

Crop Residue Management: A Step to Sustainable Future

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Crop residue is the portion of the plant that is left in the field after harvest of the crop, which is not used domestically or sold for commercial purpose (i.e.- straw, stems, leaves, stalks, roots). crop residue is also the those which are generated from packing sheds and discarded during processing.

Types of crop residue

There are two different types of crop residues

Field/Harvest residue

It is the left-out material after harvest of the crop. These can be ploughed directly into the soil. Good management of crop residues improves soil physical, chemical and biological properties

Example- straw, stubble, stovers, haulms, leaves

Process residues

Process residue is the material left after the crop is processed into a usable resource. These can be used as animal fodder and soil amendment, can be used as organic manures and be used in manufacturing sector.

Example-bagasse, molasses, cobs of maize, sorghum, bajra, groundnut shells

Multiple use of crop residues

The crop residues can be used for various purposes

- Livestock feeding
- Soil mulching
- Bio manure/compost
- Mushroom production
- Bio-fuel
- Biochar production
- Thatching in rural house holds
- Fuel purpose in domestic and industrial sector
- After incorporation to soil, improve soil physical, chemical and biological properties

Crop residue management

Crop residue management is the conservation system that promotes use of non-commercial portion of the plant for protection and improvement of soil system. It is a cultural practice that includes fewer or less intensive tillage operation, preservation of more residues in soil from the previous crop. It helps to protect soil and water resources and provides additional plant nutrient and environmental benefits

Necessity of crop residue management

Effective nutrient management involving available organic sources including plant-based waste and crop residues is very important step to provide additional nutrient deficit apart from chemical sources. It will help to the reduce demand for chemical/external fertiliser source as the demand of chemical fertiliser will increase by 10-15% in near future.

Benefits of crop residue management

- Acts as soil amendment
- Improves soil structure
- Erosion control
- Balances soil temperature
- Enhances soil microbial activity
- Nutrient recycling
- Reduces water evaporation
- Improves soil water holding capacity

The major effect of crop residue management in soil:

It develops soil physio-chemical properties of soil in various way. Some of the major points are mentioned below.

Effect of crop residue on physical properties of the soil

- Soil structure
- Soil bulk density and porosity
- Hydraulic conductivity
- Soil temperature

- Soil moisture

Effect of crop residue on chemical properties of the soil

- Organic carbon
- Soil pH
- Cation exchange capacity
- Available N, P and K
- Available micro nutrients

Effect of crop residue on biological properties of the soil

- It provides energy for growth and activities of microbes and acts as substrate for microbial growth
- Provides suitable environment for biological N fixation
- Increase soil enzymatic activities
- Increase microbial population
- Humus formation

Problems faced by farmers with crop residue left in the field

Use of combine harvester leaves around 80% residue in field making difficulty in crop management. Farmer find it laborious and are burning it on field to get rid of it and start new sowing

Impact of stubble burning

Stubble burning causes a wide range of problems on environment, soil fertility, health hazards, impacts economy and many more

a. Impact on Environment

The burning of 1t of paddy straw releases 3 kg particulate matter, 60 kg CO, 1460 kg CO₂, 199 kg ash and 2 kg SO₂, increasing the air pollution.

A large number of toxic pollutants like methane, volatile organic compound and carcinogenic polycyclic aromatic hydrocarbons are released that rise to the formation of smog.

b. Impact on Soil Fertility

Stubble burning destroys existing soil minerals, soil organic matter that makes soil less fertile.

The heat from burning paddy straw penetrates 1cm into the soil, elevating the temperature to 33.8 to

42.2 degree Celsius, that kills the bacterial and fungal populations critical for a fertile soil. Loss of eco-friendly pests. Drastic reduction in solubility capacity of the upper layers of soil.

In addition, other soil properties like soil temperature, pH, moisture, available phosphorus are greatly affected due to burning.

c. Impact on Human Health

Burning crops release particulate matter (PM) 2.5 that is easily carried away along the wind, causing numerous health issues.

These particles are tiny enough to get trapped deep inside the lungs, increasing the risk of lung cancer by 36 percent.

The smog-formation and poisonous gases arising from the stubble burning in Punjab and Haryana turns Delhi and other regions of the Gangetic plains into a gas chamber.

Children (below 5 years) and elderly (above 59 years) in urban areas are at high risk of acute respiratory infection (ARI) associated with crop burning, compared to those living in rural areas.

d. Impact on Economy

According to a report published by the International Food Policy Research Institute (IFPRI) in January, 2019, India loses \$30 billion every year from crop fires.

The estimated the economic cost of exposure to air pollution from crop residue burning at USD 35 billion or nearly Rs. 2.35 lakh crore annually for the three north Indian states of Punjab, Haryana and Delhi.

Further, it warns that in next five years economic loss because of burning of crop residue would be \$190 billion.

Solution for crop residue burning problem

By proper crop residue management farmers will not only help in reducing pollution but also will improve the soil productivity and will also get additional profit.

Some of the methods are-

1. Waste decomposer
2. Conversion of crop residue

3. Use of Agriculture machinery

A. Waste decomposer

Waste decomposer are effective microorganisms for in-situ decomposing of crop residues. This is sprayed on post-harvest stalk and residue and kept for about 1 month. Microbial Decomposer Technology is a microbial-based strategy, abundant in nitrogen fixing bacteria (*Azotobacter*, *Azospirillum*, *Rhizobium*, *Acetobacter*) and *Pseudomonas fluorescence*.

Benefits of Decomposer

- Microbial waste decomposer is simple, reliable, economical option for crop residue management.
- Used in quick composting of biowastes (Such as crop residues, wheat and paddy straw, animal manure, garden weeds and litter, grass, hedge cuttings, and garbage).
- Waste decomposer works as Biofertilizer, biocontrol agents and as well as soil health reviver.
- The decomposed materials can be used as biopesticide for the eco-friendly management of agricultural and horticultural crops (drip irrigation, foliar spray as biopesticide).

B. Conversion of crop residues

Crop residues can be converted to animal feed, Recycled products, Card board, paper etc. It can be used in setting up Bio-mass fuel plants to generate fuel using paddy husk

C. Use of Agriculture machinery

- Happy Seeder (used for sowing of crop in standing stubble)

- Rotavator (used for land preparation and incorporation of crop stubble in the soil)
- Zero till seed drill (used for land preparations directly sowing of seeds in the previous crop stubble)
- Baler (used for collection of straw and making bales of the paddy stubble)
- Paddy Straw Chopper (cutting of paddy stubble for easily mixing with the soil)
- Reaper Binder (used for harvesting paddy stubble and making into bundles)

Government Initiatives towards Reducing Stubble Burning

Laws that are in operation pertaining to crop residue burning are mentioned below

- The Section 144 of the Civil Procedure Code (CPC) to ban burning of paddy
- The Air Prevention and Control of Pollution Act, 1981
- The Environment Protection Act, 1986
- The National Tribunal Act, 1995

Conclusion

Now a days stubble burning is a most negative trend or practice in agriculture that is causing lot of health issues, environmental pollution and in addition also a great loss of economic and opportunity for employment generation, value addition and development. Proper crop residue management will not only improve soil physio chemical and biological properties but also will sustain the environment with economic development.

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