

Role of mulch in Sustainable Agriculture

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Introduction

Mulch is a layer of organic or inorganic material applied to soil to provide many benefits for plant growth and soil quality. It acts as a protective layer, helps control soil moisture, reduces plant growth, controls soil temperature, prevents soil erosion, and improves overall soil health and fertility. Mulch is widely used in agriculture to support permaculture practices and increase crop yields.

According to the University of California, Agriculture and Natural Resources, mulch is defined as "any material applied to the soil to protect or improve the area." These materials can include many materials such as straw, leaves, compost, sawdust, plastic, and many other organic and inorganic materials.

Types of mulch

Mulch can be divided into several organic and inorganic types, each with their own unique properties and uses.

1. Organic Mulch - Organic mulch is derived from natural materials such as garbage, bark, straw and compost. Some popular types of organic mulch include straw, sawdust and compost.

a. Straw mulch: Straw mulch helps conserve soil moisture, suppress weed

growth, and acts as a barrier to soil erosion. It also slowly decomposes, adding nutrients to the soil.

b. Wood Chips: Wood chips are nice and slow to decompose, suppressing plants and controlling soil moisture over the long term.

c. Compost: Compost mulch enriches the soil with essential nutrients, improves soil structure and supports microbial benefits. It also helps reduce weeds and save water.

2. Inorganic Mulch - Inorganic mulches are non-vegetable materials such as rocks, stones and plastic. It has different advantages over organic mulches.

a. Gravel and Stones: Rocks and gravel provide good plant protection, good drainage and long-lasting mulch. They are also fire resistant and add beauty to the garden.

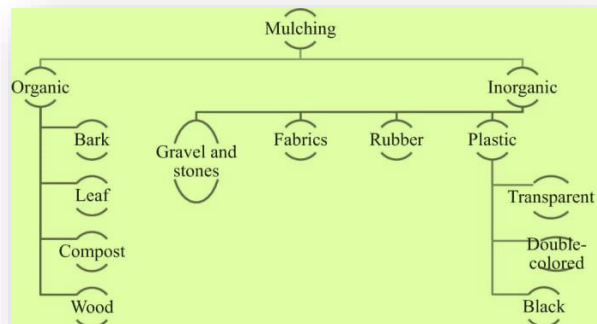


Fig 1. Types of Mulch

b. Plastic Mulch: Plastic mulch helps protect healthy plants and retain soil moisture by reducing evaporation. It also increases soil temperature, which is good in cold climates.

Importance of mulching in Sustainable Agriculture

Mulching is a practice in sustainable agriculture that involves applying a layer of material to the surface of the soil to improve the condition of the soil and stimulate crop growth. It has many uses, from controlling soil moisture to reducing plant growth, improving soil structure and reducing erosion. The importance of covering in permaculture:

1. **Conservation of Soil Moisture:** Mulch acts as a protective layer and reduces the evaporation of water from the soil. By creating a barrier between the soil and the air, it helps preserve moisture, especially in regions where temperatures are high and rainfall is low. This helps maintain appropriate soil moisture for plant growth, reduces the need for frequent irrigation, and promotes water conservation in agriculture.

2. **Weed Suppression and Reduced Herbicide Usage:** Mulch prevents weeds from germinating and growing by blocking sunlight and preventing seeds from coming into contact with the soil. This reduces resource competition between plants and crops, reduces the need for pesticides and allows better control of the plant environment. Therefore, mulching can reduce pesticide use in agriculture.

3. **Enhancement of Soil Structure and Fertility:** Organic mulch, such as compost,

straw or leaves, breaks down gradually, enriching the soil with essential nutrients and organic matter. This decomposition process improves soil structure, promotes better aeration, fluid and microbial activity. Improving soil structure improves root penetration, nutrition and overall plant growth, making agriculture more profitable and sustainable.

4. **Reduction of Erosion and Prevention of Soil Compaction:** Mulch protects the soil from rain, reduces the force of water hitting the soil and reduces soil erosion. Mulch can also prevent soil from becoming compacted by heavy rain or foot traffic by creating a physical barrier. Paying attention to the integrity of the topsoil is important for maintaining long-term soil health and fertility, making mulching a good way to reduce erosion and soil compaction.

Challenges and Limitations of Mulching in Agriculture

1. *Potential for Pests and Diseases:* Incorrect mulch selection or application can cause crop damage by creating favorable conditions for pests and diseases.

2. *Nutrient Tie-Up and Imbalance:* Some types of mulch can temporarily absorb nutrients from the soil as they decompose, causing nutrient deficiencies and affecting crop growth.

3. *Moisture Regulation Challenges:* In some climates, mulching can be effective, preventing water from seeping in and causing root disease.

4. *Cost and Labour Intensiveness:* Applying mulch can be laborious and expensive,

especially for large farms, creating financial problems for some farmers.

5. Affecting Microclimate and Temperature: Mulch affects the microclimate around plants, possibly causing temperature changes that may not be suitable for some crops.

Future Perspectives and Innovations in Mulching and Sustainable Agriculture

1. Biodegradable Mulches: Researchers are developing biodegradable mulch materials derived from renewable resources that provide plants with good control and moisture retention while minimizing environmental impact.

2. Precision Mulching Technologies: Innovations in precision agriculture help target the application of mulch materials, optimize their use and reduce waste, thereby increasing cost efficiency and environmental sustainability.

3. Mulching for Carbon Farming: There is interest in agriculture using mulch, particularly focused on increasing carbon sequestration in agricultural soils, to mitigate climate change.

4. Incorporating Beneficial Microorganisms: Scientists are exploring the use of microbial mulches to improve soil fertility and plant health and improve the relationship between crops and beneficial organisms.

5. Integration of Remote Sensing and AI: The combination of remote sensing technology and artificial intelligence can monitor and control mulching practices, thereby improving resource use and increasing agricultural productivity.

Conclusion

Mulch plays an important role in supporting permaculture by controlling soil moisture, reducing weed growth, improving soil structure and fertility, reducing erosion, and reducing the need for synthetic chemicals. It supports the long-term sustainability of the environment and agriculture by helping to conserve water, sequester carbon and reduce carbon monoxide emissions.
