. Silpani Kalan Lift Irrigation Minor off takes at RD 234000-R Narwana Branch near village Jhansa. This minor runs parallel to Narwana Branch. The discharge of this minor at its head is 18.71 cusecs which is lifted through pump house with a lift of 8.50 feet. Villages receiving irrigation facilities from this minor are Jhansa, Ajmatpur, Dhunia Majra, Gogpur, Bhustala, Silpani Kalan, Jhewarheri, Hasanpur, Panwa, Bachganwan, Balahi and Dabkheri. The total area served is about 45,000 acres.

Satluj Yamuna Link Canal (SYL).- SYL Canal was planned to carry Haryana's share of surplus Ravi-Beas waters. This canal having 91 kms. length in Haryana territory was completed in June,1980. SYL Canal having a capacity of about 7500 cusecs is a carrier channel and is running parallel to Narwana Branch but this does not irrigate any area in this district.

MODERNISATION OF EXISTING CHANNELS/LINING OF WATERCOURSES.-

The increasing demand for water has made this source scarce. Its most extensive use is for irrigation. In order to conserve water, Haryana State started the work of lining and modernization of canals in 1978 under a World Bank Aided Project.

In Kurukshetra district, out of 332 Kilometres of unlined channels, about 278 Kilometres of channels were lined by March 31,1991. Similarly lining of kacha watercourses under World Bank Aided project was undertaken by Haryana State Minor Irrigation &Tubewells Corporation and about 114.97 Kilometres length of watercourses were lined in this district by March 31,1991 during June, 2002 the Haryana State Minor Irrigation &Tubewell Corporation was closed and whole record has been transferred to the Irrigation Department. The Command Area Development Authority is undertaking the work of lining of new watercourses and about 170.25 Kilometres of watercourses have been lined by CADA Division, Kurukshetra upto March 31,2006.

Flood protection works.- This district is affected by floods from Markanda, Tangri and Saraswati rivulets. After the unprecedented rains during the year 1978-79, the Government of Haryana gave priority to construct a number of flood protection works, *bunds*, stone

studs and embankments in this district. Bentan Nallah drain, Jakhwala drain and drain along RMB upstream Jhansa were also constructed to drain out flood waters during the past some years. The total length of *bunds* and drains in this division is 127.91 K.M. and 71.47 K.M. respectively.

Communications.- Mainly the communication system of the Irrigation Department is wireless. In the past, teleprinter was the main communication system of the Department to regulate canal supplies and deliver flood message, which was replaced by wireless system during the year 1994-95. At present, the wireless is set up at Budhera, Jyotisar, Pehowa and Jhansa under the control of Kurukshetra Water Services Division. In addition , Flood Control Rooms are set up every year during the Monsoon season at Jyotisar, Shahabad, Pehowa and Jalbhera.

Groundwater exploration.- The Groundwater occurs in the district both in confined and unconfined conditions. Aquifer material consists of alluvium i.e. sand, silt, *kankar* and gravel, which form potential aquifer zones. The depth of water level varied from 14.13 to 27.5m below the surface in the district during May, 2005. In most parts of the district, water levels were recorded between 10 and 20m. However, in the central parts of the district, it was more than 20m. Water table elevation in the district ranged from 260 to 240 m amsl and groundwater movement is from northeast to southwest direction. Water table has declined all over the district during the past decade. During the last 10 years (1996 to 2005) water level has declined in the range of 1.5m to about 7m.

Shallow tubewells tapping water bearing zones yields 400 to 900 Ipm for moderate drawdowns. Depth of the deeper tubewells range from 80m to 125m. These tubewells tap unconfined aquifer group and yield 2000 Ipm to 4000 Ipm for moderate drawdown of 4 to 5m. Test drilling in the district has established three district aquifer groups down to 450m depth in Upper Yamuna Basin, which includes eastern part of the district covering Shahabad, Ladwa and parts of Thanesar Block. At Mathana site located about 10 km from Kurukshetra town, three groups of aquifer were identified.

The Aquifer Group-I is an unconfined aquifer, which extends from table to about 140m depth. The Aquifer Group-II, which is under

semi confined/confined state occurs in the depth range of 150m to 328m and is underlain /overlain by 24m and 50m thick clay layer. A tubewell tapping this aquifer at Mathana has yielded 1890 Ipm for 11m of drawdown for 7000 minutes of pumping. At site Dhabkheri, located northwest of Kurukshetra town in Ghaggar Basin, the shallow unconfined aquifer having water bearing zones from 16 to 102m and yield was 4140 Ipm of water 5.6m of drawdown for 2875 minutes of pumping. Deeper confined aquifer in Ghaggar basin was tested at site Tikri, located in Pehowa Block tapping aquifer zones 233 to 402m yielded 3785 Ipm for 16.8m of drawdown for 360 minutes of pumping.

Exploration in the district was carried out by Central Groundwater Board for the first time during 1971-77 and later in the year 1995-96. Details of exploratory work carried out are summarized below:-

Sr. No	Location of Exploratory Borehole	Year of construc-tion	Drilled Depth (mbgl)	Static Water Level (mbgl)	Depth of construc-tion	Yield (Ipm)	Draw down (m)
1.	Thana Bhagpur	March, 1971	307	2.97	110	184	4
2.	Tikri	April, 1973	463	4.08	406	227	17
3.	Mathan	December, 1975	456	9,00	370	114	12
4.	Dhab Kheri	October, 1977	131	10.09	105	248	6
5.	Ram Nagar	1995-96	352	21.15	151	-	-

Ground Water Exploration was also carried out by Haryana State Minor Irrigation (Tubewells) Corporation during 1971 by drilling five exploratory boreholes. The hydrogeological details are given below:-

Sr. No.	Location of Exploratory Borehole	Year of construc-tion	Drilled Depth (mbgl)	Static Water Level (mbgl)	Depth of construc-tion	Yield (Ipm)	Draw down (m)
1.	Dhabri	May, 1971	147	-	113	169	14
2.	Jhansa	July, 1971	171	-	97	191	9
3.	Thol	July, 1971	202	5	137	218	19
4.	Barshami	July, 1971	311	9	274	378	-
5.	Jyotisar	Nov., 1971	220	6	119	298	7

In terms of water quality, groundwater of shallow aquifer is, in general, fresh and is marginally saline at places. No problem of either CI, SO4, NO3, or F1 has been reported from any part of the district.

Water resources estimation of Kurukshetra district (GEC, 1997) reveals net groundwater availability of the district is 40438.70 Ham. Gross groundwater draft in the district is of the order of 66973.60 Ham. The district as such has stage of groundwater development as 165 percent and has been categorized over-exploited. All the five blocks of the districts are categorized as over-exploited, Out of these five Blocks, Ladwa has highest level of groundwater development i.e. 208 percent.

TABLE - I

LIST OF VETERIANRY INSTITUTIONS FUNCTIONING IN THE DISTRICT DURING 2003-04

VETERINARY HOSPITALS

1. Thanesar
2. Kirmach
3. Ladwa
4. Shahabad
5. Jhansa
6. Pehowa
7. Thaska Miranji

HOSPITAL-CUM-BREEDING CENTRES

1. Umri
2. Amin
3. Lukhi
4. Uhurala
5. Khanpur Kolian
6. Charuni Jattan
7. Ismailabad
8. Kharindwa
9. Thol
10. Bhore Saidan
11. Harigarh Borakh
12. Gunthala Garhu
13. Thana
14. Dabkhera
15. Chinarthal
16. Hasanpur
17. Jakhwala
18. Pahaladpur

19. Daulatpur
20. Pindarsi
21. Babain
22. Mehra
23. Nalvi

VETERINARY DISPENSARIES

1. Bir Mathana
2. Mathana
3. Kaulapur
4. Beholi
5. Bahadurpura
6. Udarsi
7. Guldehra
8. Kamoda
9. Mangoli Jattan
10. Sanghor
11. Kanthal Khurd
12. Barwa
13. Bhustla
14. Sirsla
15. Chharpura
16. Jalkheri
17. Budha
18. Mahwa Kheri
19. Chamo Kalan
20. Dadloo
21. Ishaq

22. Jhimerheri
23. Jadaula
24. Kakrala/Kakrali
25. Malikpur
26. Ruan
27. Kharkali

STOCK MAN CENTRES

1. Palwal
2. Jyotisar
3. Mirjapur
4. Salpain Khurd
5. Hathira
6. Teora
7. Ajrana Kalan
8. Lohar Majra
9. Morthla
10. Masana
11. Fatupur
12. Chhalondi
13. Tatka
14. Saleempur
15. Halalpur
16. Dhangla
17. Haripur
18. Jhardi Khurd
19. Khanpur Jattan
20. Labdi

21. Lakhmari
22. Mohri
23. Arnoy
24. Bakali
25. Bodhni
26. Unia Majra
27. Jalbehra
28. Murtzapur
29. Sarsa
30. Seonsar
31. Kalsa
32. Kainthla
33. Karah-Sahib
34. Bhatt Majra
35. Nalvi
36. Rohti
37. Sulakhni
38. Kurari
39. Teora
40. Yara

SEMAN BANK

1. Pehowa

REGIONAL ARTIFICIAL INSEMINATION CENTRE

1. Pipli
2. Ram Saran Majra.