

# Crop residue management

Crop residues are the parts of plants left in the field after the crops have been harvested and thrashed. Crop residues are good sources of plant nutrients, are the primary source of organic material added to the soil, and are important components for the stability of agricultural ecosystems.

Crop residue is not a waste but rather a tremendous natural resource. About 25% of nitrogen (N) and phosphorus (P), 50% of sulfur (S), and 75% of potassium (K) uptake by cereal crops are retained in crop residues, making them valuable nutrient sources.

## Potential uses for wheat residues

- As livestock feed
- For preparing bedding for animals
- In composting
- For biogas generation
- For mushroom culture
- As a raw material for industry

## Crop residues as animal feed

In many parts of the world (particularly in areas with low yield potential), crop residues are essential for feeding to animals. Animals are left to graze freely on harvested fields or straw is collected off the land and taken to the pen to feed livestock and prepare bedding. This scenario, if not managed sustainably, often results in deteriorating soil fertility; nutrients are removed from the land and not returned and the bare soil is exposed to wind and water erosion. Some nutrients may be returned to the soil through the manure left by grazing animals; however, most of the nitrogen is lost to the air.

## Burning of crop residues

With the advent of mechanized harvesting, farmers have been burning large quantities of crop residues, particularly in areas with high yield potential. As the crop residues may

interfere with tillage and seeding operations for the next crop, many farmers prefer to burn the residues left in the field. The burning of these residues (which is not at all a sustainable practice) leads to the following:

- Air pollution (particularly due to the release of carbon dioxide, nitrous oxide, ammonia, and particulate matter in the atmosphere), which farms environment and contributes to global climate change.
- Substantial waste of precious nutrient resources and organic matter in the soil, especially nitrogen.
  - It is reported that 40 to 80% of the nitrogen in wheat crop residue is lost as ammonia when it is burned in the field.
  - The ash left on the soil surface after burning crop residues causes an increase in urease activity and may cause N losses from soil and applied fertilizer
- Deterioration of soil physical properties (crop residue, being an organic material, leads to an improvement in soil structure and fertility, whereas burning residues leads to a corresponding loss in soil fertility).
- Residue burning can have a beneficial short-term effect on the N supply to subsequent crops, but has negative long-term effects on overall N supply and soil carbon levels.



*Figure 1. Burning of residues not only causes losses of nutrients and organic matter, but also contributes to the air pollution and global climate change.*

### Crop residue management (CRM)

CRM practices are used to conserve soil and water.

- CRM systems include conservation tillage practices such as zero-till, reduced till, bed planting, and other practices that provide sufficient residue cover to protect the soil surface from the erosive effects of wind and rain.
- CRM is a year-round system, which includes all field operations that affect the amount of residue, its orientation to the soil surface and prevailing wind and rainfall patterns, and the evenness of residue distribution throughout the period requiring protection.
- Crop residues and their appropriate management suppress the weeds: through their physical presence on the soil surface as mulch; by restricting solar radiation reaching below the mulch layer; by direct suppression; and by controlling N availability.
- CRM and tillage practices also influence the efficiency of soil-applied pre-emergence herbicides. Because pre-emergence herbicides are applied to the soil, the amount and quality of residues and also ash left behind after residue burning might affect their effectiveness. This means that a higher rate of herbicide application is often needed to achieve effective weed control.
- The main advantages of CRM over conventional systems include fuel and labor savings, as well as long-term benefits to soil structure and fertility.

### Tillage, mechanization, and CRM

There are **two options** for managing crop residues:

- **Complete retention** of crop residues at the soil surface by using zero or reduced tillage systems. Successive crops can be sown using zero-tillage after straw is left on the soil surface.
- **Partial removal** of crop residues from the soil surface. In areas where there is high demand for animal feed, controlled grazing is permitted or a percentage of the crop residues are removed from the field for feed or silage. An adequate amount of residue must be left on the field to provide soil surface protection. After a few years of CRM, yields will increase, meaning that the amount of residue removed for animal feed is often equal to the entire amount of residue produced prior to adopting the crop residue management system.



Picture 2 - Partial removal of wheat straw for fodder while leaving long stubble in the field.

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