

## Mulching: Promising technology for the cold arid region in Ladakh

**A covering layer of any material applied on the soil surface is called mulch and the process of covering the solid surface around the plants with organic or synthetic material to create the congenial condition for plant growth, development, and efficient production is termed as mulching. This article discusses the importance of adopting mulch technology in cold arid regions of Ladakh.**

THE Leh district of Ladakh territory is located around 3500 m above mean sea level. Out of the total area of this region, the net cropped area is only about 10,920 ha because of its undulated topography and harsh climatic conditions. Ladakh region is a cold arid geographical belt in the rain shadows of Trans Himalayas characterized by scarce vegetation, major annual precipitation, fluctuating climatic conditions with cold and harsh winters and warm summers accompanied by dry winds. Since it is a high-altitude region, the average temperature reaches 25°C during the day in summer while it drops to -15°C during the night in winter. Night-time temperatures can drop below zero even in summer, hence making severe stress for most of the vegetables to grow profitably. However, plastic mulching significantly moderates the soil temperature which is in the range of 3 to 7°C depending on the thickness and colour of the film, thus making a congenial microclimate around the root zone of the vegetable plants. The trials conducted by DIHAR and ICAR establishments in the region have found mulching as a cross-cut method to counter low-temperature stress. Hence, most of the farmers of this region use mulching for getting more production of vegetables.

### Types of mulching

There are two main types of mulches namely, organic and inorganic.



Mulch laying

**Table 1.** Different types of plastic mulches and their uses

Type of plastic mulch	Usage
Transparent	Increase soil temperature during the day and water management, soil solarization
Black	Prevent the growth of weeds, better yields and water management
Black and white	Prevent the growth of weeds, better yields and reflects the light on the plant
Black and silver	Insect repellent, prevent the growth of weeds, better yields, reflects the light on the plants and water management

**Organic mulches:** Organic mulches add nutrients and humus to the soil and improve its tilth and moisture holding capacity. Kinds of organic mulches are Grass clippings, Hay and straw, Leaves, Pine needles, Lawn clippings, Compost, Newspaper and Bark chips.

**Inorganic mulches:** Inorganic mulches are inert materials that have not originated from living materials; they do not add nutrients and humus to the soil. Kinds of inorganic mulches are gravels, pebbles, plastic: reflected plastic mulch, infra-red transmitted (IRT) plastic mulch, biodegradable or eco-friendly plastic mulch and colour plastic mulch.



Planting of cole crops in black mulch



Black mulch in squash and cole crops

### Mulching in cole and cucurbit crops at high altitude areas of Leh (13,900 feet)

#### Methodology of laying the plastic mulch

- Prepare the field thoroughly by ploughings followed by planking and incorporate sufficient compost and required nutrients.
- Level the field and divide it into plots/beds of convenient size.
- Cut the plastic film according to the plot/bed size with 15 cm extra with respect to length and width.
- Lay the polythene sheet on the plot stretch properly and press the size of the sheet so that it may not blow off by the high-intensity winds.
- As per the recommended spacing of the crop to be transplanted, cut small slits/holes with a knife or blade in the sheet keeping in mind the final diameter of the stem of the crop.
- Transplant the seedling in the holes and irrigate with

water cane for proper establishment.

- Irrigate daily for up to one week preferably in the evening.

#### Advantages of plastic mulching

- **Reduced labour cost:** Labour charges are reduced by almost 75 to 80% with the use of plastic mulch in crop production which is otherwise incurred on weeding, frequent irrigations and other cultivation practices, especially in vegetables.
- **Soil health maintenance:** Strong blowing winds is a common phenomenon in cold arid regions that remove the top fertile layer of soil from the fields. Plastic mulching helps in arresting wind erosion and soil blowing is physically obstructed. Sometimes, due to heavy irrigation through flooding, the soil gets eroded from one place to another. Plastic mulching reduces the run-off and prevents erosion. It also improves soil fertility and texture by encouraging

**Table 2.** Economics of vegetable cultivation under mulching vs traditional

Vegetable	Cost of cultivation (₹/ha)		Net returns (₹/ha)		B:C ratio	
	Without mulch	With mulch	Without mulch	With mulch	Without mulch	With mulch
Tomato	97450.0	114850.0	108350.0	138760.0	1.11	1.42
Chili	68500.0	77550.0	101450.0	138400.0	1.48	1.78
Coloured capsicum	170500.0	226500.0	264500.0	465500.0	1.55	2.06
Cabbage	80850.0	104625.0	97950.0	132840.0	1.21	1.27
Cauliflower	80500.0	103400.0	90450.0	140500.0	1.12	1.35
Knol khol	82500.0	103650.0	93650.0	14400.0	1.14	1.39
Strawberry	175750.0	205500.0	215950.0	486940.0	1.23	2.36





Demonstration of black polythene mulching effect on squash at Leh

earthworms and microorganisms' activity in the soil. Mulching insulates the soil and maintains the temperature beneficial for plant growth and improves the physical properties of the soil. Mulches, especially organic mulches are reportedly found to decrease soil compactness owing to the release of organic acids and increase in organic matter content of the soil. Mulches are very efficient in checking weed growth and preserving nutrients in the soil by reducing the loss of nutrients through profuse weed growth during the cropping season. Overall soil health is maintained and improved by way of soil conservation for efficient and sustainable crop production and productivity.

- **Impressive B:C ratio:** Various trials conducted at different locations of high-altitude areas reported an improvement in profitability of vegetable production in terms of significant increments in net returns as well as in B:C ratio. Though the cost of cultivation of vegetables increased by 15 to 25% owing to the additional cost incurred on buying plastic mulch and its laying charges, vegetable production through the use of plastic mulch is found to be more cost-effective and remunerative due to cost-cutting in weed management and higher productivity.
- **Improved growth and yield of crop:** The results of field experiments conducted in cold arid region of Leh-Ladakh indicated an overall improvement in the performance of vegetables in terms of yield, early yield, horticultural, and quality traits with the use of plastic mulch.
- **Improved water usage:** Frequency of irrigation is reported to decrease in trials and demonstration conducted at Precision Farming Development Centre (PFDC) Leh, 20-33% water saving is achieved through plastic mulching in horticultural crops in the case of conventional irrigation methods. Plastic mulching reduces evapotranspiration losses from the fields, thereby conserving moisture in the root zones for longer periods and reducing the frequency of watering. Water application losses are minimum in the mulched fields; hence gross water requirement of the crop is comparatively low. Efficient water utilization is achieved through plastic mulching and moisture losses due to seepage are reduced. Plastic mulching checks weed growth eliminating the competition for moisture

and nutrients between the weeds and the main crop.

#### Points to ponder for effective mulching

- Properly stretch and press the polythene sheet along the margins with the help of soil to avoid blowing by the gust of wind.
- A silver black polythene mulch with 40  $\mu$  (microns) thickness is recommended for most of the vegetables, however, a 50  $\mu$  and above thickness sheet may be used for long-duration crops depending upon recommendations. Red colour polythene sheet is found more effective than black mulch in some locations for chili cultivation. Hence, due care should be taken while selecting the type and colour of mulch.
- Biodegradable plastic mulch may be used but its useful life is short.
- After crop harvesting, remove the mulch in such a way that it can be reused. It should be stored in a place inaccessible to rodents after cleaning and folding properly for reuse in the next cropping season.
- Animal-drawn mulch layer machines are available in the market which reduce the time and cost of laying mulch in the field.

#### SUMMARY

Mulching is no less than a boon for cold areas because of its outstanding feature to moderate the soil temperature, the microclimate zone of the plant foraging area. The moderation of soil temperature streamlines various biochemical activities in soil which has a direct impact on the physiological processes of growth and development of plants. Organic and inorganic mulches both are effective in making the microclimate congenial for the plants with their own pros and cons. Polythene mulching with the highest B:C ratio, is an integral part of strawberry cultivation owing to its direct impact on fruit quality which otherwise gets damaged due to soil contact. In addition, the impressive B:C ratio makes this practice particularly beneficial in cold regions where the economics of vegetable cultivation is largely affected by environmental control.

For further interaction, please write to:

Dr Ankit (Scientist-C), DRDO, Ministry of Defence. \*Corresponding author: ankit.tiwari2601@gmail.com