A CASE STUDY

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Present scenario of polyhouse farming in Haryana

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ABSTRACT : Agriculture has played and will continue to play a dominant role in the growth of Indian economy in the foreseeable future. It represents the largest sector producing around 28 per cent of the GDP, is the largest employer providing more than 60 per cent of the jobs and is the prime arbiter of living standards for seventy per cent of India's population living in the rural areas. In some of the temperate regions where the climatic conditions are extremely adverse and no crops can be grown, man has developed methods of growing some high value crop continuously by providing protection from the excessive cold, which is called as polyhouse technology. With the polyhouse technology, farmers can grow almost any fruits, ornamentals and vegetables in any season. This technology has made possible to have all vegetables throughout the year. According to study, in Haryana state 620 different types of polyhouses were found including 7-Hi-Tech, 50-WIT, 106-AINSH and 457-NVPH. The total number of polyhouses in Haryana are 614 with covered area of 17,57,920 m^2. In Haryana, 1,956 people were found to be engaged in polyhouse farming.

KEY **W**ORDS : Polyhouse, Hi-tech

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Indian agriculture has come a long way from being an era of frequent droughts and vulnerability to food shortages to becoming a significant exporter of agricultural commodities. This has been possible due to persistent efforts at harnessing the potential of land and water resources for agricultural purposes (IARI, 2011). Indian agriculture, which grew at the rate of about 1 per cent per annum preceding fifty years pre independence, has grown at the rate of about 3 per cent per annum in the post independence era. The diversity of physiographic, climatic and soil characteristics enables India to grow a large variety of horticultural crops – fruits, vegetables, flowers, spices, aromatic and medicinal plants, plantation crops etc (CMIE, 2007). Haryana, with just 1.4 per cent (4.4 M ha) of the total geographical area of the country, is the second largest contributor of food grains (17.6% in 2011-12) to the national food basket. During the era of 'green revolution', agro-technological packages generated by the scientists and practiced by hard working farmers increased the food grain production from just 2.6 million tonnes in 1966-67 to 16.6 million tonnes in 2011-12 (Gupta, 2012). Increase in population and its demand of agriculture products are changing patterns of land use making potentially unsustainable demands on the country's natural resources.

During 21st century, agriculture has many challenges around the world. The foremost challenge is to increase the food grain production per area and tackle climate change. Climate change is adversely affecting the food grain production and water resources. India is a home to 17 per cent of the world's population but has only 4 per cent of water. Per capita land availability and size of

holdings are continuously decreasing with increasing population, urbanization and industrialization (Singh *et al.*, 2007). The changing climatic condition has brought very unpredictable rainfall patterns and has frustrated many farmers. Due to increasing population, reducing cultivable land and scarcity of water for irrigation, efforts are required on war footing to save each single drop of water and increase production with conservation of land and water.

Polyhouse farming is an alternative new technique in agriculture, gaining foothold in rural India. It reduces dependency on rainfall and makes the optimum use of land and water resources. Polyhouses are structures utilized as microclimate environment to make the plants grow well in unfavorable climatic conditions. They are extremely useful when plants, in particular period of the year, cannot be grown in open country or in areas where the climate never guarantees a good quality crop (Gusman *et al.*, 2008). Polyhouses are essentially microcosms aimed at providing physical environments suitable for the survival and growth of plants. Polyhouse cultivation has been evolved to create favourable micro-climates, which favors the crop production and are possible all through the year or part of the year as required. The primary environmental parameter traditionally controlled is temperature, usually providing heat to overcome extreme cold conditions. High temperature (upto 40^0C) and humidity (70-80%) exhibit a significant influence on the rate of photosynthesis. Generally, the higher the temperature and humidity, assuming CO_2 and light are abundant, the faster the photosynthesis takes place. By warming the air immediately around crops, polyhouses effectively extend the growing season and allow the cultivation of crops from lower latitudes (Patel and Rajput, 2010).

RESEARCH PROCEDURE

Field survey to study the existing conditions of polyhouses :

Locale of the study :

The present study was conducted in 21 districts of Haryana state. The information regarding number, area and type of polyhouses and subsidy provided by Govt. of India and Haryana on polyhouse farming which were installed under National Horticulture Mission was collected from respective district Horticulture Offices of Haryana state.

Sampling procedure :

The yearly growth and progress of polyhouses in each district was measured. Polyhouses were categorized according to technology used in polyhouse. Four different types of polyhouses were studied during work *viz.*, Hi-technology polyhouse (Hi-tech), Anti-Insect Net Shade House (AINSH), Naturally Ventilated Polyhouse (NVPH) and Walk-In-Tunnel (WIT).

Variables and their measurements :

A well structured interview schedule was developed containing information about number, type, area of polyhouse and total cost of installation with provision of subsidy. The yearly growth and progress of polyhouses in each district was measured. Polyhouses were reviewed for their type, sizes, structured materials and plants grown (vegetables, flowers and fruits) and financial assistance provided by Central and State Govt. with workers involved in polyhouse farming.

Tools and techniques of data collection :

Researcher visited different district Horticulture Offices of Haryana state to collect details of polyhouses including their number of polyhouses, area under polyhouses, subsidy provided by central and state Govt. with total cost of installation and involved manpower in polyhouse farming. The data were collected form respective district through personnel interview and electronic communication.

Analysis of data :

The area, subsidy and number of polyhouse were simply calculated and tabulated by sum of total. To calculate area under polyhouses in different years following formula was used:

$$\frac{\text{Area under polyhouses farming (m}^2\text{)}}{\text{Area under agriculture land (m}^2\text{)}} \times 100$$

The increasing and decreasing level of number and area under polyhouse farming was calculated by:

$$\frac{\text{Area under polyhouses farming in m}^2\text{ (at present)} - \text{Area under polyhouses farming in m}^2\text{ (previous year)}}{\text{Land under polyhouses (previous year)}} \times 100$$

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Different type of polyhouses in Haryana state :

The results in Table 1 illustrate district wise different types of polyhouses in Haryana state. Table elucidates that in Haryana only 7 Hi-tech polyhouses were installed including 4 in Karnal, 2 in Hisar and 1 in Ambala. Although WIT polyhouses were found comparatively lesser in number to NVPH and AINSH polyhouses. WIT polyhouses were found in 11 districts *viz.*, Karnal (19), Hisar (13), Panipat (6), Sonepat (3), Kaithal (2), Yamunanagar (2), Bhiwani (1), Jhajjar (1), Kurukshetra (1), Mahendergarh (1) and Panchkula (1). A total number of 614 polyhouses were found in Haryana state including 7-Hi-Tech, 105-AINSH, 452-NVPH and 50-WIT.

Area under different type of polyhouses in Haryana state :

Results in Table 2 depict the area under different polyhouses in Haryana state. The findings in table reflect that maximum area was covered by NVPH polyhouse *i.e.* 13,67,687 m^2 followed by AINSH (2,35,739 m^2) and WIT (1,37,286 m^2). The lowest area (17,208 m^2) was observed in Hi-Tech polyhouse. Data in Table 2 give a clear glance that Hi-Tech polyhouses were found only in 3 districts (Ambala, Hisar and Karnal) with area of 1,800 m^2, 3,592 m^2 and 11,816 m^2, respectively. AINSH polyhouses were found in all districts except Rohtak, Fatehabad and Palwal. On the other hand WIT polyhouses were observed in 11 districts *viz.*, Ambala (1,400 m^2), Bhiwani (42837 m^2), Hisar (21,504 m^2), Jhajjar (5,332 m^2), Karnal (30,600 m^2), Kurukshetra (448 m^2), Mahendergarh (2,880 m^2), Panchkula (495 m^2), Panipat (24000 m^2), Sonepat (3,790 m^2) and Yamunanagar (4,000 m^2). Only NVPH type polyhouses were found in all districts with different coverage area in Haryana state. Overall the total area under polyhouse farming was 17,71,121m^2.

Increase in polyhouses in Haryana state:

Data in and Fig. 1 revealed the year wise increase in polyhouses in different districts. Findings indicate that in 2010-11, the total number of polyhouses were 54 including 20 in Karnal, 9 in Bhiwani, 6 in Sonepat, 5 in Panchkula, 3 in each districts *i.e.* Panipat, Jind and Sirsa, 2 in Yamunanagar, 1 in each district *i.e.* Ambala, Hisar and Mahendergarh. The total number of polyhouses in 2011-12 and 2012-13 were 178 and 382, respectively with increase in number of 204 polyhouses.

Table 1 : Different type of polyhouses in Haryana state

Districts	Polyhouses (number)				
	Hi-tech	AINSH	NVPH	WIT	Total
Ambala	1	10	27	0	38
Bhiwani	-	13	39	1	53
Faridabad	-	1	12	0	13
Fatehabad	-	0	8	0	8
Gurgaon	-	9	7	0	16
Hisar	2	6	49	13	70
Jhajjar	-	2	12	1	15
Jind	-	2	14	0	16
Kaithal	-	3	17	2	22
Karnal	4	10	59	19	92
Kuruksherta	-	7	29	1	37
Mahendergarh	-	2	6	1	9
Mewat	-	2	8	0	10
Palwal	-	0	6	0	6
Panchkula	-	17	31	1	49
Panipat	-	9	24	6	39
Rewari	-	1	5	0	6
Rohtak	-	0	33	0	33
Sirsa	-	3	13	0	16
Sonepat	-	7	32	3	42
Yamunanagar	-	1	21	2	24
Total	7	105	452	50	614

Table 2 : Area under different type of polyhouses in Haryana state

Districts	Area (m^2)				
	Hi-tech	NVPH	WIT	AINSH	Total
Ambala	1800	156608	1400	42207	202015
Bhiwani	-	92279	42837	514	135660
Faridabad	-	37568	-	1008	38576
Fatehabad	-	21562	--	-	21562
Gurgaon	-	37339	-	8000	45339
Hisar	3592	161582	21504	12144	198822
Jhajjar		39172	5332	5088	49492
Jind	-	37389	-	8000	45389
Kaithal	-	16148	-	5312	23410
Karnal	11816	205995	30600	28059	276470
Kuruksherta	-	92572	448	17725	110745
Mahendergarh	-	14318	2880	2590	19788
Mewat	-	24031	-	4064	28096
Palwal	-	16300	-	-	16360
Panchkula	-	67610	495	45067	129832
Panipat	-	74928	24000	29415	128343
Rewari	-	3218	-	500	3218
Rohtak	-	95332	-	-	90612
Sirsa	-	35948	-	3008	38776
Sonepat	-	100188	3790	22038	126016
Yamunanagar	-	37600	4000	1000	42600
Total	17,208	13,67,687	1,37,286	2,35,739	17,71,121

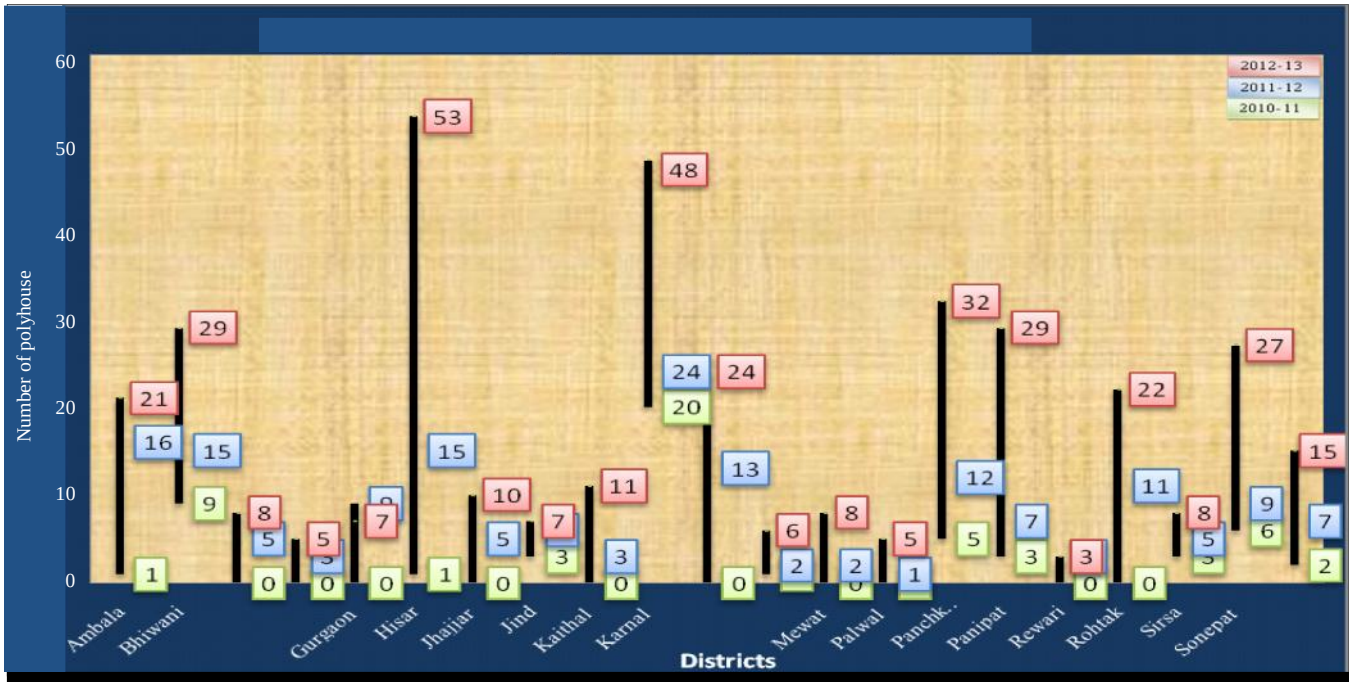

Fig. 1 : Increase in polyhouses in Haryana state (2010-13)

Increase in area under polyhouses in Haryana state:

Results in Fig. 2 demonstrate the year wise increase in area under polyhouses in different districts of Haryana state. The total area under polyhouses in 2010-11 was 1157830 m^2 followed by 499759 m^2 in 2011-12 and 1153525 m^2 in 2012-13. The maximum area under polyhouse farming in 2010-11 was in Karnal district (37,424 m^2) followed by Bhiwani (26,497 m^2) and Sonepat

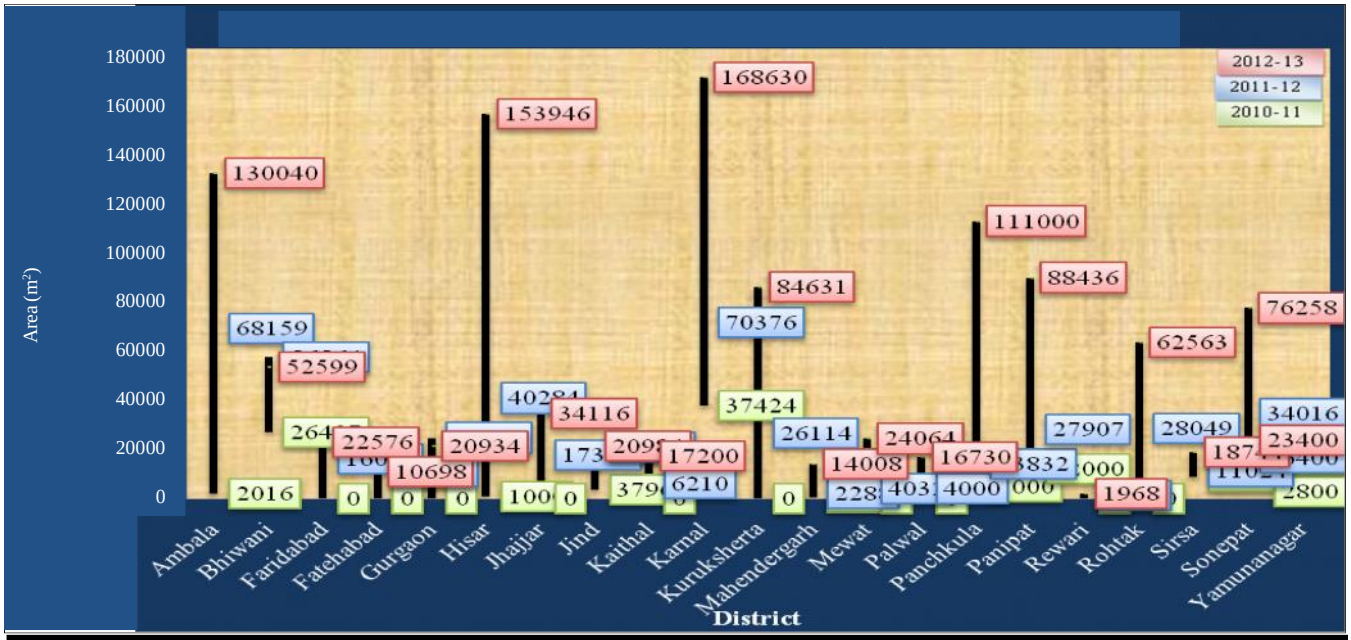

Fig. 2 : Increase in area under polyhouses in Haryana state (2010-13)

Table 3 : Increasing level of number of polyhouses in Haryana state

Districts	Year				
	2010-11	2011-12	Increasing level (%)	2012-13	Increasing level (%)
Ambala	1	16	93.7	21	95.2
Bhiwani	9	15	40.0	29	68.9
Faridabad	-	5	-	8	37.5
Fatehabad	-	3	-	5	40.0
Gurgaon	-	9	-	7	28.6
Hisar	1	16	93.4	53	98.1
Jhajjar	0	5	-	10	50.0
Jind	3	6	50.0	7	57.2
Kaithal	-	7	-	15	53.3
Karnal	20	24	16.7	48	50.0
Kurukshetra	-	13	-	24	45.8
Mahendergarh	1	2	50.0	6	83.3
Mewat	-	2	-	8	75.0
Palwal	-	1	-	5	80.0
Panchkula	5	12	58.3	32	84.4
Panipat	3	7	57.1	29	89.6
Rewari	-	3	-	3	0.0
Rohtak	-	11	-	22	50.0
Sirsa	3	5	40.0	8	62.5
Sonepat	6	9	33.4	27	77.8
Yamunanagar	2	7	71.4	15	86.7
Total	54	178	68.2	382	85.5

(15,742 m^2). In the year 2011-12 and 2012-13, maximum coverage area under different polyhouses was found to be in Karnal district *i.e.*70,376 m^2 and 1,68,630 m^2, respectively.

Increasing level of number of polyhouses in Haryana state :

Table 3 represents the increasing and deceasing level of polyhouses in different districts of Haryana state. Findings illustrate that in the year 2011-12 maximum increase in number of polyhouse was observed in Ambala (93.7%) followed by Hisar (93.4%). More than fifty per cent increase in number of polyhouse was found in Yamunanagar (71.4%), followed by Panchkula (58.3%), Panipat (57.1%) and Jind (50.0%). In 2012-13, maximum increase in polyhouses from year 2010-11 was found in Hisar (98.1%) and Ambala (95.2%). Only in Gurgaon district the number of polyhouses decreased (28.6%) in comparison to 2011-12 to 2012-13. The overall increase in polyhouses from 2010-11 to 2011-12 was 68.2 per cent and 85.5 per cent from year 2010-11 to 2012-13.

Increasing level of area under polyhouses in Haryana state :

Data in Table 4 give a clear picture of increase in area under polyhouses in different districts of Haryana state. From year 2010-11 to 2011-12, the high level of increasing area was observed in Hisar (97.5%) followed by Ambala (97.0%), Yamunanagar (82.9%) Jind (81.6%) and Mahendergarh (78.2%).More than fifty per cent increase in level of area under polyhouses was observed in Panchkula (63.8%), Panipat (57.0%), Sonepat (53.7%) and Bhiwani (53.2%). In case of increasing level of polyhouses form 2010-11 to 2012-13, the high level was obtained in Hisar (99.3%), Ambala (98.5%) Mahendergarh (96.4%) and Panchkula (95.5%). In Gurgaon district, the area under polyhouses decreased (16.6%) from 24,405 m^2 to 20,934 m^2 in the year 2011-12 to 2012-13.

Polyhouses in Haryana state with specification of area, number and workers :

Findings in Table 5 give the overall view of

Table 4 : Increasing level of area under polyhouses in Haryana state

Districts	Area under polyhouses (m^2)				
	2010-11	2011-12	Increasing level (%)	2012-13	Increasing level (%)
Ambala	2016	68959	97.0	130040	98.5
Bhiwani	26497	52599	49.6	56564	53.2
Faridabad	-	16000	-	22576	29.1
Fatehabad	-	10864	-	10698	-1.55
Gurgaon	-	24405	-	20934	-16.6
Hisar	1000	40284	97.5	153946	99.3
Jhajjar	-	17376	-	34116	49.1
Jind	3796	20609	81.6	20984	81.9
Kaithal	-	6210	-	17200	63.9
Karnal	37424	70376	46.8	168630	77.8
Kuruksherta	-	26114	-	84631	69.1
Mahendergarh	500	2288	78.2	14008	96.4
Mewat	-	4032	-	24064	83.2
Palwal	-	4000	-	16730	76.1
Panchkula	5000	13832	63.8	111000	95.5
Panipat	12000	27907	57.0	88436	86.4
Rewari	-	1250	-	1968	36.5
Rohtak	-	28049	-	62563	55.1
Sirsa	9008	11024	18.3	18744	51.9
Sonepat	15742	34016	53.7	76258	79.4
Yamunanagar	2800	16400	82.9	23400	29.9
Total	1,15,783	4,96,594	76.8	11,57,490	90.0

polyhouses in Haryana state showing the area under cultivation in polyhouses and people engaged in polyhouses. The total number of polyhouses in Haryana in all 614 with an area of 17,71,121 m^2. In Haryana, 1,956 people were found to be engaged in polyhouse farming. The maximum number of polyhouses and area was found in Karnal district *i.e.* 92 and 27,647 m^2, respectively with involvement of 290 people. The total cost of installation of all types of polyhouses in Haryana was Rs. 1,19,92,77,596 with provision of subsidy of Rs. 77,95,67,598.

In Haryana state 620 different types of polyhouses were found including 7-Hi-Tech, 50-WIT, 106-AINSH and 457-NVPH. The total area under polyhouse farming was 0.49 per cent of total cultivated area in Haryana state. With the involvement of the government national boards and the respective state agricultural agencies, the area under protected cultivation is expected to rise at about 84.2 per cent between the period 2013 to 2017 (Paroda, 2013). A total of 17,40,712 m^2 area was found under polyhouse farming with maximum area covered by NVPH (13,67,687m^2), followed by AINSH (2,35,739 m^2) and WIT polyhouse (13,7286 m^2). Hi-tech type of polyhouse was found only in three districts *i.e.* Karnal, Hisar and Ambala with an area of 11816m^2, 3592m^2 and 1800m^2, respectively. Maximum number of polyhouses were found in Karnal district (92) followed by Hisar (69). On the other hand, maximum area under polyhouse farming was found in Karnal district (2,76,470m^2) followed by Ambala district (202015m^2) and Hisar (198822m^2). According to Five Year Plan (2012), Andhra Pradesh, Gujarat, Maharashtra, Haryana, Punjab, Tamil Nadu and West Bengal states are consistently expending the area under polyhouse farming. Maharashtra and Gujarat had a area of 5,730.23 hectares and 4,420.72 hectares under protective cultivation, respectively. Regarding year wise detail of polyhouses in Haryana, results depict that in 2010-11, 55 different types of polyhouses (Hi-Tech, AINSH, NVPH and WIT) were present in Haryana, which increased to 173 in 2011-12 and 378 in 2012-13 with increasing level of 68.2 per cent and 85.5 per cent, respectively. High level of increase in

Table 5 : Polyhouses in Haryana state with specification of area, number and workers

Districts	Number of polyhouse	Total area under polyhouses (m^2)	Provision of subsidy (Rs.)	Total cost (Rs.)	Involvement of workers (number)
Ambala	38	2,02,015	1,30,65,280	1,95,62,881	133
Bhiwani	53	1,35,660	3,13,98,875	6,31,01,670	189
Faridabad	13	38,576	3,78,22,818	4,46,71,600	49
Fatehabad	8	21,562	1,03,12,809	1,61,91,544	19
Gurgaon	16	45,339	92,06,254	2,39,79,285	46
Hisar	70	1,98,822	23,92,46,043	36,14,68,971	227
Jhajjar	15	49,492	2,46,98,362	2,94,94,867	53
Jind	16	45,389	58,37,435	1,37,58,720	54
Kaithal	22	23,410	64,60,400	87,02,500	51
Karnal	92	2,76,470	14,73,48,488	19,93,86,647	290
Kuruksherta	37	1,10,745	6,13,90,889	9,57,83,608	121
Mahendergarh	9	19,788	39,74,178	46,54,442	28
Mewat	10	28,096	86,52,200	1,04,61,300	35
Palwal	6	16,360	46,77,000	54,09,800	17
Panchkula	49	1,29,832	4,02,24,398	7,77,04,185	160
Panipat	39	1,28,343	3,28,14,610	5,28,47,960	111
Rewari	6	3,218	10,99,202	27,07,546	21
Rohtak	33	90,612	3,15,71,552	5,83,07,078	99
Sirsa	16	38,776	66,63,736	78,54,061	56
Sonepat	42	1,26,016	5,31,17,169	8,90,15,531	144
Yamunanagar	24	42,600	99,85,900	1,42,13,400	53
Total	614	17,71,121	77,95,67,598	1,19,92,77,596	1,956

number and area of polyhouses were found in Hisar district (98.1% and 99.3%) followed by Ambala district (95.2% and 98.5%). On similar lines results were found under FYP (2012), that area under shade net house increased to 199.07 hectares from year 2007-12 in India. The significant growth of area under plastic tunnel and Hi-Tech polyhouses was observed in the year of 2007-13 *i.e*. 4.3 per cent and 2.2 per cent, respectively. Further area limit in polyhouse cultivation per farmers increased from 1000 m^2 to 4000 m^2 in Tamil Nadu (Madaan, 2011).

Polyhouse farming is an area where Government initiatives have been far more forthcoming though not as complimentary for human resource development but technical support to the farmers adopting polyhouse farming. Govt. of Haryana is providing subsidy on different parameters involved in polyhouse farming like; structure, crop, mulching and irrigation. Findings explain that maximum subsidy provision was for Hi-Tech polyhouses *i.e.* Rs. 1,405/ sqm. In case of NVPH and WIT polyhouses the subsidy was based on height of structure like in NVPH subsidy of Rs. 700/sqm at the height of 5mt. and Rs. 935/sqm at height of 6.5mt is provided. In WIT polyhouses subsidy varied from Rs. 450-600/sqm based on height of 2.5mt-3.5mt. Subsidy on AINSH polyhouses was Rs. 600/sqm. Khanna (2013) stated that a polyhouse involves an investment of about Rs. 35 to 45 lakh, out of which Govt. of Gujarat subsidize it by 65 per cent for common farmers and by 75 per cent for tribal, schedule castes and schedule tribal. In Punjab state, central Govt. gives 50 per cent subsidy to setup polyhouses and in Himachal Pradesh farmers get 75 per cent subsidy (Anonymous, 2012).

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8th Year
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