POLYHOUSE PRODUCTION: CLIMATE RESILIENT AGRICULTURE FOR ENSURING FOOD SECURITY IN INDIA

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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 70 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. A typical, traditional farm of 500 square meters would generate an estimated annual income of Rs. 10,000 to 20,000, compared to estimated annual income from similar sized polyhouse of Rs. 45,000 to 50,000. According to present study the polyhouse establishment cost for 100 m^2 is out of them mostly expenditure (Rs. 62740) given by govt. as subsidy and only small amount (Rs. 20334) is to be beared by farmers. Regarding production, a 100 m^2 farm can produced crop of worth Rs 45000 in six month. In Haryana, 1,956 people were found to be engaged in polyhouse farming.

Keywords: Hi-tech, polyhouse, subsidy

INTRODUCTION

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 (Anonymous, 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). 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).

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). 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 unfavourable 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. High temperature (up to 40^0C) and humidity (70-80%) exhibits 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. The excess heat allows indigenous warm weather crops to be sown weeks earlier and harvested when frost would ordinarily damage or kill exposed crops (Patel and Rajput, 2010).

A typical polyhouse varies from 400 - 10,000 m^2 suited for farmers with small and marginal land holding. A low to medium cost polyhouse could cost between Rs. 175/m^2 to Rs. 500/m^2, whereas a high cost fully automated polyhouse costs Rs. 2,000 m^2. Most Indian farmers cannot afford such high costs. Therefore, Government of India through National Horticulture Mission (NHM) under Ministry of Agriculture is providing assistance to farmers up to 50 per cent to promote use of such systems (Joshi and Madame, 2009). A typical, traditional farm of 500 square meters would generate an estimated annual income of Rs. 10,000 to 20,000, compared to estimated annual income from similar sized polyhouse of Rs. 45,000 to 50,000 (Upadhyaya, 2009). Under optimal conditions, growing vegetables and fruits in a greenhouse can give the farmer up to ten times for what they would get if they did the same in an open rainfed field (Anonymous, 2012). Present study was conducted to find out the present situation of polyhouse farming as well as benefit of establishing polyhouse farm for vegetables.

METHODOLOGY

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. Regarding production of polyhouse farming, farmers were interviewed with the help of questionnaire regarding types of crop produced, expenditure and total benefit.

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 was collected form respective district through personnel interview and electronic communication.

Analysis of data

To calculate area under polyhouses in different years following formula was used:

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

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

$$\text{Increasing and decreasing level of number and area under polyhouse farming (\%)} = \frac{\text{Area under polyhouses farming in m}^2\text{ (at present) - Area under polyhouses farming in m}^2\text{ (previous year)}}{\text{Land under polyhouses (previous year)}} \times 100$$

RESULTS AND DISCUSSION

Different type of polyhouses in Haryana State

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 depicted the area under different polyhouses in Haryana State. The 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. 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 presented in Figure 1 revealed the year wise increase in polyhouses in different districts. Findings indicated 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 districts 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.

Increase in area under polyhouses in Haryana State

Results presented in Figure 1 demonstrated that 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 (37,424m^2) followed by Bhiwani (26,497m^2) and Sonepat (15,742m^2). In the year 2011-12 and 2012-13, maximum coverage area under different polyhouses was found to be in Karnal district i.e. 70,376m^2 and 1,68,630m^2, respectively.

Increasing level of number of polyhouses in Haryana State

Findings illustrated 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.

No. of polyhouse and area under polyhouses with involvement of workers in Haryana district

Findings presented in Table 1 divulged the number of polyhouses with area under polyhouses and people engaged in polyhouses. The total number of polyhouses in Haryana was 615 with area of 1835541 m^2. In Haryana 1956 people were found to be engaged in polyhouse farming.

Polyhouses in Haryana State with specification of area, number and workers

Findings presented in Table 1 gives the overall view of polyhouses in Haryana State showing the area under cultivation in polyhouses and people engaged in polyhouses. The total number of polyhouses in Haryana were 614 with an area of 17,57,920 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 (Table 2).

The data presented in Table 2 showed that approximate cost for establishment of 100 m^2 Polyhouse is Rs 62740/-; out of them Rs 43416/- is given by Govt. as subsidy and only Rs 20334/- is to be beared by the farmer. Besides this, Govt. is also providing subsidy for crop plantation. According to results, if we calculated the six month profit expenditure ratio, it was found that producing three crops *viz*., Tomato, kheera and yellow shimla chilli can result of expenditure of Rs 19002/-, with the benefit of Rs 45, 000/-. Because in first six month, the cost of installation is high so the benefit will be less, but after that the benefit will be in multiple.

CONCLUSION

Overall, it was found that Govt. is initiating the farmers for polyhouse farming by providing them subsidy on different schemes. In Haryana farmers are also taking advantage by producing maximum in minimum land. There are also many success stories of farmers regarding polyhouse farming.

STORY TELLING

Dev Dutt Chauhan, 27, a trained Ayurveda (pharma) degree-holder, who quit his job with Dabur company, has set up a 1,000 square metre polyhouse at Bhall Balwan (Khandoror) village in Bilaspur last year.

Chauhan sold red and yellow capsicum in Delhi markets during the Commonwealth Games (CWG) and earned Rs 1.50 lakh. "This year, too, the crop yield has been very good. I have fetched rich returns by supplying the produce to Delhi and The Oberoi Cecil in Shimla. My produce is completely organic and I also used the Internet to tie up for marketing," he says.

Haryana Director General Horticulture, Dr Satyavir Singh, said that the Government will bear 75 per cent of the expenditure, while 25 per cent expenditure will be borne by the farmer. Some of the districts which have been identified for these projects are Sonepat, Rohtak, Palwal, Mewat, Bhiwani, Hisar, Fatehabad, Sirsa and Jind.

All these centres had demonstrated advanced farm technologies of Israel to maximise cultivation and achieve quality production of vegetables. These include high-tech polyhouses and protected modes of cultivation like net houses, polyhouses and walk-in tunnels.

Each of the 11 centres will be opened on three acres of land, with an investment of Rs 25 lakh. The farmers who own the land will be free to sell the

seedlings grown in the high-tech polyhouse here. The 12th centre will be wholly owned by the state. It is likely to be opened in Gurgaon to cater to the demand among farmers in Rewari, Mahendragarh and other adjoining areas.

Dr Avri Bar Zur, Counsellor, International Cooperation-Science and Agriculture, of Israel said the success of the Gharaunda centre is evident from the keen interest shown by farmers. "Farmers who open the regional centres on their farms will be given assistance and guidance by the Israeli experts. Successful implementation of these new technologies by farmers is a very major stage of the project for us," he said.

Another reason for the migration to polyhouse farming is the skyrocketing land rates. "Five years back an acre was priced around Rs 25 lakh but today it is Rs 5 crore. The present generation of farmers are more interested in easy money and are selling their land to real estate developers and industry. Compared to traditional farming, polyhouse farming had a one-time investment with reduced losses.

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Table 1: Number of polyhouse and area under polyhouses with involvement of workers in Haryana district

District	Number of Polyhouses	Total Area Under Polyhouses (m^2)	Involvement of Workers (Nos.)
Sonepat	42	126016	144
Ambala	40	200215	133
Bhiwani	53	218722	189
Panipat	39	128343	111
Jind	16	45389	54
Sirsa	16	38776	56
Mahendergarh	9	19788	28
Panchkula	49	113172	160
Gurgaon	16	45339	46
Rewari	6	3218	21
Rohtak	33	90612	99
Hisar	69	196620	227
Jhajjar	15	51492	53
Karnal	92	276490	290
Fatehabad	8	21562	19
Kuruksherta	37	110745	121
Faridabad	13	38576	49
Kaithal	22	23410	51
Yamunanagar	24	42600	53
Palwal	6	16360	17
Mewat	10	28096	35
Total	**615**	**1835541**	**1956**

Table 2: Economic analysis of polyhouse production 100m^2

The Economics	App. Price (Rs)	Subsidy Given by Govt (Rs)	Bear by Itself (Rs)
Expenditure on the construction on polyhouse (low technology polyhouse)			
Construction of NVPH polyhouse	52,500-00	34,100-00	18,400-00
Drip irrigation	11,240-00	9306-00	1934-00
Labor	1,000-00	-	1,000-00
Total	62,740-00	43,416-00	20,334-00
Expenditure on crop production (Yellow shimla chilli , kheera and tomato from October to march , Six months)			
Planting	8,076-00	5,250-00	2,826-00
Manure and fertilizer	200-00	-	200-00
Cost of water	4,50-00	-	4,50-00
Labor (1 person)	6,000-00	-	6,000-00
Others	200-00	-	200-00
Total	14,926-00	5,250-00	9,326-00
Total expenditure	**77,666-00**	**48 666-00**	**19002-00**
Income			
Yellow Shimla chilli 6 qlt (rate Rs 25/ kg)	15,000-00		
Kheera 6 qlt (rate Rs 10/ kg)	6,000-00		
Tomato 8 qtl (rate Rs 30/kg)	24,000-00		
Total	45,000-00		

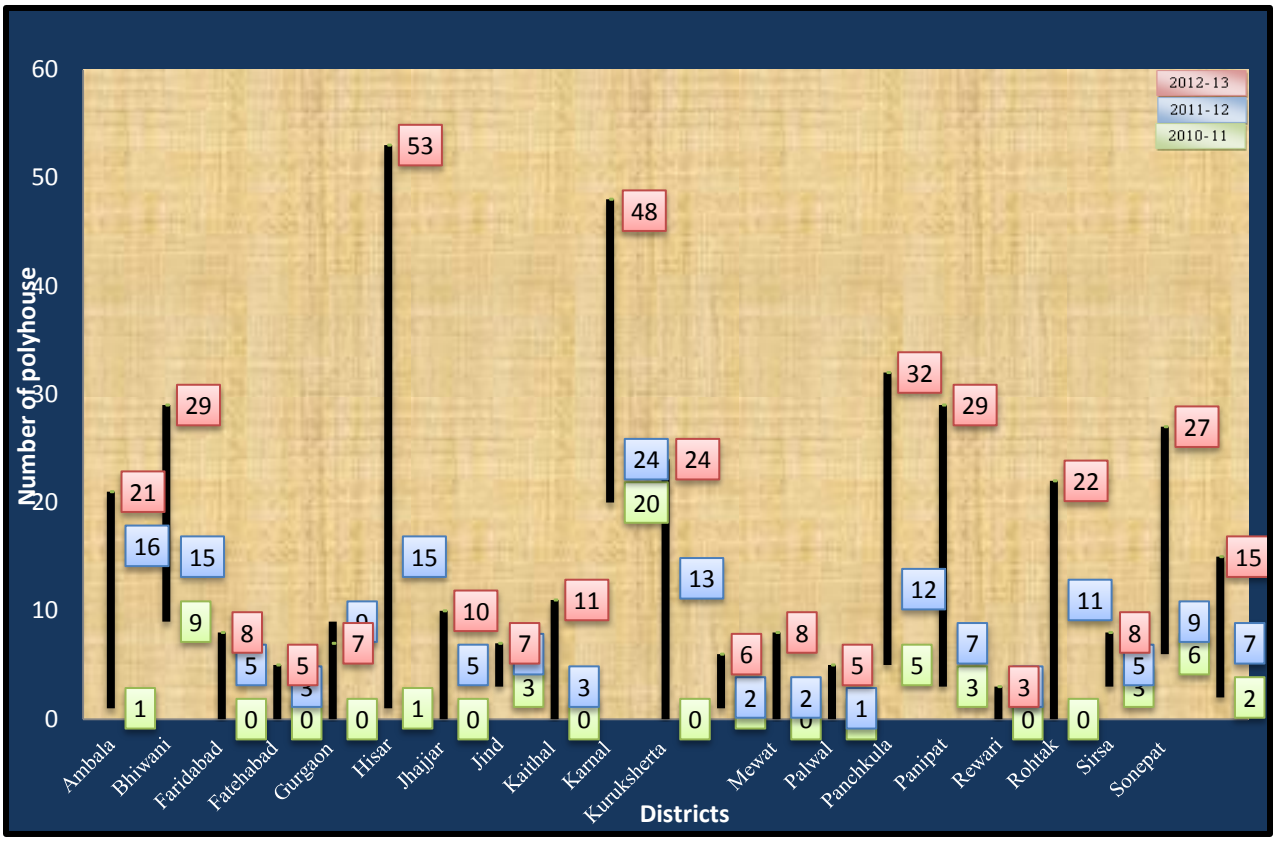

Fig. 1: Increase in polyhouses in Haryana state

[MS received : July 22, 2017] ***[MS accepted : August 15, 2017]***