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# Improving Soil Health by Giving Incorporation of Crop Residues Precedence Over Burning

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## Introduction

Every year, a lot of agricultural residue is produced at harvest times in the form of woody stalks, leaves, and tops, as well as cereal straws. It is quite difficult to dispose of such a vast amount of crop waste. The crop wastes are burned in situ to quickly and inexpensively clear the field and allow tillage processes to move forward unhindered by leftover crop material. Farmers choose burning because it is a quick and simple approach to deal with the massive amounts of crop residues and get the field ready for the following crop well in advance.

Burning agricultural waste produces significant amounts of suspended particulates and air pollutants. Punjab, Uttar Pradesh, Haryana, and Maharashtra are the primary states where the majority of crop residues were burned on farms. Haryana and Punjab, the two states alone, each provide 48% of the total and burn the same amount in farmland.

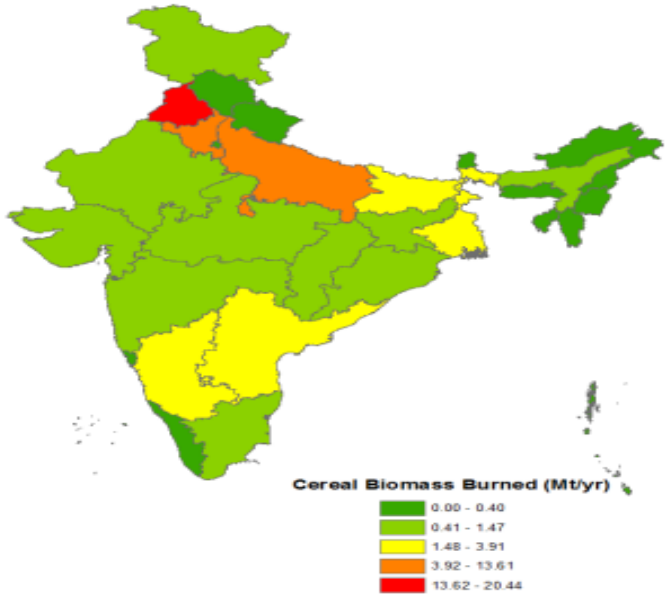


**Fig 1: State wise distribution of crop residue burnt in India (Jain *et al.*, 2014)**

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**Harmful Effects of Crop Residue Burning**

In terms of crop residue, rice contributed the most (43%), followed by wheat (21%), sugarcane (19%), and oilseed crops (5%) [Sahai *et al*., 2011]. A production surplus of 22,289 Gg of paddy straw is reportedly produced in India each year, of which 13,915 Gg is burned on-site. As a result of the in-situ burning of a considerable volume of residue, losses of soil organic matter, N (up to 80%), P (25%), K (21%), S (4-60%), and N (up to 80%) are experienced (Bhattacharjya et al., 2019). Crop burning significantly disrupts the soil's carbon-nitrogen balance. Frequent burning destroys the soil's beneficial microflora and fauna, lowers the soil's potential for retaining nitrogen and carbon, and loses a significant amount of organic matter. Another negative impact of agricultural waste burning is the projected gaseous emission of 70% $CO_2$, 7% CO, 0.66 percent $CH_4$, and 2.1 percent $N_2O$. The effects of these air pollutants on human health are detrimental. Pneumoconiosis, pulmonary TB, bronchitis, skin conditions, eye irritation, cataract, corneal opacity, and blindness are among the illnesses they might bring on. The heat produced when wastes are burned raises the soil's temperature and reduces the bacterial and fungal population. The burning of residue raises the subsoil temperature to roughly 33.8-42.2 °C at a depth of 10 mm, and long-term impacts may even extend to the top 15 cm of soil (Gupta *et al*., 2004).

**Benefits of Crop Residue Incorporation**

Large-scale crop residue burning from the rice-wheat system in Punjab, Haryana, and western Uttar Pradesh raises major issues with pollution, health risks, and nutritional loss in addition to GHG emissions. Crop residue can be used for a variety of productive purposes, including bioenergy, production and absorption into fields, but only if they are properly gathered and maintained. Fig 2 represents how the farmers manage the crop residue generated in the field. Though most of the farmers prefer burning, incorporation of crop residue is a economical and beneficial method manage it. Crop residues produced worldwide contain about 1.5 pg (1 pg = 1015 g) of carbon, making them a potentially significant source of OM that may be applied to the soil. Returning crop leftovers can boost the amount of organic matter in the soil and offer a favourable habitat for the development and spread of microorganisms. Because agricultural leftovers can replenish the soil with new organic matter, agglomerates grow bigger and more stable as they are added.

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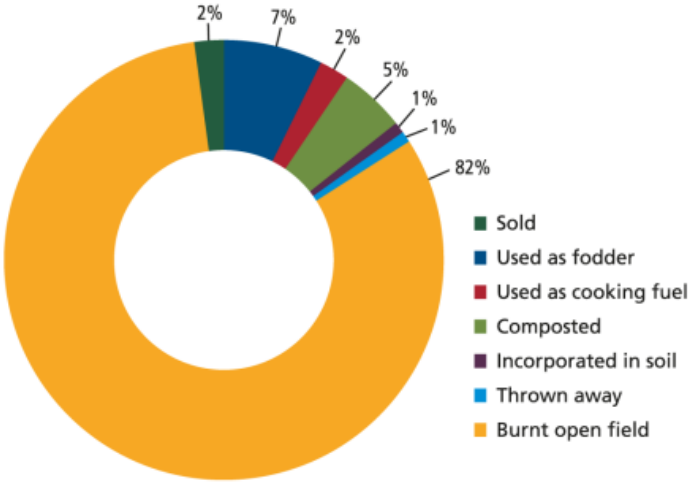


**Fig 2: Managing crop residue by farmers through various approaches (Meena, 2017)**

On an average crop residue of different crops contain approximately 80% of nitrogen (N), 25% of phosphorus (P), 50% of sulphur (S) and 20% of potassium (K). If the crop residue is retained in the soil itself, it can enrich the soil with C, N, P and K as well. Returning crop residues to soil can improve soil physical properties by increasing soil moisture content, decreasing bulk density, and increasing total porosity and aggregate stability. Soil total porosity is one of the basic physical properties of the soil and an index for the evaluation of soil fertility and productivity. The soil porosity increases when mixing crushed crop residues with the soil through deep plowing. Crop residue returning can increase soil moisture content by reducing surface runoff and direct evaporation, improving soil saturated water conductivity and water infiltration. Some studies have indicated that crop residue returning can increase the amounts of antagonistic microbes, and then control soil-borne plant diseases. Crop residue application has the potential to improve saline-alkali soils through water and salt management.

**Conclusion**

Burning of crop residue reduces the fertility of the soil, which ultimately results in lower soil productivity and lower yield outputs. Utilizing crop residue in the field will help restore the majority of nutrients to the soil and limit the emission of dangerous gases, which is one of the key strategies to address this issue.

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