RESPONSE OF MULCHING ON STRAWBERRY UNDER FEILD CONDITION

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ABSTRACT

In field condition judicious use of water is essential for increasing area under strawberry (*Fragaria* x *ananassa* Duch.) production with limited water supply. Therefore, uses of moisture conservation measures are essential under such situation. Mulching has been advocated as an effective means for conserving soil moisture. It works as an insulating barrier which checks evaporation from soil surface and effect of sunray on the strawberry. Mulching is an agricultural and horticultural technique in which the use of organic materials (plant residues-straw, hay, groundnut hulls, leaf and compost, peat, wood products-saw dust and animal manures), and synthetic materials (paper, polyethylene, wax coated papers, aluminium and steel foils etc.) with or without shallow tillage, for the purpose of increasing soil productivity is involved. This technique is very useful in protecting the roots of the plants from heat, cold or drought or to keep fruit clean. It checks evaporation and modifies the soil and air microclimate in which a plant is growing. Mulch is used to cover soil surface around the plants to create congenial condition for the growth. This may include temperature moderation, salinity and weed control. However, it is preferred in fruit orchard, flower and vegetable production, nurseries and forest where frequent cultivation is not required for raising the crops. Most commonly used agricultural mulch is black plastic. Clear plastic mulch is used in some areas due to its increased soil warming characteristics. White or aluminum reflective mulch is used where soil cooling is desired, such as establishing fall crops during the heat of summer.

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INTRODUCTION

Any material used (spread) at surface or vertically in soil to assist soil and water conservation and soil productivity is called mulch. The word mulch has been probably derived from the German word "molsch" means soft to decay, which apparently referred to the use of straw and leaves by gardeners as a spread over the ground as mulch (Hutton and Handley, 2007). Mulches are used for various reasons but water conservation and erosion control are the most important objective for its use in agriculture in dry regions. Other reason for high mulching use includes soil temperature modification, soil conservation, nutrient addition, improvement in soil structure, weed control and crop quality control. Mulching reduces the deterioration of soil by way of preventing the runoff and soil loss, minimizes the weed infestation and checks the water evaporation. Mulches are either organic or inorganic. Organic mulches are those derived from plant and animal materials. Those most frequently used include plant residues such as straw, hay, peanut hulls, leaf mold and compost, wood products such as sawdust, wood chips and shavings and animal manures. Organic mulch properly utilized can perform all the benefits of any mulch with the possible exception of early season soil warming. Inorganic mulch includes plastic mulch and accounts for the greatest volume of mulch use in commercial crop production. The plastic materials used as mulch are poly vinyl chloride or polyethylene films. Owing to its greater permeability to long wave radiation it can increase temperature around the plants during night in winter. Hence, polyethylene film mulch is preferred as mulching material for crop production. Now a day application of black plastic mulch film is becoming popular and very good results have been achieved particularly in rain fed agriculture. The black polyethylene mulch also checks all types of weeds in addition to soil moisture conservation therefore, black plastic mulch is more beneficial (McCann, *et al.* 2007). Organic mulches have the advantage of being biodegradable, but decomposition may result in a temporary reduction in soil mineral nitrogen. In addition, the natural phytotoxins released when organic materials decompose may not only inhibit the growing of weeds but also the crop plants (Walters, S.A. 2003). Black polyethylene mulches are used for weed control in a range of crops under the organic system of crop production. The use of black polypropylene woven mulch is usually restricted to perennial crops. Various colours of woven and solid film plastics have been tested for weed control in the field (Hundal, *et al.* 2000). Inorganic mulches (black polyethylene 25, 50 and 100 µ) on growth of strawberry cv chandler. The growth attributes were significantly influenced by organic and inorganic mulches. The black polyethylene mulch was found to be superior to other mulches.

EFFECT OF MULCHES ON SOIL AND PLANTS

Conserve soil moisture: The conservation of soil moisture through mulching is one of the important purposes. The micro-climatic conditions are favourably affected by optimum degree of soil moisture. When soil surface is covered with mulch helps to prevent weed growth, reduce evaporation and

increase infiltration of rain water during growing season. Plastic mulch helps prevent soil water loss during dry years and sheds excessive water away from the crop root zone during periods of excessive rain fall. Sutagundi, R.H. (2000) reported that treatment receiving straw mulch recorded significantly higher net returns (Rs. 30,894 ha^{-1}) and B:C ratio (1.80) compared to control as result of soil water conservation. Chawla (2006) stated the same results that mulching improves the ecological environment of the soil and increases soil water contents.

Reduce infiltration rate: Mulching increase the total intake of water due to formation of loose soil surface. The rain drops on mulched soil do not seal the particles as they do on un mulched soil. This sealing effect of rain drops results in more loss of water through erosion. The water infiltrated in soil can be utilized by crops there-by crop yields are increased. Mulches obstruct the solar radiation reaching to soil. Infiltration and soil evaporation are among the key processes that determine soil water availability to crops in semi arid agriculture. Mulch cover reduces surface runoff and holds rainwater at the soil surface thereby giving it more time to infiltrate into the soil.

Reduce run-off and soil erosion: Soils from dry region are highly susceptible to water erosion and wind erosion because rainfall occurrence is frequent during intense storms and surface is not adequately protected by vegetation which effectively retards runoff. Therefore to reduce erosions by wind and water is an important reason for using mulches in dry regions. Crop residues when applied at adequate level increase infiltration rate. Decomposition of these residues results in improving soil aggregation and suitability for crop production. Mulch can effectively minimize water vapour loss, soil erosion, weed problems and nutrient (Thakur, *et al.* 2000).

Reduce weed growth and keep the crop clean: By providing a physical barrier, mulching reduces the germination and nourishment of many weeds. If somehow weeds are growing they become pale and ultimately die. The mulching favours the reduction of evaporation leading to higher soil moisture content, a reduction in weed growth and the decomposition of added mulches might have also contributed to increase the supply of nutrients and moisture for overall increase in crop yields. Loose materials like straw, bark and composted municipal green waste can provide effective weed control. Saw dust is a wonderful soil improver and weed suppressor as it conserves soil moisture, decreases run-off, increases infiltration and percolation, decreases evaporation, etc. and weed growth can be substantial under clear mulch (Waterer, D.R. 2000). White and green covering had little effect on weeds, whereas brown, black, blue or white on black (double color) films prevented weeds emerging (Bond and Grundy, 2001).

Pest control: Transparent polyethylene mulch reduced whitefly populations, aphids caught in yellow traps and virus diseases incidence, in comparison to bare soil. The reflective plastic mulches can reduce the incidence of aphid-borne viruses and exclude some species of pest (Saroa and Lal, 2003). Transparent

mulch reduced the incidence of virus disease, and delayed by 2 weeks the onset of virus symptoms compared with the bare soil (Ngouajio and Ernest, 2005). Transparent mulch has a reflective effect and reduces the incidence of virus diseases by confusing aphids, which vector the virus. The mode of action of the transparent mulch is probably the result of high reflectance of UV light. The success of living mulches is the suppression of pests and weeds population.

Maintain soil temperature: Mulching reduces soil temperature in summer and raises it in winter. It prevents the extremes of temperatures. During summer, mulching conserves the soil moisture due to reduced evaporation. The cooling effect of soil promotes root development. In general, the effect of mulching on the temperature regime of the soil varies according to the capacity of the mulching material to reflect and transmit solar energy. Mulches results in greater water content and lower the evaporation. White mulches decrease soil temperature while clear plastic mulches increase soil temperature. The soil temperature can be higher up to 7^0C under clear mulch compared to bare soil. At night, condensation on the underside of the mulch absorbs the long wave radiation emitted by the soil thereby slowing cooling of the soil (Lamont, W. J. 2005). The ability of clear mulches to produce soil temperatures high enough to control weeds, plant pathogens and nematodes forms the basis for the soil solarization process (Stapleton, *et al.* 2005).

Plant growth and development: The effects of mulches on plants are operative through the effects of mulches on soil water, soil temperature structure and erosion. Reduced evaporation is major reason for the growth of the plants and there by high crop production due to mulch. Mulching provides a favourable environment for growth. Therefore, mulched plants usually grow and mature more uniformally than un mulched plants. Increase in soil temperature and moisture content stimulate root growth which leads to greater plant growth. Using black plastic mulch for growing strawberry is also beneficial as it improves growth, flowering and tuberous root formation, as well as cuts down weeding.

Improved quality and yield: Properly installed plastic mulch helps keep soil from splashing onto the plants during rainfall, which can reduce grading time. This is probably due to better plant growth which is governed by soil temperatures with minimum fluctuations, and soil moisture as well. Marketable fruit yield from mulched plot was significantly higher than those produced on bare soil.

Promote earlier harvest: Mulch can be used effectively to modify soil temperature. Black or clear mulch intercept sunlight which warms the soil. White or aluminum mulch reflects the suns heat and keeps the soil cooler. Black mulch applied to the planting bed prior to planting will warm the soil and promote faster growth in early season, which generally leads to earlier harvest. Clear mulch warms the soil more than black and usually provides even earlier harvest. Warm season vegetable, such as cucumbers, muskmelons, watermelons,

eggplant, peppers, usually respond well to mulching in terms of early maturity and more yields. **Reduced fertilizer leaching:** As excessive rainfall is shed from the root zone, fertilizer loss due to leaching is reduced. This is particularly true in sandy soils. This allows the grower to place more pre plant fertilizer in the row prior to planting the crop. They are also efficient in reduction of nitrates leaching and contamination of surface and ground waters by these compounds. Mulches improve soil physical properties, prevent erosion, supply organic matter, regulate temperature and water retention, improve nitrogen balance, take part in nutrient cycle as well as increase the biological activity (Singh and Singh, 2006).

Stimulate soil micro-flora: Mulching stimulates soil micro-organisms such as algae, mosses, fungi, bacteria and other organisms like earth worms etc., owing to loose, well aerated soil conditions, uniform moisture and temperatures thus resulting in a more rapid breakdown of organic matter in the soil and release of plant nutrients for crop growth. Under the mulch layer earth worms proliferate and help to improve the soil aggregate stability and infiltration etc. Mulching conserves moisture, suppresses weed growth, protects the upper fertile soil from erosion, minimizes variation in soil temperature and affords winter protection. Important role of mulch to support existence of most species of soil macro invertebrates. Soil biota increase under mulched soil environment thereby improving nutrient cycling and organic matter build up over a period of several years (Holland, J.M. 2004). Organic mulching technology support diversity of beneficial soil macro invertebrates.

CONCLUSION

Mulching has been advocated as an effective means for conserving soil moisture. It works as an insulating barrier which checks evaporation from soil surface and affects of sunray on the strawberry. Various types and colours are available, but whichever type is chosen, it is essential to select the correct width and thickness to last the life of the crop. Using polythene mulches (except white), results in soil warming, depending on the type used and the time of the year. All types will conserve soil moisture by reducing evaporation from the soil surface. All types except clear and white types suppress weed growth and thereby remove the need for herbicides, eliminating any associated growth checks. Since runners cannot root through plastic, polythene mulches provide a useful way of maintaining discrete plants. Clear polythene gives the greatest soil warming effect, as radiation passes through to the soil producing a 'glasshouse' effect which can advance cropping by up to a week. However it will not suppress weed growth and can only be used after a residual herbicide is applied prior to laying the polythene. White polythene has similar limitations. White on black polythene laid white side up is useful for delaying cropping. The white side reflects light and heat, keeping the soil and therefore the roots cool, whilst the black side suppresses weed growth. Black polythene is probably the most widely used type at present. It suppresses weed growth and warms the soil by conduction and radiation, and so

advances cropping by several days. However, in very hot sunny weather, fruit resting on the black polythene can be damaged and straw is therefore sometimes used to protect the berries from 'cooking'. Certain pests, in particular vine weevil, find the microclimate beneath the polythene very attractive and numbers can build up rapidly.

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