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Crop Residue Management A Better Way

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The crop residue is the material left after the harvesting of crop and byproduct of agriculture based industry. Every year huge volume of crop residues are produced both on-farm and off-farm. It is estimated that approximately 686 Mt of crop residues are produced per year in the country. These crop residues are used for animal feeding, soil mulching, manure making, thatching for rural homes and fuel for domestic and industrial use. Crop residue and Field residue e.g. stalks, leaves, and stems etc. Processed residue e.g. seed, bagasse, and roots etc.

Field residue

Field residue are materials left in an agricultural field or orchard after the crop has been harvested. This residue includes stalks and stubble (stems), leaves and seed pods.

Process residues

Process residue are those materials left after the processing of the crop into a usable resource. These residues include husks, seeds, bagasse and roots. They can be used as animal fodder and manufacture of organic manure *viz*. vermicompost.

Generation of crop residues in India

The Ministry of New and Renewable Energy (MNRE, 2009), Govt. of India has estimated that about 500 Mt of crop residues are generated every year**.** The generation of crop residues is highest in Uttar Pradesh (60 Mt) followed by Punjab (51 Mt) and Maharashtra (46 Mt). Among different crops, cereals generate maximum residues (352 Mt), followed by fibres (66 Mt), oilseeds (29 Mt), pulses (13 Mt) and sugarcane (12 Mt). The cereal crops (rice, wheat, maize, millets) contribute 70% while rice crop alone contributes 34% to the crop residues. Wheat 22% of the crop residues whereas fibre crops contribute 13% to the crop residues generated from all crops. Among fibers, cotton generates maximum (53 Mt) with 11% of crop residues.

Surplus of crop residues

Estimated total amount of crop residues surplus in India is 91-141 Mt. Cereals and fibre crops contribute 58% and 23%, respectively and remaining 19% is from sugarcane, pulses, oilseeds and other crops. Present status of crop residue management - Burning. Farmers have been burning large quantities of crop residues. Estimated that about 93 Mt of crop residues are burnt on-farm in the country.(Pathak et al.2010). Out of 82 Mt surplus residues from the cereal crops, 44 Mt is from rice followed by 24.5 Mt from wheat, which is mostly burnt on-farm. Farmers have been burning large quantities of crop residues. Estimated that about 93 Mt of crop residues are burnt on-farm in the country.(Pathak et al.2010). Out of 82 Mt

surplus residues from the cereal crops, 44 Mt is from rice followed by 24.5 Mt from wheat, which is mostly burnt on-farm.

Why farmers burn residues in field?

- Clearing of fields for next crop
- The use of combine harvesters.
- Collection is time ,labour consuming process.
- No economic alternate use.
- Declining number of livestock.
- Long period for composting.

Impacts of Crop Residue Burning, Smoke & soot particles, Pollution (Affecting- Human health's. Loss of Nutrients e.g. N, P, K & S, increase GHGs. Soil hardening & erosion due to no cover.

Loss of nutrients due to paddy straw burning (per ton)

- **Nitrogen 5.5 kg**
- **Sulphur 1.2 kg**
- **Phosphorus 2.3 kg**
- **Potash 25.0 kg**
- **Organic Carbon 400 kg**

Potential uses of crop residues

Bio-fuel production

- Conversion of lingo-cellulosic biomass into alcohol is of immense importance as ethanol can either be blended with gasoline as a fuel extender and octane-enhancing agent or used as a neat fuel in internal combustion engines.

Gasification

- The crop residues can be used in the gasifiers for 'producer gas' generation.
- Gasification is a thermo-chemical process in which gas is formed due to partial combustion of crop residues.

Biochar production

- Biochar is a charcoal-like substance produced from agriculture and forest wastes which contains 70% carbon.
- Biochar is produced through slow pyrolysis (heating in the absence of oxygen) of biomass.
- It is a fine-grained charcoal and can potentially play a major role in the long-term storage of carbon in soil.

Managing crop residues with conservation agriculture

- Zero-till drill
- Happy Seeder
- Straw Reaper
- Super Straw Management System
- Paddy Straw Chopper
- Hay Rake
- Baler

Advantage

- Improve physical, chemical biological capacity of the soil.
- Reduce GHGs emission.
- Reduce cost of cultivation.
- Decrease weed population.

Limitation

- Machine dependent.
- Perennial weed problem.
- PE herbicide less effective.
- Nutrient application under residue retention another challenge.
- Allele-chemical effect of crop residue.

Zero-till drill

- Zero-till farming is a way of growing wheat / other crops without tillage or disturbing the soil in paddy/other crop harvested fields.
- Advantage:-

Advantage:

1. Reduces labor, saves time
2. Saves fuel
3. Reduces machinery wear
4. Increases organic matter
5. Traps soil moisture
6. Reduces soil erosion

Happy Seeder

Happy Seeder is one of the unique techniques which is used for sowing seed without any burning of Crop residue.

- In this machine a Rotor unit is attached at front of seeding unit that cuts & spread straw in between the rows, as mulch.
- Majority of the residue is not disturbed and seed is sown in a single pass.
- Majority of the residue is not disturbed and seed is sown in a single pass.
- This technology is eco friendly with environment for the health of soil as well as it also saves water.

Advantages

- Removes the need to burn rice stubble before planting wheat, therefore reducing air pollution.
- Direct sowing also reduces soil disturbance, enabling it to retain more nutrients, moisture and organic content.
- Saves money as less time is needed on carrying out field operations, which in turn reduces fuel and labour costs.

Super Straw Management System (Super SMS):

The Super SMS cuts the straw in small pieces and scatters it around behind the tail of the combine.

Advantages

- Easy direct sowing of wheat with happy seeder
- The scattered straw helps in conserving the soil moisture
- Avoid burning straw or removal of straw.

Straw Reaper

- The left over wheat stalks after cut by combine harvester, thresh and blow out the straw to netted trolley attached which allows blowing of dust particles

Advantages

Recover wheat straw after combine operation

- Recovered wheat straw is used as cattle feed.
- The capacity of machine on an average is 0.4 ha/h and straw recovery is about 55-60%.
- The quality of bhusa is high comparable with that made available thresher.
- There is an additional grain recovery of 50-100 kg/ha

Paddy Straw Chopper

- It is a machine for chopping all types of crop residue / straw such as wheat, Paddy, Maize, Sorghum, Sunflower etc.
- Machine consists of a rotary shaft mounted with blades named as flail to harvest the straw and chopping unit consisting of knives.
- The chopped and spreaded stubbles are easily buried in the soil by the use of single operation of Rotavator or disc harrow
- Subsequently, wheat sowing is done as usual by the use of , no-till drill or traditional drill/other equipment

Hay Rake

- It is used for collect straw into windrows for later collection (e.g. by a baler).
- It reduces the work of baler.
- Baler
- It is used to compress raked residues of rice, wheat, fodders, sugarcane, legumes etc into compact bales that are easy to handle, transport, and store.

Two different type of bale–rectangular or cylindrical, of various sizes, bound with twine, strapping, netting or wire

Advantage

- Crop residues are turned into bales which is used for animal feeding as well as bio fuels.
- Creates alternative business for farmers to sell bales to power plants.

Mulcher Machine

- Used for mulching of straws of crops such as rice, maize, sunflower and tobacco residues easily
- This machine shreds the weeds and stock of row crops in orchards

Cutting height is adjustable by two wheels at the back of the machine

Residue management- Policy and development needs

Laws and legislation:

- Developing and implementing appropriate legislation on prevention and monitoring of on-farm residue burning
- Supplying machineries on subsidized rates and providing soft loans for purchase of implements
- Introduction of carbon credit schemes to benefit the farmers

National Policy for Management of Crop Residue (NPMCR): The situation demands that an appropriate policy package of technical and policy interventions for crop residues management is formulated for adoption by the States. Accordingly, "National Policy for Management of Crop Residue (NPMCR)" has following major objectives:

- Control of burning of crop residue to prevent environmental degradation and loss of soil nutrients and minerals by promotion of in-situ management (incorporation in soil, mulching, baling/binding for use as domestic/industrial fuel, fodder) of crop residue;
- Diversified use of crop residue for various purposes like charcoal gasification, power generation, as industrial raw material for production of bio-ethanol, packing material, paper/board/panel industry, composting and mushroom cultivation etc.;
- Capacity building and awareness about ill effects of crop residue burning and its effective utilization and management; and
- Formulation and implementation of suitable law and legislative/policy measures to curb burning of crop residue.

Conclusion

- Cereal residue has a potential to emerge as a one of important source of nutrient due to huge amount.
- Addition of residue play important role in improving soil physical, chemical and biological properties over long run there by sustaining production system.
- Use of surplus residue for energy generation instead of on farm burning is better to cop up with increased air pollution due to residue burning.
- Farmers should aware of the adverse effects of paddy straw burning at the farm level and human health related problem.