

## Plasticulture in Horticulture (An innovative Option for Enhanced Productivity and Profit)

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### **Introduction**

Plastic has become an integral part of our everyday life. Right from pen to file covers to tiffin boxes to water bottles to racks to furniture, it finds place in every activity of life. Even the food we eat has indirect use of plastics in it. In today's world, population is increasing tremendously. There is need to increase food production to overcome the hunger problem in the world. India is the second largest producer of the fruits in the world. The per capita consumption of the fruits in our country is still 46 g/capita/day which is far below from the requirement of 85g/capita/day ([www.ncpahindia.com](http://www.ncpahindia.com)). The productivity of almost all the fruits in India is very low as compared to other fruit growing countries of the world. So, it is necessary to increase fruit production by use of high-tech horticulture and plasticulture is one of the most useful agricultural high-tech inputs which can change the scenario of Indian agriculture in new era. Plastics and plasticulture are widely utilized and increasing in modern-day horticulture throughout the world. Plasticulture is also a step towards achieving food security. Plasticulture is a scientific way of carrying out agriculture and horticulture, which not only improves the productivity, but optimizes the input resources as well, thereby reducing the cost.

Plastic encompasses a wide variety of resins or polymers with varied characteristics. While there are natural polymers but only synthetic polymers are referred as plastics. Plastic has become a popular material in our daily life due to its structural integrity, chemical property and versatile nature. It provides variety of applications in modern agriculture and has the potential to transform Indian agriculture and bring in a 'second Green Revolution' in India.

## Applications of plasticulture

### 1. Protected Cultivation

A cropping method known as protected cultivation involves growing horticulture crops inside of enclosures that protect them from weather and pests for guaranteed, climate-resilient, and increased output of high-quality goods. You can practise protected cultivation in the following buildings:

**Naturally ventilated polyhouse technology:** This unique construction shields the crops from unfavourable weather, insect pests, and many viruses and is built of G.I. pipes, insect proof netting, and clear plastic sheets. This style of polyhouse has a 40 mesh, insect-proof nylon net covering all four sides of the greenhouse. Sides are covered with rollable plastic curtains purchased from the ground. With the aid of a pipe, this plastic curtain is rolled up and down throughout the winter for proper cross ventilation. Polythene film that is 200 microns thick and transparent covers the roof. For natural air flow and insect-free ventilation, a nylon net made of insect-proof material can be utilised in place of roof ventilators. A polyhouse of this type doesn't need power. This type of structure is suitable for peri-urban areas where high value vegetables like tomato, capsicum, parthenocarpic cucumber etc. and flowers like rose, chrysanthemum and gerbera can be grown easily.



- ◆ **Off-season vegetable production under walk-in tunnel during winter:** In the months of December and January, the north Indian plains experience a harsh winter. During a harsh winter, cucurbitaceous vegetables including summer squash, bottle gourds, cucumbers, tomatoes, and French beans can be grown outside of the normal growing season. Due to the high market prices for off-season produce, farmers can make a larger profit. During the winter season (December–January), walk-in tunnels—temporary structures made of G. I. pipes and clear polythene—can be used for the off-season cultivation of vegetables like summer squash, bottlegourd, cucumber, etc. to increase yields per unit area and to command high prices for off-season produce. For vegetable growers, this arrangement is very beneficial and profitable. This temporary plastic structure is

erected over the crop during the peak winter months of December to mid-February and thereafter, the structure can be removed from the crop. The plastic sheet can be reused for 4-5 years. Walk-in tunnel is suitable for growing off-season vegetable under north Indian plains and lower hills.

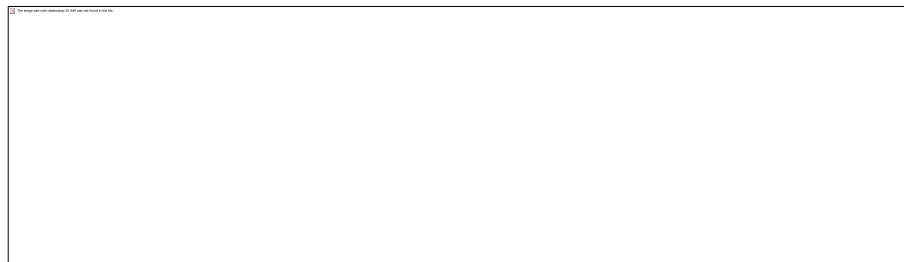
- ◆ **Insect proof net houses for healthy nursery raising:** By using an insect-proof nylon net, it is feasible to develop a healthy and virus-free nursery in an easy insect-proof net home during the rainy season in an open environment. A good nursery of early cauliflower, cabbage, etc. can be developed by using a 40-45% shade net covering during the height of summer when the temperature is 40-45 C. On the other hand, by covering the insect-proof net house with 200 micron thickness plastic sheet, it is possible to raise the nursery of various vegetables such as tomato, capsicum, brinjal, cucurbitaceous crops, and cucumber during the harsh winters. We can raise healthy, virus-free nursery year-round in a single facility by making minor adjustments.



## 2. Water Management

Plastic plays a major role in water management technology in the rural sector.

- ◆ **Minor irrigation system:** Plastic pipes, tubings and components particularly from PVC/HDPE/LDPE have been found to offer most effective techno-economics solution for viable minor irrigation widely all over the world in the following irrigation system.
- ◆ **Sprinkler system:** Sprinkler system raises water utilization efficiency to 60-85 per cent as against other irrigation methods which are 25-35 per cent. Crops like wheat, gram, pulses, vegetables groundnut, sugarcane, cotton, soybean, fruits etc. can be effectively irrigated by plastic sprinkler irrigation systems.



- ◆ **Drip/trickle irrigation:** The water saving can amount up to 60-70 per cent implying an almost 3-fold extension of the area of crop possible from a well, canal, etc. This method involves laying plastic next to the base of the plants through which water drips or trickles at a predetermined rate through emitters. The lateral line is made of flexible PVC or LDPE whereas rigid PVC/HDE is used for subsurface lines only. It connects LDPE/HDPE micro tubes or distributors to the sub-main line. The latter is usually made of MDPE or rigid PVC and connects with laterals with HDPE/rigid PVC main line.



- ◆ **Tube wells:** The usage of plastic for tube wells in irrigation is essentially as casing and strainer pipes of HDPE/PVC
- ◆ **Flow irrigation/lift irrigation:** Plastic pipes and tubing (HDPE/PVC/LDPE) have effectively replaced flood irrigation and open channel irrigation for better and more efficient water management.
- ◆ **Drainage:** Water logging usually results in salinity problems as they water evaporates with time leaving behind salty soil unfit for agriculture. Hence, good irrigation plans need to have a parallel drainage system. HDPE and rigid PVC pipes are widely for drainage of land and lowering water tables.

### 3. Mulching

Mulching has been an age-old practice among farmers to conserve moisture. It also helps to keep fruit clean. Mulching involves covering of soil with natural crop leftovers or plastic films around plant to decrease moisture loss through evaporation, reduce weed growth and insulate the soil from low night temperature of the environment. So, it helps to protect plant roots from heat, cold & drought and also decreases soil erosion by high intensity of rain.

- ◆ **White Film Mulching:** White film mulching, by reducing the amount of transmitted radiation, lowers the soil temperature.
- ◆ **Black Film Mulching:** Black film mulch is opaque to incoming solar radiation and acts like black body absorber (UV, visible, and infrared) and radiator (infrared).
- ◆ **Infrared Transmitting Film Mulch:** Infrared transmitting (IRT) film mulch is discovered recently in polymeric mulch technology and selectively transmits a section of electromagnetic spectrum.
- ◆ **Colored Film Mulches:** Red color mulch gives best results in tomato while blue color mulch produces best result for peppers by reflecting photosynthetic active wavelengths. Silver mulch is reported to control whitefly, whereas yellow-brown plastic mulch is reported to delay the incidence of yellow leaf curl.

#### 4. Packaging, Storage and transportation

Packaging is one of the most crucial aspects of the marketing and distribution of agricultural goods. Between the farm and the customer, more than 30% of agricultural products are lost. The packaging must be able to withstand long distance shipping, climate, storage conditions, and repeated handling during distribution and agricultural produce marketing.





PVC cling wrap , punnets and tray fruit packing

- ◆ **Plastics in post-harvest operations:** Plastic crates and boxes are used extensively for on-farm handling, storage and transportation of farm produce. Plastic films and nets are used as packaging units, bottles and containers are used for various processed horticultural products. HDPE crates have become one of the most well-known products all over the country for industrial, household as also plasticulture applications. At present, major plasticulture applications are crates for milk bottles/pouched and crates for oil pouches, fruits and vegetables, etc.



### Conclusion

Plasticulture allows for a significant reduction in the carbon footprint of the products depending on the applications. Bioplastics can greatly reduce our dependence on fossil resources which are significantly more harmful to the environment. One can expect to see a surge in the production and use of Bioplastics in the coming years. Further research and development in biodegradable polymers is the need of the hour because of human responsibility towards environment. This is the main driving force implementing the tremendous potential of biopolymers in the future.

## References

Dwivedi N and Dwivedi S K (2020) Soil solarization: An eco-friendly technique to eradicate soil Fusaria causing wilt disease in guava (*Psidium guajava*). *Int. J. Fruit Sci***20**: 1765-72.

Kumar R, Antil R S and Ali A (2021) Effect of packaging material and postharvest calcium treatment on weight loss, decay and biochemical quality of strawberry fruits during storage. *J. appl. nat. sci* **13**: 1158-65.

Lokesha R, Narayanaswamy P, Girijesh G K, Suresh D E and Shivakumar B S (2021) Effects of different mulches on yield and water use efficiency of pomegranate cv. Bhagwa. *IJCS* **9**: 3128-30.

Lufu R, Ambaw A and Opara U L (2021) The influence of internal packaging (Liners) on moisture dynamics and physical and physiological quality of pomegranate fruit during cold storage. *Foods***10**: 1-25.

Mahajan B V C, Chahal T S, Dhillon W S and Kapoor S(2018) Postharvest quality maintenance of W. Murcott mandarin using packaging films. *Indian J. Agric. Sci* **88**: 1270-74.

Orde K M and Sideman R G (2019) Low tunnel and cultivar effects on day-neutral strawberry yield and characteristics in New Hampshire. *Hort Technology* **29**: 795-810.

