

Low-Cost Polyhouse Technologies For Higher Income and Nutritional Security

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Introduction

During winter season under north Indian conditions, it is extremely difficult to grow tomato, capsicum, cucurbits, French bean, amaranth etc. in open field condition, however various types of protected structures have been developed for growing some high value crops continuously by providing protection from the excessive cold. This is called greenhouse technology which provides 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. This is possible by erecting a greenhouse / 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. Protected technology in high value vegetable crops can be established as a small scale industry in major vegetable growing areas of our country by progressive farmers especially in peri-urban areas.

Production of off-season vegetable nurseries under protected structure has become a profitable business. The main purpose of raising nursery plants in protected structure is to get higher profit and disease free seedlings in off season to raise early crop in protected condition or/and open field condition. The low cost Polyhouse is economical for small and marginal farmers, who cannot afford huge cost of high-tech poly house. The temperature inside the poly house is 6-10 °C higher than outside during winter. The cold waves during winter season (December to February) do not enter inside the poly house and inside environment becomes conducive for quick germination of seed and growth of seedlings. Many times farmers produce good amount of cucumber, capsicum and tomatoes during main season, which eventually leads to the market glut and fall in price. On the other hand, due to weather extremes during winter, it is difficult to grow high value vegetables like tomato, capsicum, cucumber, gherkin etc. in open condition. Therefore, low-cost polyhouse technology was introduced for off-season production of vegetable nurseries as well as for raising crops of high value vegetables.

Material and methods

An experiment was conducted at the research farm, Division of Vegetable Science, IARI, New Delhi, during third week of November, 2012-13 by utilizing two types of low cost polyhouses (polyhouse for raising nursery and crops and low height poly house for crops). Seedling as well as crops of various vegetables were grown under these structures. The recommended cultural practices were followed to raise a good crop. The method of raising vegetable nursery and crop and cost of various protected structures is given below.

1. Raising nursery under low cost polyhouse:

The low cost poly houses were made with PVC pipes and tied with *sutli*. These structures were covered with 700 gauges (200 μ m) UV stabilized polythene sheet. The seedlings were raised in two types of containers viz. Polybags and portrays. Well-decomposed and sieved farmyard manure in combination of fym: sand: soil in ratio of 2:1:1 by volume was used as growing media. For cucurbits, the polybags of 9x5 cm sizes were filled with the above mixture (fym, sand and soil) keeping 2-3 cm vacant from the top. 3-4 fine holes were made in the bottom of filled bags to drain extra water during irrigation. The filled bags were kept inside poly house in groups in such a way that one person can easily sow the seeds and work. A poly house of 10 x 5 m size could accommodate 8000 polythene bags (9 x 5 cm sizes) on ground. One seed was sown in each bag during last week of December after treating them with thiram @ 3g/kg seed. After sowing of seeds, a thin layer of sand was put to fill the top of the polybags in order to facilitate proper germination and to avoid crust formation. Immediately after sowing the seed, light irrigation was given by watering can, which contained captaf @ 2ml/litre of water. After one week of sowing again new seeds were sown where seed germination could not take place. After 30-35 days of sowing, when the seedlings became 10-12 cm long and four true leaves had emerged, they were kept outside the polyhouse for 2-3 days for hardening by holding irrigation for two days. Hardening of vegetable seedlings before transplanting in the main field was very effective in reducing transplanting shock and also resulted in better crop stand. In the first week of February when danger of frost was over, the seedling were transplanted on the northern slope of prepared channels in the field after removing the polythene bags with the help of blade without distributing the earth ball. After transplanting, light irrigation was given for better establishment of plants. The vertical space of polyhouse was occupied by preparation of two stories bamboo benches on which 7000 seedlings of cucurbits were raised in portrays (10 cc) filled with same media in same way. The cost of construction of polyhouse (50m²) is given in Table 1.

Table1: Low cost polyhouse for raising vegetable nursery.

Size of structure (10m (L) x 5m (W) x 7' (H)) = 50m²

S.No	Particulars	Rate (Rs.)	Expenditure (Rs.)
1.	13 PVC pipes (20', 1.25'' size)	Rs. 400/-	5,200/-
2.	16 PVC pipes (20', 0.75'' size)	Rs. 300	4,800/-

3.	Polythene	100 m ²	Rs. 19/-	1,900/-
4.	Sutli	1 kg	Rs. 400/-	400/-
5.	Bamboo Bench	9 m x1.5 ft. (3 Nos.)	-	2,000/-
6.	Labour charges	4 Nos.	Rs. 300/-	1,200/-
	Grand Total			15,500/-

2. Growing crops under temporary protected low height polyhouse:

Vegetable crops like French bean, amaranth and summer squash which are determinate in growth habit and could not be grown under open field condition during winter season successfully, they were grown under low height low cost temporary poly structure which was highly suitable for raising these crops during off season. Seeds were sown on raised bed during IInd fortnight of November and whole bed was covered with low height poly structure after sowing and it was made airtight. The seeds germinated due to conducive environment under protected structures. Once all the seeds have germinated the polythene sheet was removed daily from both end during sunny day and again covered in evening to maintain the inside temperature optimum. All the cultural practices recommended for cultivation of the crops raised under protected structures were followed. In February when outside temperature was ideal and frost chances were over, the polythene sheet was removed and structure was dismantled and kept safely for future use. The cost of construction of temporary protected low height poly structure is given in Table 2.

Table2: Temporary protected low height low cost poly-house for raising vegetable crops.

Size of structure (10m (L) x 5m (W) x 3' (H)) = 50 m²

S.No	Particulars	Expenditure (Rs.)
1.	19 PVC pipes (20', 0.75''size) @ Rs. 300/- per pipe	5,700/-
2.	4 PVC pipes (20', 1'' size) @ Rs. 400/- per pipe	1,600/-
3.	Polythene sheet (700 Gauge, 12 x 5m) = 60 m ² @Rs. 19/- per m ²	1,140/-
4.	Sutli (1/2 kg)	200/-
5.	Labour charges 3 No. @ Rs. 300/- Per labour/per day	900/-
	(Total)	9,540/-

Note: polyhouse structure may last for minimum 3years.

Results and Discussion

Nursery under low cost polyhouse:

The high-tech nurseries are raised in soilless media (cocopeat, perlite and vermiculite mixture) and the nursery management and plant nutrients supply is a specialized and tedious work as these soilless media does not contain any nutrients. In soilless media,

nutrients are applied in the form of N: P: K (1:1:1) @ 140 ppm once a week through the fine sprinkler to maintain the uniformity in application of nutrients. However, in our study the fym: sand: soil mixture was used which was found easy to manage even by small and marginal farmers. Seedlings were raised in protrays and polybags which helped in proper germination, provided independent area for each seed to germinate, reduced the mortality rate, maintained uniform and healthy growth of seedlings, easy in handling and storing, reliable and economical in transportation. Production of off-season vegetable nurseries under protected structure was found a profitable business. Higher profit and disease free seedlings were found in off season to raise early crop in protected condition or/and open field condition. The low cost polyhouses were found economical for small and marginal farmers, who cannot afford huge cost of high-tech poly house. By adopting this technique, a cucurbit crop was raised one and a half months in advance than normal method of direct seed sowing in the field. Similarly the nursery of other vegetables like, tomato, chilli, capsicum, cole crops etc. can be raised and sold to get higher profit. The nursery was raised for 45 days under this structure, however, the same structure can be used for round the years by applying various types of cladding materials. The economics of raising vegetables nursery is given below.

Economics of raising nursery under poly house

Size of structure (10m (L) x 5m (W) x 7' (H)) = 50m²

No. of seedlings 8000 (polybags) + 7000 (protrays) = 15,000/-

Seedling @ Rs.2/- = Rs. 30,000/-

Investment cost (polyhouse, polybags, protrays) = 15,500 + 5,000 = Rs. 20,500/-

Net profit 1st year (30,000 – 20,500) = Rs.9500/-

Net profit 2nd year (30,000 – 5000) = Rs.25000/-

Net profit 3rd year (30,000 – 6000) = Rs.24,000/-

Low cost polyhouse technology for raising crops

The low cost polyhouses which were used for raising nursery, the same type of structures was utilized for raising crops during winters. The high value crops like cherry tomato, gherkin, bitter gourd (gynoecious) and cucumber (parthenocarpic) were grown during November second fortnight. The temperature inside polyhouse was 6-10⁰C higher than outside. The cold waves during December-January did not enter and the growth of the plants were normal. All the recommended cultivation practices of these crops were followed to raise a good crop. Harvesting of gherkin started from last week of January. Gherkin recorded Rs. 43,500/- and Rs. 59,000/- profit from 1000 m² area during first year and second year respectively.

Harvesting of cherry tomato was started from midFebruary and net profit of Rs. 33,750/- during first year and Rs. 50,000/- during second year was recorded.

In Bitter gourd (gynoecious) a net profit of Rs. 23,750/- was recorded in first year and Rs. 40,000/- during second year onwards.

Parthenocarpic cucumber recorded Rs. 37,000/- profit during first year and Rs. 52,500/- during second year onwards.

Table3: Off-season vegetable production under low cost polyhouse (1000 m²)

Crop	Variety	Spacing (cm)	Crop duration (Months)	Total Production (kg/1000 m ²)	Estimated Sale Price (Rs./kg)		Cost of cultivation (Rs.)*	Total Income (Rs.)	Net Profit (Rs.)
					Farmer	Market			
Gherkin	DG-6	50 x 50	4	2,300	30	50-60	25,500	69,000	43,500
Cherry Tomato	Cherry Red Cherry Yellow	60 x 50	5	2,000	30	80-100	26,250	60,000	33,750
Bitter gourd	Gynoeocious	60 x 50	4	2,000	25	50-60	26,250	50,000	23,750
Cucumber	Parthenocarpic	50 x 50	4	2,500	25	40-50	25,500	62,500	37,000

Second year onwards profit: - Gherkin: Rs. 59,000/-, Cherry tomato: Rs. 50,000/-, Bitter gourd: Rs. 40,000/- , Cucumber: Rs. 52,500/-

The crops were raised for 4 to 5 months duration under polyhouses. However, with the same structure other crops can also be grown by utilizing different types of cladding material like shade net etc.

Temporary protected low height polyhouse:

Vegetable crops like, French bean, amaranth and summer squash were grown during winter season successfully under low cost low height temporary poly structure during off season from November to February when it was difficult to raise under open field. French bean was harvested during first week of February. The results showed that French bean recorded a net profit of Rs. 18,500/- during first year and Rs. 33,000/- from second year onwards. Summer squash, which is a bush type cucurbit, harvesting started from second week of February and it recorded net profit of Rs. 47,250/- in first year from an area of 1000 m² and Rs. 59,500/- from second year onwards. Amaranths harvesting was started from last week of January and it recorded Rs. 15,000/- and Rs. 25,000/- profit from 1000 m² area during first year and second year respectively.

Table3: Off-season vegetable production under temporary protected (winter protection)

Crop	Variety	Spacing (cm)	Crop duration (Months)	Total Production (kg/1000 m ²)	Estimated Sale Price (Rs./kg)		Cost of cultivation (Rs.)*	Total Income (Rs.)	Net Profit (Rs.)
					Farmer	Market			
French bean	Contender Pusa Parvati	50 x 7	110	950	40	70-80	20,000	38,500	18,500
Summer Squash	Pusa Alankar Australian Green DS-8	50 x 50 50 x 50	115	4500	15	40-50	20,250	67,500	47,250
Amaranth	Pusa Lal Chaulai Pusa Kiran	50 x 50	120	1500	20	40-50	15,000	30,000	15,000

Low Height Polyhouse (1000 m²)

Second year onwards profit: - French bean: Rs. 33,000/-, Summer squash: Rs. 59,500/-, Amaranth: Rs. 25,000/-

The structure was utilized for raising crops from November to February. However, with the same structure other crops can also be grown by utilizing different types of cladding material like shade net etc.

Conclusion

The off-season nursery production was found profitable under low cost polyhouse of 50 meter square area. Similarly, cultivation of high value off-season vegetables under low cost protected structures was found a viable technology for growing vegetables successfully during winter with temporary protection from November to February. The produce from protected structures was off-season and hence fetched higher prices in the market. Under low cost protected structure of 50 m² a total of Rs. 9500/- was earned in first year and around Rs. 24,000/- from second year onwards by raising off-season nursery. Similarly a net profit of Rs.15, 000/- and 59,500/- can be earned by growing French bean and gherkins in first year and Rs. 43,500/- and Rs. 59,000/- second year onward from 1000 m² area respectively. Therefore to enhance income and to ensure nutritional security of the small and marginal farmers, off-season nursery as well as vegetables cultivation under low cost poly houses is found to be economical and profitable enterprise.

References

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