

Impact of Crop Residue and its Management in Punjab

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ABSTRACT: This study is carried out how the burning of crop residue (CR) after harvesting affects the fertility, physiochemical and biological properties of the soil. In Punjab its monoculture of rice-wheat because they are majorly grown cereals there as compared to other crops. Combine harvester use increase the amount of CR in the field and make farmers to burn it in the open field. By burning the residue there are several problems which arise like pollution, human health, visibility. So for the management of CR, there is need to create awareness among farmers.

Keywords: Crop Residue (CR), Nitrogen (N), Carbon Dioxide (CO₂), Indo Gangatic Plains (IGP)

I. INTRODUCTION

As per the United Nations agriculture waste includes harvested crop residue, slaughter house waste, pesticide in the soil and water, poultry houses, farm waste[24,25,26]. The harvest waste is known as Crop Residue, either from field or orchard. Some field residues are stalks and stubble, leaves, and seed pods[25,27,28,29]. The CR Surplus amount in India that available is 142mt a year out of which 92mt is burnt each year. Sugarcane tops is generally surplus residue, which are burnt after the harvesting by the farmers in the fields. Other crops as oilseeds, pulses, chilli and cotton are generate surplus residue which is used as fuel There is biomass of bamboo about 4 million metric ton. There is no CR for fodder crops. Air quality in Delhi National Capital Region (NCR) is a major concern due to its severe impact on human

health. CR can be used in various agro based applications in field but the cost of collection of waste is much higher than the benefits we get. As India is second largest producer of wheat and rice, so it produces CR about 500 mt/year. This topic is more important all over India due some reasons which are: due to its organic composition it can be used as beneficial waste of society and other is high volume of CR creates several bad impacts on environment due to unsuitable management of residue[30].

Agriculture Growth in Punjab:

Punjab is included in the region of Indo Gangatic Plains (IGP) in which wheat and rice is mostly followed by the farmers. This plan of 2-3 crops a year providing food security to IGP population for production of about 50% food grains to the country[1,2]. Whereas, rice -wheat rotation of the IGP, occupies 53% of the total area and about 42% of the total farming area of the India[3]. Punjab shares about 20 and 10% total production of wheat and rice respectively. These crops are producing CR of 51 mt in Punjab. Rice CR produced 22.9mt and wheat about 23.1mt and reported about 95% of paddy straw and 23% of wheat straw is burnt in the fields [8]. Major reason for this is lack of buyer for power generation, little time for succeeding crop, lack of government involvement.

By managing CR in field both the livestock and field are benefitted from this as it will provide nutrients to both independently.[19]

Table 1: CR produced by major crops:[11,12]

Source	Composition
Rice	Husk, Bran
Wheat	Bran, Straw
Maize	Stover, husk, skins
Millet	Stover
Sugarcane	Sugarcane tops, bagasse, molasses

Adverse effects of burning CR:

Respiratory and cardio vascular problems due to

- Increase in CO₂ – 70%
- 7% increase in Carbon monoxide
- 2.1% increase in NO₂
- Particulate matters 3kg
- Carbon monoxide 60 kg
- Carbon dioxide 1460 kg (13 tha⁻¹)
- Ash 199 kg
- Sulphur oxide 2kg

On burning of a tonne of straw releases the following in the air as reported by Hyderabad, Centre of Sustainable Agriculture:



- Image Source: NASA Earth Observatory image of fog and haze distribution over the Northern States of India on 8 November 2017[18].

Soil/ha losses:

- Organic carbon 95 lakh ton
- Urea 80 kg
- Diammonium phosphate 13.75kg
- Potash 128 kg

Deterioration of soil causes

- Loss of wheat yield 1q/ha
- Loss may be of Rs 500 crore per year due to reduction in yield and nutrient loss

Effect of paddy/wheat straw burning on temperature

- The temperature of 7 cm top soil rises after straw burning
- Variation in equilibrium of micro organism like fungi (9:1), the percent bacteria (4:1) and carbon: Nitrogen ratio (11.1)

Impact of in situ Rice Crop Residue Burning on Soil pH and EC[8]

Some pH samples collected from Bathinda which indicates the alkaline in nature. pH increased after burning CR.

Table 2: pH and EC of pre and post burning of in-situ rice crop

Village Name	Co-ordinates		pH Mean±S.E		EC (µS/cm) Mean±S.E	
	North Latitude	East Longitude	Pre Burning	Post Burning	Pre Burning	Post Burning
Gulabgarh	30.143	74.988	8.27±0.043	8.57±0.087	699±10.13	800±9.29
Gehri bhagi	30.115	74.96	7.83±0.033	8.03±0.023	383±4.93	476±7.4
Gehri butter	30.096	74.877	7.98±0.45	8.28±0.035	526±10.1	607±10.4
Sangat	30.082	74.941	7.32±0.04	8.32±0.054	392±8.65	504±6.87
Katar Singh wala	30.168	74.994	8.41±0.063	8.54±0.078	355±3.45	590±8.54
Chak Ruldu	30.186	75.123	7.97±0.029	8.6±0.076	281±3.20	440±13.43
Rama Mandi	30.215	74.948	8.07±0.043	8.47±0.095	331±3.42	541±7.9
Mohalla	30.071	74.755	7.86±0.05	8.56±0.082	346±4.12	532±13.5

Management:[10]

- Residue baling for the use in industries and removal of straw
- In-situ incorporation of residue
- Surface management of residue and mulching
- Using straws and stubbles for mulching which further help in maintaining the soil fertility and decrease the rate of evapotranspiration from field
- Proper tillage practices should be done , wheat-rice (7-8 times).
- By not burning the CR is helps in improving the wheat-rice yield with starter dose of N 15-20 kg/ha.
- Water Saving The management of residue play important role in protection of soil surface but also decrease the evaporation losses and water saving by the use of crops. The residue on the soil surface reduces the touching of sunlight and decreasing the air exchange which resulted in less use of energy for the loss of water from the surface of soil (evaporation). The water saved with the management of residue is used by the crop for transpiration [19].
- Composting of waste can be useful for soil fertility. Composting is natural process of decomposition of waste by several micro-organism under suitable atmosphere and used as organic fertilizer[21]. Hettiarachchi et al. publication go through the problems faced for waste composting[20].

The field where compost is added , it will give more yield, and resistance to drought, disease and toxicity. [21,22,23]

Government intervention:

To reduce the rate of crop residue burning initiative is taken by government officials and

agencies. Many government projects have been started for educating the Indian agriculture society about agricultural waste management and to promote alternative method for crop residue management. There are some laws which are made to stop CR burning: The Section 144 of the Civil Procedure Code (CPC) to ban burning of paddy; The Air Prevention and Control of Pollution Act, 1981; The Environment Protection Act, 1986; The National Tribunal Act, 1995; and The National Environment Appellate Authority Act, 1997. National Green Tribunal have taken measures in Rajasthan, Haryana, Punjab, Uttar Pradesh to limit the CR burning[14,15].

National schemes and policies:

National Thermal Power Corporation (NTPC) directed by the Government of India to add CR pellets (10%) with coal for power generation [16]. This give farmers profit of about Rs. 5500 per ton of CR.

Rashtriya Krishi Vikas Yagna (RKVY), State Plan Scheme of Additional Central Assistance launched in August 2007 is a government initiative, as a part of the 11th Five Year Plan by the Government of India[17] in which 8 projects were established in different villages in Uttar Pradesh. Approximately 456 farmers are trained for management of bio- compost production. Most of the farmers are benefitted by this.[17]

National policy for management of crop residue (NPMCR):

It provides the state wise data of crop residue and burnt residue[13]. According to NPMCR highest CR is produced by UP (60mt), Punjab (51mt), and Maharashtra (46mt) with total of 500 mt/year out of which 91mt is burnt. Wheat and rice alone contributes 70% of CR. The Ministry of Agriculture attributes the increase in the on-farm

crop residue burning to the shortage of human labor. Jitendra et al.[9] , reported that 80% of the crop residue burning took place during the post-harvest period of April-May and November-December. The reason behind this is less time gap between previous and next crop, so farmer burn the CR because it takes less time and less money as compared to mechanical and labor method.

Objectives of schemes:[13]

1. Optimum utilization and in-situ management of crop residue to prevent nutrition loss form soil.
2. Mechanized equipments in farming for grain recovery and CR management in subsidy or rent.
3. Use satellite-based remote sensing technologies to monitor crop residue management with the National Remote Sensing Agency (NRSA) and Central Pollution Control Board (CPCB).

II. CONCLUSION:

The sustainable management of agricultural waste has become a great challenge, especially for developing countries such as India with an increasing population, production rates and economic growth. The burning of CR leads to change in physiochemical and biological properties of the soil. Due to burning there is loss of two important nutrients from the soil that are N&P. Many several micro and macro-nutrients are also reduced which will make financial burden on farmer for the next crop. Burning also create huge pollution in nearby kilometers area and burning sensation in eyes. Some alternate methods should be developed instead of burning for CR management like mulching and government should be involved in this management practice. Burning CR will have negative impact on agriculture and farmers with other areas also. Government also started several projects and policies for managing crop residue and stop burning. Constant burning and fog in November and December shows the above policies is not fully prevented crop burning. The real reason behind CR burning is more socioeconomic than the agricultural or waste management ones. Several mechanized tools can be rented or given in subsidy to farmers for CR management.

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