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RESEARCH ARTICLE :

Protected cultivation : Introducing farmers to innovative practices

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SUMMARY : Polyhouse is type of advanced agriculture where you can increase production by creating same modified climate by covering a steal or bamboo structure with UV stabilized (200 micron) film. Polyhouse building is still suppose to be a difficult and highly skilled work so that consultancy charges are too high and its not possible for Indian farmer to build it by using locally available inputs. But now Govt of India and Govt. of Haryana is providing subsidy of 65 per cent, 90 per cent and 50 per cent on cost of polyhouse, irrigation system and planting material, respectively. The present research deals with the technical aspect of polyhouses and economic cost of establishment. Besides this specific parameters are also studied which are important for making the higher production inside.

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KEY WORDS :
Polyhouse, Technical and economic aspects, Subsidy

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BACKGROUND AND OBJECTIVES

Agriculture is the backbone of India's economic activity and our experience during the last 50 years has demonstrated the strong correlation between agricultural growth and economic prosperity. The present agricultural scenario is a mix of outstanding achievements and missed opportunities. If India has to emerge as an economic power in the world, our agricultural productivity should equal those countries, which are currently rated as economic power of the world. We need a new and effective technology which can improve continuously the productivity, profitability, sustainability of our major farming systems. One such technology is the green house technology. Although it is centuries old, it is new to India.

Polyhouse technology:

Growing plants is both an art and a science. About 95% of plants, either food crops or cash crops are grown in open field. Since time immemorial, man has learnt how to grow plants under natural environmental conditions. 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. So, polyhouse technology is the technique of providing favourable environment condition to the plants. It is rather used to protect the plants from the adverse climatic conditions such as wind, cold, precipitation excessive radiation,

extreme temperature, insects and diseases. It is also of vital importance to create an ideal micro climate around the plants (Gusman *et al.*, 2008). This is possible by erecting a polyhouse / glass house, where the environmental conditions are so modified that one can grow any plant in any place at any time by providing suitable environmental conditions with minimum labour. Polyhouses are framed or inflated structures covered with transparent or translucent material large enough to grow crops under partial or full controlled environmental conditions to get optimum growth and productivity.

Status of polyhouses in India:

While polyhouses have existed for more than one and a half centuries in various parts of the world, in India use of polyhouse technology started only during 1980's and it was mainly used for research activities. This may be because of our emphasis, so far had been on achieving self-sufficiency in food grain production. However, in recent years in view of the globalization of international market and tremendous boost and fillip that is being given for export of agricultural produce, there has been a spurt in the demand for polyhouse technology. The National Committee on the use of plastics in agriculture (NCPA-1982) has recommended location specific trials of polyhouse technology for adoption in various regions of the country. Polyhouses are being built in the Ladakh region for extending the growing season of vegetables from 3 to 8 months. In the North-East, polyhouses are being constructed essentially as rain shelters to permit off-season vegetable production. In the Northern plains, seedlings of vegetables and flowers are being raised in the polyhouses either for capturing the early markets or to improve the quality of the seedlings. Propagation of difficult-to-root tree species has also been found to be very encouraging. Several commercial floriculture ventures are coming up in Maharashtra, Tamil Nadu and Karnataka states to meet the demands of both domestic and export markets (Five Year Plan, 2012.). The commercial utilization of polyhouses started from 1988 onwards and now with the introduction of Government's liberalization policies and developmental initiatives, several corporate houses have entered to set up 100% export oriented units. In just four years, since implementation of the new policies in 1991, 103 projects with foreign investment of more than Rs. 80 crores have been approved to be set up in the country at an estimated cost of more than Rs. 1000 crores around Pune, Bangalore, Hyderabad and Delhi. Thus, the area under climatically controlled polyhouses of these projects is estimated to be around 300 ha (IARI, 2011).

Costs of establishing a polyhouse in India:

The cost of constructing a greenhouse structure differs with respect to the type of technology being adopted. In India, three types of greenhouse production technologies could be identified. The first group represents the low-cost polyhouse technology. This group had taken foreign greenhouse designs and fabricated the structures indigenously in India with little or no environmental control systems. The second group imported polyhouse structures with special environmental control systems like the fan-and-pad system to control temperatures and maintain required humidity levels in the greenhouses to improve quality control. The third group is the most technologically oriented. They also imported polyhouse structures and the fan-and-pad environmental control systems with additional structure features to allow the use of artificial growing media for cultivation, such as rockwool blocks (Paroda, 2013). In India, nearly 72 per cent of the growers adopted the low-cost indigenous technology, while 21 per cent adopted the second type of greenhouse, and only 7 per cent adopted the high-cost imported polyhouse with artificial medium of cultivation. The total investment costs varied significantly among the three groups. High cost green house may be a multispan structure. The cost estimates may vary considerably due to crop, cladding material and

Table 1 : Cost economics of high cost polyhouse (100 m^2)

Sr. No.	Specifications	Cost Rs./m^2
1	If double layer polyethylene used	100
2.	CO_2 generation and distribution	150
3.	Evaporative cooling	200
4	Heating system	100
5.	Humidification system	100
6.	Lighting	200
7.	Night curtain / Shading system	150
8.	Drip system	20
9.	Nutrient application system	100
10	Porous flooring	100
11.	Benches	150
12.	Structural cost	300
13.	Miscellaneous	180
	Total expense	2,00,000

*Average cost of High Cost Greenhouse per square metre Rs. 2000.00

environmental control system. The additional cost involved per sq. m. is stated below.

"The National Bank for Agriculture and Rural Development (NABARD) also extends support to such projects. Along with polyhouse, other activities like dairy farming and processing units helps to create employment and generate revenue (Singh *et al.*, 2007).

Maintenance of favourable environment in naturally ventilated green house :

Ventilation in greenhouse:

A green house is ventilated for either reducing the very high greenhouse air temperature or for replenishing carbon dioxide supply or for moderating the relative humidity in the greenhouse. Air temperatures above 35^0 C are generally not suited to greenhouse crops. It is a quite possible to bring greenhouse air temperature below this limit during spring and autumn seasons by providing adequate ventilation for the greenhouse. The ventilation in a greenhouse could either be natural or forced. In natural ventilated, air becomes less dense as it gets heated and, thus, rises. This chimney effect could be used to move the warm air out and cool air in. winds permit creation of additional natural ventilation in the greenhouses (Patel and Rajput, 2010).

Control of temperature in green house:

In a composite type of climate like in Haryana, the ambient temperature rises above 30^0 C in the month of march due to which inside air temperature of a closed poly house exceeds 38^0 C and becomes detrimental to the inside plants. In order to remove the inside hot air, the poly house should have continuous side ventilators along the south and north wall. In a 100 m^2 area poly house, the size of these ventilators should be equal to the length (16m) and height (2m) of these walls. With the

Table 2 : Cost estimates of medium cost green house (4 x 25 m^2)

Sr. No.	Specification	Cost (Rs.)
1.	Cost of Greenhouse (100m^2)	175000.00
2.	Additional items on GH-2 (for fans –2)	1000.00
3.	Electrical Fittings (Power point distribution, boxes, MCB etc.)	3000.00
4.	Mist spray assembly	2000.00
5.	Inflation blower	1000.00
6.	Two fans (60 Cm dia)	10000.00
7.	Monoblock AC pump (3hp)	3500.00
8.	Water tank (Sintex) 1000 liters	4000.00
9.	Thermostat/ Humidstat	2000.00
10.	Cooling pad and fittings (local made)	3000.00
11.	Labour (extra)	1500.00
12.	Additional film for double layer	3500.00
	Total expense	50,000.00

*Cost of green house of medium type per square metre Rs.525.00

Table 3 : Cost economics of simple, pipe framed green house (100 m^2)

Sr. No	Item of work	Qnty.	Rate / unit (Rs.)	Total amount (Rs.)
1.	G.I. Pipe 25 mm dia.'B Class	60.0 m	65.00/=	3900.00
2.	G.I. Pipe 15 mm dia. 'B Class	175.0 m	25.00/=	4375.00
3.	M.S.Flat 19x3mm Size	80.0kg	16.50/kg	1320.00
4.	M.S.L angle 19x19x3mm Size	20.0kg	17.50/kg	350.00
5.	UV stabilised film	175.0 m^2	20.00/=	3500.00
6.	Plastic beading	150.0 m	4.00/=	600.00
7.	Mesh 40-60 size all round	65.0 m^2	22.00/=	1430.00
8.	Door frame and fitting	L.S		425.00
9.	Labour cost	L.S		650.00
10.	Bolts, nuts and welding rods	L.S		400.00
11.	Earth work and concreting of foundation	L.S		550.00
	Total expense			17,500.00

*Average cost per square metre Rs.175.00

Table 4 : Assistance for protected cultivation under NHM (Kulkarni, 2012)

Sr. No.	Component	Estimated cost	Pattern of assistance
1.	Green house		
	Small and marginal farmers	Rs. 650/ Sq.m for Hi-tech Rs.250/ Sq.m for Normal	50% of the cost subject to a maximum of Rs. 325/ Sq.m for hi-tech and Rs. 125/ Sq.m for normal GH, limited to 1000 Sq.m /beneficiary
	Other farmers	-do-	33.3% of cost subject to a maximum of Rs. 215/ Sq.m for hi-tech and Rs.67/ Sq.m for normal GH limited to 1000 Sq.m
2.	Mulching	Rs. 14,000/ha	50% the total cost subject to a maximum of Rs.7000/ha limited to 2 ha per beneficiary
3.	Shade net	Rs.14/Sq.m	50% cost subject to a Maximum of Rs. 3500/500 Sq.m limited to 2 per beneficiary
4.	Plastic tunnel	Rs. 10/Sq. m	50% of cost subject to a maximum of Rs. 5000/1000 Sq.m limited to 5 ha per beneficiary
5.	Creation of water resources	Rs. 10 lakh per unit	Limited to 10 ha area on community basis.

start of March month, the polyethylene sheet over these ventilators should be rolled upto allow the entry of outside cool air. By doing so, inside air temperature of the poly house drops significantly. However, in the month of April, when the outside air temperature exceeds 33-35^0 C, natural ventilation through the side ventilators provided at sufficient distance on the centre of the poly house roof should also be opened. The optimum size of the ventilator should be 1m x 1m on each side of the roof at the centre.

Control of humidity in greenhouse:

For most crops the acceptable range of relative humidity is between 50-80%. However, for plant propagation work, relative humilities upto 90% may be desirable. Humidification in summer can be achieved in conjunction with greenhouse cooling by employing appropriate evaporative cooling methods such as fan and fogging systems. Sometimes during winters when sensible heat is being added to raise the greenhouse air temperature during nights the relative humidity level might fall below the acceptable limit. In that situation, humidifiers might need to be operated to circumvent the problem. Greater distance would form hot air pocket inside the poly house and the proper removal on inside air would not take place. If both the side as well as top ventilators is opened, then this type of ventilators replaces the internal hot air by external cooler one during the hot sunny days with weak wind. The external cool air enters the greenhouse through the lower side opening while the internal air exits through the roof openings due to density different air masses of different temperature causing the lowering of temperature in the greenhouse significantly (Anonymous, 2012) (Fig. 1 and 2).

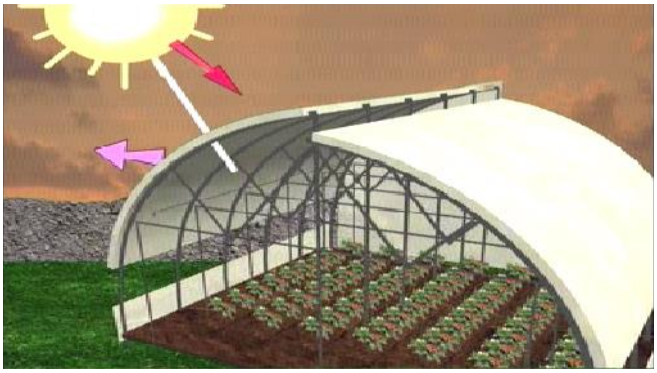

Fig. 1 : Control of humidity

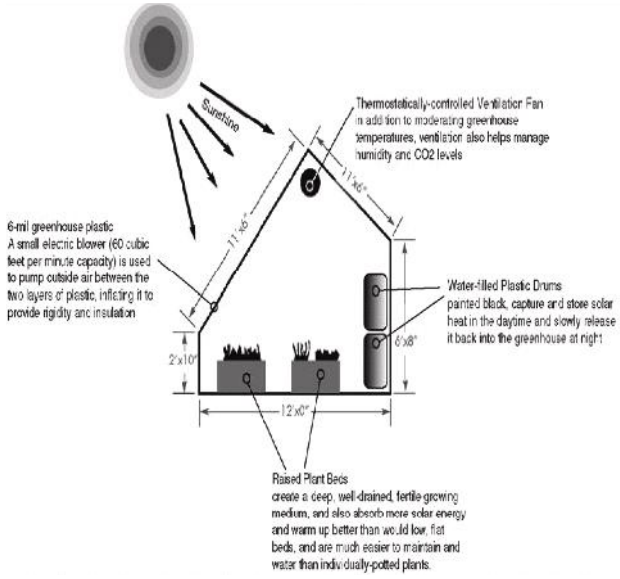

Fig. 2 : Working of green lay in green house

Conclusion :

Fruits and vegetables are missing in the diet of poor marginal Indian because of their overall shortage. Majority of farmers are not ready to shift their crop land

to fruits and vegetable cultivation, hence under such condition poly houses can be the only answer for this. We need promotion of fruits and vegetables cultivation for financial support to the farmers and total food security to all. The poly house technologies are advanced in Israel, Holland, Spain, Italy, Kenya, South Africa, Japan and China. But unfortunately much neglected in India. India and Holland having more or less same land under flower cultivation but in world's flower export, Holland's contribution is 70% and India's contribution is just 1% or even less because of advanced technology of polyhouses in Holland (Khanna, 2013). 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 (Madaan, 2011). 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 beared by farmers. Regarding production a 100 m^2 farm can produced crop of worth Rs. 45000 in six month (CMIE, 2007). In Haryana, 1,956 people were found to be engaged in polyhouse farming. In study different types of polyhouses were studied on the basis of technology used for making them. In India as well as in Haryana three different types of polyhouses technology are used namely; low technology polyhouse, medium technology polyhouse and high technology polyhouse. The operation cost is depend on types of technology. In research detail data analysis was done on each and every small aspect of polyhouses.

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