

Utility of Plastic Mulching in Horticulture



The course of our agricultural development in India is determined to a great extent by how efficiently the water resources are utilized. A situation has come, wherein the utilization of every drop of water has become indispensable to sustain the growth in agricultural production. Mulching is a predominant act in inter-culture operation. Mulching, primarily, refers to that condition wherein the soil around the stem of a plant is covered from all sides in such a way that adequate moisture for growth is conserved, weeds do not grow and even the requisite normal temperature is maintained around the plant. Mulching is of two types - natural as well as plastic films. The technique of mulching is generally, practiced by farmer's using dry grass, dry leaves, sugarcane trace, saw dust, straw, hay, banana leaves, composts, etc. in their orchards/fields to conserve water existing in the soil. In general, farmers come across two sorts of problems while carrying out natural mulching – (i) natural mulching is not possible everywhere and every time on account of unavailability of suffice material, and (ii) natural mulching also gets destroyed/decomposed in a comparatively lesser time. Of late, plastic films have come into use for the purpose of mulching due to its inherent advantages of efficient moisture conservation, and weed control, soil temperature retention and maintenance of soil structure. Besides, the volume of plastics material to be used per unit area is much lesser than that of traditional mulch material and, hence, plastic films are easy to handle, transport and lay in the field.

Why plastic mulching should be used in horticulture?

- To prevent weeds to grow
- To conserve moisture
- To save water
- To maintain soil temperature
- To prevent soil compaction
- To increase root branching, extension and diameter
- To provide a conducive environment for crop growth
- To permit carbon di-oxide enrichment of the plant
- To improve rate of seed germination
- To improve productivity
- To improve the quality of produce
- To make agriculture work more effective in dry land

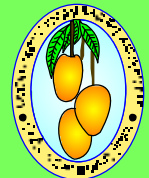
Following qualities are necessary in optimum mulching

- It should be available in plenty at the local level
- It should be loose and can be spread easily
- It should not be a positive conductor of light and heat
- It should not effect the movement of gas and air
- It should not be changed frequently
- It should not be harmful for plants

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What is mulching ?

The technique of covering the soil by dint of natural crop leftovers or plastic films for soil and water conservation is called mulching. As plastic mulches act principally while blocking evaporation of water from the soil surface and by selectively transmitting, absorbing and reflecting incoming radiation. The main soil parameters affected by the presence of mulching are soil moisture and soil temperature. The use of plastic mulching is one such technology, which helps in utilizing the irrigation water to its last drop, paving the way for a flourishing agricultural growth.

Plastic mulching

The change in soil environment can be favourably controlled by the selection of an appropriate mulching material. The most versatile of all the mulches at present is, however, plastic mulch which is manufactured in different film colours, thicknesses and widths. These plastic film mulches are generally made from low density polyethylene (LDPE) or linear low density polyethylene (LLDP).

Both, transparent and black mulch films, are generally used for the purpose of mulching. The black film has the advantage of suppressing the growth of weeds due to its opaqueness, in contrast to transparent film, for which herbicide coating on the inner side of the film is required for checking weed growth. Black film also has higher UV resistance than transparent film and, hence, the rate of deterioration of black film due to exposure is much lesser than the transparent film. Black plastic mulches generally show very low reflectance and transmittance of short-wave radiation, but a high transmittance of long-wave and high absorbance of short-wave radiation. The low transmittance of visible light, especially photo-synthetically active radiation results in the inhibition of weed growth, while the transmittance of infra-red radiation allows warming of the soil. The difference in reflectance and emissivity of black and silver mulches has implications for the quality of radiation reaching the crop canopy. Compared to black mulches, reflective mulches re-emit less heat, thus maintaining lower leaf temperatures, alter the red-far- red light balance leading to phytochrome- mediated changes in plant morphology, and reflect more ultraviolet which repels insect-pests such as aphids, thrips and whiteflies. Given their characteristics with respect to incoming solar radiation, black mulches generally show higher root-zone temperatures than would occur in bare soil, while silver or white mulches generally maintain cooler root-zone temperatures. While the effects of root- zone temperature on crops grown with plastic mulch may have complex interactions with other factors also. The root-zone temperature is an important factor to be considered in the management of any crop under plasticulture. These changes in root- zone temperature have a number of effects on crop growth and development, including increasing yield. Black film has proved to be effective in

plains to keep the crop cool during summer and the clear transparent film in hilly areas for raising soil temperature in winter.

Types of Plastic Mulching

- **Photo-degradable plastic mulching** – This type of plastic mulch film gets destroyed by the light of sun in a shorter period
- **Bio-degradable plastic mulching** - This type of plastic mulch film which gets absorb in the mud in an organic condition

The colour of plastic mulching film

By a proper selection of plastic mulch composition, colour and thickness, it is possible to very precisely control the soil environment. The colours of plastic mulch films can be black, transparent, white silver, blue, red, etc. But the selection of the colour of plastic mulch film depends on specific targets. Generally, the following types of plastic mulch films are used in horticultural crops :

- Black plastic mulch film** – The black plastic film is helpful in conserving moisture, controlling weeding problem and reducing the outgoing radiation.
- Reflective silver film** – It generally maintains the cooler root-zone temperature.
- Transparent film** – It increases the soil temperature and is mostly used for the solarization of the land.

Thickness of film

In plastic mulching, the thickness of film should be according to the types and age of horticultural crops.

Recommended thickness of mulch film for different crops

Crop duration	Name of crop	Thickness of mulch film	
		Micron	Guage
Annual crops	Vegetable crops, strawberry, etc.	25	100
Biennial crops	Papaya, banana, Sugarcane, cotton, maize, etc.	50	200
Perennial crops	Fruit crops, plantation crops, rose, etc.	100	400

Extent of surface coverage under film

% Coverage	Crops recommended
20	All creeper crops
40	Initial stage of orchard crops
40-60	Fruit crops & cucurbitaceous family
70-80	Papaya, pineapple and vegetables
100	Soil solarization

Thickness of plastic film

Thickness			Coverage in 1 kg m ²	Wt. in 1 m ² Gram
Micron	Guage	mm		
25	100	0.025	42	23
50	200	0.05	21	46
100	400	0.10	11	93
200	800	0.20	5.3	209
250	1000	0.25	4.29	233

Spreading of the plastic mulch

Generally, the mulch film is spread around the soil/plant from all sides at the time of sowing or implanting of plants or in existing orchards. In a short duration crop, plastic film should be spread at the time of preparing the land for sowing and the film should be adequately suppressed so that it should not get displaced in wind. In a new plantation as well as an existing one is placed of fruit crops, plastic mulch film should be spread in a plate circular size. After covering, it should be properly suppressed with mud so that it should not get displaced.



Banana under black film



Guava under black film with drip



Procedures of laying plastic film with drip in mango



Pomegranate under black film



Litchi under black film



Potato under black film with drip



Brinjal under mulch and unmulched with drip

Water management

After plastic mulching, drip irrigation method is the best way of irrigation in horticultural crops. Wherever drip irrigation system is not available, there alternative is removing the film from one side to carryout irrigation by the help of irrigation channel. After irrigation, mulch film is once again properly pressed under mud.

Advantages of plastic mulching in horticultural crops

In properly managed fields using plastic mulches, crop yield could be significantly higher i.e.,10 to more than 80 per cent. Several studies in India over the decade have confirmed the results obtained elsewhere in the world. A large variety of crops could be brought under the plastic mulches. All fruit crops, vegetable crops, tuber crops, oil seed crops, commercial crops, floriculture, spices and medicinal and aromatic plants plantation crops have been successfully mulched with plastic films.

Crop	% increase in yield
Guava	26.0
Lemon	20.0
Kinnow	46.8
Pomegranate	33.0
Banana(1.5x1.5 m)	50.0
Banana(1.8x1.8 m)	18.0
Pineapple	32.0
Papaya	80.0
Grapes	50.0
Mango (Dashehari)	27.0
Mango (Langara)	45.0
Mango (Chausa)	30.0
Apricot	43.0
Peach	65.0
Amaranthus	84.0
Brinjal	27.0
Cauliflower	71.0
Cabbage	75.0
Cotton	45.0
Chilli	62.0
Colocasia	50.0
Lady's finger	55.0
Pea	66.0
Potato	35.0
Tomato	65.0
Ginger	28.0
Turmeric	21.0
Coconut	75.0
Sugarcane	50.0

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