

**Stubble Burning- A Rationale for Asphyxiation of Macrocosm**

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ABSTRACT: *Stubble burning is one of the major problems in India since last decade. During winter season mostly north India is blanketed under smog which is mostly contributed by farm stubble burning, causing pollution, low visibility, breathlessness to major three states & UT -Delhi, Punjab and Haryana. Its permanent solution is the need of the hour which involves the contribution of good governance, scientific aspects and cooperation. This article tries to highlight the various implications and way forward for this problem.*

Keywords: asphyxiation, macrocosm, atmosphere, predicament, from paddy burning

I. Introduction

The shrouding of the atmosphere with the smoke, either created naturally or fabricated has become a growing peril over the recent years. Whether it's because of the natural bush fire at Amazon in Brazil which destroyed almost 17 %of the biodiversity since 1970 or due to the manmade venture such as stubble burning in India. Any of such activities sabotage the ecosystem which results in cascade of corollary, for instance burgeoning greenhouse gas emission, global warming, pollution, respiratory disorders and finally the breakdown of the stakeholders because of the unsuccessful policies adopted by them to control such activities which was further aggrieved by the greed of mankind to exploit the natural resources to crunch the unsustainable thirst of economic growth. As per the Newton's law stated every action has equal and opposite reaction , such incidence has also been observed in case of India , where in recent years the action of stubble burning most prevalent in the north Indian state has tainted the air as its reaction.

The chronicle of this jeopardy dates back to 1960s when the green revolution was introduced. Farmers in Punjab and Haryana were encouraged to do wheat-paddy crop rotation to make India self-reliant in grains production .The Punjab Preservation of Subsoil Water Act (2009) made it mandatory for farmers to transplant paddy late during the Kharif season to prevent loss of water. This gives the farmers very little time between harvesting the rice crop and preparing the field for the next winter crop. Since then stubble burning became common as its quick, cheap and easy way to clear the field of any rice chaff residue. The mechanised harvesting machines leave stalks that are about one-foot tall

which could be quickly cleared by burning. In the traditional methodology farmers harvested and ploughed fields manually, tilling plant debris back into the soil. But this time taking sustainable method has been replaced by the swift unendurable methodology of stubble burning. Section 188 of the Indian Penal Code (IPC) makes stubble burning a crime. Additionally, it was notified as an offence under the Air (Prevention and Control of Pollution) Act, 1981. Despite being banned, the practice continues in India, where farmers cite a lack of viable alternatives to clear their fields of stubble.

Stubble burning has been practiced by farmers from all over the world which involves the intentional burning or setting on fire of crop residue to remove them from the field in order to sow the next crop. But as we say even the venoms has certain advantageous features likewise there are certain advantages of Stubble Burning as well namely, it is the cheapest and quickest way to deal with crop waste. It destroys weeds including those that are resistant to herbicides and kills other pests also, such as slugs. However, there should be some balance between the advantage and disadvantage ratio and if it gets disturbed overweighing the undesirable one then it will be having huge impact on the mankind.

II. Ubiquitous in North Western states

State of Punjab and Haryana is considered as the bread basket of the nation which grows approximately 20% of the wheat produced in India and 10% of the rice. One of the by-products of such intensive food production is smoke. There are two main growing seasons in Punjab: one from May to September and another from November to April. In November, farmers typically harvest rice and sow wheat. After the harvest, they often set fire to leftover plant debris which we call it as stubble burning which is prevalent in the state of Punjab and Haryana.

As per Punjab Pollution Control Board, the data collected by satellite shows a total of 36,755 farm fires that has happened in Punjab from September 21- November 2 in the year 2020. Compared to 22,507 farm fires during the same period in 2019, while this figure was 24,429 farm fires in 2018[1]. This manifest that the cases of stubble burning is multiplying every year. According to the statistics stated in the National Policy for Management of Crop Residues of the central agricultural ministry, approximately 82 per cent of the 50 million tonnes of surplus crop residues in the states of Punjab, Haryana and Uttar Pradesh is burnt. Punjab alone produces about 19-20 million tonnes of paddy straw and about 85-90 per cent of this paddy straw is burnt in the field. The high economic cost of managing the paddy straw and the less time to adopt the traditional practices of using paddy straw for animal bedding and mulching, forces the farmers to opt for the choice of burning it and choking the environment.

III. Strategies and Policies

In order to put a stop to this predicament which has almost smothered the nation by tainting the atmosphere, the government has come up with several policies some of which was fruitful and the rest went in vain. This includes Draft Policy for Management and Utilisation of Paddy Straw in Punjab, 2013, which provides alternative options for utilising paddy straw in the state. Punjab has also set up a Paddy Straw Challenge Fund of one million dollars for scientists globally to come up with a technological solution. National Policy for Management of Crop Residues of 2014 proposes to control crop residue burning, adoption of technical measures, diversified uses of crop residue, capacity building and training along with the formulation of suitable laws and policy interventions. Punjab government has provided tractor-mounted 'happy seeders' to farmers to cut down the rice stubble and sow wheat seeds simultaneously. In spite of this the farmers continued with stubble burning because

they found these happy seeder machine to be not so cost effective. To use a 'happy seeder' machine, farmers have to disburse Rs.1000 per acre of land as machine rent and a further Rs.2000 for diesel[2].

IV. Implications

Stubble burning in Northwestern states is one of the chief rationale behind the swelling air pollution of Delhi and nearby states. As per BBC, the smoke is likely to travel as far as Delhi, some 250km away, augmenting to the national capital's deleterious smoke [3]. Not only Delhi but hundreds of millions of people agonize by inhaling the toxic haze. In winter, stubble burning causes 26% of the city's pollution [4].

As per System of Air Quality and Weather Forecasting and Research (SAFAR) of Indian Institute of Tropical Meteorology, Pune, the estimated impact of stubble burning in PM 2.5 levels of Delhi ranged between 2% (07.11.2019) to 46% (31.10.2019). When 1 tonne of crop residue is burnt on the field, it releases approximately 1,400 kg of CO₂, 58 kg of CO, 11 kg of particulate matter (PM), 4.9 kg of NO_x and 1.2 kg of SO₂ [5], nitrogen (5.5kg), phosphorous (2.3 kg), potassium (25 kg) and sulphur (1.2 kg) in the soil. Moreover, the heat from burning crop residue kills critical bacterial and fungal populations in the soil. PM emissions from crop burning in one year are more than 17 times the total annual particulate pollution in Delhi from all sources—vehicles, industries, garbage burning, etc. Similarly, the total national annual emissions of CO₂ from crop residue burning are more than 64 times the total annual CO₂ emissions in Delhi [6].

The spread of smoke from paddy burning towards nations NCT and the surrounding states is because of the north westerly winds which also carries the dust from the dust storm originating in Rajasthan, Pakistan and Afghanistan, further adding up to the deteriorating air quality of landlocked Delhi. Landlocked geography of Delhi and nearby regions is because of the Himalayas that obstruct the escape route of air which arrest the smoke and intensifies the pollution. This is further aggrieved by the large high rise which reduces the air speed.

A geographical phenomenon called inversion reduces the dilution of smoke. This condition is notable during winter months and as an aftermath this smoke get mixes up with fog producing smog, bringing down the visibility and putting humans health in danger [7].

Ministry of Environment, Forest and Climate Change has launched National Clean Air Programme (NCAP) in January 2019 to tackle the problem of air pollution in a comprehensive manner with targets to achieve 20 to 30 % reduction in PM₁₀ and PM_{2.5} concentrations by 2024 keeping 2017 as base year. The Central Government has notified a Graded Response Action Plan (GRAP) for Delhi and NCR for different levels of pollution[8].

As per central Ground Water Board, the stage of groundwater development is very high in the states of Haryana and Punjab 133% and 172 % respectively compared to an average value of 62% for India, which implies that in these states the annual groundwater consumption is more than annual groundwater recharge. Upon this, Punjab and Haryana is producing majority of the water intensive crop requiring more irrigation, thus depleting groundwater and creating water crisis in these state and adjoining areas. Another implication of stubble burning is the diminishing soil fertility because the heat generated during the burning kills the bacterial and fungal populations which are crucial for fertile soil. It can also cause an increase in 'enemy' pests because, during the burning, many microorganisms in the air are killed. The loss of these organisms leads to an increase in the pests, in turn, causing increased diseases in crops.

The air pollution distress the health in varying ways ranging from skin and eyes irritation to severe neurological, cardiovascular and respiratory diseases, asthma, chronic obstructive pulmonary disease (COPD), bronchitis, lung capacity loss, emphysema, cancer, etc. It also leads to an increase in mortality rates due to the prolonged exposure to high pollution. As per the report of The Energy and Resources Institute (2019) air pollution had led to about 5 million deaths in South Asia in 2012 which is around 22% of the total deaths in the region [9].

Alternative uses of crop stubble

Owing to the increase in worry coupled with the stubble burning, several initiatives has been taken for its proper management so that alternative uses could be promoted instead of burning. Such as:

Promoting torrefied pellets:

Torrefied biomass pellets are regarded as one of the most efficient biofuel manufacturing processes. Torrification can bring the properties of agro-residue closer to coal properties, making biomass co-firing at higher ratios economical feasible.

Using residues for Co- firing:

It is the process of utilization of a certain portion of biomass with the existing base fuel. Co-firing increases efficiency of biomass–energy conversion. several countries has adopted this technology in their powerplants including UK, Denmark, Germany and Netherlands, Finland, Sweden, Russia, Belgium, Austria, Hungary, Italy and Spain. A number of Asian countries such as Japan, China and South Korea have already adopted co-firing technology. Some of the power plants located in these states can opt for higher percentage of biomass co-firing at their older power stations. Punjab, Haryana and Uttar Pradesh are the major contributor to the agricultural production of the country. But in recent years, the three states have had to bear the stigma of excessive stubble burning. Some of the power plants located in these states can opt for higher percentage of biomass co-firing at their older power stations. These states can easily meet co-firing needs of their older plants by utilizing the available surplus agro-residue [10]

Bedding Material for Cattle:

According to the research conducted by the Department of Livestock Production and Management, College of Veterinary Sciences, Punjab Agricultural University, paddy straw bedding helped in improving the quality and quantity of milk as it helped the animals to keep themselves warm during winter season reducing the heat loss from the body and also providing clean, hygienic, dry, comfortable and non-slippery environment preventing injury and thus its advised to use paddy straw for making bedding materials for cows.

Straw decomposition using Bacteria and fungi:

Microorganisms helps in faster and effective degradation of cellulose and lignin present in the straw. The decomposition of the straw restores the fertility of the soil. Several fungal species such as white rot fungus are capable of decomposing varying agricultural waste including rice stubble namely banana sheath (dried), sugarcane waste, coir pith, maize, pulse waste, and cotton stubbles and this decomposition process get enhanced if it is in aerobic mode rather than anaerobic [11]. In India, **Indian Agricultural Research Institute, Pusa, has developed Pusa bio-decomposer** which is a solution of seven fungi species capable of **turning crop residue into manure** in 15 to 20 days and therefore, can prevent stubble burning [12].

Compost production

Composting of the agricultural residue produces nutrient rich compost which will be high in NPK ratio, approximately consisting of 2% nitrogen 1.5% phosphorus and 1.4-1.6% of potassium and therefore improving the productivity of the soil. It can improve crop yield by about 4-9 % [13]

Animal feed and fodder

Fodder along with the crop residue if provided to animals will act as an alternative to roughages in feed shortage periods and also helps in coping up the deficiencies. Crop residues are a valuable source of animal feed and utilizing the residues by grazing is very effective in returning plant nutrients to the soil. In the USA, pigs are often used with cattle to utilize crop residues, whereas, in South Africa, beef cattle alone or cattle with sheep are more commonly used.

Paddy straw utilization in mushroom culture

Usually in case of mushroom culture wheat straw is used as raw material as in the case of Punjab but according to recent research conducted in paddy straw management the per quintal cost of paddy straw is less as compared to the wheat straw [14]. Paddy straw could also be utilized in making paper pulp board and floor tiles as well.

Other ideas

The cases of stubble burning could be seen very much prominent especially in the state of Punjab and Haryana compared to south India because of absence of crop diversification. Crop diversification as a policy intervention needs to be emphasized by the government on account of the devastation caused by the present cropping system such as depleting groundwater, poor soil quality and air pollution. Moreover this helps in improving resilience from the effects of greater climate variability and extreme events. It can be implemented in various ways such as crop rotation, poly-cultures, increased structural diversity, or agroforestry. Policy design on crop diversification has to be revamped in such a way that its provisions should be very much clear to the farmers about alternate crop options available to them and there is a need of convergence with various other policies such as the National Rural Employment Guarantee Scheme, National Rural Livelihood Mission and agro-enterprise related schemes. This will create a symbiotic relationship between the farmer as well as farmer and thus easing out the mechanism of crop diversification.

There is lot of misconceptions among farmers regarding paddy straw management which needs to be resolved. These misconceptions include improvement in soil fertility due to stubble burning and reduction in yield due to use of in situ machines [15].

Remote sensing with Geographical Information System (GIS) can be used as an effective method in determining the stubble burn area at regional and global levels which further helps in taking action to cope up with stubble burning [16]

Conclusion

Stats show that various agro based economy of the world has answered this problem by implementing various scientific manoeuvres and on -field management. This too can be easily answered in India and might generate a secondary source of income for the Indian farmers.

A holistic approach is required to address crop residue burning which should be multi-disciplinary and involving various stakeholders. Under [Aatmanirbhar Bharat Abhiyan](#) i.e. self-reliant India, farmer

awareness campaigns, economic incentives such as minimum support prices for alternative crops, along with infrastructure support such as agricultural inputs for identified alternative crops, cold storage facilities and market promotion mechanism will come to the rescue of the present situation. Using agricultural and environmental policies and applying alternative uses of residue, India is capable of dealing with this problem and help in reduction of pollution and other health hazards caused by stubble burning.

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