

Mulch: a boon for crop management

Jagroop Kaur¹ and Harsimrat K Bons²

Punjab Agriculture University, Ludhiana (Punjab) 141 004

The burning of paddy straw due to predominance of rice crop during kharif creates a huge problem of air pollution along with degradation of soil health. So, this surplus paddy straw can effectively be utilized as surface mulch in different crops to control the environmental pollution in addition to many other benefits such as moderation of microclimate, improvement of water and nutrient use efficiencies and consequently the enhancement of crop productivity.

Key words: Crop, Management, Mulch

ANY material used (spread) at surface or vertically in soil to assist soil and water conservation and soil productivity is called mulch. Mulching is the application of covering material on the soil surface. Mulch works as an insulating material both in summer and winter. It avoids the sunlight from reaching the soil, alters the net radiation at the soil surface, minimizes the evaporation and also checks the escape of vapours out of the soil surface. It regulates the soil temperature. It reduces the soil temperature during summer and increases the temperature during winter. Weed seeds germinate when exposed to light, but under mulch they remain dormant. Organic mulches on degradation release nutrients and hence increase the nutrient availability. Mulch increases the water infiltration rate of soil, reduces the soil compaction and reduces the beating action of rain drops and hence decreases the soil erosion.

Why mulching?

To check environmental pollution: Burning of crop residue especially paddy straw can be avoided by using it as mulch which increases the greenhouse gases emission and particulate matter (causes various breathing problems like asthma, allergies etc). Burning of 1 tonne of paddy-straw results in release of 3 kg

particulate matter, 60 kg carbon monoxide (CO), 1,460 kg carbon dioxide (CO₂), 199 kg ash and 2 kg sulphur dioxide (SO₂). Mulch application also helps in decreasing the fertilizer leaching with irrigation water or rains and hence decreases the underground water pollution.

To ensure efficient use of water: Water use efficiency is increased with mulching by checking surface runoff and soil evaporation (i. e. approx 30 to 70% of total evapo-transpiration) which is unproductive. In kinnow plants, 20% moisture saving was observed under paddy-straw mulch as compared to no mulch.

To improve soil fertility: Mulching helps in improving soil fertility through nutrient recycling and soil erosion control. One tonne of paddy-straw contains 6.2 kg of nitrogen

(N), 2.3 kg of phosphorus (P), 25 kg of potassium (K), and 1.2 kg of sulphur (S). On burning, all of carbon (C), 90% of N, 20-25% of P and K and 60% of S present in straw is lost.

To mitigate high or low temperature stress: Mulching modifies the microclimate such as relative humidity, soil and canopy temperatures etc. It helps to reduce terminal heat stress/heat stress at reproductive stage in winter (*rabi*) crops especially in wheat. It was observed in wheat crop that paddy-straw mulching @ 6 tonne/ha increased the minimum soil temperature by 1.1°C and 1.4°C and decreased the maximum soil temperature by 3.5°C and 4.0°C than no mulch application during emergence in 2013-14 and 2014-15, respectively (Fig 1).

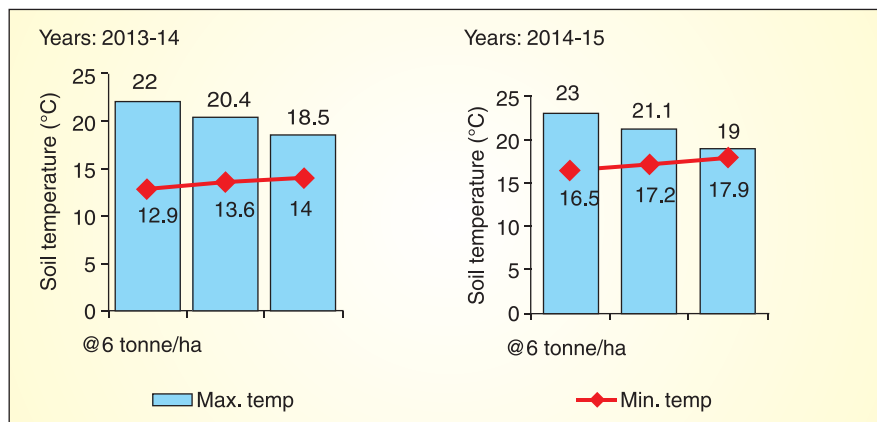


Fig. 1. Effect of mulch levels on soil temperature (5 cm soil depth °C) upto crop emergence in wheat between 2013-14 and 2014-15.

To suppress weed infestation: Weed population is suppressed under mulching as mulch acts as barrier for reaching the solar radiation on soil surface. Weed dry matter reduced from 8.85 q/ha to 5.57 q/ha with mulch as compared to no mulch in kinnow plants.

Types of mulches

There are two types of mulches: organic and inorganic.

(A) Organic: These are categorized as plant and animal origins.

(a) *Plant origin:* These are originated from live mulch: e.g cover crops, intercrops; trash mulch: e.g straw, weeds, chopped leaves, newspaper, bark, sawdust and stubble mulch tillage; and crop residue retention.

(b) *Animal origin:* It is originated from compost and manure.

(B) Inorganic: These are categorized as plastic films, polyester garden fabrics, and gravel or stone.

(a) *Plastic films:* Depending upon colour of film e.g. black, white, silver/aluminium etc; *Degradability:* e.g. Non-degradable/Photo-degradable/Bio-degradable plastic sheet. LDPE or HDPE; Wavelength-selective mulches (Infrared radiation transmitting (IRT)/Selective light transmitting (SLT) mulches.

(b) Polyester garden fabrics

(c) Gravel or stone

Scope of mulching?

The conservative estimates revealed that the crop residues are available in abundance as given in (Table 1).

In Punjab, 50.75 mt/yr crop residues are generated. Out of which, 24.83 mt/yr crop residues remains surplus and 19.62 mt/yr are burnt. So, there is availability of crop residues in Punjab.

Recommendation of mulching in different crops

The data of research trials showed



Fig 2. Paddy straw mulch application in wheat



Fig 3. Paddy straw mulch application in kinnow plantation

Table 1. Quantity of crop residues generated in India (MNRE 2009)

Crops	Residue generated (mt)	Unutilized crop residue share (%)
Cereals	352	58
Fibres	66	23
Oilseeds	29	7
Pulses	13	2
Sugarcane	12	2
Total	472	8 (Other crops)

that application of mulch improves the soil-health and yield of different crops, as discussed here.

Turmeric: Straw mulch @ 36 q/acre (0.404 ha) should be applied after first irrigation.

Mentha: After planting, apply paddy-straw mulch @ 24 q/acre (0.404 ha).

Sugarcane: Application of paddy straw or rice husk or sugarcane trash or tree leaves @ 20-25 q/acre (0.404 ha) is recommended after complete germination of sugarcane by mid-April. It helps in many ways viz. reducing soil temperature, conserving soil moisture, suppressing weeds and reducing incidence of shoot-borer.

Wheat: Sowing of wheat should be done in standing stubbles of rice crop with Happy seeder.

Potato: Effective control of annual weeds can be achieved by application of paddy straw mulch @ 24 q/acre (0.404 ha) immediately after planting.

Chilli: The number of irrigations can be reduced upto 9 from 15 to 16

with the use of paddy straw @ 25q/acre (0.404 ha).

Guava: Application of paddy-straw @ 40 q/acre (0.404 ha) reduces the weeds and increases the fruit yield and quality.

Effect of mulching on economics

Higher net returns with mulch were reported by various scientists. In wheat, maximum net returns (₹ 65,100/ha and ₹ 60,427/ha) were obtained where paddy-straw mulch was applied @ 6 tonne/ha than where no mulch (₹ 57,165/ha and ₹ 54,680/ha) was applied, during 2013-14 and 2014-15, respectively.

SUMMARY

Higher B:C ratio (1.29) was found under mulch over no mulch in kinnow. In another experiment on turmeric crop conducted at Punjab Agriculture University, Ludhiana, B:C ratio of 3.43 was observed under straw mulch compared to 1.03 with no mulch. During study it was also observed that plastic mulch is expensive, application of organic mulch is labour intensive and cumbersome and there is problem of rats and snakes.

¹Assistant Agronomist, Department of Agronomy; ²Assistant Horticulturist, Department of Fruit Science; Corresponding authors' e mail: shekhonaman80@gmail.com

Pradhan Mantri Krishi Sinchai Yojana

This Yojana brings

- Per Drop More Crop • Inputs from MoWR and DOLR received
- Increase in agricultural production and productivity and enhance farm income.