

Role of Mulching in Dryland Agriculture

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Abstract: *The efficient use of water is crucial factor during crop growth periods which can greatly improve the yield. Soil moisture is the most limiting factor in dryland agriculture. It is lost as evaporation from the soil surfaces and as transpiration from the plant surfaces. Evaporation has to be arrested as it is not directly related to productivity whereas transpiration can be reduced to some extent without affecting the productivity of plants. The evaporation losses can be reduced by applying mulches. The agriculture in dryland can be done with mulching in different ways as stubble mulching, plastic mulching, straw mulching and vertical mulching. Therefore, conservation of soil moisture by using mulching may be an efficient option to save water as well as rising production in dryland farming.*

Keywords: Mulching, soil moisture, Dryland and yield

I. INTRODUCTION

Dryland farming is an improved system of cultivation where by maximum quantity of water is conserved by soil and water management. Arid and semiarid areas with rainfall between 750-1150mm and lower moisture availability for crops are selected for cultivation. Dryland farming in India demands a great deal of effort to ensure that the soil is not deprived of moisture. Mulching technique establish the linkage between soil and Agrometeorology which can modify the crop growing environment. Basically mulching is a protective layer of a material that is spread on the top of the soil to control or to modify the effect of local climatic condition. This is an important operation to be carried out for better usage of water. Therefore mulching could be an effective choice for saving water along with increasing production in dryland farming. Mulching is defined as a coating material in spread over the soil surface (Kasirajan Ngouajio, 2012). Mulching is an important cultural practice that can lessen the quantity of work essential in gardening helping to produce healthier plants and potentially growing vegetable produces. Mulching is the exercise of productive covering of the soil surface around the plants with the living or non living mulch to make promising condition for the plant growth and efficient crop production (Chakraborty *et al.*, 2008; Kader *et al.*, 2017). It shield soil to protect organism and plant roots from diverse meteorological conditions. Mulching optimizes water use and helps to advance crop development along with yield (Yu *et al.*, 2018). The principle objective of mulching are controlling erosion and saving water in low rainfall regions. While natural mulches such as leaves, straw, tree waste, grass clippings, bark clippings and compost have been used for centuries during last 60 years the arrival of synthetic materials has changed the means and profits of mulching. The research as well as field data available on effect on synthetic mulches make a vast volume of useful literature. Mulches may broadly categorized into live mulch and dead mulch. Live mulch is a living cover of a crop, the species for live mulch must be quick emergence and soil covering, short height, low water and nutrient demands such as legume, cereals especially *Secale cereale* L (rye). The living mulch not only provides for the effective management of weeds. But also for the decrease of insect pest pressure in lower requirement for pesticide use (Tyagi *et al.*, 2017). Dead mulch is further four types 'organic mulch, inorganic mulch, synthetic mulch and soil dust mulch'. Organic mulches can decompose naturally, example soft and hard bar chips, grass clippings, agricultural residues straw (Iqal *et al.*, 2020). Now it is important to know the effectiveness of mulching which is equally useful and essential for soil and water conservation practices in the rainfed areas.

1.1 Selection of Mulching

In broad, the choice of selection of an appropriate mulching material depends on the type of material, ecological location, colour, thickness, perforations and availability of materials, cost effectiveness and feasibility of crops (Wang



et al., 2015). Consider individual mulch characteristics when making selection. Do not mulch with material from the crop which increase the risk conveying viruses or pest to cultivated crops and also don't use that mulch that contains weed seeds.

1.2 Types of Mulches used for Dryland Condition

A. Organic Mulches

The examples of organic mulches and their uses are given below;

1) Straw Mulching

Paddy and wheat straw and other crops residues like stubbles, groundnut shell, cotton shells etc. are the commonest mulching materials used. Though straw is poor in nutrient value but after decomposition, it makes soil more fertile. Among organic mulching materials, straw has a long life in comparison to other mulches.

2) Grass Clippings

This is one of the most abundantly and easily available materials across the country. It provides nitrogen to the soil, if incorporated fresh. Use of dry grass is suggested to prevent from developing its own root

3) Bark Wood Mulching

Hardbark wood clippings contain more nutrients than the softwood bark wood clippings are not easily and abundantly available and also they are long lasting and allow proper aeration to soil underneath.

4) News Paper Mulching

Newspaper mulching helps to control the weeds. 1 or 2 cm thick sheet of newspaper should be used and edges should be fastened with materials like pebbles, gravels, etc. The application of newspaper to be avoided on windy day.

5) Vertical Mulching

Vertical mulching is one of the most effective ways to treat trees and shrubs. The aeration and soil treatment create an environment that mimics nature and allows for greater nutrient uptake, increased root growth and the potential regeneration of a damage root system. The process involves creating dozens of holes in a grid pattern around a tree root zone, reducing soil compaction while improving aeration. Then these holes are filled with pea gravel, sand, peat moss, compost or mulch for added nutrition within the root zone.

B. Inorganic Mulches

1) Plastic Mulching

Advancement in plastic chemistry has resulted in development of films with optical properties that are ideal for a specific crop in a given location. Both black and transparent films are generally used for mulching. There are two types Photodegradable plastic mulch and Biodegradable plastic mulch.

2) Photodegradable Plastic Mulching

This type of plastic mulch films get destroyed by sunlight in a shorter period.

3) Biodegradable Plastic Mulching

This type of plastic mulch film is easily degradable in the soil over a period of time.

4) Colour of Film

Soil environment can be managed precisely by proper selection of plastic mulch composition, colour and thickness. Films are available in a variety of colours like Black, Transparent, white Silver, Blue, Red, etc. But the selection of the colour of the plastic mulch film depends on specific targets.

5) Black Plastic Film

It helps in conserving moisture, controlling weed and are reducing outgoing radiation .

6) Reflective Silver Film

It generally maintains the root zone temperature cooler .

7) Transparent Film

It increases the soil temperature and preferably used for solarisation .

1.3 Effect of Mulching on Dryland Agriculture

Mulching is very helpful in conserving soil moisture in dryland areas after reducing the rate of evaporation(yang *et al.*,2015;kader *et al* 2017;chakraborty *et al* .2008).plastic mulch having moisture barricade properties does not allow escape of soil moisture, because the soil moisture evaporates beneath the mulch film, after condensing gone back into the soil as water droplets. Thus moisture is conserved for many days ,that's why increases the irrigation period and lessens the irrigation demand during period of crop cultivation(Kader *et al.*2017).plastic mulching is much effective compared to straw mulching for soil water conservation(Li *et al.*2017).Reducing rate of surface evaporation for soil moisture conservation and diminishing soil erosion is the foremost asset of mulching technique (Qin *et al.*,2016).Mulches have the ability to retain moisture in the root zone of plants (Smith *et al.*,1997).Consequently ,water may be accessible for an extend period for the plants .(Pakdel,2010).

1.4 Effect of Mulching in Weed Management

The mulches can cover the soil surface or work like a physical barrier and prevent the germination of weeds or physically control seedling appearance .The less weed intensity is recorded in polythene and straw mulch plots compared to the chemical and unmulched plots .The much and unmulched treatment control of weed has recorded large differences in plot of various crops .The combination of drip and sugarcane trash mulch is best treatment that save water about 44% and produce highest crop yield. This treatment reduces the weed intensity about 95% ,increases the crop yield ,about 53% and save the irrigation water about 44% compared to flood irrigation without mulching.

II. CONCLUSION

Among all the mulches ,soil moisture conservation is higher in rice straw mulch and black plastic mulch as compared to soil without mulch. Drop in competition of weeds with the crop and its environment in soil organic carbon were resulted in better growth and yield (Manjeet et al).Mulching has become an important water conservation practice in modern agricultural practice in arid and semi arid environment. The mulch material protect soil surface from sunlight which reduces evaporation by preserving soil water and altering soil temperature . These practices might have greater scope in future as there is an increase in yield of the crop .Therefore , it is concluded that the various mulching practices can be used to conserve the water resources in agriculture which leads to improve crop yield in dry land farming.

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