

Crop residue and its on farm and off farm utilization ways

Simran Jasht, Diksha

Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Abstract

Crop residues, which are the leftover plant parts after harvest acts as a reservoir of N, P, K, and numerous micronutrients. To recycle organic matter and nutrients back to the land and ensure agricultural sustainability, efficient crop residue management in an eco-friendly manner is critical. Farmers used to consider crop waste to be trash, which was frequently burnt by fire. This leads to an increase in global warming and side by side decreasing soil fertility. These crop residues might be used as animal feed, to produce bioenergy, charcoal, as a substrate for mushroom growing, as a domestic fuel, or to make boards, among other things, which come under off-farm utilization. The other means for utilization of crop residue management can be achieved in the field itself, which is known as on-farm utilization of crop residues. This can be done by either using it as mulching or under a zero-tillage system for maintaining the soil fertility in long term. The soil of the field is the capital of the farmer, the higher the amount of carbon in the soil, the more fertile the field will be, there are many benefits of mixing crop residues in the soil of the field.

Keywords: Crop residue, Global warming, Zero tillage, On farm and off farm utilization.

Impact of crop residue burning

Crop residues (CRs) are plant portions such as stems, leaves, and roots that remain in the field after harvesting the economic part of crops. Collecting and managing field residue requires not only a lot of energy and effort but also takes time, which delays the planting of the following crop. As a result, in many countries, agricultural leftovers are burned on-site, causing air pollution, impeding nutrient recycling, and harming soil microorganisms owing to warming and carbon loss. Wheat and rice account for the majority of agricultural residues burned in the field, which contributes to air pollution by producing gaseous pollutants such as CO₂, CH₄, CO, N₂O, NO_x, SO₂, and a substantial number



of other particulate matter. These pollutants harm human health by degrading air quality and exacerbating eye and skin illnesses. Stubble burning not only depletes soil nutrients but also affects soil parameters such as soil temperature, pH, moisture, available phosphorus, and soil organic matter. Though no accurate number of worldwide residues burning data is known, around 92 Mt of agricultural waste is burned each year in India alone.

Methods for crop residue management

Crop residue can be managed in one of two ways: on farm and off farm disposal

Off farm disposal of crop residue

Livestock feed

Using crop residues as feed for livestock by the farmers is an age-old practice in which collected crop leftovers are cut and stored. However, its low protein and mineral content limits its usage as fodder, but this may be solved with slight value addition. Likewise, nitrogen-rich substances are added to make them more palatable and nutritious. There may be other uses of crop residues as many times wheat straw is utilized as a bedding material for livestock.

Mushroom Cultivation

Wheat and rice straws are great substrates for button mushroom production. Mushroom cultivation utilising agricultural wastes as a substrate is a profitable venture in case of mixed farming or diversified agriculture, where crop waste may be converted into high-value, nutrition food *i.e.*, mushroom.

Packaging material

Modern applications of straw are making boards by mixing them with a suitable binder, bio-composite materials. Other uses include are for interior designing, packaging, false roofing, and other related applications. There is a growing need for ecologically friendly composite boards, notably as an alternative for synthetic and solid wood products.

Biochar

Biochar is produced through pyrolysis where waste biomass is burnt at a higher temperature (300–600°C) in limited or anaerobic conditions. The carbon from agricultural residue, which otherwise is released into the atmosphere as CO₂, is detained in the form of biochar for a significantly longer period. So, this modern strategy of crop residue management allows us to reduce carbon impact.



Biogas

The biogas may be utilized as cooking gas or as an energy source to generate power, which is made by certain anaerobic bacteria acting on crop residue mixed with cow dung. Also, they can be turned into briquettes and utilized as fuel for a variety of applications.

On-farm utilization of crop residues

Three major options for the on-farm utilization of the crop residues are surface retention (mulching, zero tillage, etc.), in situ incorporation (where the stubble is managed on site) and ex situ composting (at some suitable place in the farm).

Surface retention

Surface retention of straw, stubble, leaves, and other plant parts is a potential crop residue management approach because it not only recycles organic carbon and nutrients but also works as a mulch to maintain soil moisture. Crop residue mulching improves agricultural input use efficiency while simultaneously maintaining soil productivity.

Ex situ composting

Another alternative for on-farm utilization of crop residues is collecting and composting, either alone or in conjunction with farmyard manure, at a suitable location on the farm. In this manner, crop residues may be aerobically or anaerobically degraded to produce nutrient-rich manure, which can be later on reversed back by applying it into the field.

In situ incorporation

In situ incorporation of crop residues entails applying straw, stubble, or crop residue to the field and mixing it with the topsoil during tillage procedures. This can be accomplished by combining a straw spreader with a combined harvester. The unmechanized method for its decomposition in situ is by employing *Trichoderma viride* (a bio decomposing fungus) inoculum to increase soil porosity, soil water content, soil organic matter, available N, P, K, thus increasing final yield.

To promote the utilization of crop residues, some centre and state-funded schemes are introduced among farmers from time to time. Like, for the financial years 2018-19 and 2019-20, the Central Sector Scheme on 'Promotion of agricultural mechanization for in-situ management of crop residue in the states of Punjab, Haryana, Uttar Pradesh, and the National Capital Territory of Delhi' has been introduced. By financing the machinery necessary for in-situ agricultural residue management, the



initiative intends to solve the problem of air pollution (caused by stubble burning in Punjab, Haryana, Uttar Pradesh, and the National Capital Territory of Delhi).

The objectives of the scheme are discussed below:

- Reducing air pollution and limiting the loss of nutrients and soil microorganisms caused by agricultural waste burning
- Promoting in-situ crop residue management through the application of suitable mechanisation inputs.
- Promoting Farm Machinery Banks (FMB) or Custom Hiring Centres (CHC) for custom hiring of in-situ crop residue management machinery to compensate for the negative economies of scale caused by small landholding and high individual ownership costs.
- Raising awareness among stakeholders by:
 1. Crop residue management approaches will be demonstrated.
 2. Capacity-building exercises
 3. Education and communication initiatives for better crop residue usage and management