

CHAPTER IV

AGRICULTURE AND IRRIGATION

AGRICULTURE

Agriculture has always been the mainstay of the people of the area comprising Jhajjar district, and its inhabitants depend heavily on agriculture and its allied occupations for their livelihood. Agriculture has, as a single largest source of employment, played a vital role in the economic development of the district. The condition of agriculture as well as cultivation in the district in the beginning of 20th century is explained under paragraph 22 of the Final Report of the Third Regular Settlement of Rohtak District (1905-1910) as follows:

“Cane cotton and wheat are of course the chief irrigated crops. With the exception of an occasional acre on the wells or floods of the *dahri* tracts cane is entirely a canal crop. Wheat is mainly a canal crop, though a little is grown on the Jhajjar wells, and after the subsidence of the floods, when it is usually irrigated by bucket-lifts. If grown *barani* it is so generally in the forms of *gochni*, so that if the wheat fails the gram may spread and take its place. Nearly half the barley of the district is found on the Jhajjar wells of which it is the crop *par excellence*. As a *barani* crop it is preferred to wheat, withstanding drought better and needing less tilth, but, like it, is often mixed with gram, when it is known as *bejhar*. The pulses are usually sown mixed with millets, *mung* and *mash* with *jowar*, and *moth* in lighter soil with *bajra*. *Gowar* is mixed with both. Pulses generally are known as *masina* or “mixtures” and when themselves fixed together, as they often are in Jhajjar, as *dhangrala*-in which form they are usually sold to the *baniya*, and by him as *moth*, the pure crop being called *gori moth*.”

After independence, the State did much progress in agriculture and other allied sectors. Jhajjar district entered in a new era of economic and agricultural development in 1997, after bifurcation from Rohtak district, wherein it registered significant growth in agriculture and industrial sector. The district has mainly agriculture based economy but is experiencing a fast change from agrarian economy to mixed economy. The government is also making all efforts to encourage agricultural production by distributing improved seeds, pesticides, fertilizers; providing latest modern techniques, machinery and easy loans; increasing irrigation facilities, etc.

When Jhajjar was carved out as a district in 1997, the area under cultivation was 1,81,000 hectares, whereas in 2016-17, it rose to 1,91,000 hectares. More than 70 percent population is directly or indirectly engaged in agriculture or allied sectors. Among the working population of the district, the percent of cultivators and agricultural labourers was 34.42 and 13.73, respectively as per Census 2011. The district lies in a belt where the proportion of both female cultivators (40.64 percent) and agricultural labourers (17.86 percent) is comparatively higher than male cultivators (32.51 percent) and agricultural labourers (12.47 percent) as per Census 2011.

LAND UTILISATION

Land Utilisation denotes the manners and purposes for which the land is being utilised in a particular area. Land use pattern includes types of land and area of land being utilised under different purposes. It is a systematic arrangement of various classes of land on the basis of certain similar characteristics mainly to identify and understand their fundamental utility effectively in satisfying the needs of human society.

Area according to village papers in 2016-17 was 1,91,000 hectares out of which 7,630 hectares was put to non-agricultural uses, 7,229 hectares was fallow land other than current fallows, 10,000 hectares was current fallows, and 15,000 hectares was barren and unculturable. The land use statistics reveal that there was an overexploitation of land for crop-raising in the district. The broad use of the land is shown below:-

	(in thousand hectares)							
Classification of area	2000-01	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17*
Area according to village papers	191	191	191	191	191	191	191	191
Cultivated area	165	176	170	171	162	165	172	168
Forests	4	-	-	-	-	-	-	-
Uncultivated area	21	14	13	14	22	24	26	17
Net sown area	146*	167	134	141	138	141	139	151
Area sown more than once	84*	73	98	84	97	98	103	54
Total Cropped Area	230*	240	232	225	235	239	242	206

* Source: Directorate of Land Records, Haryana

Net area sown had increased from 1,46,000 hectares to 1,51,000 hectares

from 2001-02 to 2016-17, however, area sown more than once that had increased from 84,000 hectares to 103,000 hectares in 2015-16 showed a decline to 54,318 hectares in 2016-17.

Land not available for cultivation.— It includes absolutely barren and uncultivable land like mountains, deserts, etc., which cannot be brought under plough. During 2016-17, an area of 15,411 hectares remained barren in the district.

Other Uncultivable Land excluding fallow lands.— This denotes land available for cultivation, either not taken up for cultivation or abandoned later on for one reason or the other and includes culturable waste, permanent pastures and other grazing lands and lands under miscellaneous trees, crops and groves, etc. During 2016-17, an area of 7,630 hectares had been put to non-agricultural uses in the district.

Fallow Lands.— These are cultivated lands, which are left uncultivated in one or both the seasons due to any reason. It consisted of 7,229 hectares of fallow land and 9,684 hectares of current fallow land during 2016-17. These were mainly found in the areas, where irrigation facilities were not sufficient.

Net Sown Area.— This includes the total area actually sown with crops and orchards during the year, the areas sown more than once in the same year is counted only once. The net area sown in the district in 2016-17 was 1,51,201 hectares, out of which an area of 54,318 hectares had been sown more than once.

Total Cropped Area.— Total cropped area was 2,05,519 hectares in 2016-17. It means total cropped area decreased from 2.30 lakh hectares to 2.06 lakh hectares during the period from 2000-01 to 2016-17 in the district.

Operational Holdings.— Operational holding is all land which is used wholly or partly for agricultural production and is operated as one technical unit by one person alone or with others without regard to title, legal form, size or location and is taken as statistical unit for data collection in Agriculture Census. The average size of operational holdings increased from 2.07 hectares in 2000-2001 to 2.09 hectares in 2010-11. The number and area of operational holdings by size groups in the district as per agriculture census 2000-01 and

2010-11 was as under:-

Size Group in hectares	Number in 2000-01	Area in 2000-01 (in hectares)	Number in 2010-11	Area in 2010-11 (in hectares)
Below 0.5	19,894	4,495	21,104	5,457
0.5-1.0	10,511	8,217	13,921	10,071
1.0-2.0	11,210	16,652	15,047	20,988
2.0-3.0	6,014	15,120	7,395	17,930
3.0-4.0	3,947	14,562	4,627	15,773
4.0-5.0	2,669	12,112	3,014	13,777
5.0-7.5	2,961	17,810	4,129	25,213
7.5-10.0	1,525	13,063	2,243	18,653
10.0-20.0	1,125	14,831	1,469	18,152
20 and above	219	7,494	254	6,844
Total	60,075	1,24,356	73,203	1,52,858

SOIL CLASSIFICATION

The soils in the district are 'fine to medium' textured and are classified in three groups i.e. (i) Clay, (ii) Sandy, and (iii) Sandy loam soil. Out of these, sandy loam soil is more prevalent counting for nearly 85 percent where as in Salhawas and Matanhail blocks, nearly 22-25 percent of the soil is sandy. Percentage of the clay soil is less. Sandy loam soil is of best quality for crop production. It comprises sand to sandy loam (*Bangar and Nardak soils*) in north eastern part covering Bahadurgarh and Jhajjar blocks. The soil contains massive beds of pale reddish brown coloured clay or coarse loam (*dohar and check type of soils*) in the southern eastern parts of the area. The nitrogen contents are low in the soils of the area. Potassium and phosphorous is medium in PLATE-I of Salhawas block whereas high potassium and medium phosphorus occur in the soils of the district. The soils of the district are classified as arid brown (solonized) and sierozem. The soils of the district have two major problems: soil erosion due to high wind velocity in summer season and water logging during rainy season. The Department of Agriculture and Farmers Welfare is providing *dhaincha* and gypsum on subsidy to improve soil health.

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 Jhajjar to provide sufficient extension support to the land reclamation programme. For tackling the problems of alkali affected land in the district, the Corporation set up the Managerial Circle in 2003 at Bhiwani which covered the present Jhajjar district also. According to the Master Plan on soil conservation prepared by the Department of Agriculture and Farmers Welfare, about 1,23,248 hectares area was affected by the problem of alkali and salinity in the district, as a result of which, such lands are either lying barren or giving very poor yield. The Central Soil and Salinity Research Institute (CSSRI), Karnal has developed a viable technology for the application of gypsum at the rate varying from 3 metric tonnes to 3.5 metric tonnes per acre. The implementation of the land reclamation programme required gypsum in bulk quantity and manpower for educating the farmers about the use of recommended technology.

The work of extension is looked after by the Department of Agriculture and the work of stocking of gypsum and other inputs like ammonia sulphate and zinc sulphate has been entrusted to the Haryana land Reclamation and Development Corporation. The State Government also provided subsidy to the farmers on the purchase of gypsum at the rate varying from 50 percent to 75 percent, from time to time, depending upon the size of holding of lands. Data of sale of gypsum, weedicides/ insecticides/ pesticides/ fertilizers and subsidy allowed to farmers on the purchase of gypsum under various schemes from 2012-13 to 2017-18 was as follows:-

Year	Sale of gypsum (in quintals)	Sale of weedicides/ insecticides/ fertilizers (in quintals)	Subsidy allowed on gypsum under various schemes (₹ in lakh)
2012-13	21,810	2,010	34.73
2013-14	18,110	2,795	32.57
2014-15	17,650	2,567	31.47
2015-16	14,640	450	34.45
2016-17	7,035	2,510	10.54
2017-18	10,792	2,618	16.18

The Corporation establishes 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, State Co-operative Agricultural and Rural Development Banks, Sarva Haryana Gramin Bank, Primary Co-operative Agricultural and Rural Development Banks and Primary Agricultural Credit Societies for reclaiming their lands.

To tackle the problem of salinity and water-logging 'Haryana Operation Pilot Project' (HOPP) was initiated in the State in October, 1994 with the support of Government of Netherlands. The cost sharing is 60:30:10 amongst Govt of India, State Government and beneficiaries for 'work component' only. The progress of reclamation of saline and water-logged soils through Sub-Surface Drainage (SSD) technology up to 2017-18 under projects executed in the district Jhajjar is tabulated as under:-

Name of Project	Villages Covered	Area reclaimed (Ha.)	Beneficiaries	Works completion
Jhajjar-I	Beri Dopana, Beri Khas, Dhandlan, Gochhi, Bakra	805	873	May, 2007
Jhajjar-II	Wazirpur, Baghpur, Beri	1,304	798	June, 2012

CROPS

The crops grown in the district 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 *zaid* crop and its harvest is called the *zaid kharif* or *zaid rabi*, according to the harvest with which it is harvested. The major *kharif* crops are paddy and sugarcane and the major *rabi* crops are wheat and barley. *Toria* (an oilseed) is cultivated as *zaid kharif* in the district. Major food grain 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.

Jhajjar is one of the leading districts of the State in agriculture production. It contributed to 10.14 percentage of total barley produced in the State in 2017-18. The following table gives decadal variation of percentage

distribution of principal crops of the district in State production:-

Name of Crop	2007-08	2017-18*
<i>Bajra</i>	4.8	9.75
Rice	1.2	2.01
Barley	2.5	10.14
Wheat	3.8	4.02
Cotton	0.1	1.29
Jowar	29.3	20.0
Gram	1.8	0.72
Sugarcane	2.0	2.08
Rapeseed and mustard	7.2	5.59

* *Source:* O/o Deputy Director Agriculture, Jhajjar

Significantly, the district contributed about 736 thousand tonnes to the total production of 18,095 thousand tonnes food grains in the State in 2016-17.

FOODGRAIN CROPS

The major crops of the district are rice (*Oryza Sativa*), cotton (*Gossypium hirsutum*), *bajra* (*Pennisetum glaucum*), *jowar* (*Sorghum vulgare*), sugarcane (*Saccharum officinarum*) in *kharif* season where as wheat (*Triticum aestivum*), mustard (*Brassica campestris*), barley (*Hordeum vulgare*) and gram (*vigna mungo*) in *rabi* season. The area of these major crops has increased since 1997 due to better irrigation facilities in the district. The area under wheat, paddy and *bajra* (millet) crops in the district accounted, respectively, for 4.19 percent, 2.81 percent and 10.07 percent of total area of these crops in the State in 2017-18. Area, production and average yield of main crops of Jhajjar district from 2002-03 to 2017-18 is given in Table IX, X and XI of the Appendix, respectively.

Wheat.— It is a principal *rabi* crop of the district and occupies an area of about one lakh hectares. Area under this crop and its production has registered good increase since the formation of district in 1997. In 1997-98, the district had an area of 90,100 hectares under wheat crop and its average yield was 3,745 kg/hectare. At 1,07,000 hectares, average yield of wheat was 5,090 kilogram per hectare in 2016-17, however, it had decreased to 4,654 kilogram per hectare in 2017-18. The main high yielding varieties are WH-1021, WH-1105,

WH-542, WH-147, WHD-943, PBW-502, PBW-509, PBW-550, DPW-621-50, PBW-343, PBW-373, HD-2851, DBW-17, HD-2967, UP-2338, Raj-3765.

Paddy.— It is an important *kharif* crop of the district and the area under this crop and its production has significantly increased in past few years due to availability of water. In 1997-98, the district had an area of 8,200 hectares under rice cultivation and its average yield was 1,577 kilogram per hectare. In 2017-18, paddy was cultivated on nearly 40,000 hectares and production was recorded at 98 metric ton. The average yield of rice increased from 1,490 kilogram per hectare to 2,438 kilogram per hectare from 2000-01 to 2017-18. The main high yielding varieties sown in the district were HKR-47, HKR-127, PR-114, PR-113, PR-109, PR-121, PR-122, Pusa-44, Pusa-1121, CSR-30.

Bajra.— This is the principal *kharif* foodgrain crop and is generally grown throughout the district. During the years of timely rainfall, it is sown extensively in the south-west of Jhajjar tehsil where the supply of canal water is less and irrigation from wells is also not available. In 1997-98, the district had an area of 29,400 hectares under *bajra* cultivation and its average yield was 1,145 kilogram per hectare. The average yield of *bajra* increased to 2,313 kilogram per hectare in 2015-16 but declined steadily to 1,564 kilogram per hectare in 2017-18. The high yielding varieties of *bajra* sown in the district were HC-20, HC-10, HHB-226, HHB-67, HHB-67 (improved), and HHB-197.

Gram.— This is also a *rabi* foodgrain crop and is mostly sown in the *barani* areas of Jhajjar. In 1997-98, the district had an area of 9,800 hectares under gram cultivation and its average yield was 626 kg/hectare. The average yield of gram increased from 707 kilograms per hectare in 2000-01 to 1,702 kilograms per hectare in 2016-17 but had shown a decrease to 1,318 kilogram per hectare in 2017-18. Its high yielding varieties were C-235, HC-1, and HC-5.

Barley.— This *rabi* food grain crop is grown in light soil mostly in parts of Jhajjar tehsil. The average per hectare yield of barley increased from 3,112 kilograms in 2000-01 to 4,076 kilograms in 2016-17, however, the yield decreased to 3,728 kilogram per hectare in 2017-18. The high yielding varieties sown in the district were BH-393, BH-902, RD-2668, and DWRUB-52.

COMMERCIAL CROPS

Sugarcane.— It is the most important cash crop of the district and is grown almost in all tehsils especially under irrigated conditions. Its production has significantly increased since the formation of district in 1997. In 1997-98, the district had an area of 4,000 hectares under sugarcane cultivation, production was 15,000 tonnes and yield of *gur* (Jaggery) was 3,629 kilograms/hectare. The yield per hectare of sugarcane increased from 4,720 kilograms in 2000-01 to 8,192 kilograms in 2013-14. The yield, thereafter, showed fluctuation and it was recorded at 6,661 kilograms/hectare in 2017-18. The main varieties of sugarcane grown in the district were CoS 8436, CoJ 64, Co 7717, CoS 767, CoJ 788 and Co 1148, CoH 99, CoH 56, Co 7314, CoH 35, CoH 119, CoH.110.

Oil Seeds.— The major world sources of edible seed oils are soybean, sunflower, rapeseed and groundnut. Seed oils from linseed and castor beans are used for industrial purposes. Mustard is the main oilseed. In oilseeds, the area being a part of composite district (old Rohtak district) was 2nd ranking in the State. As a new district, it stood at 7th position with average yield of 557 kilogram per hectare and production of 18,100 tonnes of oilseeds at an area of 32,500 hectares. The district witnessed highest average yield of 2,330 kilograms/hectare in 2016-17 with production of 58,250 tonnes at 25,000 hectares. During 2017-18, average yield of oil-seed was 2,124 kilograms/hectare with total production of 61,808 tonnes at 29,100 hectares.

Pulses.— *Arhar*, *mash* and *masar* are three main pulses grown throughout the district. *Arhar* is mainly grown as sole crop during *kharif* season. *Masar* is grown as pulses with *til* during *rabi* season under irrigated and unirrigated conditions. These pulses are grown in all types of soil. In 1997-98, the district had an area of 14,100 hectares under pulses cultivation and produced 8,000 tonnes of pulses. In 2016-17, the district had average yield of 1200 kilograms/hectare with production of 18,000 tonnes of pulses at 15,000 hectares. The high yielding varieties grown in the district include Manak, Paras, PDU-1, T-9, KU-300, Mash-48, Mash-1, Massar 9-12 No.TT3, T-35.

HIGH YIELDING VARIETIES

The agricultural production has increased due to consultation with scientists of Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar and use of high yielding varieties of seeds, fertilizers, water conservative devices, new innovative implements, etc. Efforts were made to bring more area under high yielding varieties of three main crops of the district i.e. rice, *bajra* and wheat. The area under high yield varieties of food grains in 1997-98 of rice, *bajra* and wheat was 2,000 hectares (24.4%), 20,000 hectares (68%) and 87,000 hectares (96.6%) respectively. The district witnessed maximum area of 26,000 hectares (83.6%) under cultivation of high yielding varieties of rice in 2011-12 whereas it was 46,000 hectares (100%) of *bajra*, and 1,00,000 hectares (99%) for wheat in 2010-11. In the later years, the area under high yielding varieties of rice showed a consistent decrease despite an increase in overall area under rice cultivation in the district. The area under high yielding varieties of rice, *bajra* and wheat from 2010-11 to 2017-18 is shown in the following table:-

(in 000' Hectares)

Year	Rice		Bajra		Wheat	
	HYV	Percentage	HYV	Percentage	HYV	Percentage
2010-11	17.0	54.8	46.0	100.0	100.0	99.0
2011-12	26.0	83.9	36.0	94.7	88.0	88.9
2012-13	9.0	39.1	28.0	96.5	90.0	98.4
2013-14	9.0	39.1	28.0	93.3	90.0	91.8
2014-15	7.0	20.0	31.7	99.1	106.0	93.0
2015-16	--	--	34.0	97.1	106.0	95.5
2016-17	--	--	38.0	95.0	101.0	94.4
2017-18	--	--	40.8	95.0	98.0	92.0

FODDER CROPS

About 6-7 percent of the total cropped area of the district remains under fodder crops. The most important fodder crops are *chari*, *green-maize*, *jai*, *barseem*. Out of these, *chari* is a leading *kharif* fodder and *barseem* is *rabi* fodder crop. The forage crops are generally grown in unirrigated conditions during *kharif* season and irrigated conditions in *rabi* season. Apart from these fodder crops, the straws of *bajra*, *jowar*, *maize*, *turi*, *wheat*, *oat*, *lucerne* and other minor cereals are also used as animal fodder in the district.

HORTICULTURE

‘National Horticulture Mission’ (NHM) was launched in 2005-06 as a centrally sponsored scheme to promote holistic growth of the horticulture sector through area based regionally differentiated strategies. The scheme was subsumed as a part of ‘Mission for Integrated Development of Horticulture’ (MIDH) during 2014-15. The scheme covers fruits, vegetables, root and tuber crops, spices, flowers, mushrooms, aromatic plants, coconut, cashew, cocoa, bamboo, etc.

Fruits.— The area and production of major fruit crops in the district was 584 hectares and 8,331 metric tonnes in 2002-03 that increased to 2,229 hectares and 21,248 metric tonnes in 2017-18 respectively. In terms of population, the ratio was 686 persons to one hectare of garden area as against the national average of 178 persons to one hectare. This inadequacy was mainly due to small holdings, lack of irrigation facilities, unfavourable climate conditions, low rainfall and brackish sub-soil water. The major fruit crops include guava, *ber*, citrus, *aonla*, etc. Growth of major fruit crops is shown below:-

Name of crop	2002-03		2017-18	
	Area (in Hectares)	Production (in Metric Tonnes)	Area (in Hectares)	Production (in Metric Tonnes)
Guava	206	3,247	839	6,550
<i>Ber</i>	267	3,360	341	795
Citrus	27	17	390	9,429
<i>Aonla</i>	0	0	48	300
Mango	2	0	8	47
<i>Chiku</i>	0	0	4	0
Grapes	31	800	1	0
Others	51	907	598	4,127
Total	584	8,331	2,229	21,248

There are two planting seasons in the district viz. Spring (February-March) and Monsoon (July to October) for evergreen plants like malta, sweet-lime, *kagzi*-lime, mango, guava and *ber*, while the planting of deciduous plants like lime, pomegranate, grapes, etc., is done in January-February when they are in dormant stage and can be lifted and planted without earth ball.

Vegetables.— With the increase of irrigation and market facilities, the cultivation of vegetables has increased considerably. The eating habits of people are changing and vegetables are becoming an integral part of their diet. According to their growing season, the vegetables are divided into two groups:-

(a) **Summer Vegetables.**— These vegetables include cucurbits, brinjal, okra, tomato, chillies, sweet potato, etc.

(b) **Winter Vegetables.**— These vegetables include a wide range of vegetables such as radish, turnip, carrot, *palak*, *methi*, *dhania*, potato, cauliflower, peas, onion, cabbage, tomato, etc. The area and production of vegetables stood at 9,868 hectares and 1,04,032 metric tonnes respectively in 2002-03, which in 2017-18, have increased to 10,211 hectares and 1,25,752 metric tonnes, respectively. The area and production of major vegetables grown in the district in different years are given as under:-

Name of crop	2002-03		2017-18	
	Area (in Hectares)	Production (in Metric Tonnes)	Area (in Hectares)	Production (in Metric Tonnes)
Potato	206	3,428	125	3,500
Onion	1,735	33,798	990	25,938
Tomato	380	3,200	1,401	7,860
Radish	1,085	10,955	1,921	14,961
Carrot	744	9,280	1,050	18,350
Cabbage	140	1,500	100	1,715
Cauliflower	355	5,990	240	4,210
Chillies	310	811	214	1,830
Ladyfinger	848	2,490	335	1,720
Brinjal	385	5,325	130	2,235
Cucurbits	2,126	14,915	2,230	25,733
Peas	275	2,455	40	300
Leafy Veg.	1,122	9,475	805	8,200
Other Veg.	157	410	630	9,200
Total	9,868	1,04,032	10,211	1,25,752

Flowers.— Major flowers grown in the district are Marigold, Gladiolus, etc. In 2002-03, 186 hectares of area was covered under flower crops producing 2,950 tonnes of flowers and 5.7 lakh cut-flowers. The district witnessed the maximum area of 386 hectares under floriculture in 2006-07 but recorded the worst production of cut flowers to the tune of only 0.2 lakh, the turnover of flowers was, however, high at 3,110 tonnes. During the last ten years, maximum turnover of 3,124 tonnes and 15.38 lakh cut flowers was recorded in 2008-09 with a lower area of 280 hectares under floriculture, whereas the district, in 2015-16, with only 103 hectares of total area witnessed the minimum turnover of 818 tonne flowers but it also recorded maximum production of 49.29 lakh cut flowers. The detail of floriculture in the district from 2008-09 to 2017-18 is given in the table below:-

Year	Area (hectares)	Production (in tonnes)	Production (in lakh cut flowers)
2008-09	280	3,124	15.38
2009-10	200	1,735	13.60
2010-11	195	1,810	8.25
2011-12	215	1,810	8.30
2012-13	151	1,258	1.45
2013-14	93	825	2.08
2014-15	72	825	2.50
2015-16	103	818	49.29
2016-17	105	860	48.42
2017-18	92	1,125	0.80

Mushroom.— There had been much fluctuation in the plantation and yield of mushroom crop in the district, which is primarily attributable to variation in market rates and lack of interest of the farmers besides other conditions. During the current decade, mushroom cultivation in the district showed consistent increase in first half and touched a production of 62 metric tonnes with 10,205 trays in 2014-15. Highest production of 67 metric tonnes was recorded in 2016-17 with only 7,197 trays. In 2017-18, the production was low at 25 metric tonnes with 4,400 trays.

ORGANIC FARMING

Organic farming is a production system that avoids use of chemical inputs and relies on agri-waste recycling to sustain the health of soils, ecosystems and people. Besides, it focuses on ecological balance, bio-diversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. Organic farming is getting popular with time and awareness. Groups of organic cultivating farmers in Sehlanga and nearby villages in Matanhail block are active from last 7 to 8 years. Islamgarh village was adopted under Sansad Adrash Gram Yojna, wherein functionaries of the Regional Centre of Organic Farming, Panchkula are active and organise regular training camps for popularizing organic farming. Farmers, who adopt organic farming, get fair price for their production and hence have better socio-economic status. They do not take their produce to grain market and wait for procurement even then they get higher prices for their organic production. Jhajjar is one of the eleven districts where two clusters of 50 acre each have been selected under Paramparagat Krishi Vikas Yojna (PKVY) for organic farming.

AGRICULTURAL IMPLEMENTS AND MACHINERY

There was a visible shift towards a more modern approach to agriculture as new implements were incorporated in agricultural procedures in the late 19th century. The more important among the iron implements were ploughs, horse and hand hoes, harrows, drills, reapers, threshers, winnowers, fodder-cutters, *kohlu* (cane-crusher) and *rahat* (Persian-wheel). In the early twentieth century, agricultural scientists and economists sometimes advocated a heavy plough and deep ploughing for dry areas. In 21st century, modern implements are being gradually used by farmers in accordance with their utility and scope for use. The following agricultural implements/machines are used by the cultivators in the district:-

Plough.— The traditional plough, which is made of wood, is an implement

which has been in use since times immemorial, is still in vogue in the district. It is very useful for small and marginal farmers. Iron plough, though rare, can also be seen with some farmers.

Tractor.— A tractor is an engineering vehicle specifically designed to deliver a high attractive effort at slow speeds, for the purposes of hauling a trailer or machinery used in agriculture or construction. The tractors in agriculture are intended for multi-purposes and are being used for work like ploughing, puddling, transportation, threshing and running of pumping sets. The numbers of tractors used in the district in 2001-02 were 11,901 and same increased in the later years. The number of tractors used in agriculture and other fields from 2010-11 to 2017-18 is given in the table below:-

Year	Tractors	Year	Tractors
2010-11	16,278	2014-15	16,768
2011-12	16,588	2015-16	16,768
2012-13	16,774	2016-17	16,726
2013-14	16,867	2017-18	18,541

Field Cultivator.— A field cultivator is a useful farming implement for stirring and pulverizing the soil, either before planting or to remove weeds and to aerate and loosen the soil after the crop has begun to grow. The main function of field cultivator is to prepare a proper seed bed for the crop to be planted into, to bury crop residue in the soil and to mix and incorporate the soil to ensure the growing crop has enough water and nutrients to grow well during the growing season.

Seed-cum-Fertilizer Drill.— The Seed-cum-Fertilizer Drill is used by the farmers in the district for simultaneous acts of seeding and fertilization in a single operation. Seeds and fertilizer are drilled at different depths thus improves germination. It helps in seed saving, economy in fertilizer, enhancement in cropping intensity and increase in returns and gross income to farmer. It also reduces the risk of some plant diseases like *Phalaris minor* in wheat. It is used for sowing different crops such as wheat, barley, maize, peas, black grams, pulses, etc. It can be retrofitted to a tractor of 35HP and above.

Mounted Offset Disc Harrow.— It is used in open farm workings for the superficial ploughing, for the shattering of clods, preparation of soil for sowing, burial of organic substances and remains, etc. It is also used to aerate the soil, to eliminate the weeds and breaking the roots. It has low purchasing and utilisation costs both for its wide working width, and for its high speed from 7 to 15 kilometres per hour. It can be used in light and medium soil.

Heavy Duty Land Leveller.— It is an advanced implement for levelling of land. It is made of special steel which gives it double life as compared to ordinary blades. The leveller is available with 6, 7 and 8 feet width. It is a simple and rugged implement which is directly fitted to the tractor. The 6mm-10mm single plate duty reinforced makes the leveller trouble free in the operation.

Thresher.— Thresher is a device that first separates the head of a stalk of grain from the straw, and then further separates the kernel from the rest of the head. Pedal Powered Thresher is a low-tech machine that is operated using pedals. 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.

Multicrop Thresher.— Farming multicrop thresher has been developed to suit large holding farmers and custom hiring. It is very suitable for crops like wheat, soyabean, peas, mustard. It is operated with 35 HP tractor. The multicrop thresher consists of hopper with automatic feeding, which is driven by the gear box. Reverse gear can be used if necessary. The threshing unit contains sharp cutting blades with spike tooth cylinder wherein the crop is cut into small pieces and then rubbed against the netted concave to give superior separating performance. Aspirators blowers are attached to threshing unit, which separate small pieces of crops residue from the seed. A shaking and bagging unit is used to collect the seeds. The unit is supplied with belts and pulleys to achieve variable cylinder speed and the speed of blower can also be changed according to the requirement. It also consists of elevator for loading seeds to trolley, pneumatic transport wheel and single hitch system.

Potato Ridger.— This implement is popular with the potato growers of the district. It is used to cultivate the space between rows of potatoes by moving the soil into ridges where the potatoes can grow more efficiently with less cone resistance to yield a better crop.

Combine Harvester.— Combine Harvester is a machine which has gained popularity amongst the farming communities of the district for easy harvest of grain crops. The name of the machine is due to its ability to combine three separate operations comprising harvesting into a single process viz. reaping, threshing, and winnowing.

Cane Crushers.— In addition to sugar industry, these cane crushers are also designed for use in jaggery industry and sugarcane juice shops.

Jhota Buggies.— Traditional means of transportation of agricultural produce i.e. two wheeled or four wheeled bullock carts or ox-carts, usually driven by a pair of oxen, are being rapidly replaced by *Jhota buggies*, which are generally two wheeled carts pulled by single male buffaloes. This mode of transportation is more popular with sugarcane growers of the district and landless labourers for whom it has become a source of livelihood too.

With the increased popularity of modern agricultural tools, some traditional tools and implements have not completely lost their utility. The use of these implements is still in vogue and it is likely to continue as these are of daily use for various farm operations. The following traditional types of agricultural tools are still popular in the district:-

<i>chausang</i>	:	long handled fork with four prongs
<i>dranti</i>	:	sickle
<i>gandasa</i>	:	fodder-cutter
<i>gandasi</i>	:	long handled chopper used for cutting sugarcane, cotton sticks, thorns and bushes
<i>hal</i>	:	a plough
<i>jeli</i>	:	long handled fork with two prongs.
<i>jua</i>	:	yoke
<i>kasola</i>	:	large mattock spade with long handle for weeding

<i>kasoli</i>	:	small mattock spade with long handle for weeding
<i>kassi</i>	:	large mattock spade
<i>khurpa</i>	:	grass spade
<i>kulhari</i>	:	hatchet
<i>mai or sohaga</i>	:	flat clod crusher
<i>santa</i>	:	ox goad
<i>tangli</i>	:	long handled fork with more than four prongs

The implements commonly used by the cultivators are seed drill, seed cum fertilizer drill, disc harrow, hand duster, harvester, knapsack spray, power spray pump, etc. Traditional implements like plough, spade, axe, chopper, hoe, sickle, flat board are also used for harrowing.

The new innovations which are beneficial to the farmers are Laser Land Leveller, Rotavator, Combine Harvester, Zero Till Seed Drill, Ridge Furrow Planter, Straw Reaper, Happy Seeder, DSR Ploughing Machine, Reaper Binder, etc. These implements are also available to the farmers on subsidy which is provided by the Department of Agriculture and Farmers Welfare, Haryana. The implements in use in the district in 2018 are as follows:

Items	Number
Tractor 35 HP	8,041
Tractor >35 HP	10,500
Harvester	40
Combine Harvester	76
Seed Drill	12,910
Seed cum fertilizer	815
Disc Harrow	15,605
Knap sac spray pump	11,510
Power spray pump	240
Rotavator	980
Cultivator	12,000
Laser Land Leveller	185

For mechanized farming, the Department of Agriculture and Farmers

Welfare, and the Haryana Agro Industries Corporation Limited extends help to the farmers through various schemes. Benefits granted under such schemes by the department in 2017-18 are given below:-

Name of Implement	Scheme	Beneficiaries
Seed drill	NFSM Scheme	30
Reaper Binder	State Plan	3
Rotavator	NFSM Scheme	20
Rotavator	NMOOP	40
Rotavator	RKVY Scheme	47
Laser Land Leveller	NFSM Scheme	19
Laser Land Leveller	State Plan	12
Laser Land Leveller	RKVY Scheme	35
Cotton Seed Drill	RKVY Scheme	30
Zero Tillage Machine	RKVY Scheme	64
Special Disc Harrow	RKVY Scheme	22
Straw Reaper	RKVY Scheme	108
Straw Reaper	State Plan	13

SEEDS

Seed is basic and most vital input that plays a vital role in boosting agriculture productivity. The Department of Agriculture and Farmers Welfare concentrates on multiplication of improved seeds and their distribution to the farmers. Haryana Seeds Development Corporation Limited (HSDC) was established with the objective of undertaking production, processing and marketing of seeds so that the quality seeds could be supplied to the farmers. The Corporation is marketing its seeds with the brand name “Haryana Beej” which is quite popular among the farmers. The Corporation has extensive network of regular sale counters in the district through which it provides to farmers an easy access to quality seeds and their purchase. The seed is also procured from National Seeds Corporation, Chaudhary Charan Singh Haryana Agricultural University, Hisar and Government Seed Farms. In the district, 8,559 quintals of certified seeds were sold to farmers in 2017-18. The following

high-yielding varieties of various crops popular among the farmers are:-

KHARIF	
Crop	Varieties
Paddy	HKR-47, HKR-127, PR-114, PR-113, PR-109, PR-121, PR-122, Pusa-44, Pusa-1121, CSR-30.
Arhar	Manak, Paras
Moong	SML-668, Satya, MH-421
Mash	PDU-1, T-9, KU-300
Gwar	HG-365, HG-563, HG-2-20
Bajra	HC-20, HC-10, HHB-226, HHB-67, HHB-197
Til	HT-1/Pragati
Jowar	Multicut
RABI	
Wheat	PBW-502, PBW-509, DBW-17, PBW-550, WH-1021, PBW-343, PBW-373, HD-2851, WHD-943, C-306, WH-542, WH- 147, WH-1105, HD-2967, UP-2338, Raj-3765, DPW-621-50,.
Barley	BH-393, BH-902, RD-2668, DWRUB-52
Gram	C-235, HC-1, HC-5
Toria	T-9, TL-15
Mustard	RH-30, Varuna, Laxmi, Pusa Mustard-24 & 25
Lentil	Sapna, Garima, HM-1

MANURES AND FERTILIZERS

The manure is a well decomposed refuse from the stable and barren yards including both the animals' excreta and straw while the fertilizers are industrially manufactured chemicals plant nutrients. 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 good yields.

Compost.— Farmyard or cattle dung manure being good manure for the maintenance and improving the soil fertility has been in use since times

immemorial. However, the traditionally made farmyard manure commonly used by the cultivators is poor in quality, largely due to faulty methods of its preparation and incomplete utilization of the useful ingredients contained in cattle dung. The Department of Agriculture and Farmers Welfare is, therefore, 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. Now-a-days, vermicompost is replacing these manures and the slurry from biogas plants is also used.

Green Manuring.— It is very important for soil fertility as it directly adds nitrogen and organic matters to the soil. The addition of organic matter improves physical composition of the soil and increases the water-holding capacity of the soil. The practice of green manuring with sun-hemp *gwar* and *dhaincha* is being steadily popularised. The government is stressing for the adoption of the practice in the district. So, seeds of *dhaincha* are provided to farmers on 50 percent subsidy. The leguminous crops like summer *moong* are also grown. During 2017-18, Haryana Seeds Development Corporation distributed 720 quintal *dhaincha* seeds for green manuring during *khariif* -2017 at 50 percent subsidy under ‘Rashtriya Krishi Vikas Yojna’.

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 of various crops. The deficiency of nitrogen, potassium and phosphorus in the soil is generally made good by addition of chemical fertilizers. Besides, the deficiency of other elements like magnesium, iron and zinc is also found in the soil of some areas. For combating these deficiencies, fertilizers containing zinc sulphate ($ZnSO_4$), magnesium sulphate ($MgSO_4$) and ferrous sulphate ($FeSO_4$) are provided by the Agriculture Department on 50 percent subsidy. In 2001-02, the total consumption of chemical fertilizers was 21,750 tonnes out of which 15,121 tonnes was nitrogenous, 6,574 tonnes was phosphatic and 55 tonnes was potassic. In 2017-18, consumption of chemical fertilizers increased to 33,607 tonnes. Fertilizers consumption from 2011-12

to 2017-18 is given in below table:-

(in tonnes)				
Year	Nitrogen (N)	Phosphorus (P)	Potassium (K)	Total (NPK)
2011-12	14,915	6,495	177	21,587
2012-13	16,902	8,292	76	25,270
2013-14	15,549	5,764	450	21,763
2014-15	17,809	5,892	376	24,077
2015-16	18,873	5,637	326	24,836
2016-17	21,356	7,186	505	29,447
2017-18	22,789	10,104	710	33,603

The use of chemical fertilizers on crops can have adverse effects on waterways caused by chemical runoff of the excess fertilizers. The organisms and fish living in water use oxygen. The excess of nutrients in the water reduces the amount of oxygen which results in quick oxygen depletion leading to death of aquatic fauna. Chemical fertilizers may cause chemical burn to crops, increased air pollution, acidification and mineral depletion of the soil. Excess nitrogen used in crop fertilization can contribute to the release of greenhouse gases such as carbon dioxide and nitrous oxide into the atmosphere. This effect is caused by using a greater amount of chemical fertilizer than the plants can readily absorb. According to the Climate Monitoring and Diagnostics Lab of the National Oceanic and Atmospheric Administration (NOAA), excess greenhouse gases trapped in the atmosphere may be contributing to increase the temperature of land and ocean surface.

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, farmers sow two to three crops yearly. Crop

rotations in vogue in the district are as follows:-

Paddy-wheat
Moong-paddy-wheat
Sugarcane-wheat
Tomato-cauliflower-potato
Moong-mash-paddy-gram
Bajra-mustard
Jowar-wheat
Cotton-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) **Stored Grains pests**

- (a) *Khapra*
- (b) *Dhora*
- (c) *Susri*

(5) **Miscellaneous Pests**

- (a) Fields rats

A package of practices for the control of various pests and diseases has been enforced in the district. These practices include preventive measures like use of resistant variety and seed treatment, spraying with various pesticides / weedicides and cultural practices like roguing of diseased plants, soil treatment, deep summer ploughing, etc.

Stored grains pests are controlled by fumigating the grains in the bins and stores with fumigants. Pesticides are supplied to the farmers through the Agriculture Department, Co-operatives and allied agencies. The total consumption of pesticides in 2001-02 was 72 tonnes in the district which decreased in the later years. In 2017-18, consumption of pesticides was 75 tonnes. Increased awareness about the side-effects of pesticides on humans and animals has, however, limited their use. Biological control is also used for which farmers are trained in Farmer Field School for Integrated Pest Management. The government also provides pest control equipments on the subsidized rates. Measures like fumigation, etc., are resorted to by the department on a large scale to reduce the damage to crops and to cover wider areas.

ACTIVITIES OF AGRICULTURE & FARMER WELFARE DEPARTMENT

Laying out Cluster Demonstration.— To implement the new technology and package and practices, on-field cluster demonstrations are conducted to know the impact of particular technology. Under this scheme, in 2017-18 cluster demonstrations were laid for DSR in 347 hectares, mustard in 160 hectares, wheat in 867 hectares, gram in 20 hectares and summer *moong* in 400 hectares.

Laying out Farm Trials.— To facilitate local adoption of research results, that have been obtained at research stations, which cannot adequately represent the range of situations encountered under specific conditions in farmers' fields

and their resource situations, these are treated by laying out on-farm trials. These farm trials help to evaluate and refine, or modify if necessary, the technologies developed at research stations to better fit, a particular resource or risk situation, and meet the needs of farmers.

Laying out Mini-kit Demonstrations.— Through its field staff, the Department arranges mini-kit demonstrations on fields of small and marginal farmers for their benefit.

Sugarcane Development work.— To look after the work of sugarcane development in particular, an Assistant Cane Development Officer is stationed at Jhajjar. Seed nurseries are maintained for distribution of healthy and disease free seeds to the sugarcane growers.

Soil Conservation Work.— The work of soil conservation is executed by the Assistant Soil Conservation Officer posted at Jhajjar. He is responsible for the project planning, preparation of new schemes and over all supervision of the works related to soil conservation keeping in view the rules and orders of the Government. He is assisted by Agricultural Development Officers and Agriculture Inspectors.

Soil Testing Service.— The Department, through its Soil Testing laboratory located at Jhajjar, provides the facility of testing of soil and water samples to the farmers. In the said laboratory, 44,426 farmers got the soil samples of their farms tested during 2018.

Installation of Bio-Gas Plants.— The installation of bio-gas plants is also one of the important activities of agriculture department. Excreta of the cattle and wet organic kitchen waste are used in bio-gas plants as raw material to produce fuel gas for cooking. Subsidy is provided to the beneficiaries who install the bio-gas plants. Rich farm yard manure is by-product of the process which gives additional benefits to the beneficiaries. There were 90 bio-gas plants in the district in March, 2018. Out of these, 10 plants were got installed during 2017-18.

Implementation of New Technologies.— New technologies such as levelling of land using ‘Laser Land Leveller’ to enhance irrigation efficiency are being

implemented in the district and Hi-tech implements are made available to farmers on rent basis.

KRISHI VIGYAN KENDRA

Krishi Vigyan Kendra is the major wing and field arm of Directorate of Extension Education, CCSHAU, Hisar. It was established at Jhajjar in 2001. It has extension specialists in the disciplines of agronomy, farm management, co-ordination, soil science, entomology, plant pathology, agricultural engineering, horticulture, vegetable crop, animal science, veterinary science, home science, etc. The specialists disseminate latest knowledge in crop production, farm machinery, soil and water management, child care and family resources management, livestock care and management, etc.

Dissemination of knowledge is done by holding farmers' fairs, training camps, demonstrations, campaigns, exhibitions, film shows, etc. The farmers of the district are frequently apprised of the results based on the latest agricultural technology developed by the scientists of the Agricultural University at Hisar. Besides contacting farmers on their farm and home, conducting demonstrations, organizing meetings, group discussions, training camps, campaigns, etc., the extension scientists publish subject matter enrichers. Krishi Vigyan 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 the programme of important activities to be undertaken by the Kendra. These circulars are sent to all Agriculture Development Officers and other extension functionaries of the district as well as to some progressive farmers.

ASSISTANCE TO FARMERS

Agriculture and Farmers Welfare Department in association with Central and State Government is providing many facilities to the farmers of the district. Agricultural Technology Mission Agency (ATMA) was started for farmer's welfare in the district in 2007-08. Besides this, various schemes like National Food Security Mission, Rastriya Krishi Vikas Yojna (RKVY), National Mission of Oilseed and Oil Palm (NMOOP) are also going on in the

district for increasing production of the crops. The different schemes and their components are as follows:-

i) National Mission of Oil Seed and Oil Palm (NMOOP)

The objective of the mission is to increase area, production and productivity of oilseeds (rapeseed and mustard). Its main components include mini-kits, demonstration plots, training camps, farmer field schools, subsidy on improved farm machineries like seed drill cultivator, knapsack spray pump, etc., besides 50 percent subsidy on gypsum for increasing productivity of mustard. Number of beneficiaries in the district against various components under this mission in 2016-17* is given in the table below:-

Demonstration	200	Farm Machinery	30
Manual Spray Pump	100	FFS	60
Power Spray Pump	80	Training of farmers	200

* the scheme was closed on completion of 2016-17

ii) National Food Security Mission (NFSM)

The main object under mission is to increase area and production under quality wheat and pulses. The components provided under this mission are cluster demonstrations, subsidy on improved farm machineries like knapsack spray pump, rotavators sprinkler sets to save water, 50 percent subsidy on gypsum and weedicides. As in March, 2018, the number of beneficiaries against various components under this mission in the district is given in the table below:-

Camps/Training of Farmers	21	Manual Spray Pump	250
Demonstration	1,794	Seed drills	130
Rotavators	400	Laser Land Levellers	950
Seed Distribution	4,500	PP chemicals	250
Gypsum	192		

iii) Agricultural Technology Management Agency (ATMA)

This agency strengthens the agriculture extension system and gap-filling mode through other agriculture extension schemes. Group approach instead of individual approach is preferred. Planning is from bottom to top and financial assistance is from top to bottom. The main components

include farmer training at different levels, farm school, farmer to farmer visits, exposure visits (EV), demonstrations, establishment of farmer interest groups (FIG), commodity interest groups (CIG), *kisan gosthi*, farmer-scientist interaction, etc. As in March, 2018, Number of beneficiaries under various components of the agency is given below:-

Demonstrations	150	EV within district	6
Training of Farmers	15	<i>Kisan gosthi</i>	20

iv) Promotion of Crop diversification

Under this scheme, the area under different crops is increased. Farmers are encouraged to adopt crop diversification instead of regular cropping pattern.

v) Others

- Direct Seedling of Rice (DSR) is being implemented over traditional method of growing rice to conserve the moisture and maintain the ground water. It also checks water logging conditions.
- Zero Tillage method is being encouraged to save high sowing cost and to increase fertilizer efficiency during sowing of wheat.

ALLIED SECTORS

Allied sectors are an important and integral part of agricultural sector. The growth of these sectors plays an important role in pushing the total agricultural growth on upward side. The thrust has been on animal husbandry and dairying. The farmers have earned a name for themselves in fish farming in the district.

ANIMAL HUSBANDRY

Animal Husbandry is the main section of farming system in Jhajjar district. Animal Husbandry activities relate to cattle breeding, artificial insemination, control of outbreak of contagious diseases amongst livestock, improvement of livestock and provision of veterinary aid. Revolutionary progress has been made in the district in recent years in improving the breed of cattle through selective breeding, culling of undesirable animals and improving

the indigenous breeds by crossing them with improved bulls. Artificial insemination for improving the breed of cows and buffaloes has been started in all the veterinary hospitals and dispensaries located in the district. Loans are also given to the breeders for the purchase of cows and buffaloes of the improved breed. The livestock and poultry population in the district as per 2007 and 2012 livestock census is given as under:-

Particulars	2007	Percentage	2012	Percentage
Cows	40,001	11.67	54,300	15.26
Buffaloes	2,37,963	69.43	2,54,908	71.62
Sheep	26,176	7.64	19,811	5.57
Goat	13,848	4.04	10,381	2.92
Pigs	6,056	1.77	7,804	2.19
Horses	329	0.10	688	0.19
Donkeys and Mules	797	0.23	200	0.06
Others	17,576	5.13	7,842	2.20
Poultry	1,40,207	--	2,24,841	--

Comparison of the livestock population of 2007 with respect to 2012 revealed an increase in population of poultry, cows, buffaloes, pigs and horses and decrease in the population of sheep, goats, donkeys/mules and others.

The activities of Animal Husbandry and Dairying Department in the district are looked after by a Deputy Director and his subordinate staff. In 2017-18, he was assisted by two Sub-Divisional Officers (AH), 80 Veterinary Surgeons, 133 Veterinary Livestock Development Assistants (V.L.D.A) and 44 other Class-IV staff.

Cattle and Buffaloes.— In his notes on indigenous breeds of cattle, Major H.T.Pease described the cattle in and about Rohtak district in 1903, “Haryana cattle vary somewhat in the different parts of the tarot. Those of Jhajjar, Rohtak, Meham and Hansi are of the best size and quality, the heavier animals being found to the north of Rohtak ...”¹ The oxen of villages around Beri and Jahazgarh have a special reputation which is said to be due to the fact

1 A Cattle Survey of the Rohtak District of the Punjab, BEIP, Publication No.41, pp. 1-2

Nawab of Jhajjar kept some bulls of Nagor breed (locally called after Bondh, a village in the neighbouring Dadri *ilaka*) at Chuchhakwas and allowed the cattle of the surrounding villages to have recourse to them¹. This breed was small, hardy, active, and hard working, but is said to have fallen off since the confiscation of Jhajjar².

The district possessed a meager stock of 2.6 percent of total livestock of the State as per Livestock Census, 1997, when Jhajjar was carved out as a district. There were 43,600 cattles in the district and 18.8 per cent of these were milch cattle whereas 7.6 percent of these were cross-bred milch cattle. Out of the total 1,53,800 buffaloes, 38.6 percent were in milk. The variation in number of cattle and buffaloes during 1997-2007 and 2007-2012 is given in the table below:-

Category	Cattle	Buffaloes
Livestock 1997	43600	153800
Livestock 2007	40001	237963
Decadal Variation 1997-2007	- 3599	+84163
Livestock 2012	54300	254908
Variation 2007-2012	+ 14299	+16945

It is clear from the table that in comparison to figures recorded during Livestock Census 1997 number of cattle had decreased by 3,599 (8.25%), but buffaloes had increased by 84,163 (54.72%) at Livestock Census 2007, and at Livestock Census 2012 the district recorded an increase in number both of cattle and buffaloes by 14,299 (35.74%) and 16,945 (7.12 %), respectively. The district has been predominantly populated with non-descript cattle of mixed breeds. The scheme envisaged artificial insemination and controlled breeding through castration of scrub bulls. At later stage, it was felt that stock could be improved by cross breeding the cows. For breeding in cows and Murrah buffaloes, the semen is supplied from Semen Collection Centre, Hisar and Jagadhari. The data of artificial inseminations undertaken and calves born from 2011-12 to 2017-18 in the district is given

1 Rohtak District Gazetteer, 1910, p. 111.

2 Imperial Gazetteer of India, Volume 21, p. 316

in the table below:-

Year	(in thousands)			
	Artificial Insemination		Calves born	
	Cow	Buffalo	Cow	Buffalo
2011-12	38.4	71.7	6.6	21.9
2012-13	23.3	80.2	7.0	22.8
2013-14	24.4	91.7	8.4	28.8
2014-15	24.4	89.2	9.0	33.3
2015-16	20.7	80.3	9.0	34.9
2016-17	26.0	96.4	9.9	37.0
2017-18	32.0	155.8	11.1	37.9

Poultry Farming.— In 1997, the number of poultry birds were 42,600 in the district, while in 2007, poultry birds increased to 1,40,207. Thus the decadal variation during 1997-2007 registered 229.12 percent (+97,607 poultry birds) growth. Livestock Census 2012 has recorded 2,24,841 poultry birds in the district, thereby, registering a rise of 60.36 percent (+84,634 poultry birds) over the figures of Livestock Census 2007.

The district has a great potential for poultry development due to its proximity to National Capital Region, Delhi. The poultry and eggs produced in the district find a ready market in Capital. The breeders of the district are supplied with White Leghorn chicks at subsidized rates either from Hatchery at Hisar or Government Poultry Farm, Ambala. Mass scale vaccination and debeaking are carried out by the veterinary institutions working in the district from time to time.

Piggery.— The concentration on piggery is low or negligible in the district. In 1997, when Jhajjar was carved out as a district, the pig population was 14,800. The pig population decreased to 6,056 in 2007, and in 2012 it increased to 7,804. Thus, there was 29 percent (+1,748) growth in pig population in 2012 as compared to 2007. To improve and develop piggery, piglets of Yorkshire and Landrace breed produced at the Pig Breeding Unit, Hisar and Ambala, are supplied to the breeders at subsidized rates.

Sheep and Goat Farming.— According to Livestock Census 1997, the sheep

and goat population was 26,500 and 21,300 respectively. After that, sheep and goat population has consistently decreased in the district. The decrease in population of goats was precipitous 35 percent (-7,452) and in sheep population 1.2 percent (-324) as compared to figures of 1997 with 13,848 goats, and 26,176 sheep recorded during Livestock Census 2007. Livestock Census 2012 recorded 10,381 goats and 19,811 sheep thereby reflecting a further decrease of 3,467 goats (-25 percent) and 6,365 sheep (-24 percent) population in the district.

The sheep and goats play an important role in the sustenance and livelihood security of a section of farmers and landless rural. The rearing of these animals is having potential for poverty alleviation with low risk. With the availability of few open pastures in the district, sheep and goat rearing is not feasible in a big way. However, promoting small units as subsidiary to the agriculture for landless labourers and those traditionally engaged in such activities is quite feasible. These animals provide meat for food, wool for clothing, skin for industrial enterprise and manure for agriculture. The following tables show the annual wool and meat production category-wise in the district respectively from 2015-16 to 2017-18:-

Wool Production				(in kilograms)
Year	Rams	Eves	Lambs	Annual
2015-16	6,108	40,002	18,124	64,234
2016-17	6,218	38,128	18,002	62,348
2017-18	6,408	37,528	17,976	61,912

Meat Production				(in kilograms)
Year	Sheep	Goats	Pigs	Annual
2015-16	2,000	7,200	1,300	10,500
2016-17	2,200	7,400	1,700	11,300
2017-18	2,000	6,800	1,000	9,800

Veterinary institutions functioning in the district have been entrusted with the work of sheep development. The local breeds of goat are improved

by natural mating with the bucks of A.B.J.Cross, A.J.Cross and Angloboven cross, Alpine cross with Beetal breed. Buck of superior quality are produced at Goat Farm, Hisar and are given to farmers for cross breeding in the State. Goats are also a good source of milk.

Livestock Diseases.— The major diseases prevalent in Jhajjar district are haemorrhagic septicaemia (*ghotu, gal ghotu* or *gal sujan*), foot and mouth disease (*munh khur, rora chapka*), sheep pox, enterotoxemia, peste des petits ruminants (*rinderpest, birla, wah, mata* and *khuni-dast*) and black quarter (*black-leg, saraha patsuja*). These diseases are controlled by inoculating prophylactic vaccines and other curative measures. Regular campaigns for inoculation and vaccinations against these diseases are conducted at regular interval. Foot and Mouth Disease Control Programme is 100 percent centrally sponsored scheme and well under control in the district. During 2017-18, in these veterinary institutions 3.37 lakh cases of livestock diseases were treated. The year-wise detail of number of inoculations and vaccinations performed in the district from 2010-11 to 2017-18 is given in the table below:-

(in lakh)

Name of the Disease	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Haemorrhagic Septicemia	3.32	3.16	4.78	5.27	5.44	5.08	4.84	5.40
Foot & Mouth	4.22	2.38	4.71	5.25	5.75	5.33	5.08	5.35
Sheep Pox	0.20	0.17	0.26	0.20	0.19	0.18	0.16	0.18
Entrotoximia	0.16	0.15	0.32	0.16	0.25	0.25	0.25	0.25
PPR	0.14	-	0.05	0.13	0.14	0.09	0.25	0.10
Swine Flu	0.01	-	0.02	0.06	0.07	0.07	0.07	0.06

Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar has extended surgical treatment facility, services of animal disease investigation staff and diagnostic services to livestock owners through the department of Animal Husbandry. In case, the field staff is unable to diagnose the disease, the matter is referred to disease investigation staff of the university which, after conducting laboratory examination, recommends suitable preventive and curative treatment for the control of such diseases.

To maximize sustainable per head productivity through regular breeding, a unique programme of ‘*Banjh Mukth Pashudhan*’ (Sterility Free Animal Wealth) has been implemented in the district in 2010-11. Under this programme, special insemination and hormonal intervention in camps is done to bring all the problematic, non-cycling cattle and buffaloes into heat and, consequently, their timely insemination resulting into successful conception. In 2017-18, in various institutions of the district 32,000 cows and 1,24,000 buffaloes had undergone artificial insemination.

Veterinary Institutions.— In 1997, there were 24 veterinary hospitals, one regional artificial insemination centre, 45 civil veterinary dispensaries, 5 sheep wool extension centres and one poultry extension centre in the district. At that time, 25 veterinary surgeons and 108 Veterinary Livestock Development Assistants were working in the district. The district progressed much during the last two decades and the facilities have increased considerably. In March, 2018, there existed a network of 93 Government Veterinary Hospitals (GVH) / Hospitals-cum-Breeding Centres and 48 Government Veterinary Dispensaries (GVD), the block-wise bifurcation of which was as follows:-

Block	GVH	GVD	Total
Bahadurgarh	34	19	53
Beri	18	9	27
Jhajjar	10	7	17
Matanhail	15	8	23
Salhawas	16	5	21
Total	93	48	141

Gaushalas.— *Gaushalas* (*goshalas*, protective shelters for cows) are institutions inspired by religious sentiments for the welfare and housing of the unproductive and useless cattle and are usually run on charity. In 1997, when Jhajjar was carved out as a district, there were only 6 *gaushalas*. In March, 2018, there were 9 *gaushalas* managed by charitable trusts in the district which were housing 16,009 cattle¹. These have been converted into ‘Cattle Breeding-

¹ <http://hargauseva.gov.in>

cum-Milk Producing Centres’ with the help of financial and technical assistance from the Government. A list of registered *gaushalas* in 2017-18 is given at Table-XII of the Appendix.

Dairy Farming.— Dairy farming is an essential component of rural areas of the district. There is a long tradition of rearing dairy animals by the farmers in the district. The farmer becomes interested in maintaining quality of milch cattle for commercial milk production, if he finds ready and remunerative market for milk at hand. Many landless families are also engaged in dairy farming. With the rise of the prices of milk, dairying has become a profitable business. Enchanted farmers’ interest, thrust of Animal Husbandry and Dairying Department*, and various other government and private agencies working in this area largely helped in increasing the milk yield in the district. As per 2007 and 2012 Livestock census, the number of female cattle (cow) and buffaloes in milch was as under:-

Year	2007 Census			2012 Census		
	Cattle		Buffaloes	Cattle		Buffaloes
	Cross bred	Indigenous		Cross bred	Indigenous	
In Milk	4,599	7,379	83,978	10,335	4,987	85,139
Dry	962	3,862	21,451	2,887	3,309	32,757
Not calved even once	217	1,125	5,815	586	1,456	5,793
Total	5,778	12,366	1,11,244	13,808	9,752	1,23,689

Note: Cross Bred Cows over 2.5 years, Indigenous Cows and Buffaloes over 3 years

Out of the total 54,300 cattle and 2,54,908 buffaloes recorded during Census 2012, nearly 23,560 (43.39%) cattle and 1,23,689 (48.52%) buffaloes were of milching age. The above table reflects that the number of cross bred cows and buffaloes registered during Census 2012 increased by 139 percent and 11.2 percent as compared to previous Census 2007 whereas, indigenous cows decreased by 21.14 percent.

The Cooperative System is primarily a three-tier system i.e. State level "Cooperative Federation", District level "Milk Union" and Village level

* Dairy Development Department was merged with Animal Husbandry Department in 2003.

"Milk Societies". All these work on the principles of Cooperation System. Under this programme, at district level, a society namely The Rohtak Cooperative Milk Producers Union Limited was established in 1972. To develop the dairy industry on the commercial lines, the Dairy Development Department was set up in 1974 and licensed one chilling centre at Bahadurgarh. The Haryana Dairy Development Cooperative Federation Limited established its 'Milk Assembling Centre' at Jatusana and Milk Assembling Centre at Jhajjar in 1978 for collecting the milk procured from the societies organized in these areas. Milk Chilling Centre, Matanhail was set up by the Union on August 14th, 2000 after the formation of Jhajjar as district in 1997. Milk Plant, Rohtak is on lease with Rohtak Cooperative Milk Producers Union Limited, Rohtak. Milk is procured from six districts including Jhajjar district. The milk procured by the Cooperative Societies in both the shifts, i.e. morning and evening, is lifted by the vehicles engaged by the Milk Chilling Centre, Matanhail on the given time and after chilling, the same is transferred to Milk Plant, Rohtak for the manufacturing of products and for transfer to National Grid as per annual agreement. The details of milk collection at Milk Chilling Centre, Jhajjar from 2011-12 to 2017-18 is given as below:-

Year	Annual milk collection in lakh litres	Average milk collection in litres per day
2011-12	50.38	13,803
2012-13	55.71	15,263
2013-14	49.29	13,504
2014-15	44.54	12,203
2015-16	59.65	16,345
2016-17	52.52	14,392
2017-18	53.78	14,735

The milk collection in 2002-03 was 34.58 lakh litres with an average milk collection of 9,474 litres per day, and it touched the highest figure of 59.65 lakh litres in 2015-16 with an average milk collection of 16,345 litres per day. The milk collection was 53.78 lakh litres in 2017-18. The Department has also established training centres at Sub-divisional level in the

district to impart 21 days dairy training to unemployed educated youth under Self-employment Scheme to create awareness about scientific methods and techniques/ management in the field. Beneficiaries are imparted training free of cost about modern dairy technology, feeding and breeding of milch animals, and production of clean wholesome milk. Under this scheme 3,832 persons were trained in the district from 2005-06 to 2017-18.

The price of a cross bred cow in 2017-18 was approximately ₹55,000, and the sale price of milk remained between ₹36-52 for cow milk and ₹40-56 for buffalo milk. The estimated average milk yield per day per animal of cows, buffaloes and goats from 2015-16 to 2017-18 is as follows:-

(Milk in Kilograms)

Year	Cows		Buffaloes	Goats
	Cross-Bred	Indigenous		
2015-16	8.87	5.31	7.99	0.97
2016-17	9.12	5.81	8.19	0.99
2017-18	9.45	6.21	8.29	1.03

Mini Dairy Scheme.— Mini Dairy Scheme was launched in the district in May 2013. The main objectives of this scheme are as under:-

- i) To provide self employment to unemployed rural youths.
- ii) To enhance the production of milk, and to meet the increasing demand of milk plants of the State in particular, and of consumers in general.
- iii) To supplement the income of the families of the young entrepreneurs.
- iv) To raise the socio economic status of the weaker section of the society.

Under this scheme, rural unemployed young men and women are assisted in securing loan through various nationalized banks. The department provides insurance margin money and attractive subsidy to the loanee. In 2014-15, the subsidy amounting to ₹16.00 lakh was granted to 100 persons. The scheme gained popularity in the district and in 2017-18, subsidy amounting to

₹51.96 lakh was availed by 114 beneficiaries.

Scheduled Caste Special Programmes Scheme

The Scheme for providing employment opportunities to Scheduled Castes (SCSP) for dairy development was launched in district in 2008-09. Sheep, buffaloes, goats, pigs, etc., are reared by Scheduled Caste, and for this purpose subsidy at prescribed rates is made available to the loanee under this scheme. After showing an enthusiastic figure of 111 beneficiaries availing subsidy of ₹22 lakh in 2009-10, the scheme witnessed consistent low figures for five consecutive years. It exhibited encouraging momentum from 2015-16 onwards. The beneficiaries and amounts disbursed under this scheme from 2011-12 to 2017-18 is given below:-

(₹ in lakh)		
Year	Number of Beneficiaries	Amount
2011-12	20	8.00
2012-13	19	5.00
2013-14	22	10.62
2014-15	25	12.25
2015-16	116	50.00
2016-17	140	63.49
2017-18	114	51.96

Livestock Insurance Scheme.— The scheme was approved by the Government of India as a pilot project in the district, along with 100 other districts in the country. It covers milch cows and buffaloes, calves, heifers, stud bulls, bullocks, and castrated male buffaloes. Fifty percent premium is borne by the Government of India (GoI), whereas the remaining is shared in equal proportion by the State Government and the beneficiary. Incentives for health care certificate and Post Mortem certificate are also provided to veterinary surgeon under the scheme. Insurance of the animals of livestock units established under the above Scheme for Providing Employment Opportunities to Scheduled Castes is provided free of cost under this scheme. The Haryana Land Development Bank is the implementing agency, and progress of the scheme in

the district from 2011-12 to 2016-17 is shown in the table below:

Year	Number of animals insured		
	under GoI Scheme	under SCSP Scheme	Total
2011-12	1,049	357	1,406
2012-13	6,950	3,050	10,000
2013-14	3,185	2,635	5,820
2014-15	2,015	1,711	3,726
2015-16	566	998	1,564
2016-17	1,626	270	1,896

Besides above, Mukhyamantri Gramin Dudharu Pashudhan Suraksha Yojna was also implemented in January, 2014 as an economic security measure to the farmers rearing milch animals and goats. Eligibility conditions were laid down for different animals for registration. Registration fee was charged at ₹100 per milch animal and ₹25 per goat under the scheme for payment in case of mortality. The farmers were not required to pay any insurance premium and all the eligible animals were treated as insured by the State Government free of cost. Under the scheme, 18,474 buffaloes, 2,579 cows and 626 goats were registered before it was discontinued on 31st March, 2015.

Integrated Murrah Development Scheme.— The steps have been taken to conserve, propagate and develop the world famous *murrah* breed. Under the scheme, the owners of recorded high milk yielding *murrah* buffaloes are awarded cash incentive ranging from ₹5,000 to ₹25,000 depending on the peak milk yield. Year-wise detail of the *murrah* buffaloes identified in the district under this scheme is shown in table below:-

Range of Milk yield in kilograms	(Buffaloes in number)						
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
13 to less than 17	1,258	774	897	681	322	--	--
17 to less than 20	640	479	462	379	155	73	75
20 to less than 25	148	99	77	75	24	16	26
25 & above	-	-	2	2	1	2	1
Total	2,046	1,352	1,438	1,137	502	91	102

FISHERIES

The fishing sector has been recognised as a powerful income generating and employment providing sector in the district as it stimulates growth of a number of subsidiary industries and is a source of low cost animal protein to the people particularly to the economically weaker sections of the society and thereby it leads towards an advantageous position to ensure national food security. It is a major source of foreign exchange.

Canals and drains situated in the district provide habitat for fish propagation. Besides these water resources, there are other natural water resources which are as follows:-

- i. Lakes/Large Ponds in Bhindawas, Khaprawas Surah, Sarai Aurangabad, Lowa Kalan, Kaloi, Durina, Jahangipur, Yaqubpur, Munirpur, Pehlpa, Zahadpur, Chadwana, Ukhal Channa, Bilochpura, Khetawas.
- ii. Almost every village has one or more ponds used for providing water for cattle, and have been leased out for fish culture.

A 'Fish Seed Farm', with a land area of 4.12 hectares and water area of 2.23 hectares has been functioning in Jhajjar since 1980-81. Fisheries Department and other agencies produced fish seed of 22 lakh Major Carp and 7.6 lakh Common Carp which led to production of 1,764 tonnes of marketing fish that fetched an income of ₹35.2 lakh in 1997-98. For generating employment, the department brought 456 hectares of area stocked in the district in 1999-2000 under fisheries. Fish seeds of 58.2 lakh Major Carp and 41.5 lakh Common Carp varieties were produced and business worth ₹ 78.60 lakh was earned during 2017-18.

The fish farming in the district is mostly done in village/panchayat ponds on lease. The Cattle visiting village ponds add fertilization in the shape of cow dung to the pond resulting in the production of natural food for fish. In 2017-18, the notified waters of the district fetched ₹ 15.17 lakh in auction. The following table shows the area and number of ponds under fish

culture, and fish production in the district from 2011-12 to 2017-18:-

Year	Area under fish culture (in hectares)	Number of Ponds	Fish seed production (in lakh)	Fish Production (metric tonnes)
2011-12	1,112	434	254	5,983
2012-13	1,096	430	309	7,103
2013-14	1,078	463	333	7,434
2014-15	1,186	475	251	8,415
2015-16	1,091	481	370	7,942
2016-17	1,117	497	525	9,214
2017-18	1,007	497	99.7	11,229

FISH FARMERS DEVELOPMENT AGENCY

Fish Farmers Development Agency has been established to create a class of fish farmers by providing technical and financial assistance to them. The important varieties of food fish available in the district are as under:-

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 calbasu* (Kalbans):** It is relatively slow growing and attains a size of about three feet (0.9 meter).

***Catla-catla* (Thaila) :** It is surface feeder and the fastest growing carp fish. It is quite popular when not grows more than two feet size (0.6 meter). Some large specimens reach up to six feet.

***Cirrhinus mrigala* (Mori):** It is a bottom feeder and grows to three feet (0.9 meter) or more.

2. MINOR CARPS

***Labeo bata* (Bata):** It attains two feet (0.6 meter) in length.

***Pangasius pangasius* (Pangus):** It attains four feet (1.2 meter) length and is a fowl feeder.

***Bagarius bagarius* (Goonch):** It grows up to six feet (1.8 meter) in size.

***Chella baccila* (Chilwa):** It attains at least seven inches (0.2 meter) length. It is used as live bait for fishing with rod and line.

3. EXOTIC CARPS

***Cyprinus carpio* (Common Carp):** It has 3 varieties, which are Scaly Carp, Mirror Carp and Leather Carp all are pond breeder and largest cultivable and domesticated fish, which show excellent growth. It is also bottom feeder and omnivorous. The common carps on average grows to 80 cm, and 14 kg by weight.

***Ctenopharyngodon idellus* (Grass Carp):** Its growth varies in different environments. Generally it grows up to 2200 mm and 45 kg by weight.

***Hypophthalmichthys molitrix* (Silver Carp):** It grows up to 600 mm and 3 kg by weight.

4. CAT FISH

***Wallage attu* (Malli):** It is very common in drains and canals. It is a predacious and piscivorous fish and grows to a size of about six feet.

***Mystus seenghala* (Seenghala) :** It is also a piscivorous fish and attains a length of four feet (1.2 meter).

5. SPINY EELS OF FAMILY MASTACEMBELIDAE

***Mastacembelus pancalus* (Groj):** It prefers pond or places of water abound in mud. It is an excellent food.

SHRIMP CULTURE

Whiteleg Shrimp Culture.— Fisheries Department conducted a successful trial in the 2014-15 on 4 hectare saline affected area of the Jhajjar district for introduction of ‘Whiteleg Shrimp (*Litopenaeus vannamei*) Culture’ under the ‘Rashtriya Krishi Vikas Yojana’. The department provided 50 percent subsidy to shrimp farmers on capital cost and working capital and distributed ₹232.24 lakh subsidy in 2017-18.

AREA UNDER FOREST

At the creation of the district in 1997-98, the total area under forest was 3812.38 hectares which increased to 3991.78 hectares through two decades. The forests in this district are situated on both sides of the roads, canals, distributaries, bunds and railway lines. These are called strip forests. Reserve forest is one where species are protected in their natural habitat. No human

interference or activity is allowed. There is no reserved forest under the control of this division. Forest department is designated as an agency for maintenance, protection, and development of the forests. There is no natural forest in the district under the control of forest department. Other forms of forests are those, which are under the control of Panchayat. In past, a lot of panchayat lands were taken up by the forest department for undertaking plantations under social forestry schemes and extensive afforestation was done. Green areas supply a variety of raw materials to varied industries. They have great bearing on ground water recharge, soil erosion, floods and environment. Forests are classified under ‘Reserved Forests’, ‘Strip Forests’, ‘Un-classed Forests’, closed under section 38 of IFA (Indian Forest Act) and Areas closed under sections 4 and 5 of Punjab Land Preservation Act, 1900. Area under forest of Jhajjar district for the year 1997-98 and 2017-18 is given below:-

(Area in Hectares)		
Classification of Forests	1997-98	2017-18
State		
1. Reserved Forest	--	--
2. Protected Forest		
• Compact Area Block	491.00	491.00
• Strips		
i. Road	1294.16	1294.16
ii. Railway Line	146.57	146.57
iii. Bund	42.42	42.42
iv. Canal	1762.19	1762.19
Unclassed	76.04	45.04
Under section 4&5 (PLPA Act, 1900)	--	210.40
Total	3812.38	3991.78

Jhajjar Division of Forests came into existence in 2004. For better administrative purposes, the entire forest division is divided into three ranges namely, Jhajjar, Bahadurgarh and Matanhail. Ranges are further divided into ten blocks and 29 beats. The forest area in the district is managed by the territorial staff of this division. The farm forestry component has raised ‘Trees Outside Forests (TOFs)’ in a good number which are a kind of private forest.

The trees of various varieties are found along the roadsides and banks of old canals which include *Shisham*, *Siris*, *Mulberry*, *Mango*, *Kikar*, *Peepal*, *Lasura*, *Gular*, *Eucalyptus*, etc. Small trees like *Kair/Beri*, etc., also grow in abundantly in unweeded fields and provide valuable fodder. In 2017-18, the district forest had a wealth of over two lakh different trees and an income of ₹40.68 lakh was accrued from forest produce in the form of dead/dry tree removal from the forest.

IRRIGATION

The economy of Jhajjar district is largely based upon agriculture. The agriculture land of the district is irrigated by Western Yamuna Canal through 53 distributaries and minors constructed in a length of 479.62 kilometers to irrigate 90,879 hectares of agriculture land. This canal network supplies drinking water to 66 villages of the district in addition to irrigation of agricultural land and raw water to Thermal Power Plant at Jharli. As the ground water in larger area is brackish, agriculture is mainly dependent on canal supplies. The agricultural land on higher terrain of the district is supplied with irrigation water by lift through 5 pump houses on distributaries and 2 pump houses on Jawahar Lal Nehru Canal. The net area irrigated by different means from 2011-12 to 2017-18 is given as under:-

(Area in thousand hectares)				
Year	Canals	Tubewells	Total	Percentage of net area irrigated to net area sown
2011-12	40	57	98	73.1
2012-13	77	48	125	88.7
2013-14	52	76	128	92.7
2014-15	49	83	132	93.6
2015-16	50	82	132	95.0
2016-17	50	88	138	91.5
2017-18	50	84	134	92.1

In 2011-12, the net area irrigated by canals and tubewells was 98,000 hectares, which rose to 1,34,000 hectares in 2017-18, leading to

an increase in percentage of net irrigated area to net area sown from 73.1 to 92.1 during the same period. The crop wise gross area irrigated in the district from 2012-13 to 2017-18 was as follows:-

Crop	(Area in thousand hectares)					
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18*
Rice	23	31	35	36	36	40
Jowar	11	12	9	9	9	8
<i>Bajra</i>	16	18	20	23	14	31
Wheat	96	97	113	110	93	106
Barley	6	5	3	2	2	1
Total Pulses	3	2	2	1	@	6
Other food crops	1	1	1	3	2	2
Sugarcane	3	3	3	3	3	3
Cotton	2	2	5	6	6	7
Non food crops	29	31	21	25	22	27

@-<500 hectares, * tentative figures; source- Director Land Records, Haryana

CANALS

Canals are the most popular and important source of irrigation due to easy supply and regular flow of water to the agriculture fields in the district. This canal network supplies drinking water to 74 water works tanks of the district. The Canal irrigation in the district is mainly provided by two canal systems- the Jawahar Lal Nehru Feeder and Jhajjar Sub Branch.

Jawahar Lal Nehru Feeder.— This feeder canal takes off from Khubru Head Works in Sonapat district and passes through Rohtak district for the irrigation facilities to Jhajjar district. All the channels in this system are fed by lift. There are 45 off take channels on this system to cater to the demand of the district. Some of the area adjoining to JLN Feeder has become water logged in nearly 20 villages for which 200 shallow tube wells were sanctioned for installation along JLN Feeder costing ₹ 1,079 lakh under Rashtriya Krishi Vikas Yojna.

Jhajjar Sub Branch (JSB).— This branch off takes from tail of Bhaulat Sub Branch and mainly irrigates the area of the district. It used to feed the Akehri

Madan Pur Pump House and further Ladain pump house from where Salhawas Lift Channel system was fed. It now stands curtailed at RD 62107. After curtailment of JSB and construction of Jawahar Lal Nehru Canal, Salhawas Lift Channel (SLC) system has been connected to Jawahar Lal Nehru Feeder. Jhajjar Distributary (RD 0-73893) off takes from the curtailed Jhajjar Sub Branch at RD 62107. Ten channels off take from this system to supply drinking and irrigation water to the district.

During 2004-05 to 2017-18, an amount of ₹55,009 lakh was spent on development as well as maintenance works of irrigation canal and drainage network. An over 65 kilometre long National Capital Region (NCR) Water Supply Channel has been constructed to supply water to the fast growing NCR region and other proposed townships of Haryana State Industrial and Infrastructure Development Corporation (HSIIDC), and Special Economic Zones (SEZ).

In 2006-07, the net irrigated area was 1,14,000 hectares in the district which enhanced to 1,38,000 hectares in 2016-17 and the gross irrigated area was 1,94,000 hectares in 2006-07 that decreased to 1,87,000 hectares in 2016-17. Percentage of gross irrigated area to total cropped area in the district increased from 81.2 percent in 2006-07 to 91.2 percent in 2016-17.

TUBEWELLS

The ground water is saline at the shallow as well as at depths in the whole district. But due to the less salinity only shallow ground water is used for irrigation purposes. Tube wells and pumping sets were introduced after independence. The pumping sets initially replaced the old traditional method of raising water manually from wells. With the electrification of villages, electricity operated tube-wells being economical gained popularity. Some area adjoining JLN Feeder in villages Beri, Bakra, Dubaldhan, Palra, Bumbulia, Akheri Madanpur, Birar, Bhurawas, Mundsa, Matanhail, Ladain, Godhri, Achhej, Paharipur and Dharana became water logged for which shallow tube wells have been installed. Tube wells and pumping sets reduce the water logging and check the rise in the water-table in the district. In 1998-99,

irrigated area was 68.5 percent of net area sown. 71,000 hectares of area was irrigated through canals, and 40,000 hectares through tube-wells. In 2017-18, the net area under irrigation was 92.1 percent of net area sown. An area of 50,000 hectares was under irrigation through canals and 84,000 hectares was irrigated through tube wells.

There were 30,737 diesel pumping sets and 4,503 electric pumping sets in the district in 2000-01 which tapped deeper layers of underground sweet water found in sandy patches and near irrigation channels. After a decade i.e. 2010-11, there were 22,288 diesel pumping sets and 7,024 electric sets. The year wise data of tube-wells with diesel and electric pumping sets from 2010-11 to 2017-18 is given below:-

Year	Diesel sets	Electric sets	Total Tubewells
2010-11	22,288	7,024	29,312
2011-12	21,700	7,308	29,008
2012-13	21,218	7,593	28,811
2013-14	20,794	8,600	29,394
2014-15	31,791	9,019	40,810
2015-16	31,792	11,085	42,877
2016-17	31,790	9,514	41,304
2017-18	33,924	6,900	40,824

In 2010-11, there were 29,312 tube-wells as compared to 40,824 tube-wells in 2017-18 in the district. The figures show that over the years, there was an increase in the tendency of irrigation through tube-wells resulting in the increased use of ground water for irrigation in the district.

NATURAL CALAMITIES

Environmental events, such as floods, an earthquakes, hurricanes, tornadoes, landslides, a volcanic eruptions, wildfires, droughts and famines, and many other natural events occurring in a particular area, when they become traumatic for the inhabitants and dangerous for their property, are often called to as natural calamities or natural disasters. In the past these were also referred to as ‘Acts of God’ being beyond the human control.

Topographically, from drainage angle Jhajjar district falls in the area of Yamuna Sub Basin which drains into river Yamuna. *Sahibi nadi* flowing in Rajasthan also used to flood a considerable area of the district during rainy season. From Seism-tectonic angle the district falls in high damage risk zone-IV. As such, the district is vulnerable to natural phenomena like flood and earthquake. In the past, it had also witnessed lack of rainfall for continuously long periods that had led to droughts and famines.

Floods.— The terrain of the district is such that there are various depressions due to which the area has always been prone to floods. In the eastern part of the district, the area is considerably even. Some area is uneven and also suffers from inundation and water logging during monsoon season. Almost the entire district, except small areas in the south western part near Sasrol, Salhawas and central part around the district, is prone to floods due to poor surface drainage and existence of geomorphic depressions located south of Jhajjar around Kaliawas, Matanhail, Dadri Toe and Badli areas. The major floods occurred in 1977, 1995, and 2010. The topography of the district is like a bowl having the lowest area of Natural Surface Level (NSL) around 700 feet above mean sea level. So the district continuously remained flood prone. Previously floods occurred due to *Sahibi Nadi*. But due to construction of various check dams like bunds in Rajasthan territory in the catchment area of river Sahibi, occurrence of floods has reduced considerably. The problem arises only when there is heavy downpour in low lying pockets and in such situation dewatering is resorted to. No flood from this side has been reported during past two decades.

In 1977, there was heavy flood as the flood water reached the district from Rajasthan through *Sahibi Nadi*. One lakh cusecs of water discharged from *Sahibi* reached and submerged the whole area of Jhajjar tehsil up to Dhansa Regulator. Depth of water was 8 to 10 feet along the left bank of outfall drain No. 8. West side of Jhajjar town was also submerged under 5 to 8 feet of flood water. This flood badly affected 79 villages and 19,878 hectares of area was submerged.

In 1995, heavy rainfall in the region resulted in a disastrous flood in the district which affected its major area. The adjoining districts too were flooded. Flood water from Rohtak side also reached the district through drain No. 8 and touched the top level of the bank. Beri tehsil was worst affected and all cultivated area got submerged under flood water. Depth of flood water was from 6 to 8 feet along and in the outfall drain No. 8 and in Bhindawas link drain. An area of 19,312 hectares was submerged under flood water and 48 villages were affected.

In 2010, due to occurrence of incessant heavy rain, area of Jhajjar town on north and west side was again submerged under flood water up to Kheri Khatiwas and Dhor villages. Beri and Jhajjar tehsils were severely affected by flood water. Depth of water was from 3 to 4 feet along the Jhajjar town bund. An area of 9,109 hectares was submerged under flood water in the district.

Prevention of Floods.— Generally, the District Flood Control Committee constituted under the Chairmanship of Deputy Commissioner inspects all flood affected areas after the flood season, and schemes are prepared, on the basis of experience of floods, for short term and long term measures. Technical Appraisal Committees, consisting of Superintending Engineers of Irrigation Department, Public Health Department, Building and Road and Police Department, scrutinize the schemes and measures proposed by Flood Control Committees. After comprehensive technical inspection, viable schemes are recommended for consideration and approval of Flood Control Board, Haryana. The priority schemes are taken up for implementation in proportion of availability of funds after approval. The priorities of the schemes are fixed by the Deputy Commissioner for short term and long term measures. Weeding operations are conducted on all big and small drains before onset of monsoon every year. The Deputy Commissioner and the officers of Irrigation Department concede the comprehensive inspection of all the drains and bunds. After heavy flood of 1977, schemes for bringing bed to design section and increasing capacity of drain No. 8, Bhindawas link drain and outfall drain No. 8 were approved in the State Flood Control Board. Village ring bunds were

also constructed around the flood affected villages and later on these village ring bunds were transferred to Panchayat Department. In 2005, Beri-Dujana-Dhor link drain was approved by the Flood Control Board Meeting and the work was carried from 2007 to 2009.

The agricultural area of the district is well supported by drainage network comprising of 42 drains constructed in length of 230.27 kilometres to drain out the excess water from fields during rainy season. Due to past experiences, various drains and pump houses were constructed for dewatering of flood water. The drain No. 8, Bhindawas link drain and outfall drain No. 8 are the major drains, which cater to the flood water from the district. Various subsidiary drains have been constructed with passage of time, which outfall into the drain No. 8 and out fall drain No. 8. Flood water is disposed through all the subsidiary drains by means of pumps into the drain No. 8 and Out fall drain No. 8. The drain No. 8 and out fall drain No. 8 carry out extra discharge for JLN Feeder at RD 235000, through escape gate and escape channel at RD 311000 JLN Feeder through Bhindawas Lake. Maximum drains depend on VT Pumps through which pumping is carried out to dispose flood water into drain No. 8. During floods, height flood level (HFL) of the drain No. 8 and outfall drain No. 8 is always above the FSL of out falling drains, so pumps are to be deployed for disposing off flood water. Earlier, there were very few permanent pump houses and provision of inlet gates on connecting inlets, etc., but in March 2018, there were 23 pump houses which were constructed to dewater the area from flood.

The drain No. 8 and outfall drain No. 8 passes through the district and is linked with Bhindawas lake through Bhindawas Link Drain and flood water is carried up to Najafgarh Nullah, which links into Najafgarh Lake near Dhansa regulator through outfall drain No. 8. The design capacity of outfall drain No. 8 is 4,000 cusec. The Bhindawas link drain is connected to drain No. 8 and further connected to outfall drain No. 8. It is the main drain passing through the district, carries flood water. During floods in 2010, both the above drains did not run smoothly due to heavy growth of weeds, *Jal Khumbi* and bed had also been silted up.

Drought and Famines — The vulnerability of any area to drought depends on the extent to which physical and climatic conditions play an adverse role in creating an unstable agriculture. The Irrigation Commission set up by Independent India in paragraph 8.14 of its report submitted in 1972 defined drought areas as those where annual rain fall is less than 75 percent of the normal in 20 percent of the years examined. Southern area of the district up to 1960's was prone to drought, but due to construction of canals, the drought and famine conditions are not prevalent for the past few decades. However, high water depletion in many parts of the district sometimes make such areas prone to droughts, and moderate to severe drought conditions occurred even during 1986, 1987, 1989, 1999, 2002 and 2006.

With insufficient means of irrigation and notoriously precarious rainfall in the past, it was natural that it should be frequently visited by famines. Each of these was given a specific name based on the year of the occurrence and is like an epoch in the history of the countryside. List of major famines (*kal or akal*) occurred in district Jhajjar is given in Table XIII of Appendix.

The district formed part of the region that was liable to frequent droughts. Before the adoption of systematic relief measures, famine resulted in deserted sites. With the spread of irrigation, the increase in the means of communication and famine relief measures, such disasters from food-grain famines ceased to recur. The rainfall is seasonal and subject to variations. Such type of rainfall makes it necessary to have artificial irrigation. However, farmers use sprinkler irrigation, drip and underground pipeline schemes for irrigation. Resultantly, the irrigated area in the district has developed into an area producing not only commercial crops but also fodder crops.

DISASTER MANAGEMENT

Disaster means a catastrophe, mishap, calamity, or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence resulting in substantial human suffering or loss of life, and damage

of property or environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected areas.

Jhajjar district is prone to many hazards like earthquake, industrial or chemical accidents, fires, rail and road accidents, floods, droughts, extreme temperature, lightening, hail storm and cloud bursts, etc. In the event of such happenings, Government agencies in the district have been equipped to play the required critical role in the Disaster Management and a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary and expedient for-

- prevention of danger or threat of any disaster;
- mitigation or reduction of risk of any disaster or its severity or consequences;
- preparedness to deal with any disaster;
- prompt response to any threatening disaster situation or disaster;
- assessing the severity or magnitude of effects of any disaster;
- evacuation, rescue and relief;
- rehabilitation and reconstruction.

The Disaster Management Act was enacted in 2005 by the Government of India, which provides for effective management of disaster at all levels like National, State or District. All the State Governments are mandated under the provisions of the Act to establish the State Disaster Management Authority (SDMA); the State Executive Committee (SEC) District Disaster Management Authorities (DDMA). To cope up with the high magnitude disaster, the National Disaster Relief Force (NDRF) has also been established by the Central Government. The quick response teams of NDRF conduct the relief and rescue operations in coordination with the State Authorities as and when required.

The District Disaster Management Authority, Jhajjar, acts under the aegis of the Haryana State Disaster Management Authority (HSDMA) which is the apex body for disaster management at the State level. The DDMA,

Jhajjar headed by the Deputy Commissioner as its ex-officio Chairman plans, coordinates and implements all measures for the purposes of Disaster Management in accordance with the guidelines laid down by NDMA and HSDMA. It gives directions to departments at district level and local authorities to take measures for prevention or mitigation of disasters and also monitors that they implement disaster management plans at their respective level¹. District Crisis Group is the apex body in the district to deal with major chemical and industrial accidents and to provide expert guidance for appropriately handling them. It prepares the District Offsite Emergency Plans arranged by various respective Major Accident Hazard (MAH) installations. The centre for Disaster Management, HIPA works for capacity building measures besides undertaking, promoting and coordinating research, and analytical studies on its own and in collaboration with other Government and Non-Government Organisations (NGOs).

Jhajjar district due to its natural saucer type physiographic shape, poor natural drainage system, and its position in Seismic Zone-IV: High Damage Risk Zone (MSK-VIII) is prone to natural calamities. Since the formation of Jhajjar as a separate district, no major calamity has occurred. Agriculture, however, is affected adversely by vagaries of nature cyclically after every four to five years in the district due to scarcity of rain, flooding, hailstorms, etc. Compensation as per the set principle-based norms is accessed, and paid in order to help the farmers and people in distress owing to various kinds of disasters. In the district, major relief distributions were witnessed in 2010-11, 2013-14 and 2015-16 which amounted to ₹68.64 crore, ₹27.34 crore, and ₹45.42 crore, respectively.

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1 District Disaster Management Plan Jhajjar, 2015, p. 20