Residue Crop (Paddy Straw) Burning Shrouds NCR

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Abstract: ***Air pollution in India is a serious issue with the major sources being stack emission, fuel adulteration, vehicle emission and traffic congestion. In winter large scale crop residue burning in agricultural fields is a major source of smoke, smog and particulate pollution. The national capital is witnessing one of the worst smog attacks in recent years during winter. As with the onset of the winter months, the decrease in temperature results in temperature inversion fovouring the accumulation of pollution near earth's surface, in combination with the high relative humidity and other meteorological parameters like calm winds typical of post monsoon months. This is the favorable conditions for all pollutants present in the atmosphere, especially those that comes from biomass burning specially paddy straw burning from the farms of Punjab and Haryana to prepare their files for winter crop. The smoke that arises from these burning contains toxic substance, including PM 2.5, CO2, CH4, CO, NOx, Sox. The paper explore the reasons behind the successive smog & other respiratory problems in NCR caused by crop residue burning, legal provision and alternatives available***.

Figure 1: stack emitting air pollutants.

Keywords: Smog, biomass burning, meteorological parameters, temperature inversion, Paddy straw.

1. Introduction

Crop residue burning :- In South & East Asia, there has been substantial increase in the area sown to rice-wheat (R-W).The increase in the area is because of the ease in the work by increasing level of farm mechanization over the last 20 years. Cultivation for seedbed preparation and harvesting in particular, is now commonly undertaken with farm machinery, wheat residue after grain harvest is valued highly for animal feed & therefore presents no different in terms of management ,as it is largely removed. Rice residue on the other hand can be large and are generally not used for animal feed (except basmati rise) consequently rice residues are usually burnt to enable tillage & seeding machinery to work effectively. Mechanized harvesting is popular with farmers of Punjab, Haryana & western UP on account of high labour wages for manual work & the anxiety of farmers to get the crop produce collected & marketed at the earliest. These machine harvested crop leaves behind enormous quantities of organic matter which after burning results in pollution emission, loss of nutrients, in soil. Farmers opt for burning as it is quick & easy approach for disposal of residue and enables farmers to plant the next crop well in time.

Figure 2: Paddy residue burning in Punjab

Paddy straw burning causing smog over the Years:-
Smog, the term is derived from the words smoke and fog. Two distinct types of smogs are recognized, one is sulfurous smog and other is photochemical smog.

(i) Sulfurous smog:- This is also called London smog, occur when high concentration of pollutants combines with dampness or fog.
(ii) Photochemical smog:- This is also called as Los Angeles smog and requires neither smoke nor fog. In this paper sulfurous smog is relevant.

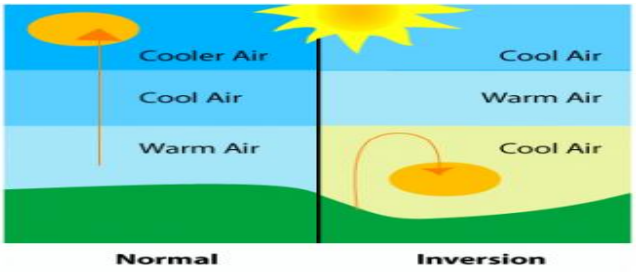
Winter Smog:- In winter the pollutants in air can result in smog, the severity of the resulting winter smog depends upon the degree of atmospheric dispersion. The lower the level of atmospheric dispersion, the higher the level of winter smog, atmospheric dispersion is mainly determined by wind speed & mixing height.

1. Wind speed pushes & disperses the pollutants horizontally, calm wind as the general case in winter means stagnant air and allows levels of pollutants to build up in the air.

2. The mixing height refers to the maximum height the pollutants can reach if dispersed vertically. In normal situations, the mixing height is enough to dispense the pollutants high into the atmosphere. The pollutants are carried up by the layer of warm rising air to the colder air higher up.

Figure 3: Smog enveloped Near central region.

In the case of temperature inversion, the pollutants are trapped at ground level, where it causes most harm. Cold air becomes trapped under the layer of warm air that acts as a lid the pollutants in the cooler layers cannot be dispersed & the pollutants stay concentrated at ground level.



Topographical Position of NCR (Area near central region):- NCR's landscape, weather, culture & growing population combines to elevate concentrations of air pollutants. As a landlocked mega city NCR has limited avenues for flushing polluted air out of the city, coastal megacities such as Mumbai & Chennai have at least a chance to replace polluted air with relatively unpolluted sea breezes, whereas NCR's surrounding regions are sometimes even more polluted than the city, as with the case of biomass burning in Punjab, Haryana & Uttar Pradesh.

Figure 4: Topographical position of National capital.

Preparation of field for Winter (Rabi) crop in Punjab & Haryana:
Farmers of Punjab & Haryana generally prepares their farm in October and early part of November for their winter crop by means of residue (paddy straw) burning.

Onset of Winter in NCR:
In NCR Winter starts in November and peaks in January, with average temperatures around 12–13 °C .NCR's proximity to the Himalayas results in cold waves leading to lower apparent temperature due to wind chill.

Lightweight PM 2.5 and Wind pattern towards NCR:
Due to residue burning in Punjab and Haryana, generated particulate matter (PM2.5), being extremely lightweight, can stay in the air for a long time and travels hundreds of miles in the prevalent wind direction i.e. towards national capital. During the autumn and winter months, million tons of crop residue are burnt, and winds blow from India's north and northwest towards east.

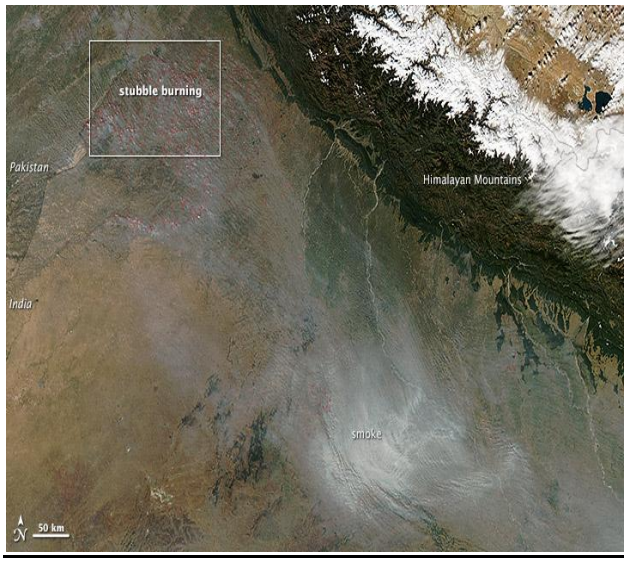


Figure 5: Wind direction from Punjab and Haryana towards National capital.

Laws related to control Air Pollution in India:-

1. Air (Prevention and control of pollution) Act 1981
2. Environmental (Protection) Act 1986
3. National Environment appellate authority Act 1997
4. The National Environment Tribunal Act 1995
5. Biological diversity Act 2002

Program & agencies to control Air Pollution in Punjab:-

1. Punjab pollution control board.
2. Punjab state council for science & technology.
3. Punjab department of Agriculture.
4. Agriculture councils.
5. Punjab energy development Agency (PEDA).
6. Punjab agriculture university (PAU)
7. Punjab state farmer's commission.

There is no specific law in Punjab to ban stubble burning. Every Deputy Commissioner (DC) has the power to impose a ban under section 144 of Criminal Procedure Act.

DC also has the power under 188 IPC. Under the law, a violator may be punished up to six months jail and a fine of Rs. 1000. Hardly any action is taken under this law against violators in Punjab. There's a lack of 'political will' resulting in poor implementation in the state.

In Haryana, the environment department had banned the burning of agriculture waste in the open fields under the Air (Prevention and Control of Pollution) Act 1981.

Even after the presence of laws/programs/institutes, the every winter smog in NCR shows the governments failure in discouraging the practice of residual burning, also banning this practice strictly is difficult as it makes life for the poor farmer more difficult.

2. Alternatives of Paddy straw burning

1) **Happy Seeder:** Happy seeder is designed for direct drilling wheat into heavy nice residue loads and therefore provides an alternative to biomass burning. It is a tractor powered machine that cuts & lifts the rice stubble, sows the seeds into the soil & deposit the lifted stubble over the sown area as mulch.
2) Livestock fodder.
3) Mushroom cultivation.
4) Paper & pulp board manufacture.
5) As a fuel in thermal power plant.
6) Ethanol production.
7) Cushioning material in the packaging of manufactured goods.
8) Floor tiles.

3. Challenges in implementing the alternatives

1. Problem with happy seeder – Despite being a low cost alternative to conventional tillage, farmers may not be inclined to adopt happy seeder because they may not believe that wheat will grow in fields covered with rice residue. Farmers that aware of the happy seeder technology, but non adopters were indeed skeptical.

2. Problem with livestock feeder – Specifically for rice straw as the case of Punjab, Haryana & UP causing smog in NCR, major challenges to use as livestock feeder as is, its low digestibility due to high silica content, along with very low protein content (2 to 7%).

Summary

Crop residue is largely burnt as it is limited value to the farmers both as livestock feed & non feed use, the paper concludes some alternatives to residue(paddy straw) burning causing smog every year to central region and stress on the challenges to implement the alternatives, The paper also talks about existing laws and regulations, Institutions and agencies available. It can be concluded that burning residue should be in the least priority and environment friendly options should be encouraged using economic instruments.

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