AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 03 Issue: 09 September 2022 Article No: 20

Paddy Residue Management

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SUMMARY

It is observed that from one acre of harvested paddy field approximately 25-35 quintal paddy straw can be obtained. Farmers mostly prefer burning of residues. In view of the serious problems associated with the burning of paddy residues, sincere efforts are needed to find ways and means to efficiently utilize the huge amount of surplus rice residues produced for maintaining soil, human and animal health, and increasing farmer's profits. The world-wide mechanization leads to large amount of rice crop residue or stubbles production. The management of rice (paddy) crop's post harvested residue is done by burning, incorporation/ amalgamation, surface retention, mulching, bailing and direct removal. The farmers prefer burning of residue in field because it is cheap and less time consuming process. But it causes air pollution, smog and addition of toxic particle into the environment leads to poor air quality and hazy floating clouds. Despite some advantages like killing deleterious pests and clearing weeds from the field, the burning leads to loss of nitrogen up to 80%, phosphorus 25%, potassium 21%, sulfur 60%, soil organic matter (SOM) and increases air pollution and CO2 concentration. The incorporation of post harvested crop residues in soil by using available agricultural implements causes immobilization of inorganic nitrogen (N2). It also affects soil temperature, moisture, bulk density and pH. Therefore, Governments and scholars together regularly preparing and amending several policies to not to burn paddy crop residues and promoting management of post harvested paddy crop stubbles by environmentally safer ways. The ecofriendly methods for residues management provides a new dimension for the application of post harvested residues as bedding material for cattle, fodder, packaging material, fuel, biogas generator, and in paper production, mushroom cultivation, and bio-thermal power plants, for sustainable environment and development. Paddy crop residues are used as an alternative fuel source in thermal plant for electricity generation in Malaysia. Thus, sustainable use and management of paddy crop residues proved beneficial for farmers, society as well as environment by enhanced economy, soil fertility and reduced pollution level.

INTRODUCTION

Disposal of paddy residue has turn out to be a huge problem in north-west Indian states, resulting farmers prefer to burn the residues in-situ. Paddy residue management is of utmost important as it contains plant nutrients and improves the soil-plant-atmospheric continuum. Burning biomass not only pollutes environment and results in loss of appreciable amount of plant essential nutrients. The objective of this article is to discuss the possible strategies, financial and socio-economic evaluation of the paddy residue management technologies and accentuates the assessment of range of potential policy instruments which would offer avenues for sustainable agriculture and environment. Timely availability of conservation agriculture (CA) machinery is of utmost significance to manage the paddy residues in-situ. Collection and transportation of voluminous mass of paddy residue is cumbersome, therefore, ex-situ residue management is still not an economically viable option. The agricultural waste opens vivid options for its versatile usage and is possible if residue is collected and managed properly. It is a prerequisite for surplus residues to be used for CA. There is an urge to create awareness among farming communities to incline them to understand importance of crop residues in CA for sustainability and resilience of Indian agriculture.

Residue Management in Paddy:

Burning of post harvested rice crop residues

The conventional way for residue management is direct removal of post harvested parts of the crop from field by traditional method. The stubble of paddy is removed from field for use as cattle feed/ fodder and other purposes. The introduction of mechanized harvesting techniques promoted farmers for burning of large quantities of crop residues left in the field. Because of the larger size of stubble after mechanical harvesting that interfere with tillage and seeding operations for the subsequent cropping. The open burning of stubble in the field responsible for the loss of nutrients, soil organic matter (SOM), flora and fauna of crop ecosystems and enhancement of air pollution and health risk. The burning practice of paddy

residues also causes substantial air pollution and killing of advantageous soil insects and microorganisms. The burning may kills soil borne injurious pests and pathogen.

The effects of open field burning of post harvested rice crop stubbles or residues.

Incorporation of crop residues in soil

Incorporation of the remaining part of paddy crop into soil may return most of nutrient and help to conserve the quality of the soil. The straw or stubbles are incorporated with soil augments its fertility, so, there will be less need of fertilizers for subsequent crops. In comparison to residue removal, the incorporation has been found to increase available phosphorus, exchangeable cations (K, Ca and Mg) and base saturation. Incorporation of rice straw into paddy soil is an effective strategy to manage rice straw, but doing it inadequately and ineffectively may result in a decline in production efficiency and an increase in greenhouse gas emissions

Shallow tillage

Shallow tillage method is conventional exercise for the management of post harvested residues. Tilling at 5-10 cm depths to incorporate crop residues in soil that is it responsible to increases the soil aeration and soil fertility. The shallow tillage of dry soil is to be carried out up to 2-3 weeks after harvesting. It can increase the carbon (C) content of agricultural field soil by aerobic decomposition of crop residues, thus minimizing negative effects of anaerobic decomposition products on subsequent crop. It also improves soil aeration, reoxidation of iron, nitrogen and phosphorus contents in soil.

Surface retention and mulching

The surface retention of residues assists in shielding the fertile surface soil against wind and water erosion. The large quantities of stubbles remaining on the surface often hints to machinery failures, thus affecting sowing of seeds of the subsequent crop. Therefore, farmers usually follow this method where no-till or conservation tillage practices are prevalent. The surface retention of some or all of the post harvested residues may be the best option in various situations.

Baling the straw

The collection and assortment of rice straw encompasses three main tasks namely: picking up of rice straw materials, compressing them into bales, and hauling them to storage or processing area. In these actions, a collecting machine (baler) is the chief compacting entity. The baler occasionally consists of the other two operations like picking up of straw and hauling of baled material that depend on operational

circumstances and determinations. A fixed baler with only a compaction unit can be used appropriately in collecting straw disposed from paddy threshers

No tillage

The no tillage method for stubbles management involves the direct drilling of subsequent crop seeds in rice residues the residual moisture is efficiently utilized for seed germination and saving of irrigation water. No tillage technology for wheat as a subsequent crop of after rice demonstrated better in terms of saving of fuel, cost of cultivation and progressing sowing time than rotavator and conventional tillage methods. The no tillage profits instantaneous advantage of residual moisture from the previous rice crop and cuts down on the subsequent irrigation requirements and reduced water use during cropping.

Removal

The straw removal can involve scraping loose straw, baling in small bales and road siding the bales, and/ or conventional hiring of manpower for the entire process. The straw is cut low using combine and kept in a windrow that may simply be baled and hauled. The uses of rice straw ranged from bedding in horse stalls and chicken coops to serving as an ingredient in bricks, wallboard and other building materials.

Effect of Residue Management on Soil Quality

- The soil quality is the capacity of a specific kind of soil, to function with in natural or managed ecosystem boundaries, to sustain plant and animal productivity.
- The greater amounts of rice residues on the soil surface reduce evaporation rates and increased duration of first stage drying tend to improve soil moisture content than bare soil.
- The soil temperature is affected through the mechanism of change in radiant energy balance and insulation by surface residue.
- The crop residues may increase soil hydraulic conductivity and infiltration by modifying mainly soil structure, proportion of macropores, and aggregate stability. The hydraulic conductivity under straw-retained direct drilled treatments was 4.1 times greater than that of straw-burnt conventional tillage treatment.
- The soil physical properties such as advanced percentage of water stable masses (>0.25 mm diameter), higher mean weight, higher porosity, lower bulk density, higher available water capacity and greater hydraulic conductivity of saturated soil improved as a result of incorporation of rice straw.
- The rice crop residues are highly siliceous in chemical nature and it has been reported that the silica rich plant material has the potential of transforming the electrochemical properties of acidic soils that reduces phosphorus fixation; improved base retention and increase the soil pH, hence the soil of field may shifted into acidic soils.
- Residue incorporation leads to more microbial activity than residue removal or burning.

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