

Stubble Burning: Pollution to Solution

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Abstract

Stubble burning is the practice of intentionally setting fire to the straw stubble that remains after grains, such as rice and wheat, have been harvested. The technique is still widespread today. In order to plant the next winter crop in a very short period of time, it's the easiest and cheapest method available for farmers.

Keywords: Stubble, Harvest, etc.

I. INTRODUCTION:

What is stubble burning?

Stubble burning is the practice of removing paddy crop residues from the field for sowing the next crop, viz., wheat. Where the 'combine harvesting' method is applied, Stubble burning becomes essential because combine harvesters leave crop residue behind. Combines are machines that harvest the crops as well as thresh, which means separation of the grain, and it's cleaning together, but it leaves stubble behind because it doesn't cut close enough to the ground. These residues put a burden on the farmer's back because they are not so useful for the farmer, and there is pressure on the farmer to sow the next crop in time. Hence, farmers eliminate the remaining crop remnants by engaging in controlled burning. Numerous research findings indicate that the leftover materials from rice and wheat cultivation play a significant role in the overall accumulation of stubble in India. Garg et al. conducted a study in 2008 and published their findings in the Indian Journal of Air Pollution Control, in which they estimated that the contribution of rice and wheat stubble loads in the total stubble was 36 and 41%, respectively, in the year 2000, while the contribution of Punjab in the total burnt stubble of rice and wheat was 11 and 36%, respectively, during the same time period. Mandal et al. In a study conducted in 2004, researchers calculated the total quantity of agricultural residue produced in India. Their findings revealed that wheat residue accounted for approximately 27% of the overall amount, while rice residue constituted about 51% of the total, which amounted to 350 million kilograms per year. Are stubbles total waste? About 25% of nitrogen (N) and phosphorus (P), 50% of sulphur (S), and 75% of potassium (K) uptake by cereal crops are retained in crop residues. Further, it is estimated that burning paddy straw results in nutrient losses of 59,000 tonnes of nitrogen, 20,000 tonnes of phosphorus, 34,000 tonnes of potassium, and 3.85 million tonnes of organic carbon. So, it is clear now that crop residue is not a waste but rather a useful natural resource. Sidhu et al. (2007)



Moreover, these synthetic petroleum derivative pollutants degrade at an extremely slow pace, the life cycle of which has been estimated by scientists to be ~500–1000 years. Only 9% of the plastic pollutants are recycled worldwide, and the remainder find their way into landfills and the oceans. Approximately 85% of all market sectors require the application of plastics. Everyday plastics have a large usage share in everyday activities. The demand of the minute is to introduce initiatives towards removing plastics for our comfortable day-to-day needs so that we can efficiently reduce consumption and provide a tidy, greener, and enhanced ecosystem. An international e-newsletter (BR/09/18/04) estimated the quantity of nutrients available in paddy straw. Based on the aforementioned research, it was determined that paddy straw contains approximately 39 kg/ha of nitrogen (N), 6 kg/ha of phosphorus (P), 140 kg/ha of potassium (K), and 11 kg/ha of sulfur (S). When these quantities were converted into monetary terms, it amounted to Rs. 424 per hectare of N, Rs. 96 per hectare of P, and Rs. 231 per hectare of S, resulting in a total value of Rs. 751 per hectare. Numerous scientific studies have been conducted, further supporting the nutritional worth of straw. Still, stubble burning is continued by farmers, which adversely affects the nutrient budget in the soil. It also results in the emission of smoke, which adds to the gases present in the air like methane, nitrogen oxide, and ammonia and causes severe atmospheric pollution.

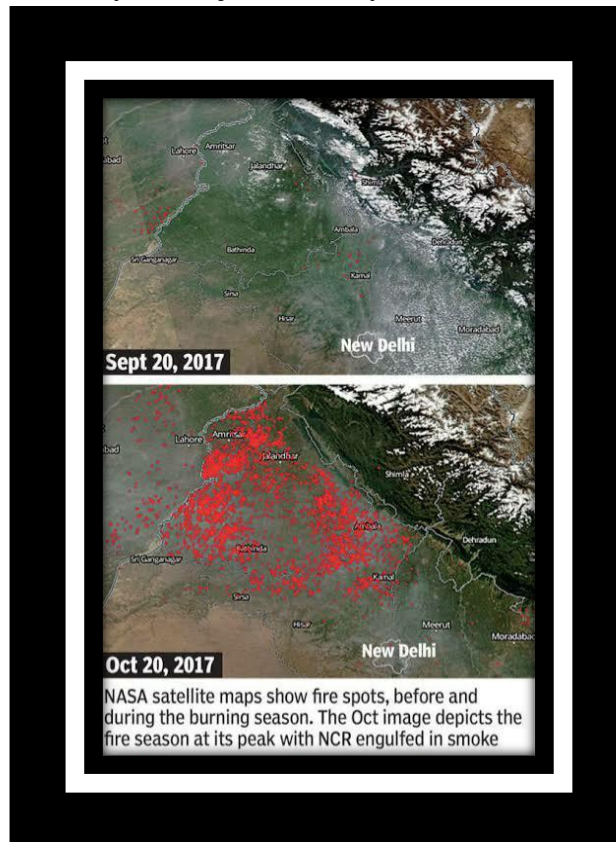
II. WHY BURNING THE STUBBLES?

Crop residue burning can be attributed to two primary factors. The first is that there is a very short window of time between the harvesting of paddy and the sowing of wheat at the end of the Kharif season. Secondly, the removal of the paddy stalk that remains on the field is a labour-intensive process. With labour being unavailable and the time window between the harvesting of paddy and the sowing of wheat being limited, the only easy option that the farmer has is burning the residue right on the field. For farmers, burning residues is cheaper and requires less effort.

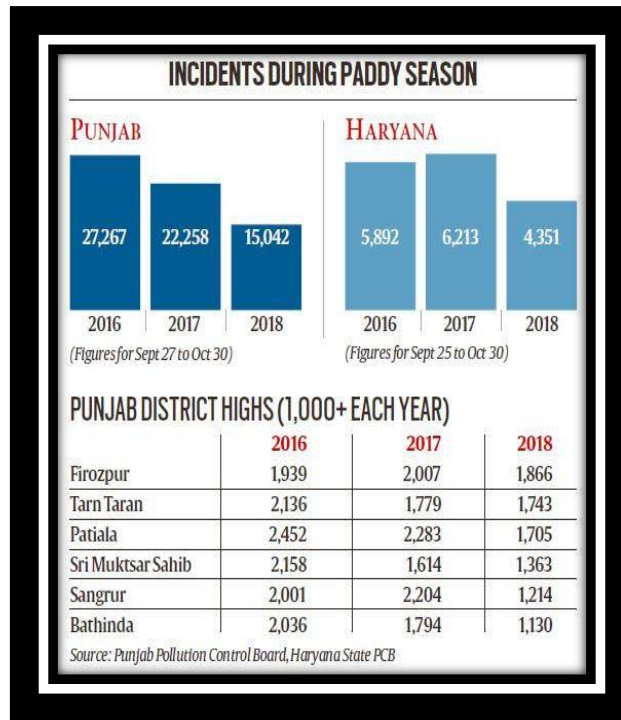
III. STUBBLE BURNING IN INDIA.

The volume of pollution caused by crop stubble burning: Open-field burning of crop stubble results in the emission of many harmful gases into the atmosphere, like carbon monoxide, nitrous oxide, nitric oxide,

sulphur dioxide, and methane, along with particulate matter and hydrocarbons. These gases have adverse effects not only on the atmosphere but also on human and animal health. The loss of nutrients through stubble burning can lead to soil degradation, reduced soil fertility, and decreased agricultural productivity over time. Additionally, the burning of organic matter releases carbon dioxide and other greenhouse gases into the atmosphere, contributing to air pollution and climate change. It has been estimated that for the year 2000, the emission of methane, carbon monoxide, nitrous oxide, and nitric oxide was 110, 2306, 2, and 84 g, respectively, from the field burning of rice and wheat straw. Punjab State Environmental Council also estimated (based on the information provided by Punjab Agricultural University, Ludhiana). The crop residues contained about 6.0 MT of carbon that, on burning, could produce about 22.0 MT of carbon dioxide in a short span of 15–20 days. Gupta et al. (2004) estimated that one tonne of straw on burning releases 3 kg of particulate matter, 60 kg of carbon monoxide, 1,460 kg of carbon dioxide, 199 kg of ash, and 2 kg of sulphur dioxide. It is clear now that this mass agricultural residue burning in the fields is seriously damaging the environment. The practice of open burning of crop residue in fields also results in the depletion of soil microorganisms and damages nearby trees and standing crops. During the months of October and November, substantial smoke clouds spread across Punjab, Haryana, Delhi, and neighboring states. Stubble burning contributes significantly to air pollution, accounting for a quarter of the pollution in Delhi. Despite a ban imposed by Punjab, this practice persists. Amid the current COVID-19 pandemic, medical professionals express concerns that emissions from stubble burning could exacerbate the COVID-19 situation in the region, particularly in Punjab and Haryana.



Crop Burning instances in Punjab and Haryana.



IV. MANAGEMENT OF STUBBLES:

Significant strides have been taken by both state and central administrations and regulatory bodies to curb crop residue burning. Legal measures have been implemented to prohibit this practice, with crop residue burning being designated as a punishable offense under the Air Act of 1981, the Code of Criminal Procedure, 1973, and relevant legislations. Farmers found engaging in this activity are subject to penalties. Enforcement efforts are being carried out by administrative officials at the village and block levels.

- **Detection and prevention:**

For the detection and prevention of burning in real time, a combination of remote sensing technology—use of satellite imagery—and a team comprising local officials, Sub-Divisional Magistrates (SDM), Tehsildars, Block Development Officers (BDO), Patwaris, and village-level workers is effective. Efforts have been underway to establish a market platform for the utilization of paddy straw and other crop residues, aiming to expand opportunities for their alternative usage. For instance, paddy straw has a considerable calorific value, so it can be used as a fuel in biomass-based power plants. Similarly, it can be further utilised for the preparation of biofuels, organic fertilisers, and in the paper and cardboard making industries. The strategy behind all of these measures is to assign a real economic and commercial value to the agricultural residue and make burning it an economic loss to the farmer.

- **Outreach and public awareness campaigns:**

Continued efforts are being made to raise awareness about the health impacts associated with crop residue burning. As we mentioned earlier, it produces extremely high levels of toxic particulates, which affect the health of people.

- **Diversification:**

Cultivation of alternate crops (apart from rice, paddy, and wheat) that produce less crop residue and have greater gap periods between cropping cycles may be prompted. Various efforts are being made for the diversification of cropping techniques, resulting in the prevention of crop residue burning.

- **Experts recommend:**

Farmers should receive compensation of Rs 1,000 per acre through the Rashtriya Krishi Vikas Yojana to encourage them to abstain from burning paddy straw. Subsidies should be provided for the purchase of rotavator machines, which facilitate the cutting and incorporation of agricultural stubble into the soil. It is crucial to comprehend the reasons behind farmers resorting to stubble burning and address the underlying issues accordingly.

- **Happy Seeder:**

Happy Seeder is a technique used for sowing wheat without burning rice residue. This technology is eco-friendly with the environment; it improves the health of soil as well as saving water. Dasmesh Turbo Happy Seeder has been considered the most successful implement for sowing wheat in rice residue without burning rice residue.

- **Stubble-burly Scheme:**

In order to curb stubble burning, the districts of Punjab state, with the help of the Agriculture Department, started a 'stubble-burly' scheme for small and marginal farmers. Under the scheme, the farmers can remove paddy stubble from the main field and bury it in a pit either in their own agricultural land or wasteland. The District Administration has a responsibility to provide workers to farmers under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) to dig up the compost pits. Moreover, under the scheme of MGNREGA, small farmers are also provided job cards for getting compost pits dug up on their land.

V. CONCLUSIONS:

- Stubble pollution can be eliminated by using a decomposer.
- Stubble can be converted to animal fodder.
- We can convert stubble into useful products such as ropes, bags, straws, etc. Slash and burn pollution can be eliminated.

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