



Stubble Burning in Regions of Northern India - Causes, Solutions & Business Opportunities

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Received: 2.02.2021 | Revised: 10.03.2021 | Accepted: 17.03.2021

ABSTRACT

In Northern states of India, one of major cause of air pollution is Residue Burning crop. Due to lack of expensive and quickly clear the field, farmers prefer to burn .There is no specific law to resolve this problem. Due to severe air pollution, Delhi NCR alone experience approx... 20,000 pre mature death annually .Many health disease like pulmonary disease, pneumoconiosis, bronchitis, cataract, coroneal opacity, blindness and pulmonary tuberculosis occurs due to pollution .The emission also contribute global warming, haze and climate change .Over the past decades. Many conversion process were developed .Integrated crop residue management approach is need of hour to control this human induced catastrophe.

Keywords: Residue, Stubble, Wheat, Health.

INTRODUCTION

Agriculture is considered as one of the important production activities and burning of crop residue generates a significant amount of air pollution. Atmospheric environment can generally absorb this pollution in a particular geographic region given its assimilative capacity. However, due to technological advancements in the agricultural sector, waste concentration has gone beyond the assimilative capacity of the environmental limit, thereby distorting the balance .Burning

of farm waste causes severe pollution of water and land on local as well as regional and global scales. Nutrient losses by burning of paddy straw estimated to the tune of 3.85 million tonnes of organic carbon, 59,000 t of nitrogen, 20,000 t of phosphorus and 34,000 t of potassium at the aggregate. This also adversely affects the soil nutrient composition. Agriculture is the primary activity of production which acts as a supporting service for both secondary and tertiary activities.

Cite this article: Sharma, R. K., & Mishra, A. (2021). Stubble burning in Regions of Northern India - Causes, Solutions & Business Opportunities, *Ind. J. Pure App. Biosci.* 9(2), 151-158. doi: <http://dx.doi.org/10.18782/2582-2845.8617>

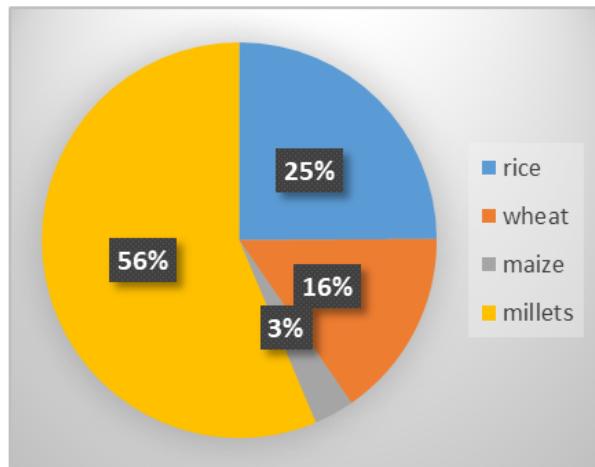
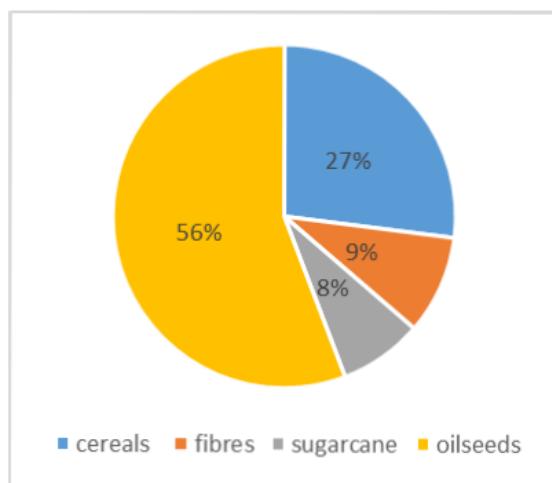
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A lot of crops are grown every year in Punjab, Haryana with rice and wheat as the major crops. The intensive farming practices of Indo-Gangetic Plains in Punjab and Haryana includes the burning of straw and other residues, as it is the easiest and most economical option to get rid of it during the short period available between the rice and wheat crops (Singh, 2018). In Punjab & Haryana rice is generally sown in May-August and harvested during the period of September-November. Wheat is sown in mid-October-November and harvested in mid of April-May. On harvesting, along with the desired crop so produced, a lot of residue is also generated which may be termed as stubble. And as time gap is less available between harvesting of rice and sowing season of wheat and vice-versa, so farmers often choose the easy way out to get rid of the residue generated along with harvested crop is burning it in the fields itself.

Hence, this practice is known as stubble burning. Earlier when the harvesting was done manually, stubble so generated was less in amount and could be managed by the farmers. But now with the advent of mechanized harvesting, a large amount of stubble is generated which is difficult to handle.

In United Kingdom, there is ban on the burning of crop stubble resulted in a decline in the emission of ammonia from 20 Gg (1000 tones) nitrogen per year in 1981 to 3.3 Gg nitrogen per year in 1991. In Australia, Stubble burning is “not the preferred option for the majority of farmers” But is permitted in some circumstances. Farmers are advised to rack and burn windrows and leave a fire break of 3 metres around any burn off. In United States & France, 0.6% of straw is burnt (Jiqin et al., 2019). In China, There is governmental ban on stubble burning.

% Residue generation from cereal crops



Source: Jain et al. Aerosol and Air quality research, 2014

- a) Contribution of different crop categories in residue generation b) Contribution of different cereal crop in residue generation
- Residue generated by different crops was grouped in four categories based on the type of crop, namely cereals (rice, wheat, maize, jowar, bajra, ragi and small millets), oilseeds (groundnut and rapeseed mustard), fibers (jute,

mesta and cotton) and sugarcane. The amount of crop residue generated was estimated as the product of crop production, residue to crop ratio and dry matter fraction in the crop biomass. The residues of rice and wheat crops are major contributors in the total stubble loads in India.

Table 1.1 States mainly contribute to stubble burning

State	Rice Area(mh)	Rice straw Output (mt)	Rice Straw Burned (mt)
Punjab	2.9	22..0	18.7
Haryana	1.3	7.5	3.0
Western U.P	1.3	4.4	1.3
Total	5.5	33.9	23.0

Source: Times of India, 2018

This belt produces an estimated 34 million tonnes (mt) of paddy straw every season Of which 23 mt is from burned within less than a month's span between mid-October and around November 10.

Reasons for burning the stubble-

- Enforcement of the Punjab/Haryana preservation of sub-soil water act, 2009.
- Short time window between paddy harvesting and sowing of wheat at the end of kharif season i.e., around 10 - 20days.
- Big size of the farms and Scarcity of labour for manual harvesting contribution of agricultural workers to total workers reduced from 62.7% to 35.96% from 1971 to 2013 in Punjab (Lohan et al. (2015).
- Use of combine harvester with the growth of mechanization, they leave 6-10cm paddy stalks on the field. (crop residue 9 tonne/ha in field).
- Cost of cleaning the field with manual labour is more expensive than the fines charged by Government (Times of India (October, 2018).
- Lack of incentives and equipment to cut the stubbles to most of the farmers.
- Poor storage facilities for straw and lack of market utilities of residue.

Negative impact-

According to WHO around 90% of people around worldwide breath polluted air, which

leads to 7 million deaths per year. One ton of stubble burning release 2 kg sulphur dioxide, 3 kg Particulate matter, 60 kg carbon monoxide, 1460 kg carbon dioxide, 199 kg Ash. Annual Nutrient loss due to the burning of paddy straw per tone is nitrogen (5kg), Potassium (25 kg), phosphorous (2.3 kg), potassium (25 kg) , sulphur (1.2 kg) (Source: www.fao.org (2018). Air pollution due to residue burning in Northern India causes an estimated loss of USD 30 billion annually (Source: International food policy research Institute (2019). In 2015, about 75 percent of deaths linked to air pollution in India Source: Umair Irfan (2018). Risk to acute respiratory infections, especially among children (<5 years). PM₁₀ and PM_{2.5} levels are gradually shooting up. These are very fine particles and can penetrate deep in to lungs, carcinogenic too.

STUBBLE TROUBLE TO DELHI (NCT)

Stubble burning in Punjab and Haryana has been found to have direct effect on rising pollution levels of Delhi's air. Changing wind pattern during October. With retreat of monsoon, North westerly winds with high moisture start blowing in Stubble burning contributes 12-60% to Delhi's pollution load depending on wind direction & speed. Below table shows pollutant, areas in delhi NCR, level and permissible limit.

Table 2:

Pollutant	Area in delhi NCR	level	Permissible limit
PM10	Punjabi bagh	1000 ug/m ³	60-80 ug/m ³
PM 2.5	Punjabi bagh	650 ug/m ³	60-80 ug/m ³
Nitrogen oxide	Anand vihar	167 ug/m ³	60-80 ug/m ³
Carbon monoxide	Igi airport	6.3 ug/m ³	2-4 ug/m ³
Sulphur dioxide	Igi airport	29.8ug/m ³	60-80 ug/m ³

Source: Delhi pollution control committee (DPCC), 2016

National Green Tribunal on Stubble Burning

NGT has banned crop burning in 2015. Penalties imposed by the tribunal per incident of stubble burning as environment compensation. For less than 2 acre of operation holding, penalty amount is 2500 Rs/acre, for 2-5 acre penalty amount is 5000 Rs/acre, for > 5 acre penalty amount is 15000 Rs/acre (Dutta.P.K, Delhi air pollution (2018), India Today). NGT insisted government to provide incentives to farmers as follows.

Stubble Management

“Converting stubble in to energy is an innovative way to address the matter.”

Setting up biomass fuel plants to generate fuel using paddy husk or making fodder from collected stubble, Utilization of stubble in mushroom farming, Straw collection by balers, Stubble treated with urea can used as a fodder to animals, Paper & straw board manufacturing, Biochar production &

utilization, New opportunities for industrial use such as yeast protein can be explored through scientific research, Packaging material, Rope making, Bio-fuels, organic fertilisers, Rice straw composting, when it is tested in PAU campus field experiments, 4-5% improved yield was recorded (source: ICRISAT, 2013), Defiberized rice straw can be used in hydroseeding (a process of planting in liquid solution along steep banks (i.e., roadsides, etc.) for erosion control.

GLOBAL STRAW UTILIZATION

The Mobile Moss Wall (City tree)

This is self-watering, self-monitoring & solar powered innovation, Developed by Berlin based company Green city solutions, This green technology mimics the action of 275 real trees to clean and cool the air. It's just a moss culture that efficiently binds particulate matter, 'N' oxides, ozone, co₂, while producing oxygen.



One city tree absorb 250 g/day particulate matter, currently city trees are found in 20 metropolitan cities around globe. Each city tree costs \$ 25000 but its good investment to make for dangerous polluted cities like Delhi.

GOVERNMENT SUPPORT

Government of Punjab is promoting “Zero Tillage Technique” since 2001–2002. This increases farmer’s profit by Rs. 2,200–3,000/- per hectare by saving 80 % of diesel as wheat

is sown in one pass only. (Source: Polash Mukarji (2016) downtoearth.org.in). Government of India recently directed the National Thermal Power Corporation (NTPC) to mix crop residue (10%) with coal for power generation. This helped farmers with a monetary return of approximately Rs.5500 per ton of crop residue (Source: Bhuvaneshwari et al., 2019). State government provides crop residue management machinery at 80%

subsidy to co-operative societies, 50% subsidy to individual farmers (Source: The Times of India, 5th July 2018) Burning of paddy crop residue declined by 15% and 41% in 2018 compared to 2017 & 2016 respectively with the help of a ₹1,151 crore central scheme (Source: The Hindu ,13th August 2019) The scheme is “Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue in the State of Punjab, Haryana ,Uttar Pradesh and NCT of Delhi’ from 2018-20.

Turning out of straw waste in to business opportunities

A2P (Agri2Power) Energy Solution Private limited

Founders of the company- Robert Berry, Sudhakar sagi, Sukhmeet singh

A2P is a national award winning startup established in March 2018, Chandigarh, Haryana.

Key product / Service-

They convert the straw into soil and energy conditioners. Four services offered by A2P (Agriculture to Power): 1. Promote Entrepreneur 2. Zero Burning 3. Reducing carbon imprint 4. Promote SMEs. They processed this straw to develop pellets or bio-fuel that could be an alternative to coal and wood. They have supplied pellets to clients in food processing, pharmaceutical and dyeing industries including Pepsi and Hindustan Unilever. In the process of straw collection, they created entrepreneurs in the village to help straw collection During one season of collection, they employ more than 30 people.”



Company pays Rs. 3000 to farmers for purchasing straw per acre. They are currently working with more than 45 farmer families and preventing paddy straw burning on 450 acres of land.

The company did not stop at producing fuel. In a matter of months, they began using the straw to create boards that could be used to build furniture Now incubated at the IARI (New Delhi), they are exploring the technology of producing biochar from straw. Also working with PAU & Indian Institute of Petroleum to explore using pellets either as a soil

conditioner or to extract oil out of pellets and use it as furnace oil.

Kriya labs Pvt Ltd

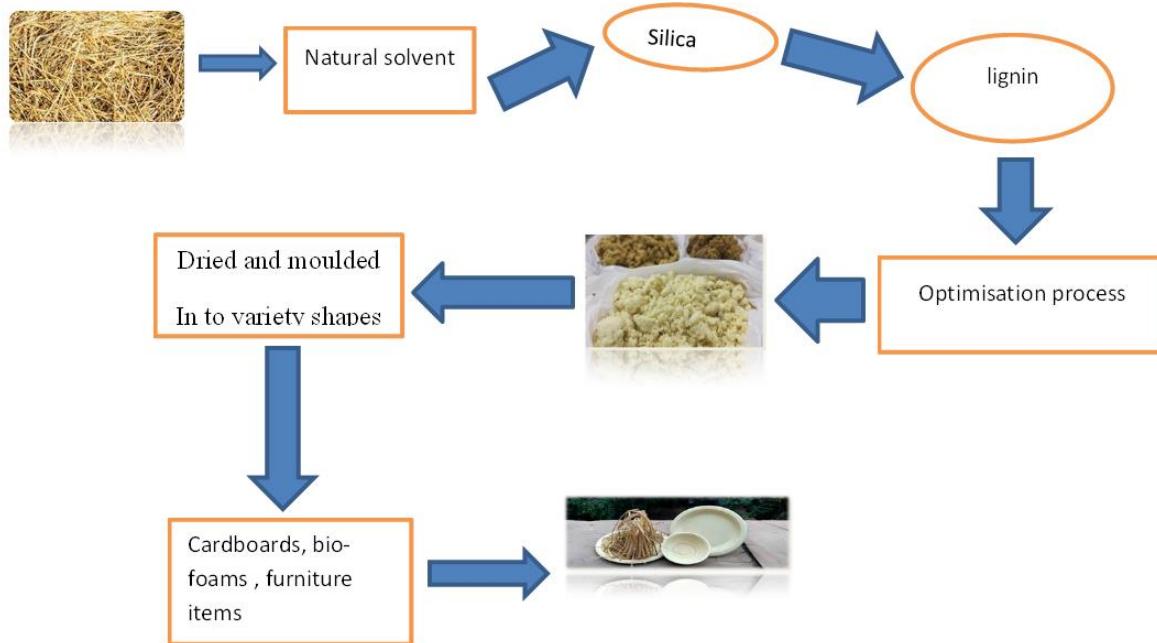
This is a start up incubated at IIT-Delhi's Technology Business Incubator (TBI)

Founder of company: Ankur Kumar

Date of Establishment: 26th September, 2017

Place: New Delhi

Developed a sustainable technology that convert paddy straw in to pulp. Does not require heavy machinery like conventional pulp making.



Additional revenue is generated by easy and profitable disposal of agro-waste 500 kg pulp can be generated from 1 tone of stubble They are working to take their technology to Government & companies Also provide operational & technical training to rural entrepreneurs about profitable disposal of agro-waste.

Building Material from Indian Rice waste

Bisman Deu, developed an environmentally sustainable building material out of paddy stubble at the age of 15. Deu's family farm is in the North Indian city of Amritsar grows both wheat and rice.

Deu started researching on the properties of rice husk She found it has a high silica content and is waterproof, termite resistant Bisman Deu, developed an environmentally sustainable building material out of paddy stubble at the age of 15 Deu's family farm is in the North Indian city of Amritsar grows both wheat and rice. Deu started researching on the properties of rice husk.

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CONCLUSION

residue are of great economic value as fuel, livestock feed, industrial raw material. Crop should be targeted to generate renewable energy, crop diversification should be adopted

.there should be creation of market for straw by encouraging innovative business idea of youth Collaborative research efforts & cooperation with other rice-producing countries in ASEAN bloc. This issue might be addressed through People's Science Movement. Only the "carrot-stick approach" towards stubble burning farmers may not be effective in India (ie., ban & subsidy grant).

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