



## Off Season Cultivation of Cucurbits Under Low Tunnel: A Cost Effective Technology for Farmers of Peri-Urban Areas of Northern India

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Plastic low tunnels are highly suitable and profitable for off-season cultivation of cucurbits like summer squash, bottle gourd, bitter gourd, muskmelon, watermelon, round melon and long melon in peri-urban areas of northern plains of India. The yield of some cucurbits like cucumber can be increased manifold compared to their open field cultivation. The economics of protected cultivation directly depends upon the initial cost of fabrication of the protected structure, its running cost and the available market for high quality produce. Therefore, plastic low tunnels which can generally be fabricated with low cost and the running cost of such structures is also very low are highly suitable.

### Introduction

India is the second largest producer of vegetables in the world next to China. Presently the total vegetable production of India is approximately 146.55 million tonnes from a total area of 8.5 million ha under vegetable crops, but the productivity and quality of most of the vegetable crops is very poor due to several biotic and abiotic stress conditions under open field cultivation. Production of vegetables under protected structures such as low tunnel provides the best way to increase the productivity and quality of vegetables, especially cucurbits. Row covers or low tunnels are flexible transparent covering that are installed over the rows or individual beds of transplanted vegetables to enhance plant growth by warming the air around the plants in the open field during winter season. Low tunnels are also advantageous in warming the soil, protecting the plants from bad weather, preventing the plant to get injured and

advancing the crop by 30 to 40 days as compared to the normal sowing. Low tunnels technology is mainly suitable for off season cultivation of cucurbits like muskmelon, round melon, long melon, bitter grand, bottle gourd and summer squash etc. Northern parts of the country, where the night temperature during winter season goes below 8°C for a period of 30-40 days, this technology could be quite suitable and cost effective for cucurbits growers.

### Advantages of Low Tunnel

- Used for raising healthy and early nursery.
- Maintains optimum temperature for plant growth.
- Enhances nutrients uptake by the plants.
- Increases photosynthetic activities of the plants.
- Used for cultivation during winter.
- Protection against wind, rain, frost & snow.

### Materials Required for Construction

- High Density Polyethylene (HDPC) / Polyvinyl Chloride (PVC) pipes of one inch diameter and 2 meter in length.
- Transparent Low Density Polyethylene (LDPE) films of 25-50 microns having 2 meter width.
- 50 cm long with 6 mm diameter Galvanised Iron (GI) wires in which Peg to be made.
- 2 number of poles having 5 cm diameter.
- Twin Poly Propylene (PP) ropes.

### Nursery Raising for Off-season Cultivation of Cucurbits

Seedlings of the desired cucurbits are raised in the nursery greenhouse in plastic pro-trays having 1.5" cell size in soil-less media in month of December or January. Seedlings of 28-32 days old at four leaf stage are transplanted under row covers or plastic low tunnels in the open field from mid January to mid February, when the night temperature is very low in northern parts of the country. Crops like summer squash can be transplanted even in the month of December for complete off-season production and this crop will be ready for harvesting in the first week of February and can fetch very high price in the market.

### Transplanting of Seedlings

Seedlings are transplanted in a single row on each bed at a spacing of 1.5-1.6 × 0.50 m. Before transplanting of the seedlings on beds, flexible galvanized iron hoops are fixed manually on a distance of 1.5 m to 2.5 m. The width of two ends of hoop is kept 40-60 cm with a height of 40-60 cm above the levels of the beds for covering the plastic on the rows or beds for making

low tunnels. Transparent, 30 micron, plastic is generally used for making low tunnels, which reflects infra-red radiation to keep the temperature of the low tunnels higher than outside field. The plastic is usually covered in the afternoon after transplanting the desired vegetable like muskmelon, summer squash, bottle gourd, bitter melon, round melon, cucumber etc. The plastic can be vented or slitted during the growing season as the temperature increases within the tunnels during the peak day time. Generally, 3-4 cm size vents are made on eastern side of the tunnels just below the top on a distance of 2.5 to 3.0 m after transplanting, and later on the size of the vents can be increased by reducing the distance between two vents with the increase in the temperature and ultimately the plastic is completely removed from the plants in the month of February and March depending upon the date of transplanting, growth of the crop and prevailing night temperature in the area.

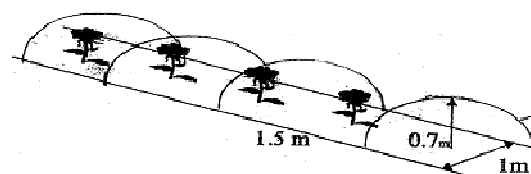


Fig-1 : Low tunnels for off-season vegetable cultivation

### Pollination under Plastic Low Tunnel Crops

Most of the cucurbits being monoecious needs pollination. The main pollinating agent is honeybees (*Apis mellifera*). When there is complete flowering bees can work in tunnels easily through the vents, made on the plastic. For effective pollination in crops like muskmelon, summer squash etc, one beehive per acre area is sufficient. The beehive box is kept on the northwest side

of the field for effective working of the bees.

### Fertigation and Plant Protection in Low Tunnel Cucurbits

The water and fertilizers requirement of crops is usually depends upon the growing season, crop and variety and soil conditions. Fertilizers are applied through drip irrigation. In muskmelon water can be applied @ 4.0 m<sup>3</sup>/1000m<sup>2</sup> at an interval of 6-7 days during the first month i.e., January and February. Fertilizer solution of N: P: K (5:3:5) is applied @ 80-100 ppm per cubic meter of water. During second month 4.0 m<sup>3</sup> of water can be applied on duration of 4 days with fertilizer solution @ 120-150 ppm/m<sup>3</sup> of water till beginning of flowering in the crop. Thereafter the fertilizer quantity is reduced to 20-30 ppm till the fruits are of lemon size after that the quantity is again increased to 120-150 ppm per cubic meter of water. Before the ripening of the fruits, the quantity of fertilizer solution is again reduced to 50-60 ppm for enhancing the quality of fruits in muskmelon. But in other cucurbits the quantity of fertigation is always in increasing order, starting from 50 ppm to 300 ppm at the peak fruiting period. If required systemic insecticide can be applied through drip irrigation water for control of insects at early stage of the crop when the crop is under plastic tunnels and no foliar spray is possible.

### Harvesting and Crop Advancement

Different cucurbits can be transplanted from first week of December to first week of February and can be advanced 30-60 days over their normal season of cultivation (Table 1). Off-season fruits produced under low tunnels can fetch very high price in the market. This technology

is quite economical for growing off-season vegetables in peri-urban areas of the northern plains of the country.

**Table 1:** Transplanting, crop advancement and expected cost benefit ratio in cucurbits.

S.No.	Crop	Trans planting time	Harvesting time	Crop advancement (days)	Expected cost benefit ratio
1	Summer squash	<sup>st</sup> 1 week of Dec	<sup>st</sup> 1 week of Feb	60	1:3 to 1:4
2	Musk melon	<sup>rd</sup> 3 week of Jan to <sup>st</sup> 1 week of Feb	<sup>nd</sup> 2 week of April to last week of April	30-40	1:2.5 to 1:3.5
3	Bottle gourd	-do-	-do-	30-40	1:2.5 to 1:3.5
4	Bitter gourd	-do-	-do-	30-40	1:3 to 1:4
5	Water melon	-do-	-do-	30-40	1:2 to 1:2.5
6	Cucumber	-do-	<sup>st</sup> 1 week of Feb	30	1:3 to 1:4

### Conclusion

Low tunnels, with location specific modifications, are highly suitable for growing vegetables in the peri-urban areas of the northern plains, cold desert areas as well as other areas of the hilly states like Himachal Pradesh, Jammu and Kashmir, Uttarakhand and North Eastern states. Indigenous technological database need to be developed in hilly regions to make adoption of protected cultivation sustainable. Cost effective and location specific design of the greenhouse needs to be developed. The package of practices including fertigation, need to be worked out for different agro-climatic situations. Use of biodegradable plastics or polymers should be encouraged to combat environment pollution. The further refinement in existing technology will definitely go a long way to harness the full potential of low cost polytunnels in vegetable production in the hilly regions.