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A RESEARCH PAPER ON CAUSES AND REMEDIES FOR AIR POLLUTION IN DELHI-NCR

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Abstract- *From last few decades, we see every year in start of winter season one opposition political party blaming on ruling party for not taking suitable remedies for severe air-pollution surrounding Delhi-NCR region, while the ruling party blaming the Punjab government for burning paralee (i.e. agriculture Residue/leftover) or discarded paddy straw to clean the fields after harvesting. And for controlling this air pollution, Delhi government started "Odd-Even" system for private vehicles and on Supreme Court intervention and ban crackers on occasion of Diwali and stop all construction activities and government starts GRAP system (Graded Response Action Plan) that is a set of guidelines and measuring implemented to combat air pollution in India's National Capital Regions.*

Keywords— Air Pollution, Crop Residue Burning.

I. INTRODUCTION

Crop burning has become a major factor contributing to air pollution and health hazards in Delhi. Every year, farmers in the neighbouring states of Punjab and Haryana burn their crop residue as a quick and low-cost way to prepare their fields for the next planting season. This practice releases large amounts of harmful pollutants into the air, including particulate matter, carbon monoxide, and nitrogen oxides. These pollutants not only affect the air quality in Delhi but also have serious health implications for the residents of the city.

The impact of crop burning on air pollution in Delhi is particularly severe during the winter months. As the temperature drops and air circulation decreases, the pollutants emitted from crop burning get trapped in the atmosphere, forming a thick layer of smog over the city. This smog not only reduces visibility and causes respiratory issues but also exacerbates existing health problems such as asthma, bronchitis, and heart disease. Children, elderly people, and individuals with pre-existing health conditions are especially vulnerable to the negative health effects of air pollution.

To address the issue of crop burning and its impact on air pollution in Delhi, it is crucial for the government to implement strict regulations and enforcement measures. Farmers need to be incentivized to adopt alternative methods of crop residue management, such as mulching or using machinery to clear their fields. Additionally, there needs to be investment in better monitoring and early warning systems to inform residents about air quality levels and potential health risks. By taking proactive steps to reduce crop burning and improve air quality, Delhi can protect the health and well-being of its residents.

The Supreme Court confirmed that Delhi-NCR region has become a gas chamber especially during winter because of main air pollutants like particulate matter, various carbon (COx), nitrogen (NOx), sulfur (SOx), and hydrocarbon oxides. These pollution release by our numerous activities, including public- private vehicles, unsystematically burning waste, manufacturing process, and transportation. The total emissions from road dust, open biomass burning, car sources, and industry in Delhi are summarized in Table 1.

Source	Pollutants Emission load (kg/day)				
Dust	(PM10)	SO2	NOx	CO	HC
Industrial	32479	264399	360526	23771	4765
Vehicular	9750	720	84200	217800	66700
Road Dust	77275				

Biomas	27730	2608	15332	132552	59968
Total	147234	267727	460058	374123	131433

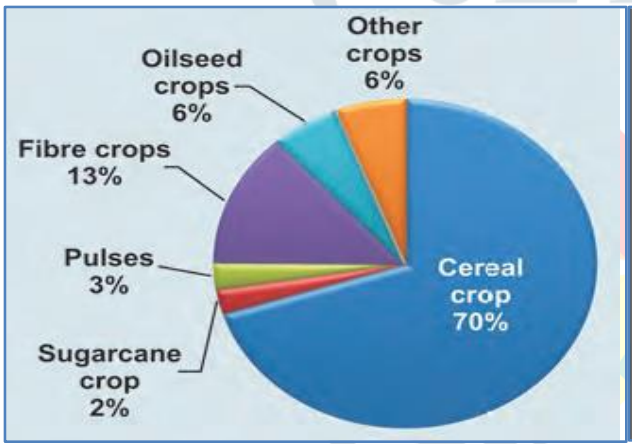
Table 1: Brief of Emission from various Sources in Delhi 9 ([A] Biomass Energy is Sustainable Solution for Pollution in Delhi)

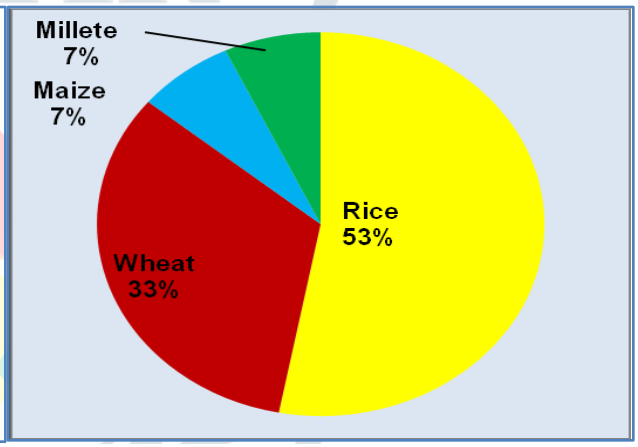
II. OBJECTIVE

The broad objectives of the study to investigate pollution by agriculture leftover and ignoring the numerous other causes responsible for air pollution and possible remedies in this article. We always curious to know which political party is right and what possible actions that a ruling party may take to control the Air pollution.

III. CAUSES OF POLLUTION

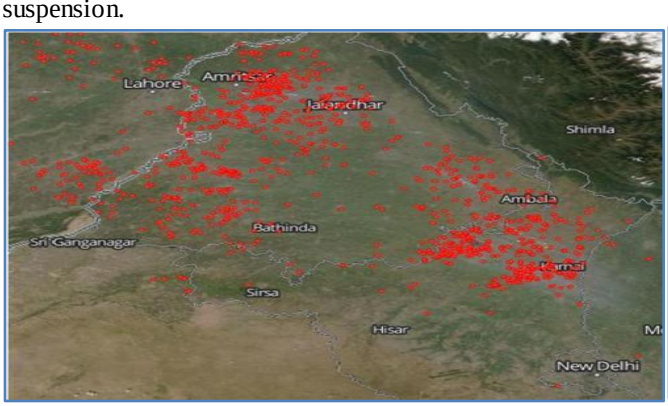
The reason for air pollution in October/ November is due to the time for switching from one crop round to another crop for which the farmers have less time and a lot of investment would be required to remove the residual of old crop/ paddy straw. So, the farmers, to save their time and money, opt the alternatives by making fire in the entire field. An estimated 500 million tons of crop wastes are produced annually as by-products, according to estimates from the Ministry of New and Renewable Energy. The greatest agricultural residue production, 60 Mt, is produced in Uttar Pradesh, followed by 51 Mt in Punjab and 46 Mt in Maharashtra. Cereals yield 352 Mt, followed by 66 Mt from Fibers, 29 Mt from oilseeds, 13 Mt from pulses, and 12 Mt from sugarcane. While rice alone supplies 53% of the crop wastes, cereal crops (millets, wheat, rice, and maize) account for 70% of the total. Currently, open field burning is used to dispose of 70–80 Mt of rice residue. However, the IPCC equations indicate that Uttar Pradesh had the largest contribution to the burning of crop residues, with West Bengal, Andhra Pradesh, Punjab, and Maharashtra.

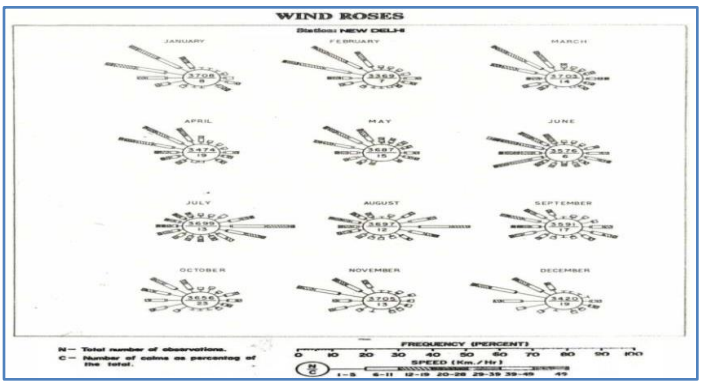




When we see the state wise hierarchy then Uttar Pradesh (22.25 Mt) is on top to burn bio-mass in open fields, and followed by Punjab (21.32 Mt), Haryana (9.18 Mt), and Maharashtra (6.82 Mt) based on documentation in 1980, 1985, 1990, 1994, 2000, 2005, and 2010 respectively. Punjab generates roughly 19–20 million tonnes of paddy straw and 20 million tonnes of wheat straw. During the Rabi harvesting season, about 80–90% of this residue is burned in the field along with wheat straw. The IPCC estimates that India burns 90 million tons of crop leftover annually, and other estimates have the country's on-farm agricultural residue burning at roughly 93 million tons. NASA has shown the picture of burning of crop in Haryana and Punjab in fig.3.

This is dangerously high during the winter months due to open crop residue burning in major agricultural regions like Punjab, Haryana, and Western Uttar Pradesh in the months of October and November. This is extremely high throughout the year compared to the typical value. Now an important question arise why Delhi NCR region is majorly affected more, why not Pakistan as it is nearer to Punjab. This can be clear with the wind-rose diagram (Fig. 4). This diagram shows the direction of the wind in the winter which blows from the north and north-west of India towards the east. In Delhi, the confluence of dense fog and smoke resulted in severe pollution. Summertime AQI values are also high, with an increase in PM10 concentration because of road dust. Even if the AQI is in the sensitive category, the pollution level lowers during the wet season because of dust suspension.





IV. METHODOLOGY

To minimize the air pollution levels in Delhi due to burning of leftover agriculture/ crop waste, all state governments should also take the necessary measures to inform, counsel, and educate farmers through the media, Gram-Panchayats, and non-governmental organisations and emphasise the use of these waste as fuel for automobiles, as briquette material, as a raw material for power generation, and motivate them for participation to make Bharat greener by lowering pollution and, eventually, global warming. The following control measures should be implemented by various federal, state, and local administrative and regulatory bodies in order to prevent crop residue burning:

(A) Ban on Crop Residue Burning: The National Green Tribunal mandated that any material that release harmful chemicals into the environment should not be burned and in case of violation of the Air Act of 1981, a court case will be register and criminal action under section CrPC 1973 will be initiate. In addition, court of the National Green Tribunal may impose a penalty.

(B) Constant monitoring of suspected places: To create a real-time monitoring system to keep an eye on the suspected location, state government agencies must collaborate with the Indian Space Research Organisation (ISRO), the National Remote Sensing Agency (NRSA), and the State Remote Sensing Agency (SRSA). Village-level workers, Tehsildars, Patwaris, Sub-Divisional Magistrates (SDM), Block Development Officers (BDO), and others should be involved in these efforts. All state governments must set up an alert system to notify concerned authorities when burning of agricultural crop residue has started in a specific area under their jurisdiction. This will allow the concerned authorities to take prompt, appropriate action using satellite imagery or other means.

(C) Create public awareness through media and campaigns: - Ait is very important that citizens must know their duties and know about the relative law, so in the beginning as a Kisan Mela organise for farmers for workshops, and training sessions to learn different ways to use crop residue. Similarly, Public awareness campaigns should be carried out through print and electronic media, radio jingles, and television shows to educate them about relative laws that will guide them how can minimising of burning of crops leftover.

(D) Collection and transportation of crop residue: - In support of this, the government must provide on a very nominal price all the necessary tools or machinery such as a rota-vator, happy-seeder, hay-raker, straw bailer and combined harvester that may help farmers to remove crop leftover and may transport, and store at a designated location in nearby area.

(E) Establishment of a market place for selling crop residue: Agricultural residue and paddy straw have a high calorific value therefore, make it useful for production of fuel in biomass-based power plants. They can also be used to make biofuels, organic fertilisers, paper, cardboard, and other materials. So, there should have a market where farmers can sale/purchase them at a fair/ subsidise price. This way, farmers can generate an extra source of income.

(F) Alternate uses of crop residues: Every year in India, there is an abundant supply of 500 million tons of crop residue [34]. Indian farmers can utilize this crop residue as an additional source of income by employing it in various ways:

- By making white coal referred as Pellet and briquette formation using of paddy straw as fuel for industrial boilers. These wastes have low combustion properties and at the same time, less bulky that helps in handling, transporting. Densification of the loose biomass in the form of briquettes, however, can solve these issues. 3kG of briquetted biomass may saves one litre of diesel.
- Together with liquid fuels like ethanol, methanol, biodiesel, and bio-oil, as well as gaseous fuels like hydrogen and methane, biomass resources can be converted into a variety of fuels for automobiles and fuel cells, which produce electricity.
- Biogas (methane, Carbon di-oxide and other gases) produced by anaerobic decomposition of organic materials that have calorific value of 16-20MJm-3. Moreover, biogas produces heat more effectively than burning.
- Biomass gasifier is a gaseous fuel released from biomass resources through a thermochemical process which generate 300 kWh of energy from one ton of biomass. The producer gas can be burned effectively to power gas turbines that generate electricity with engines that function without emitting smoke. The production gases can be burned directly for heating or cooking after the proper conditioning. The technology of gasification has the potential to successfully utilize crop leftovers for production of briquettes and pellets, while also creating jobs. For generation of Biomass gasifier, Government established 25 numbers of biomass-based power plants out of which 20 MW capacity Sirohi, Rajasthan is the largest one.
- Crop leftovers may also be used to produce hydrogen by any thermochemical processes like pyrolysis and gasification. It reduces dependency on unstable fossil fuel source. A Hydrogen Development Board must be established in India in order to further the development of technologies for generating, distributing, transporting, and storing hydrogen as well as to investigate fuel cell technology for effective hydrogen end use. The following are the main gaseous compounds that crop leftovers produce:
- Pyrolysis of biomass → H_2 + CO_2 + CO + Hydrocarbon gases
- Catalytic steam reforming of biomass → H_2 + CO_2 + CO
- Gasification of biomass → H_2 + CO_2 + CO + N_2
- Compost has traditionally been prepared by piled in dung pits and used as animal bed covering from crop leftovers. In the animal shed, 1 kg of do absorb 2-3 litres of pee. This adds nitrogen to the straw and bacteria accelerates the breakdown process, which takes 75–90 days. This new material may enhance soil fertility and overall health.

- Fine-grained charcoal known as "bio-char" is another substance with good value of carbon through a process named pyrolysis in absence of oxygen. It has the potential to be extremely important for both carbon sequestration and greenhouse gas reduction. However, with today's technology, it is not commercially viable and cannot be made popular among farmers. However, it would become economically practical once all the costly products and by-products, like heat energy, gas like H2, and bio-oil, were caught and utilized in the bio-char synthesis process. The creation of an affordable pyrolysis kiln is necessary to produce bio-char from surplus crop leftovers.

Surface runoff harvesting. In this method, rainwater flows away as surface runoff and can be stored for future use.

- Groundwater recharge. Groundwater recharge is a hydrologic process where water moves downward from surface water to groundwater.

V. CONCLUSION

The following point wise conclusions are drawn from this research are as under:-

Burning of crop waste will lead the air pollution that will affect citizen's health. Every year, due to Air pollution AQI level of that area breaks its last past year's peak record. Not only this, air pollution increases the Global warming effects, subsequently increases UV rays on earth resulting disturbing the ecological balance. To find any appreciable improvement in Delhi's air quality, crop residue burning must be immediately stopped entirely. The public's cooperation, stringent enforcement of the restrictions, and their exact execution are all necessary to address the issue of air pollution. It should be mandatory to control illegally burning of crops leftovers irrespective the outcome short term/ long term prospective in India's capital city if a number of measures recommended by various authorities, courts, and tribunals. Furthermore, government has to provide all necessary tools & tackle and machineries to remove, collection, transportation, storage and provide a suitable market place where subsidise crops residue can be sale/ purchased. And establish more and more bio-waste plants, composting plants etc. In contrast, citizens need to understand to not to burn crops leftover illegally and in case someone violating the guidelines, complaint the concern department so that action could be initiated against culprits.

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