

Low Tunnel Technology for Vegetable Crops

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Vegetables are a rich source of vitamins, carbohydrates, salts and proteins. Due to increased health awareness, high population growth rate, change in diet patterns, there is a year-round high demand for fresh vegetables in the country in domestic and export market. Due to unfavourable climatic conditions, there is a flood of vegetables in the season and high-priced vegetables in off-season. With the introduction of greenhouses, low and high poly tunnel technology with controlled temperature and humidity, vegetables can be cultivated in off season also. Low tunnels also known as plastic tunnels are miniature structures producing greenhouse like effect. Launched in 1999, as a pilot project by the Agricultural Technology Management Agency, the low tunnel technique is catching up among the farmers. They facilitate the entrapment of carbon dioxide which enhances the photosynthetic activities of the plant that helps to increase yield. Among the different types of covers available to use with LTs, spunbonded row covers of various thicknesses are most popular. They are semi-transparent porous fabrics that allows airflow and ventilation, hence helps to avoid condensation that may damage the foliage in contact with water.

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History

- Hoop houses or poly tunnels have been existed since 1940s. With each passing decade their design continues to evolve.
- The first use of plastic film in agriculture has been done by Professor. E. M. Emmert in 1948 when he built the first plastic greenhouse, a wooden structure covered with cellulose acetate film. Later, he replaced that film with more effective polyethylene film due to unstable behaviour of cellulose acetate film on exposure to temperature and moisture.
- After this, introduction of plastic film in agriculture began on a wider scale and in 1950s, it replaces paper for mulching vegetables. The first plastic tunnels were used in Fresno County by Mr. Richard Espinoza to grow Japanese eggplants and Chinese long beans in 1981. He was introduced to this technique when he was on a tour to San Diego vegetable growers in 1981. Later on, he built the first tunnel laying machine followed by building many low tunnels for the local vegetable growers.
- Walk in tunnels, low plastic tunnels etc. were evaluated for cultivation during normal and off – season at Indo- Israel Project in IARI, New Delhi during the year 1999- 2000 to 2000- 2003. In India, the low tunnel technique was launched in 1999, in Punjab as a pilot project by Agricultural Technology Management Agency (ATMA).
- This technique has proved a boon for vegetable growers, especially those with small land holdings.

Principle Behind

Low tunnel farming works on the same principle as that of a greenhouse. It helps to create conditions during winter equivalent to those in summers. Therefore, the vegetables that are sown in summer can easily be cultivated in winters inside these low poly tunnels.

- In general, low tunnels allow shortwave solar radiation to pass through during the day and the

plastic material slows longwave radiation from the surface at night. It converts the light energy from the sun into heat energy which provides warmth to the plants grown inside it and promotes early growth of plants. The interior of the tunnel heats up faster from the incoming solar radiations as it passes through the transparent polythene sheet and is absorbed by the black polythene sheet spread over the soil.

- The plastic sheet on the surface serves three purposes- 1) it traps heat 2) it reduces evaporation or conserves moisture 3) it eliminates the growth of weeds.

Advantages and Disadvantages:

1. **For raising healthy seedlings-** it is done by modifying the microclimate inside low tunnels which helps the grower to raise healthy and early nursery. This can be an extra source of income for a farmer by selling those seedlings to another village.



Fig 1: Growth difference in cucumbers grown under low tunnel as compared to open field

2. **Enhances nutrient uptake by the plants-** the plants grown inside low tunnels have stronger root development in comparison with the plants in open field. Therefore, it enhances the uptake of nutrients.
3. **Maintain optimum temperature-** every crop requires certain temperature to grow like cool season crops require around 21° C and warm season crops require temperature as high as 32° C. Low poly tunnels are capable of maintaining an optimum temperature for summer sowing crops if cultivated in winter season.

4. **Reduces Evapotranspiration-** the use of mulching technique inside low tunnels reduces the water loss from the plants and soil. So, it takes longer for a plant to dry.
5. **Provides protection-** the plants that are cultivated under low poly tunnels have a protection against wind, frost, rain and snow.
6. **Dissembled easily-** this technique is light in structure and therefore can be dissembled easily and relocated to another place after cultivation has been done.

Disadvantages

1. Less production of vegetables in comparison to high tunnels.
2. Crop management operations are difficult like spraying, hoeing, fertilizer management become quite tough for a grower to do in low poly tunnels.
3. Temperature maintenance is difficult and it requires regular monitoring by the grower because for some temperature sensitive crops like – tomato and pepper, if they grow too tall and touch the row cover sheet, it will get deteriorate.
4. Dismantling must be done manually and therefore labour intensive.
5. Repair and support are significant obstacles.

Conclusion

The growing population, rapid industrialization and urbanization is gradually decreasing the cultivated land area and so the demand of fresh vegetable under shrinking land area forces the policy makers to think beyond open field cultivation. Therefore, these low-cost poly tunnels offer an immense scope for the farming community of India.

A low cost and low maintenance technique, low tunnel technology ensures supply of vegetable during scarcity and helps the grower to obtain reasonable and profitable return of their produce. By increasing air temperature, reducing wind damage and providing a degree of frost protection, the low tunnels accelerate crop production and extend the growing season. There is a need of efforts to minimize the initial investment for establishment of protected

structures. Government support as well as intervention of NGOs for financial help and arrangement for skill development programme on protected cultivation will help to increase the area

under protected cultivation. The further refinement in existing technology will definitely go a long way to harness the full potential of low-cost poly tunnels in vegetable production in the hilly regions.

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