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Mulching with Agro-waste: An Alternate to Agro-waste Based Power Generation

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Abstract: Mulching technically means covering of soil. Mulch provide the conditions that are favourable for the growth of plant and crop production. Mulch can be organic or inorganic. Agro-waste can be used as organic mulch. Agro-waste usually used for mulching are paddy straw, rice husk, bagasse, ground nut shell, sawdust, soybean husk, cotton stalk, sunflower husk, jute waste, chana husk etc. Mulch helps in saving water use for irrigation by keep the watering frequency down, suppress weeds, protect against high temperature, reduce erosion, retain moisture, provide nutrients. This paper helps to explain the benefits of agro-waste mulching and propose alternative way of utilizing agro-waste by mulching instead of burning agro-waste in open fields or burning it for power generation.

Keywords: Mulching, Agro-waste, power generation.

1. INTRODUCTION

In agriculture predominated countries, a good amount of agro-waste is burnt in the open field. Burning of crop residues like paddy straw and rice husk after crop harvesting cause emission of green house gasses. For the management of agro-waste one way adopted is to produce electricity using this agro-waste as fuel. But Agro-waste power generation faces majors risks like fuel availability and unstable prices, problems of ash melting, slagging, clinkeriation at the base of boilers, super heater choking, agglomeration and drop in boiler temperature due to moisture in the bales. All these problems results in frequent shut downs of the plants and they do not operate continuously. Transportation of agro-waste from fields to power generation plants add to gas emission and labour cost. The other alternative for efficiently utilisation of agro-waste like paddy straw and rice husk is mulching [1].

Mulching is the process of covering the ground to protect and provide favourable condition for the plant growth and crop production. Types of mulches are:

***Inorganic mulches*:** In inorganic mulches, black sheets are used to cover the plants and crop to protect it from environment, moisture retention, weeds suppression

***Organic mulches*:** Organic mulches are those mulches which are made out of natural substances. Organic mulches provide nutrients and enrich the soil as they decays. Agro-waste like paddy straw fall in the category of organic mulch.

Characteristics of good mulching is that it should be economical, available, environmental friendly, provide nutrients to soil and free from weeds and insects. All these condition are fulfilled by paddy straw.

2. PROBLEM DEFINITION

Agro-waste management is a big challenge for farmers. Paddy straw is available in significant quantities to farmers after the rice crop harvesting. Management of this rice straw is a major problem. Around 6 tonne of straw is produced per hectare of rice cultivated [2]. Paddy straw is usually not used as ruminant fodder because of low protein, high silica content and lignin, that results in low digestibility [3]. An alternative to gainfully utilise paddy straw, other than burning in open field or in thermal plants, is to be explored.

3. PROPOSED SOLUTION

Mulching has various benefits and could be a attractive alternative to power generation, using crop residue like paddy straw. Since it is used in the field site itself that will minimize transport and labour cost. The other benefits of mulching are:

Water Saving: Mulching reduce the evaporation process in the irrigated land as it helps the soil to retain moisture for long time. Mulching helps in protecting fields against water erosion and increase the duration of first-stage drying. Mulching reduces the runoff velocity of water. The amount of water saving and retention is proportional to amount of straw mulch [4], [5]. According to Singh R.P. *et al.* (2008) mulching saves 30% of irrigation water. This would help save 168kWh/ha of electricity used by submersible motors for pumping water [2].

Weed suppression: Weed is a plant that has no value and it hinders the growth of main plant or crop. The rice straw much is effective in weed management. Devasinghe *et al.* (2011), illustrated that the mulching with rice straw at the rate of 4t/ha was effective in weed suppression under

Direct Seeded Lowland Rice method [6]. Mulching helps weed suppression by stopping light from reaching it. Because of lack of adequate amount of light they can't photosynthesise and are not able to grow.

Temperature control: Mulching affects the soil temperature by changing the amount of radiant energy balance and insulation [7]. The radiant balance is affected by amount light reaching the surface and reflected by mulch. The insulation effect of residues is determined by the amount of mulch used [8]. In summers or hot season, mulch is beneficial for crop production, as it keeps the soil temperature low [9].

Soil erosion prevention: Mulch helps in preventing soil erosion by covering the soil. Soil erosion causes loss of soil fertility by eroding top soil, loss of soil organic matter, and decreased water-supplying capacity. Mulching of crop residue on fields, reduces soil erosion. Mulching reduces the runoff velocities of water and improves permeability of the soil by protecting the structure of the soil on the surface. Mulching prevent crusting and sealing of the soil surface [10].

Fertilizer: The organic mulches like paddy straw and rice husk are rich in nitrogen, silicon and potassium. About 40% of the nitrogen (N), 40 to 50% of the sulphur (S), 80 to 85% of the potassium (K), 30% to 35% of the phosphorus (P) is given by paddy straw that is required for the growth of plant and crop maturity [11]. During rain, potassium in the paddy straw gets leached in the soil.

More Yield: Mulching increases the soil pH value, which is an important factor affecting soil fertility. Low pH of soil converts the nutrients into forms that are not readily available to the crop. It also increases the solubility of plant toxic metals like aluminium that results in hampered growth and a general lack of plant's physical strength. In some cases because of weed reduction yield of crop increases [12].

Environmental friendly: Mulching agro-waste in fields is environmental friendly. Burning of crop residue cause loss of nutrients present in residues. Study observed that one tonne straw on burning releases 60 kg CO, 1460 kg CO_2, 199 kg ash,2kg SO_2 and 3 kg particulate matter [13].

4. CONCLUSION

The abundance of crop residue after harvesting usually results in agro-waste mismanagement. Usually, farmers burn the residue in open to clear the land quickly for next crop. Burning of agro-waste releases harmful gases and decrease the soil fertility [13]. Some initiatives have been taken by government, to gainfully utilize crop residue in agro-waste based power plants for power generation, but agro-waste power generation is facing majors risks because of seasonal availability of paddy straw, high silicon amount in agro-waste that results clinkering and slagging in boilers. Mulching is other alternative that can be adapted by farmer because of its benefits and low labour cost. Mulching is an ecological approach to utilize the crop residue and agro-waste. Mulching helps to retain moisture in soil, to suppress weeds, to control temperature of soil, to act as a fertilizer and to increase yield in some crops. Further, mulching the fields reduces soil evaporation and save irrigation water that indirectly results in electricity saving.

5. FUTURE SCOPE

It is observed that mulching saves the irrigation water by increasing moisture retention of soil. Further study can be conducted to determine the optimal amount of mulching to save the irrigation water, because excessive use of crop residue as mulch is also not beneficial from economical point of view.

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