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Low Tunnel Farming in Cucurbits

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INTRODUCTION

By changing climatic situation, the best option to use the land and other resources more efficiently is the production of vegetables under protected condition. Year round availability of quality vegetables both for domestic use and export can be assured by adapting protected cultivation. Protected cultivation means the modification natural environment to reduce one or more of abiotic stress for optimum plant growth, which can be achieved in green houses, poly hoses, net house, poly-tunnels and cold frames. Under these structures, the yield of vegetable crops can be several times higher than those of open field conditions, the quality of produce is also better and input use efficiencies are usually higher. In many European Countries, USA, Japan, China, Israel, Morocco, Turkey *etc*., where extreme climate reduces the choices for year round outdoor production, and vegetables are being produced in protected environments. In India, the total area under greenhouse vegetable cultivation is around 10,000 ha. One system of protection is a low tunnel.

What is tunnel farming?

Producing off season crops in controlled atmosphere inside polythene tunnels is called Tunnel Farming. From December to February, it is not possible to grow summer vegetable in open fields due to low temperature and high frost levels, so these are developed inside polythene tunnels so that proper atmosphere may be given to plants for their maximum growth and yield. Tunnel farming is the source of earlier crop production and higher crop yields because of controlled atmosphere, and this earlier crop produce gives high-quality profits to the farmers.

Forms of Tunnel Farming

1. Low tunnel- Summer squash
2. Walk in tunnel- Cucumber, Musk melon, Round melon, Long melon, water melon
3. High tunnel- Bottle gourd, Ridge gourd, Sponge gourd

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Selection criteria for different types of tunnel

1. Crop to be sown.
2. Crop Stature
3. Investment capacity
4. Crop nature
5. Variety to be sown
6. Management level

Offseason cucurbits production under low tunnel technology

Low tunnels are flexible transparent covering over the individual beds or rows of transplanted cucurbits to increase plant growth by creating favorable microenvironment around the plants under low tunnel in the open field during winter season. Low tunnels increases air and soil temperature efficiently thus enhancing vegetative growth, increases crop yield, recover water and nutrient use efficiency and advancing the crop by 30 to 40 days as compared to the normal sowing. Insect nets and row covers can also exclude insects from the crop and reduce the pest damage. In short, productivity and land use efficiency of crop can be improved by low tunnels. Low tunnel farming is mainly suitable for off season cultivation of cucurbits like muskmelon, round melon, long melon, bitter grand, bottle gourd and summer squash. This cost effective technology is mainly suitable for cucurbits growers in northern parts of the country, where the night temperature goes below 8℃ during winter season for a period of 30- 40 days.

Fig. 1: Low tunnel technology

Fig. 2: Walk in tunnel technology

Fig. 3: High tunnel technology

Benefits of low tunnel

• Used for raising early and healthy nursery.
• Optimum temperature can be maintained for plant growth.
• Increases nutrients uptake by the plants.
• Enhances photosynthetic activities of the plants.
• Cultivation during winter is possible.
• Provide protection against wind, rain, frost & snow.
• Insect and pest infestation is reduced

Nursery Raising of cucurbits under low tunnel

In month of December or January, seedlings of the preferred cucurbits are raised in plastic pro-trays having 1.5" cell size in soil-less media in the nursery of greenhouse. 28-32 days old seedlings are transplanted under plastic low tunnels at four leaf stage in mid January to mid February in open field under northern parts of the country when the night temperature is extremely low. In the month of December, the summer squash crop can also be transplanted for complete offseason production and this crop will be prepared for harvesting in the first week of February. In last, the farmers can get very high price in the market.

Seedlings transplanting under low tunnel

Seedlings are transplanted in a single row on each bed at spacing of 1.5-1.6 × 0.50 m. Flexible galvanized iron hoops on a distance of 1.5 m to 2.5 m are set manually before the transplanting of the seedlings on beds. For making low tunnels, 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 and 30 micron, transparent plastic is generally used which reflects infra-red radiation to keep the temperature of the low tunnels higher than outside field. After transplanting, the plastic is usually covered in the afternoon in cucurbitaceous vegetables like cucumber, muskmelon, bottle gourd, bitter gourd, round melon and summer squash. During the growing season, the plastic can be vented. On eastern side of the tunnels, 3-4 cm size vents are made 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. In the month of February and March, the plastic is completely removed from the plants depending upon the date of transplanting, growth of the crop and prevailing night temperature in the area.

Table 1: Time of transplanting in cucrbits

Sr. No.	Name of crop	Transplanting time
1.	Cucumber	Third week of Jan to first week of February
2.	Muskmelon, Watermelon	Third week of Jan to first week of February
3.	Bottlegourd, Bittergourd	Third week of Jan to first week of February
4.	Summer squash	First week of Dec

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Pollination under Plastic low tunnel

The main pollinating agent is generally honeybees (*Apis mellifera*) in low tunnel and the sex form in most of the cucurbits are monoecious and needs pollination. When there is complete flowering bees can work in tunnels easily through the vents, made on the plastic. One beehive per acre area is required for effective pollination in crops like muskmelon, summer squash *etc*. For effective working of the bees, the beehive box is kept on the northwest side of the field.

Fertigation and Plant Protection in low tunnel

Fertilizers are applied through drip irrigation. During the first month (January and February) water can be applied @ 4.0 m^3/1000m^2 at an interval of 6-7 days in muskmelon. Fertilizer solution of N: P: K (5:3:5) is applied @ 80-100ppm /m^3 of water. During second month, water can be applied 4.0 m^3 on duration of 4 days with fertilizer solution @ 120-150 ppm 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 /m^3 of water. In muskmelon, the quantity of fertilizer solution is again reduced to 50-60 ppm before the ripening of the fruits for enhancing the quality of fruits. But in other cucurbits the quantity of fertigation is constantly 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 of cucurbits

Table 1: Time of transplanting in cucrbits

Sr. No.	Name of crop	Harvesting time
1.	Cucumber	First week of March
2.	Muskmelon, Watermelon	Second Week of April to last week of April
3.	Bottlegourd, Bittergourd	Second Week of April to last week of April
4.	Summer squash	First week of Feb

Off-season fruits obtained from cucurbitaceous vegetables produced can get very high price in the market under low tunnels. Growing off-season cucurbitaceous vegetables is quite economical in peri-urban areas of the northern plains of the country.