Food and Agriculture Organization of the United Nations

# Tunnel farming for off-season vegetable cultivation in Nepal


| | |
|---|---|
| **Source** | FAO Strategic Objective 5 – Resilience, in FAO |
| **Keywords** | Crop diversification, drought, vegetables, off season cultivation, protected cultivation, hail |
| **Country of first practice** | Nepal |
| **ID and publishing year** | 7714 and 2013 |
| **Sustainable Development Goals** | No poverty, zero hunger, climate action and life on land |



## Summary

This practice describes how to reduce the impact of high and low temperature fluctuations and hail storms that often affect crop yields, as well as to grow crops off season to guarantee food supply at the household level to local farmers.


## Description

Vegetables are a required source of vitamins, proteins, essential nutrients and carbohydrates for a balanced diet. In the mid-hill region in Nepal, farmers are limited to grow seasonal vegetables and are dependent on marketing mechanism of demand and supply.

Growing off-season vegetables and fruits means improving the diet and increasing the household income. In the absence of storage infrastructure and vegetable processing industries, off-season vegetable farming is the only viable option that can add value to the farmers' produce.

Temperature fluctuations during summer make the vegetable crop susceptible to insects, pests and diseases and similarly, cold temperature during winter create favourable conditions for diseases.

The tunnels offer protection to vegetables crops both in summer and in winter. The tunnel farming offers maximum crop yields, better maintenance of the fertility of land, controlled temperature and humidity, protection from wild animals and insects and better water conservation.

In order to produce vegetables under protection, it is necessary to consider a wind-free area, but if this is not possible, windbreaks should be erected or planted. Water must not be very saline, as it is further enriched by the addition of fertilizers.

Finally, the tunnel must preferably be situated close to a market, in order to facilitate that products reach the market place as soon as possible. Crops such as cucumber, capsicum, tomato, pepper, bitter gourds, melons, brinjal and water melon are highly valued vegetables that show significant increase in yield when grown in tunnel farming.

### 1. Implementation of the technology

In general, tunnels may be:

- Low: which are less expensive compared to high tunnels but crop yield is low. Soil preparation, spraying and picking is difficult in this tunnel. Cucumber, melons, watermelons, bitter gourds, squashes, and snake gourds, etc. can be grown in these tunnels.



TECA
TECHNOLOGIES and PRACTICES for SMALL AGRICULTURAL PRODUCERS

- Walk-in: which are lower in height compared to high tunnels. Walk-in-tunnels provide higher yields than low tunnels because of better sun light and ventilation. The tunnel is suitable for growing tomatoes, cucumbers, sweet pepper and hot pepper.
- High: High tunnels give maximum yield of crops and make easy soil preparation, picking, spraying due to its width and height. The tunnel is suitable for growing tomatoes, cucumbers and sweet peppers.

**1.1 Building tunnel structures is inexpensive and relatively easy**

- The structure of the tunnel is made of bamboo sticks and wooden poles of 1-inch diameter.
  As single bamboo sticks are thin, combining two or three sticks bundled together provide a sufficiently strong bow and girder construction, strong enough to hang strings that support vegetable growth such as tomatoes, cucumbers and beans.
- A transparent plastic sheet is placed on the structure to allow sunlight during the day passes through the plastic sheet, and is absorbed by the black sheet spread over the soil. This raises the temperature to desired levels.
  The plastic sheet on the soil serves three purposes: first it traps heat, second it reduces water loss and third it eliminates growth of weeds as seeds germinate from the holes made in the plastic sheet.
  During winter and summer times, the roof may be covered with leaves or locally available crop residues to protect from cold weather. During autumn and spring, the structure is left without protection facilitating aeration.
- Good cross ventilation and potential stresses caused by heavy wind, hail or rain must be considered while constructing the structure.

**1.2 Growing vegetables in tunnel farming**

Seeds are planted in plant blocks / seed-trays, and one seed is sown into each compartment of the tray, lightly covered and kept wet. Seedlings remain in the seed tray until they have grown to about 10 cm.

Seedlings are then planted in the planting bags and kept wet. Climbers are trained up to overhead wires by pieces of string. The bottom part of the string is placed in the planting hole. The plant is placed on top of the string and firmed down into the growth medium to remove air from the roots. Then the other end of the string is fastened to the overhead wire.

Tomatoes, cucumbers, green peppers, beans and sweet melons can all be trained up in this way to the wires that are strung above the rows and are fastened to the roof of the tunnel. The string is constantly wound around the main stem of the plant. This applies to all the plants except green peppers, in which case three or four stems can be used.

**1.3 Irrigation in tunnels**

During summer, irrigation is required every five to seven days, depending on the type of soil, whereas in December and January, light water is required every 10 to 15 days.

The quantity of water can be changed keeping in mind the climatic conditions. In water shortage areas, the most efficient use of water are through drip irrigation, maximizing the use of water, as well as fertilizers, applied though drips as fertigation, especially in the initial growth stages.

Figure 1. High tunnel

© FAO/TECA

Figure 2. Low tunnel

© FAO/TECA

**2. Technical, economic, financial, social and environmental attributes of the technology**

- Protection from heat and cold waves and hail storm.
- Reduces the impact of vegetable crops.
- Possible to cultivate the crop throughout the year.
- Provides opportunities for crop diversification.
- Household income for women.
- Less labour requirement.

**3. Minimum requirements for the successful implementation of the practice**

- Access to capital.
- Availability of local materials for construction.
- Protection from heavy wind.

**4. Agro-ecological zones**

- Subtropics, warm/mod cool

**5. Objectives fulfiiled by the project**

**5.1 Women-friendly**

Provides household income to women.

**5.2 Resource use efficiency**

More efficient use of land in building the tunnels enables improved protection from extreme climate. Less labour required which means improved use of resources.

**5.3 Pro-poor technology**

Practice allows for more crop diversification and cultivation throughout the year which guarantees more food security and more added source of income.