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**PLASTICULTURE**

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**The Scientific Agriculture**  
**Volume 01, Issue 04 (October 2022),**  
**Page No. 10-12**

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**Plasticulture**

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The term plasticulture refers to the practice of using plastic materials in agricultural applications. The plastic materials themselves are often and broadly referred to as "ag plastics". Plasticulture ag plastics include soil fumigation film, irrigation drip tape/tubing, plastic plant packaging cord, nursery pots and bales, but the term is most often used to describe all kinds of plastic plant/soil coverings. Such coverings range from plastic mulch film, row coverings, high and low tunnels (polytunnels), to plastic greenhouses.

Plastic used in agriculture was expected to include 6.7 million tons of plastic in 2019 or 2% of global plastic production. Plastic used in agriculture is hard to recycle because of

contamination by agricultural chemicals. Moreover, plastic degradation into microplastics is damaging to soil health, microorganisms, and beneficial organisms like earthworms. Current science is not clear if there are negative impacts on food or once food grown in plasticulture is eaten by humans. Because of these impacts, some governments, like the European Union under the Circular Economy Action Plan, are beginning to regulate its use and plastic waste produced on farms.



## Types of plastics used

Polyethylene (PE) is the plastic film used by the majority of growers because of its affordability, flexibility and easy manufacturing. It comes in a variety of thicknesses, such as a low density form (LDPE) as well as a linear low density form (LLDPE). These can be modified by addition of certain elements to the plastic that give it properties beneficial to plant growth such as reduced water loss, UV stabilization to cool soil and prevent insects, elimination of photosynthetically active radiation to prevent weed growth, IR opacity, antidrip/antifog, and fluorescence. Polypropylene (PP) is often used for agricultural plant packaging cord.

## Applications

### 1. Greenhouses and walk-in tunnel covers:

A greenhouse is a large structure in which it is possible to stand and work with automated ventilation. High tunnels are hoop houses, manually ventilated by rolling up the sides. Greenhouse and

high tunnel films are usually within the parameters of 80-220 $\mu$ m thick and 20m wide, and have a life span between 6–45 months dependent on several factors. Monolayer polyethylene films are better suited for less extreme environmental conditions, while multilayer covers made of three layers, one EVA19 layer inserted between two low-density polyethylene layers has been shown to have a better performance under harsh conditions.

### 2. Small tunnel covers:

Small tunnel covers are about 1m wide and 1m high, and have a thinner polyethylene film than the large tunnel covers, usually below 80 $\mu$ m. Their lifetime is also shorter than that of the larger versions; they usually have a usable life span of 6–8 months. Use of small tunnels is less popular than both the more expensive but durable greenhouses/walk-in tunnels and the cheaper plastic mulch.

### 3. Plastic mulch:

Plastic mulch in a field near Merstone, Isle of Wight, UK. Plastic mulching is when a thin plastic film

is placed over the ground, poking holes at regular intervals for seeds to be planted in, or placing it directly over plants in the beginning stages of growth. The films remain in place for the duration of the cultivation (usually 2–4 months) and usually have a thickness of 12-80 $\mu$ m. The main functions of plastic mulch are to insulate and maintain a consistent temperature and humidity of the soil, preventing evaporation of moisture from the soil, minimization of seedtime and harvest, prevent weed growth, and to prevent erosion. Pigmented or colourless films can be used, each with specific advantages and disadvantages over the other.

Black films prevent weed growth, but do not transmit light to heat up the soil; clear films transmit light and heat the soil, but promote weed growth. Photosensitive films have been developed that are pigmented to prevent weed growth, but still transmit light to heat the soil. These photosensitive films are more costly than either the clear or black polyethylene sheeting. Black

plastic mulch controls evaporation from the soil and improves soil water retention. Plastic mulching proved to reduce irrigation requirements in pepper by 14-29% because of elimination of soil evaporation.

Flowering time was also reduced in okra when black plastic mulch was used; the plants reached 50% flowering 3–6 days earlier than un-mulched plots. Plant height in okra was significantly increased with black plastic mulch use compared to those grown in bare soil. Evaporation from soil accounts for 25-50% of water used in irrigation, using plastic mulch prevents much of this evaporation and thus reduces the amount of water needed to grow the crop.

This conservation of water makes plastic mulch favourable for farmers in dry and arid climates where water is a limited resource. As the second most used ag plastic in the world, the volume of plastic mulch used every year is estimated at 700,000t.