

# Protected Cultivation- an enthusiastic pathway for Farm Income and Employment

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*Abstract— Protected cultivation is a specialized agricultural system in which a certain control of the soil-climate ecosystem is exercised by modifying its conditions like soil, temperature, solar radiation, wind, humidity and air composition. Not only Soil-climatic ecosystem, such protected structures are really congenial for protecting economic plants from disease causing viruliferous pathogens, harmful insect-pests and noxious weeds. It generally refers to providing congenial conditions for better plant growth, year-round cultivation which enhancing the production level through artificial means. In protected structures, production as well as Gross and net return from vegetables and flowers are higher than open field conditions and productivity is also higher as compared to open conditions. As per a survey conducted by Centre for Research in Rural and Industrial Development (CRRID), vegetable or flower yields under Protected Cultivation are 5-10 times higher than open cultivation depending on the crop. In modern agriculture, protected structures held an extreme potential for more production with higher productivity. Quantity and quality of produce is also much better than open field produces. That's why today, by adopting such structures for cultivation of high value cash crops farmers are fetching a satisfactory amount of return. In today's era, This Protected structure has become really economic for farm income generation and also a huge opportunity of Self-employment for educated youth. Greenhouse automations, Drip & Sprinkler irrigation, Fertigation, various engineering properties (aero & hydrodynamic, microcontroller, drying equipments) all must require skilled and experienced employees for performing all works efficiently. Not only skilled labours, huge manpower also needed to operate various intercultural operations. As per GTFL data, in Nasik and Pune, cultivation of Bell pepper under greenhouses, farmers earn about Rs.1 to 9 lakhs from 1 acre land, while under open condition, they can fetch hardly Rs.90,000/- to 1lakh, by investing more amount of*

*input here. For that reason here, we're going to analysis how these protected structures are able to enhance the net return of farm and creation of employment in this sector.*

*Index Terms- Green House, Poly House, Employment, Farm Income, Cultivation, Protected Structure, Environment*



## I. INTRODUCTION



Protected cultivation is a cropping technique wherein plants are grown under a controlled environment. A huge no. of crops can be efficiently grown up during all seasons by artificially controlling its microclimate. Now in present days, feeding varieties food grains to a huge no. of population is really challenging task, also conventional farming strategies become a barrier of it. More no. of economic crop loss are happened in farmer's field in daily years due to lack of knowledge and experience of them. Whereas such protected structures or greenhouses are really beneficial where the farmers can grow crops on their own land as well as able to give more profit and food grains without any damages and impurities. By adopting these protected structures, farmers can gain a satisfactory amount of farm income only by investing lower amount of inputs, where they can fetch highest input use efficiency. For generating a good net return of farm and cultivating quality products through year-round, protected structures are indisputably ideal condition. Protected cultivation enables cultivator to produce several fold of good quality production which is difficult in normal conditions due to climatic and other constraints. Year round cultivation, a controlled microclimate, Disease-insect-pests-weeds free condition, artificial irrigations,


artificial cooler and heater all modified and efficient activities undoubtedly increase the annual farm income. The average farm and household income of the protected growers was observed to be increased by about 25 and 11 per cent. The labour utilization pattern on protected cultivation was found to be almost four times higher than that of the open-field cultivation indicating a significant contribution in enhancing the employment opportunities. In lot of sectors inside a greenhouse, huge opportunities of employment of educated youth are readily available. Ventilation position, soil testing kits, irrigation set up, fogger, mist, heater, automatic sprayer all operations are must needed a qualified as well as experienced

human mind. Moreover, for giving training to new adopters about such innovative objectives, a skilled entrepreneur is really indispensable. Greenhouse automation is also a trending project in modern technology, where only presence of a microcontroller and sensor can detect everything inside a greenhouse, and act accordingly to meet at optimum level. Huge amounts of manpower or labour are also essential to perform other auxiliary activities, where automation is very rare. Moreover, for improving farmer's socio-economic status protected cultivation is really crucial in today's world.

Different Types of Protected Structures: -

SL. No.	Protected Structures	Suitable Crops	Season	Pictures
1.	Shade Net House	Leafy Vegetables, different Root vegetables, Ornamentals, Tuberose and Green fillers	Peak summer months (April to August)	
2.	Modified insect proof net houses	Tomato, cucumber, capsicum, okra, brinjal, other cucurbits.	Throughout the year	

3.	Naturally ventilated Green houses	Tomato, cucumber, capsicum, Various ornamental flowers etc.	September to March	
4.	Plastic low tunnels	Mainly cucurbits, strawberry, French bean etc	December to February	
5.	Walk-in Tunnels	Off Season vegetables, mainly cucurbitaceous vegetables, coriander seeds	December to February	
6.	Temporary plastic walls	Vegetables, seed spices like Cumin, Fennel etc.	Mid December to mid-January	

7.	Plastic mulches	All kind of vegetables and fruit orchards	Throughout The year	
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Enhancement of Farm income through Protected cultivation: -

Year-Round Cultivation of Off-season crops: -

The cultivation of summer vegetables is possible in winter season and also all winter vegetables can be grown in every season even in rainy season with the development of polyhouse. The regulation of climatic requirements such as temperature, light, humidity, CO<sub>2</sub> and also use of soil less media have made it possible. The production of vegetables involves geponics, soil less culture, hydroponics, aeroponics techniques. Installation of different active cooling agents Mist, fogger, evaporative cooling pads, air circulation fans are also helpful for cultivating cool seasoned vegetables in off-season also. More amounts of ventilation and Fibre-reinforced plastics can able to outward the warm air inside from greenhouse. Like that, double covering material can easily check the heat loss inside from greenhouse due to dead-air space between two covering materials. Installation of Unit heater, central heater and radiation heating effectively raise the temperature of protected structures and make it favourable for summer crops. Rain shelter houses are mostly made up of GI pipes or bamboo poles with roofs made up of transparent UV-stabilised low density polyethylene film. The structures are naturally ventilated and protect from direct shower. The use of rain shelter is highly effective in vegetable production, particularly in heavy rain areas. In this way, by producing highly nutritious and demandable crops throughout year, farmers can easily fetch high amount of return in off-season also.



Summer Season Cauliflower cultivation in Polyhouse



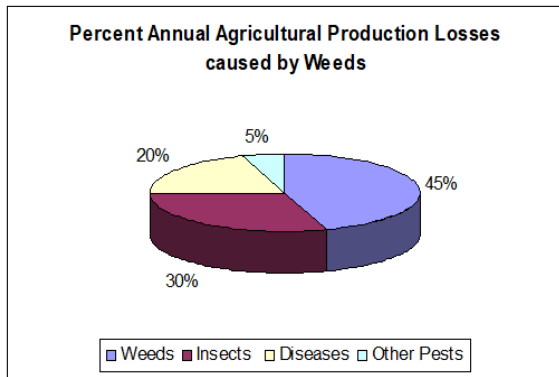
Tomato Cultivation in polyhouse during Winter

- Possible cultivation in problematic regions  
75 Mha of land in India come under such problematic regions like Desert land, severe frost, wasteland etc. In many places Biotic and Abiotic stresses are also very serious concern in some places. Whereas the protected cultivation is really efficient to increase the production of crops alone by about 60-70 million tonnes, in such areas. In case of Hot- arid region, Evaporative cooling coupled with active ventilation and shading can reduce greenhouse air temperature by up to 8°C, NIR reducing cladding material, Fogging, mist, Humidifiers all can effectively reduce the temperature inside the Greenhouse. In cold region, double insulated cladding materials effectively can prevent

heat loss, installation of Unit heater can able to moderate the inside temperature for crop growing. In Problematic zones, Drip fertigation effectively reduce the mobilization of chemical fertilizers, Soil testing and synthetic chemical application also can keep neutral Soil pH. Uneven span type structures are equally relevant for Mountaineers. By installing such protected structures farmers can easily initiate the cultivation in problematic zones also and fetch 20-25% more benefit.

• Insect-pest, Disease free Cultivation

Insect-pest, noxious pathogens and noxious weeds cause a utmost severe damage to the economic field crops. The damaging potential of such harmful agents, we can estimate from this pie diagram. Where noxious weeds and pests are the main causal agents for economic yield loss.



Being a vectors of more than one toxic diseases, pests become a great concern in today’s agriculture. Weeds also may increase the production cost too much extent. In open field conditions nearly one third of the crops may be lost due to the attack of insects and worms, whereas in polyhouses farming, we can harvest the crops about 2 to 3 times more without much damage or loss. Use of physical barriers such as insect proof screens, nets, Ultra-violet radiation absorbing sheets as well as with fogger and mist application of insecticide or with the help of drip irrigation, application of nematicide can effectively control the insect-pest infestation. Use of Disease pathogen free utensils and totally modified climate inside polyhouses can inhibit the disease inoculum or further growth any fungi. Genetically better planting materials completely prevent the weed seeds and modified

timely and exact quantity herbicide applications easily check the weeds inside protected condition. With no weed growth there is higher uptake of micro-nutrients by the active zone of the roots. In this way, farmers can promote high crop yield and enhanced quality of produce and can earn a better price from such quality products.

- Possible cultivation under un-favourable agro-climatic condition: -

Every crops having their own particular microclimate, which essentially needed to maintain for higher yield and return. Different agro-climatic condition become a constrain on this verities cultivation. But protected structures, it is possible to cultivate all types of crops without considering the climatic condition. In Himachal Pradesh under the protected structures, The production of tomato in the state had also shown a significant increase by about 20 per cent and 61 per cent from 2005-06 to 2015-16, respectively. Installation of different new technology inside the greenhouses significantly stimulates the production of all types of crops everywhere.



Greenhouse at hot climate with mist, air circulation fan and cooling pad



Greenhouse heating system

- Cultivation of high value Horticultural crops :-  
The demand of horticultural crops is really a trending in today's generation. Different coloured fruits and vegetables are also essential to consume for good health and nutrition. With protected cultivation farmers can always expect high value horticultural produce of cherries, capsicum and muskmelons. These houses make help in reducing the adverse effects of rains, scorching sun, wind, rain, snow, birds, hail etc. in herbs, ornamentals and veggies. Due to less infestation of insect-pest, disease, quality production of such sensitive crops become fruitful in today's era. Qualities of flower raised in these structures are mostly significantly than open field condition, so they are mostly used for export. The internal rate of return (IRR) varies from 31 per cent for carnation with capsicum to 73 per cent when the only carnation is grown. Bhatnagar et al. (1990) reported that during winter, in the hilly region of Uttar Pradesh, capsicum was grown under greenhouse with increased yields of 50 quintals per ha as compared to those in open fields (24 q/ha). The yield of capsicum per square meter of the cultivated area in the greenhouse was found to be 2.34 times more than open field condition due to installation of various modified controller (Humidifier, Aero & Hydroponics, Microcontroller, Fertigation unit, Heater, Mist, cooling pad etc.) to make inside climate favourable to crop grown. The farmer gets the maximum share in consumer rupee from direct marketing of such products. Sharma et al. tells that in cut-flowers profitability under polyhouse conditions has been found the maximum in major flower crops (rose, carnation, liliun, gerbera, and chrysanthemum). By growing such high value and

demandable horticultural crops, farmers can easily attract the consumers and fetch a profitable net return.



Carnation Cultivation Under Greenhouse



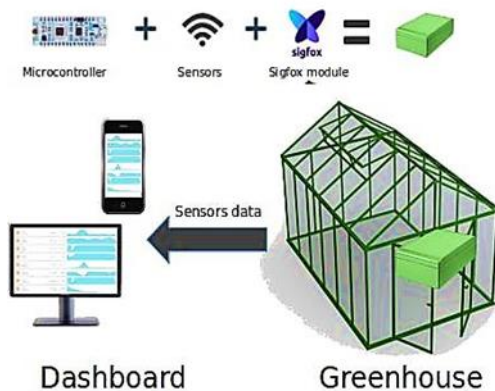
Capsicum Cultivation under Greenhouse climate

- High Resource Use efficiency in Protected structures:-  
Protected cultivation involves the intensive use of resources such as soil, water, fertilizers, pesticides, and energy. Not only the increased production and productivity per unit of land, water, energy and labour, high quality and clean products, but also high water and fertilizer use efficiency, subsidy provision for establishment of high cost infrastructure, high input use efficiency are equally maintained by those protected structures. Sustainable greenhouse system that: does not need any fossil energy and minimizes the carbon footprint of equipment; with no waste of water nor emission of fertilizers and full recycling of the substrate; with minimal need of plant protective chemicals, The greenhouse can benefit from the reduction of waste through better management of irrigation and climate. In polyhouses, the water is supplied by drip irrigation with due effect, water is less

utilized when contrasted with open cultivation. It diminishes reliance on rainfall and makes the ideal utilization of land and water assets. Application of chemical fertilizer and pesticide by judging its optimum requirement, it can save those costs of farmers also. with an aquifer-based cooling energy savings of 30%, production increases of 20% in tomatoes and 80% reductions in pesticides can be realized inside of polyhouse. Polyhouse farming can help the farmer generate income by minimizing the extra cost around the year growing multiple crops and fetching premium pricing for off-season vegetables.

- Generation of Employment through Protected cultivation:-

Greenhouse Automation and Computerised Greenhouse is essentially needed such skilled and experienced employees. Installation and Application of Microcontroller and Sensor for generation an Automatic greenhouse, lot of technologies are involved which must require an educated youth. Such intelligent sensors easily detect the inside condition as well as the favourable climate for raising crops and act accordingly itself. By which proper concentration of each chemicals, irrigation, temperature, humidity all are maintained accurately. For monitoring and operating, labour employment is increased day by day with the enhancement of such computerised Greenhouse techniques. This concept not only generates the huge employees but also effectively increases the Farm net return.



For Construction of main frame of a greenhouse or other related parts, efficient Labour requirement is essential. Suitable structure for a particular region, which type of cladding materials, designs, roofing

configuration all can be efficiently fulfilled by an experienced labour. The exact place for construction, what will be the length, breath and height of all structural components of greenhouse all are decided by them. For an efficient and effective protected structure construction, most of the labour requirement is happened.



To perform various agricultural operations inside Greenhouse lot of labour requirements can be observed for keeping all set inside greenhouse. Raising nursery of different crops in the protected structure is to get higher profit and disease-free seedlings, Irrigation control, several intercultural operations (weeding, Hoeing, earthing up, pinching, nipping), staggered harvesting, manual operating greenhouses must require some labours for doing these more efficient production. Due to this, employment generation is almost four times higher than that of the open-field cultivation.

For Transportation of products, a considerable amount of labour is also required. Transporting of all raw materials for construction, moreover transportation of final products of cultivation, lot of efficient labours are must needed and huge employment has found.

For raising awareness or giving training about the utility of such protected structures to small and marginal farmers, some experienced entrepreneurs are really needed in today's generation with the gradually increasing of population. Some qualified or trained persons can easily give training about the whole detailed operations, utilities and modifying climate strategies inside the greenhouse in details to newly adopters by organizing various campaigns. The efforts to make them acquainted about the benefits and

opportunities associated with Protected Cultivation through small scale and low investment requiring technologies, such farmers are slowly getting into the interventions and improving their income from small patch of lands owned by them.

### CONCLUSION

The study revealed that protected cultivation had a significant impact in enhancing the crop productivity and was approximately three times higher in comparison to the open-field conditions as well as providing a significant contribution in enhancing the employment opportunities in various sectors. Protected cultivation technology aims at enhancing the socio-economic characteristics of the farmers and to generate a higher income, employment and a decent standard of living to the small and marginal farmers also. Through this Protected structure, Capsicum and Tomato accounted more than 75 per cent of total employment on both the categories. A lot of employment generation also can be found equally in small and marginal sectors. Various modification and lot of new opportunities undoubtedly enhance the smart and sustainable agriculture inside the polyhouse, along with assists farmers to fetch a great Net farm return and high market demand of products, which ultimately increases the Indian GDP due to this agriculture sector. Adoption of such hi-tech technology, Greenhouses on farmer's own field certainly assures a satisfactory amount of farm income and moreover huge employment of others.

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