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Role of Mulches in Agriculture

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Introduction

Weeds can be controlled through the following methods such as chemical, mechanical, physical, biological and cultural. Application of herbicides is one of the faster weed control method yet this is an expensive method and has some harmful effects on the surrounding environment, human health and on the domesticated and wild animal health. The practice of highly use of pesticides and herbicides in agriculture is discouraged due to its un-desirable effects on the surrounding environment and other organisms. In conservation agriculture crop rotations, mulching, use of cover crops and good crop husbandry are very useful measures to suppress weeds. Therefore, environment friendly weed control methods are required to be used for weed management to avoid the incidences of undesirable effects. Mulching may be one of the best strategy for weed management.

Mulch is a material that may be organic or inorganic in nature which spread on the soil surface which provides shelter against raindrop, solar radiation and evaporation. Mulches help to preserve moisture, suppress weeds and improve soil stability and avoid insect pest physical attack. Organic mulches help to moderate soil temperature, provide efficient control on weeds, decrease rate of evaporation and add nutrients and humus in the soil.

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Mulching prevent soil erosion and has the ability to reduce the soil born-diseases. Mulching can be used as the management strategy for the improvement of water use efficiency (WUE) of soil and decreasing weed growth. In many developed countries like America and Australia straw mulch is used which improve various features of soil i.e. enhance soil moisture retention, reduce wind erosion, improve soil structure, control weed sand add nutrients in soil. Mulch has the ability to increase root growth and improve crop production by enhancing plant efficiency for N utilization. Physical application of mulch improves soil particle aggregation and enhance rate of infiltration of water. Chemical mulch provides a slow release type of nitrogen, add humic acids, phosphorus and potassium in the soil which facilitate to increase their uptake and utilization. Biological mulch is the component of Integrated Pest Management program which provides control to phytophthora root rot, against dual aggressive and competitive microbes. Mulches improve the covered land area and also protect the soil surface from erosion. There are two types of mulching material (organic mulch; living and inorganic mulch; non-living).

Additional effects of mulching are also reported that these enhance nutrient availability for plants and ultimately improve growth. Mulches decrease soil temperature through proper covering of soil and also reduce the impact of rain drops. Mulch cover provides shelter to the soil from solar radiations and ultimately reduces the evaporation rate of soil. 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. The present review describes the role of mulches in improving crop yield, weed control, soil water conservation and physical and chemical properties of soil.

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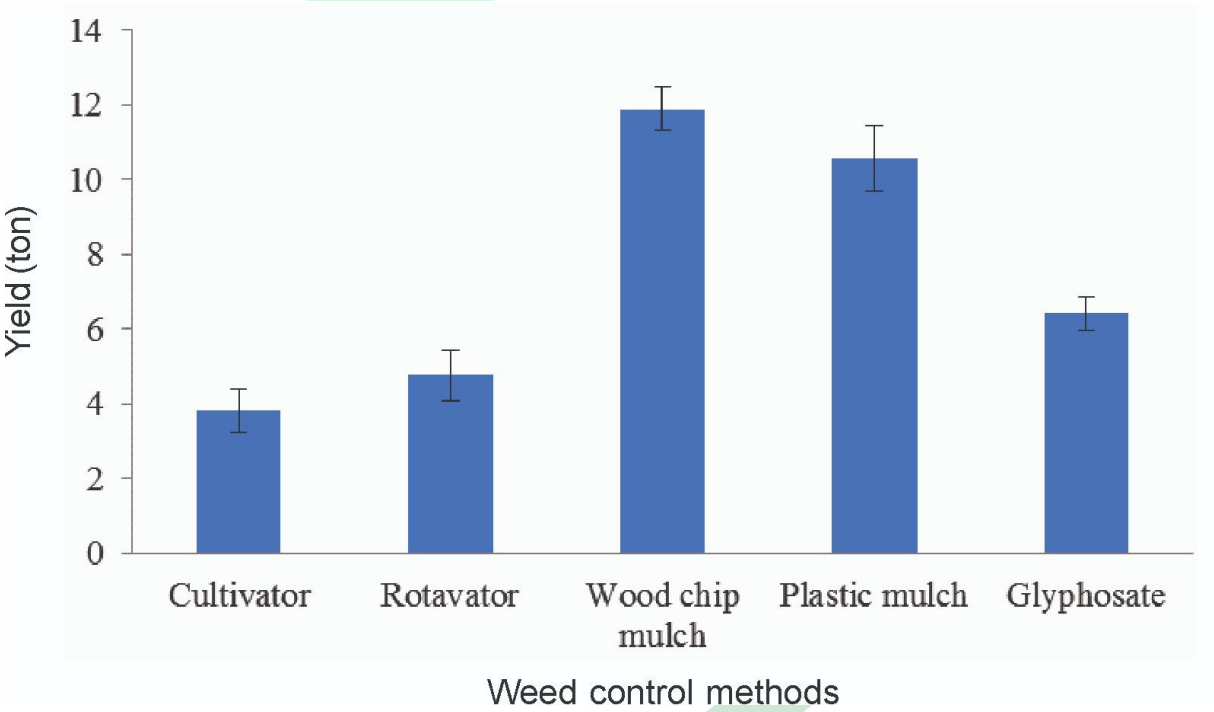
Effect of mulches on crop yield

Mulching is a supreme agronomic practice helps in conservation of soil moisture and regulating soil's physical condition. Under deficit irrigation condition, 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. In another study reported that mulches significantly minimize the losses of water through evaporation. They spread a sheet of 2 cm layer of variant mulches on the soil surface. The results showed minimum loss of water happened in wheat straw mulch that was 50% lesser as compared to control.



Mulches and weed control

Organic mulches minimize weeds by various means. Firstly, by interception of light they lump germination of seed, dropping soil temperature, and prominently diminishing day–night temperature variations. Resulting in germination of lesser seeds beneath mulch than on bare soil. Secondly, mulch hinders the development of those weeds physically that do germinate. If thickness of mulch is enough to avoid light from reaching the confined seedlings they die ultimately. Thirdly, some mulch resources like fresh-cut forages and grain straw release natural substances that prevent growth of weed seedling for numerous week period after applying a practice called as allelopathy. Finally, organic mulch has ability to

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boost crop growth and competitiveness against weeds bysoil moisture conservation and moderating soil temperature. Weeds are suppressed physically by spreading crop residues as mulch on soil surface. Hand weeding could be one of the most useful practices for weed control in maize crop. Plastic mulches may be useful weed control method in small maize fields in the areas where the cheaper and plenty of man power is not available. Mulching conserve the soil and water as well as efficiently control the weeds. Mulching reduces the degradation of soil by way of preventing the runoff and soil loss, decreasing the weed invasion and checks the water evaporation. Mulches improve physical, chemical and biological properties of soil and also help in retention of soil moisture and control of temperature fluctuations. Mulches enhance the growth andyield of crops by adding nutrients in soil.

Effect of mulch on physical and chemical properties of soil

Application of mulch reduced the rate of run-off under semi arid climatic conditions and significantly improved soil physical and chemical properties than control. The soil water content and crop yield benefits can be derived by using mulch cover in the crop rotation. In the semi-arid regions mulching may be a suitable agronomic technique for conserving soil and water and controlling soil temperature regime. Mulching had a positive effect on temperature regime and soil water content.

	Fertilizer	Compost	Wood Chips
Density	Lower +	Lower ++	Lower ++
Moisture	Same	Up +	Up ++
Organic matter	Same	Up ++	Up +
Respiration	Up +	Up ++	Up ++
pH	Same	Up ++	Up +
Nitrogen	Same	Up ++	Up +
Phosphorus	Up +	Up +++	Up +
Potassium	Same	Up +++	Up ++

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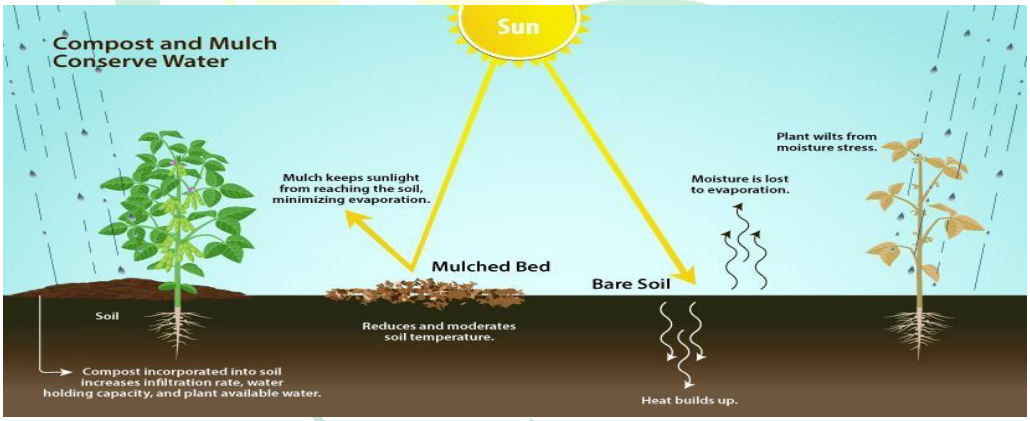
Organic and in-organic mulches can provide a number of benefits such as weed suppression, retain soil moisture, enhance water infiltration rate, moderate soil temperature, improve water holding capacity, soil porosity, organic matter concentration, cation exchange capacity and reduced diseases. The biological properties of the soil improved by mulching and increased soil water contents. The use of organic waste materials like plant residues, animal dung and saw dust mulch improve the physio- chemical properties of the soil and reduce environmental pollution.

Mulches and soil water conservation

Use of plastic mulching for saving of water is useful practice in many crops. The effect of plastic mulching on soil water conversation in spring maize was recorded in arid region. There was increase of 0.9-30.8 % in evapotranspiration and 4.0-110.3% in yield for all plastic mulched weed control measures over non-mulched. The water saving with plastic mulch was 2-61% higher than non-mulch and the variation increased with the decreasing soil water content. Finally results showed that under low soil water content, spring maize with plastic mulch maintained high water use efficiency and more profits than non-mulched.



It was observed that application of organic mulches showed significant improvement in water use efficiency and nitrogen use efficiency in wheat crop. Surface application of mulching is an efficient method for controlling runoff and increasing infiltration rate and it nearly removed or significantly reduced runoff as compared with those fallow soils depending on intensity of rainfall or rate of water application. Soil surface mulching with crop residues collectively reduce runoff as well as direct evaporation from wet soil surface and ultimately increase water availability.