



Mulching: An Approach towards Conservation

(*Saurabh Kumar¹, Arun Kumar¹, Abhishek Maurya², Arushi Chandel¹ and Satyam Singh³)

¹Department of Agronomy, BUAT, Banda -210001

²Department of Soil Science & Agricultural Chemistry, BUAT, Banda -210001

³Department of Genetics & Plant Breeding, BHU Varanasi -221005

*Corresponding Author's email: shagirdsaurabh@gmail.com

Mulching is a water and soil conservation practice in agriculture. Large amount of water is lost through a human carelessness, as one example is using huge amount of water, excess water application. Mulching is a soil and water conserving practice which helps in weed management with the help of soil solarization process in which a mulching material is spread around the plant. It has various advantages as it will help in retaining soil moisture, enhancing structure of soil and prevents plants from weed growth. Mulching proves to be beneficial for reducing soil erosion, maintaining soil structure and temperature. It increases soil fertility status and decrease incidence of pest and disease.

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Introduction

As the population of India is continuously rising, we have to adopt some means of sustaining our agricultural growth and it can be done through conservation farming. Agriculture is an occupation that depends on the natural resources for its progress and among these natural resources, water is one of the important limiting factors that play a major role in increasing agriculture production. Farmers in recent years have adopted various techniques to overcome the problem of water usage in crop production. Mulching is one such technique being practiced not only to conserve the water but also to improve the soil's physical characteristics, improve plant growth and increase the productivity. It also plays a crucial role to increase the soil temperature, check weed growth and helps in more efficient use of soil nutrients. The term 'mulch' originated from the German word 'Molsch,' which means an organic or inorganic material used to spread over the upper surface of the soil. Farmers use straw, hay, organic manure, or polythene mulch as a protective layer over the soil surface around the plants, creating a favorable environment for plant growth.

Mulching is an excellent technique that involves spreading organic or inorganic material over the soil's surface to create a favorable environment for plant growth. Mulch serves as a barrier that repels soil pathogens and certain insects, while also suppressing weed growth, making it a great alternative to chemical herbicides. Additionally, mulching provides a protective barrier against, surface runoff, wind erosion, direct sunlight, regulates soil temperature, accelerates seed germination, and helps increase yield. The area that is covered by mulch, its soil biota improved that helps in increasing nutrient cycling and build up organic matter contents of soil for a long period of time.

Mulching is a great management strategy for improving water use efficiency of soil and reducing weed growth. When mulch is physically applied to the soil, it can improve soil particle aggregation and enhance the rate of water infiltration. On the other hand, chemical

mulch provides a slow-release type of nitrogen and adds Humic acids, phosphorus, and potassium to the soil, which facilitate their uptake and utilization. Biological mulch is also an important component of Integrated Pest Management programs, which can provide control against *Phytophthora* root rot and other aggressive and competitive microbes. Mulches help improve the covered land area and protect the soil surface from erosion.

Mulches could be of both organic and synthetic (inorganic) in origin. The organic mulch consists of animal and plant residues. The most commonly used organic mulch include straws, husks, grasses and cover crops (live mulches), saw dust, compost, and manures, while the most frequently used inorganic mulch throughout the world is polyethylene plastic mulch. The application of plastic mulch in agriculture is getting popular throughout the world, and its usage is increasing day by day.

Potential advantages of mulching in agriculture

Soil moisture conservation: Many abiotic factors are responsible for the loss of moisture from the soil and converting it into barren land. These variables could be high winds, elevated temperature levels, harsh climatic conditions, and competing plantation such as weeds. It has been estimated that presence of weeds could result in loss of water up to 25% due to evapotranspiration. Mulches can potentially reduce weed infestation and evaporation losses and enhance the percolation and retention rate of soil. It was reported that straw mulch can decrease the rate of evaporation by 35%. Likewise, it was reported that non-living mulch materials had greatest capability in moisture conservation in soil as compared to un-mulched soil. The organic mulch have attained greater value than the inorganic mulch in agricultural lands, as the organic mulch could increase the percolation and water retention of soil. Generally, the livestock wastes, residues of crop plants, and different types of stone gravels are used as mulch materials to retain the soil moisture. Supplemental irrigation is lowered by mulching because of their water retention ability, simultaneously reducing the runoff of soil profile.

Regulation of soil temperature : Mulching covers the soil surface, and hence, it is helpful in maintaining the soil temperature which is beneficial for overall crop growth. Extreme temperature condition under early growth stages of plants may cause the plants to go under stress conditions as newly established roots are not able to uptake the proper amount of water and essential plant nutrients. Therefore, the judicious maintenance and regulation of soil temperature is a very critical factor for optimum plant growth. The selection of specific mulching type for particular purpose is of significant importance. For instance, coarse mulches are more beneficial than the finer ones of the same category in controlling the temperature at favorable conditions. Various types of mulches have different effects on soil temperature. Some mulches increase the soil temperature as compared to the barren soil or living mulches due to absorption of solar radiation.

Reducing soil compaction and erosion: The mulching materials protect the soil from wind and water erosion phenomenon and reduce the compaction of soil which can badly affect the roots of crops consequently reducing the growth and development of plants. It checks the flow rate of rainwater and therefore, restricts the water and soil runoff. Rainwater runoff does not directly touch the ground surface, allowing it to slow down and consequently enhance the infiltration rate of water. This process leads to increased moisture availability for plant utilization. The mulch material can reduce the beating action of rain drops or alleviate the heavy weight of feet and tires of heavy implements.

Reduction in weed population: Mulching is a favorable tool for controlling the weed populations in nursery as well as field. Any kind of mulch covers the soil and creates the physical pressure on the weeds. When mulch is spread on the soil surface, they act as barriers

in the passing of light resulting in reduced germination of small-seeded weed species. Mulches act as physical obstacles in the emergence of weeds.

Inhances plant growth, development and yield: There are many research studies which showed the positive impacts of mulches on the germination, survival of newly grown plants, and transplantation of seedlings and overall performance of crop plants in relation to un-mulched treatments. Mulching is helpful in retaining water position in soil which finally results in high yield and better water use efficiency. Maximum crop yield was recorded through application of plastic mulch.

Soil Erosion Prevention: Mulch can help to prevent soil erosion, which is important for flowers that have shallow root systems and are vulnerable to soil erosion, such as annuals and some perennial flowers.

Disease Prevention: Certain mulch materials, such as organic mulches (e.g., straw or wood chips), can help reduce soil-borne diseases by acting as a barrier between the soil and the plant. This is particularly beneficial for susceptible flowers like peonies and phlox.

Nutrient Retention: Organic mulches break down over time, enriching the soil with organic matter as they decompose. This can improve soil structure and nutrient content, benefitting most of the crops.

Soil pH Modification: Some types of mulch, like pine needles or oak leaves, can slowly acidify the soil over time, which is beneficial for acid-loving flowers such as azaleas and rhododendrons.

Types of Mulching Materials

1.) Organic Mulch: Organic mulches are made from plant or animal matter. The soil characteristics are improved by organic mulches. It improves the soil physical, chemical and biological properties. Organic mulches are effective at minimizing nitrate leaching, boosting soil physical qualities, enhancing biological activity, balancing the nitrogen cycle, providing organic matter, controlling temperature and water retention, and reducing erosion.

Straw: After harvesting, straw or crop remains are readily available. Straw mulch is a lightweight material that is simple to apply and use. Paddy straw is now commonly utilized as field mulch, as it improves crop cultivation conditions. It makes the soil fertile after decomposition by adding organic matter.

Wood Chips: Reprocessed wood and a variety of tree species are used to make wood chips. Wood chips, especially those made from reprocessed wood and a variety of tree species, are commonly used as mulch in gardening and landscaping. While they offer numerous benefits such as moisture retention, weed suppression, and soil insulation, they also have certain drawbacks, one of which is their high carbon-to-nitrogen (C:N) ratio.

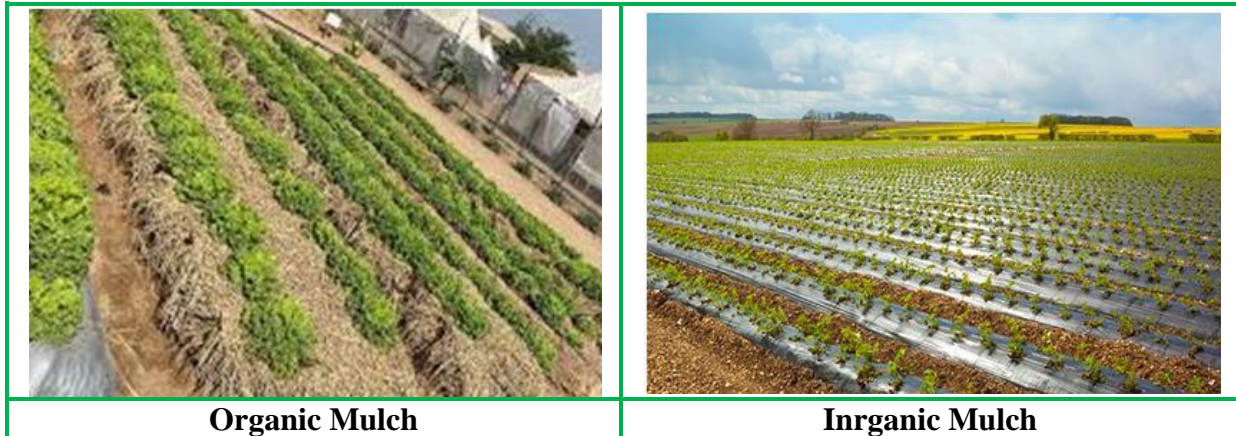
Sawdust: Sawdust is a popular mulch in locations where it is readily available. It is found during wood finishing procedures. Sawdust generally have lower nutritional value for plants and a slower breakdown rate due to their higher carbon-to-nitrogen (C:N) ratio. This slower breakdown is a result of microorganisms requiring nitrogen to decompose the carbon-rich material effectively.

Compost: One of the best mulching materials is compost. soil conditioner that may be easily made at home using a variety of waste items such as leaves, straw, grass, and plant wastes, among others. It increases the population of microbes by improving the soil structure of the soil and provides nutrients. It boosts the properties of the soil, as well as the carbon content, which improves the soil's capacity to retain water and improves soil health.

Others: Grass clippings, Dry leaves, Newspapers, Bark clippings.

2.) Inorganic Mulch: G ravel, Pebbles and Crushed stones: Perennial crops benefit from mulching with these materials. A 3-4 cm layer of small rocks effectively controls weeds.

However, they can generate excessive heat in the soil during summer due to their reflective properties, creating a warm environment.



Plastic mulch: Black and transparent both films are used for mulching. When compared to other mulches plastic mulches are completely impermeable to water; it therefore prevents direct evaporation of moisture from the soil and thus limits the water losses and soil erosion over the surface.

Type of Plastic Mulch:

Photodegradable Mulch: Photodegradable film has much the same qualities as other black or clear plastic film, but this is formulated to break down after a certain number of days of exposure to sunlight.

Black Plastic Mulch: Black plastic mulch is predominate color used in plant production is an opaque blackbody absorber and radiator. Black plastic mulch absorbs maximum UV, visible, and infrared wavelengths of incoming solar radiation and re-radiates absorbed energy in the form of long-wavelength infrared radiation. Soil temperatures under black plastic mulch during the daytime are generally 5° F higher at a 2-inch depth and 3° F higher at a 4-inch depth compared to the other soils which are not covered by mulching material.

Transparent Plastic Mulch: Clear plastic mulch absorbs little solar radiation but transmits 85% to 95% of incoming solar radiation. The under surface of clear plastic mulch usually is covered with condensed water droplets and this water is transparent to incoming shortwave radiation but is opaqueto outgoing long wave infrared radiation.

Conclusion

Mulching is an excellent technique in agriculture which is advantageous to increasing the growth and quality of production of the crops. Mulching is a great management strategy for improving water use efficiency of soil and reducing weed growth. When mulch is physically applied to the soil, it can improve soil particle aggregation and enhance the rate of water infiltration. In future, farmers will make use of this innovative technique which help to conserve moisture, control weed growth and will help to improve soil health.