

Plastic mulching - A Step for efficient water utilization

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Plastic mulching is an agricultural practice where plastic materials are used to cover the soil around crop's root zone. This technique has become popular due to its numerous benefits in improving crop production.

Benefits of Plastic Mulching:

- **Moisture retention:** Plastic mulch helps to retain soil moisture by reducing evaporation. Less frequent watering is needed, which conserves water and reduces irrigation costs.
- **Weed suppression:** The plastic barrier blocks sunlight, preventing weed seeds from germinating. Reduces competition for nutrients and water, leading to healthier plants.
- **Soil warming:** Dark-coloured plastics absorb and retain heat from the sun, warming the soil. Promotes early plant growth and extends the growing season, especially beneficial for crops that require warmer soil temperatures.
- **Reduced soil erosion:** Plastic mulch protects the soil surface from rain and wind. Minimizes soil erosion and nutrient loss.
- **Cleaner Fruits and Vegetables:** Plants grown on plastic mulch have less direct contact with soil. Results in cleaner produce and reduces the risk of soil-borne diseases.

Types of plastic mulches:

1. Black mulches
2. Clear or transparent mulches
3. Two side mulches
 - a) Yellow/black
 - b) White/black
 - c) Silver/black
 - d) Red/black
4. Degradable mulches.
 - a) Photo degradable.
 - b) Bio-degradable

By proper selection of plastic mulch based on composition-colour and thickness, it is possible to precisely control the soil environment.

1. Black plastic mulches

The black plastic film does not allow sunlight to pass through onto the soil. Thus, photosynthesis does not take place in soil in absence of sunlight below the black film. Hence, it arrests weed growth completely. The black plastic mulch is helpful in conserving moisture and controlling weed growth. However, it may increase the soil temperature. It has been reported that during hot climatic conditions, using plastic nets and non-woven fabrics (layer of polyester or polyvinyl alcohol) in place of black mulch film is helpful in increasing yield of vegetables, especially that of leafy vegetables.

2. Clear or transparent mulches

The transparent film will allow sunlight to pass through and the weeds will grow. However, by using herbicide coating on the inner side of film weed growth can be checked. The transparent film is quite successful as soil solarisation film for disinfecting the soil in order to reduce soil borne diseases and some weeds. This application is quite successful in nursery raising by solarising the beds before sowing seeds for nursery raising, which gives near 100% seed germination & disease-free nursery. While the black film has proved to be effective in plains to keep crop cool during summer, the transparent film is effective in hilly areas for raising soil temperature in cold climatic conditions during winter.

3. two-side colour mulches

Wavelength selective or photo-selective films (also called two-side coloured) are designed to absorb specific wavelengths of the sun's radiation, which changes the spectrum of the sunlight passing through the film or being reflected back into the plant canopy. These light changes can have a marked effect on plant growth & development. These films enable growers to control different plant properties such as leaf & fruit size, colour, root development, yield, branching, plant height, growth, inter node length, time of flowering, bloom size, strengthen plant stems, encourage fruit to grow lower down on plants, and aid in disease control

by keeping insects away. The effects are warming of soil temperature, blocking weed growth, increasing colour saturation in developing fruit & increasing carbohydrate transport to developing fruit. Compared to black mulches, wavelength selective mulches re-emit less heat, thus maintaining lower leaf temperatures, alter red-far-red light balance leading to phytochrome mediated changes in the plant morphology, and reflect more ultraviolet rays, which repels insects & pests such as aphids, thrips & whiteflies, which transmit viruses. The white/black, silver/black, and aluminized black mulches generally maintain cooler root-zone temperatures, thus suitable for most Indian regions. Effects of some of the coloured mulches are given below:

- Yellow/black-attracts certain insects & thus acts as a trap for them, which prevents disease.
- White/black- Cools the soil.
- Silver/black-Cools the soil, though not to the extent of white/black film & repels some aphids & thrips.
- Red/black Partially translucent allowing radiation to pass through & warm soil but also reflects radiation back into plant canopy, changing ratio of R:FR light, which results in changes in plant vegetative, flower development & metabolism to early fruiting & increased yields in some fruit & vegetable crops.

In the recent past, coloured mulches have gained interest. Research has indicated control over plant height and plant structure by certain coloured films that vary the reflected light quality in the plant canopy. Some coloured films have been implicated in reducing insect population on plants. Research has even matched mulch colour with crops giving best yield responses. For example, red for tomato and blue for brinjal.

4. Degradable Mulches

- Photo-degradable mulches: This type of plastic mulch film gets disintegrated under sunlight over the designated mulching period.
- Bio-degradable mulches: This type of plastic mulch film gets disintegrated under natural environmental conditions & gets mixed in soil after mulching period.

Installation and maintenance of mulches

Preparation:

The soil should be prepared and smoothed before laying the plastic mulch. This includes removing debris and ensuring proper soil moisture levels. The plastic is laid over the soil and secured with stakes or soil at the edges to prevent it from blowing away. The mulch should be stretched tightly

to avoid gaps. Plants are usually transplanted through holes cut in the mulch. For direct seeding, small slits may be made. Regular inspection is needed to check for any damage to the mulch and to manage any issues with pests or weeds that might emerge. After the growing season, the plastic mulch is removed and ideally recycled. Some types of mulch can be reused or repurposed, but many end up as waste.



Land preparation



Bed preparation

Soil moisture

- Check moisture levels: Ensure the soil is adequately moist but not waterlogged. Plastic mulch should be applied to soil that is neither too dry nor overly wet.

2. Laying the Plastic Film:



Laying of mulch sheet using farm machinery



Manual Laying of mulch sheet

Placing a plastic mulch on the raised bed

Select the appropriate type of plastic film (black, clear, or coloured) based on your needs. Black plastic is commonly used for weed control, while clear plastic warms the soil more quickly. Ensure the film is the correct thickness (usually between 0.5 to 1.5 mils) for durability.

3.Unroll and position

Cut the plastic film to the required length, allowing for extra material at the ends for securing. Start at one end of the field or row and unroll the film along the planting area. Ensure it is stretched tightly and evenly. Anchor the film by using soil or specific mulch anchors to secure the edges of the plastic film to prevent it from blowing away. This can be done by digging a small trench along the edges and covering the plastic with soil using metal or plastic staples to hold down the edges. If using multiple strips, overlap the edges by several inches and secure them to prevent gaps. Smooth out any wrinkles or air pockets in the plastic film. Wrinkles can trap water and reduce the effectiveness of the mulch. Ensure the plastic film fits snugly over the soil, with no significant gaps or areas where it may lift.



Securing the edges

Cut holes in the plastic film according to the planting requirements for your crops. The size and spacing of holes will depend on the type of crop and planting density. Use a utility knife, scissors, or specialized hole-cutting tools for clean cut

Cutting holes in the plastic film



For transplants, place them through the holes in the plastic film and gently press the film around the base of the plant to secure it. If direct seeding, place seeds into the holes and ensure they are properly covered with soil.



Transplanting



Direct seeding

Regularly inspect the plastic film for any tears or holes. Repair any damage promptly to maintain effectiveness. Occasionally check for weeds that may grow through the holes or around the edges. Manage them as needed to prevent competition with your crops. Monitor soil moisture and adjust your irrigation practices. Plastic mulch reduces the frequency of irrigation but ensure plants receive adequate water.

Subsidy on plastic mulching

- Being capital intensive, the Government of India has provided subsidy @50% of permissible system cost of Rs.20,000/ha i.e. a net subsidy of Rs.10,000/ per ha for the adoption of mulching by farmers with a ceiling of 2 ha per beneficiary the under National Horticulture Mission (NHM) and Horticulture Mission for North Eastern & Himalayan states (HMNEH) and other related schemes. These schemes are implemented through Horticulture



Department in respective states.

Removal & disposal of used mulch films

- Non-degradable mulch films do not disintegrate in the soil. Therefore, after use, mulch film should be removed & disposed off properly so as to avoid any plastic pollution problems