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OFF SEASON CUCURBITS FARMING INSIDE LOW TUNNEL—A REVIEW

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ABSTRACT

Off season cucurbits cultivation under low tunnels has spreaded in recent years. Low tunnels modify the microenvironment around the plant by increasing soil and air temperatures and reducing ET in comparison with open field in winter season, which force the early yield of cucurbits. Produces have high market value in off-season. So this technology might have boon for vegetable grower.

Key words : *Off-season, low tunnel, cucurbits.*

India is the largest producer of vegetables in the world next to China. Presently food security by vegetables is our top priority according to population. Vegetable production faces biotic and abiotic stress which hinder in production and productivity in the open field.There is a year round high demand for fresh vegetables in the country in domestic and export market due to: increased health awareness, high population growth rate, changing dietary patterns of increasingly affluent middle class,the production of vegetables all around the year enables the growers to fully use the resources and supplement income from vegetable growing as compared to other normal agricultural crops. Raw cover 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. It also protect from cold/ cold injury and advancing the crop by 30 -40 days as compared to the normal sowing. Low tunnel technology is mainly suitable for off season cultivation of cucurbits like muskmelon, watermelon, round melon, long melon, bitter gourd, bottle gourd, and summer gourd etc. The low tunnel could be increasingly necessary to mitigate adverse effects of climate change on fruit growing (Carlen and Kruger, 2009).So vegetable farming using low tunnel is good option. Low tunnels are miniature structures producing green house. In these tunnels, plastic sheets are used for roof covering of the tunnel with shaped construction having low height, which is built with steel bars or bamboo strips. These tunnels facilitate the entrapment of carbon dioxide, thereby enhancing the photosynthetic activity of the plants and hence the yield. These structures also protect the plants from the high winds, rain, frost and snow. Besides being inexpensive, they are easy to construct and dismantle. Low tunnels are being used for producing high quality, high valuednurseries and crops such as tomatoes, cucumber, radish, beans and capsicum. With this technology, the farmers can capture the market in the early season and may get good return of the produce. The price of the produces have high premium value during their off-season availability by adopting the season forcing techniques like green house, poly house net house and low tunnel (Enoch and Enoch, 1999) but installation of these structures are costlier so unaffordable by the small and marginal farmers. Generally,the tunnels are made in north to south direction to receive maximum sunlight. Transparent plastic of 30-50 micron is commonly used for making low tunnels, which reflects infra-red radiation to keep thetemperature of the low tunnels higher than outside. These tunnel increases the inside temperature andentrapment of carbon dioxide, resulted more photosynthetic activity of crops hence early produce. Theycreate a favourable microclimate around the crops by proving, frost and pest protection and reducingmoisture loss. (Butler and Ross, 1999).

Nursery raising : The low tunnel techniques can use for raising seedlings by modifying the microclimate (Ken-Bar 2004.Cucurbits seedlings are raised in pro-tray system. This is quite good system because the roots are proliferated mostly on the outer periphery of the root media ball and they can be removed very easily without any kind of damage to root of the seedlings. Mostly artificial soil media is used for raising healthy and vigorous seedlings of vegetable in plastic pro-trays. There are three ingredients viz., coco peat, vermiculite and perlite which are being used as a rooting medium for raising the nursery. In this respect there are three type of soilless rooting medium i.e. coco

peat, perlite and vermiculite medium are required. Role of Coco-peat medium is improved porosity, drainage and air movement activity. Perlite having its role in to improve aeration and drainage is essentially expanded heat of aluminium silicate rock and white granular product whereas vermiculite is expanded heat of mica having good water holding capacity.

Benefit of this nursery is better root development of transplants and reduction in the mortality in transplanting of seedling as compared to the traditional system of nursery raising. Moreover, the root development under this system is more vigorous compared to soil medium grown seedlings. One can also grow off-season nursery of these cucurbits for advancing their crop over the normal season and for complete off-season cultivation of these vegetables under low cost protected structures like plastic low tunnels etc. (Singh *et al.,* 2005). Under this technology seedlings of the required cucurbit vegetable are raised in multi-celled plastic plug-trays with a cell volume of 18-20 cc. These cells may be of any shape like inverted pyramid, round, hexagonal, etc. Soilless medium consisting of coco peat, vermiculite and perlite is used in a 3:1:1 ratio on volume basis mixed well with required water. The plug-trays are filled with mixed soilless medium and then a slight impression is made in each cell by gentle pushing with the first finger of hand and then one seed in each cavity is sown. After sowing of the seeds a thick layer of mixed media is put over the seeds in each multi-celled plug-tray and is being pressed with gentle palm then allowedby a light irrigation through fine sprinklers. If the temperature is low (12°C during night) especially during winters, the plug-trays are kept in the temporary germination room by keeping the trays in layers one over the other and the temperature of the germination room is kept at 24-25°C through the use of hot air blowers. The plug-trays are taken out of the germination room just after germination of the seeds and are spread on the floor of the nursery greenhouse or benches. Irrigation in the plug-trays is done as per requirement, normally once a day during winter and twice a day during summer season or hot months. Fertigation is done thrice a week and in each fertigation N: P: K: (20:20:20 grade) solution is applied at 100-140 ppm. The seedlings of different cucurbits are ready for transplanting within 25-35 days of seed sowing during peak winter months (i.e. December and January).

Advantages of low tunnel technology :

Light Structure and cost effective cost structure

Easy to install

It can be easily dismantle and relocate to other sites

Maintenance is very easy

Raising healthy seedlings

Increases photosynthetic activities of the plants

Used for cultivation during winter season

Protection against wind , rain, frost and snow

Encourage organic production

Getting earlier produces which fetches premium price in the vegetable market.

Limitation of low tunnel technology :

Lack of awareness among farmers pertaining to potentials of low tunnel

Lack of major research programme on low tunnel based vegetable farming

Material required for fabrication of low tunnel :

High Density polyethylene(HDPC/Polyvinyl PVC

Transparent Low Density polythene(LDPE) films of 30-50 microns having 2 meter width

Galvanized Iron rod/ bamboo strip

Installation of low tunnel : Transplanting of the seedling is done in a single row on each bed at a planting distance of 50 cm on drip or surface system of irrigation. The distance between the rows is kept 1.5 to 1.6 meter. Before transplanting of the seedling of cucurbits on beds, flexible galvanized iron hoops or bamboo strips are fixed manually at a distance of 1.5 m to 2.0 m. The width of two ends of hoops is kept 45-60 cm with a height of 45- 60 cm above the surface of the beds depending upon the crop and its planting Generally , the tunnels are made in North to south direction to receive maximum sunlight. Generally 30-50 micron (Infra-red grade) transparentplastic is commonly used for making low tunnels. These plastic

Table-1 : Transplanting, crop advancement and harvesting in cucurbits.

S. No.	Crops	Transplanting time	Harvesting time	Crop advanced
1.	Summer squash	First week of December	First week of February	60
2.	Musk melon	First week of December	2nd of April to last week of April	30-40
3.	Bottle gourd	First week of December	Last week of March	30-40
4.	Bitter gourd	First week of December	Last week of March	30-40
5.	Water melon	First week of December	2nd of April to last week of April	30-40
6.	Cucumber	First week of December	Last week of March	30

are stretched over the miniature tunnel and one side of tunnels are fixed by soil with the help of spade and other side is temporarily is fixed by putting stone or other materials.Generally, 3-4 cm size vents are made on eastern side of the tunnels just below the top at 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 temperature According to situation in day time plastics are removed from unfixed side and again in evening time beds are covered again. Finally the plastic is completely removed from the plants during February or March depending upon the crop, its growth and prevailing night temperature at that time.

Pollination : Being a monoecious crop, it need pollination to better fruits set which is usually performed by honey bees(*Apismelifera* L.). One beehive having 30000 workers is sufficient for one acre.The beehive box is always kept on the north-west side of the field for best activity of bees.

Fertilizer and Irrigation management : Crops are irrigated either drip irrigation or surface irrigation. but drip irrigation is always better over surface irrigation. Because it saves 50 -60 % water and time, labour costs, fertilizer given through drip irrigation called fertigation. After making fertilizer solution of N: P: K(5:3:6) is applied @80-100 ppm per cubic meter of water. The water and fertilizer requirement of the crop depends upon the growing season, variety and type of soil.

Weed management : Chemical weeding is a cost effective method over manual weeding.Herbigation is an effective method of applying herbicide through irrigation system to control field weeds.

Insect-pest management : Pumpkin beetle can be said as one of the serious pests of Cucurbitaceous family because it attacks at every stage of the cucurbits and heavy losses can be done by it to all cucurbits except bitter gourd (Rajak, 2000),) Cucurbits are generally are infected by red pumpkin beetle in cotyledanary/seedlings stage. These beetles are controlled by carbaryl (Sevin trade name by Bayer company) @ 2g/litre or dusting with carbaryl (Sevin) in early morning.

Disease management : Fungal diseases are controlled be application ofMancozeb or hexaconazole @ 2g/litre of water at 15 days interval. In case of viral disease, use of resistant varieties is best option to avoid.

Low tunnel and Yield : Ogden and van Iersel (2009) have indicated that low tunnels modify climatic conditions, promoting earlier flowering and fruit ripening as well as fruit precocity production. In similar study conducted by Ibarra *et. al.* 2001 observed that muskmelon crop grown under plastic cover flowered 24 days earlier than uncovered plants. Joublan and Vergara (2003)found row covers increased the number of fruit and weight, yield per plant and sugar concentration compared to the control treatment and he also observed that there was an increase of 643.42% in height (relative to height atthe planting time) of the plants grown under low tunnel than those grown withouttunnel (602.87%). Stem diameter increase was higher in tunneled plants (265.63%) than plants growing without tunnel (233.83.Singh *et al. (*2006) cited that plastic tunnel and mulching effect was high over controlled plots in term in significantly higher plant spread, dry matter accumulation and yield attributing characters compared to control.

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. Generally cucurbits are harvested from 15 February onward. This is economical for growing off season vegetables in peri-urban area of the northern plains of country. City dwellers are able to purchase these high priced vegetable. So this technology is being improved socio-economic status .

Low tunnel and Economics : Net income and cost benefit ratio is significantly influenced by date of sowing and growing conditions. Net income and cost benefit ratio is increased under tunnel cucurbits farming. This might be due to high market value in off-season

CONCLUSIONS

Being low cost technology, it has been accepted widely by vegetable growers. It encourages off season cucurbits cultivation (likediara cultivation) and earlier harvested produces get premium prices in the market. This technology is boon in the hilly regions of India as well as plain region if cultivation of cucurbits in winter (November to February)

REFERENCES

1. Butler, B.R. and Ross, D.S. (1999), Extending the production season for vegetables andsmall fruits. College of Agriculture and Natural Resources, University of Maryland.pp1-5
2. Carlen, C., and E. Kruger.2009. Berry production in changing climate condition and cultivation systems: further research requirements. *Acta Horticulturae, 838:* 225-228.
3. Enoch, H.Z. and Y. Enoch (1999). The history and geography of green house, p. 1-15. In: G.
4. Joublan, J.P., Vergara, M. (2003). Vegetative and productive development of strawberry (Fragaria Ananassa Duch.) using row cover of spun bonded polyester with different densities.
5. Ogden, A.B., and M.W.VanIersel. 2009. Southern highbush blueberry production in high tunnels: temperatures, development, yield, and fruit quality during the establishment years. *Hort. Science 44*: 1850-1856.
6. RAJAK, D.C., 2001. Host range and food preference of red pumpkin beetle, *Aulacophora foveicollis* Lucas (Chrysomeliade: Coleoptera). *Agric. Sci. Digest., 21:* 179-181.
7. Singh, R.K. and Satpathy, K.K. 2005. Scope and adoption of plastic culture technology in north east hill region. In: Agricultural mechanisation in North East India, ICAR, Research Complex for NEH region, Barapani. Pp. 114-21.
8. Singh, R., Asrey, R., Kumar, S. (2006). Effect of plastic tunnel and mulching on growth and yield of strawberry. *Indian J. Hort.*, *63,* 18–2