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Stubble Burning: An Isolated Issue with Collective Concerns

YUVA POORNIMA A[1]

ABSTRACT

India being one of the largest agro - based economy produces large amount of agricultural waste, including crop residues. The act of stubble burning is the intentional fire setting to the residues after the economic crop parts have been harvested. It is considered to be the cheapest and fastest way to get rid of the stubble among the farmers, but it has aggravated air pollution along the regions where the practice is in existence. The other effects of stubble burning are seen to be heat penetration and loss of soil fertility over the environment. The impact of stubble burning is more severe posing a grave threat to the human health and wellbeing. The effects extend even to the agricultural productivity directly and indirectly. This paper would discuss on the impact of stubble burning caused over the environment, agriculture and to the human race. It also justifies the claim that it remains an isolated issue which lacks proper attention from the State and the Centre despite having consolidated and collective impacts. Along with, it would discuss the alternatives to the practice, the technological assistance, interventions by the Government through the schemes and the legislations. One such effective method would involve the sustainable management practices for crop residues using it as a biomass energy. Also the importance of awareness among farmers is laid emphasis, while the implementation gap is to be erected by the government also.

Keywords: *Intentional fire setting, Agricultural productivity, Sustainable management.*

I. INTRODUCTION

"People are breathing smoke, not air"

-Dr. Pushpa Kumar Lakshmanan[2]

Agriculture has been the backbone of the nation, where about *two third of the population* is engaged in agriculture and its allied activities. The country's 54.6 percentage of the total

[1] Author is a LLM student at Chennai Dr. Ambedkar Government Law College, India.

[2] Dr, Pushpa Kumar Lakshmanan, Fullbright Scholar of Harvard Law School, University of Delhi during his keynote speech at the National Webinar on the theme "Impact of COVID-19 on Water, Environment and related Ecological and Human Systems", June 5, 2021.

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workforce is still engaged in this sector.[3] During 2020 -2021, while the GVA for the entire economy of the nation contracted by 7.2 percentage GVA, agricultural sector maintained a *positive growth of 3.4 percentage* still.[4] In such an agro based economy which tops the list by second position as a consequence produces large amount of agricultural waste, including crop residues. While this is used as the animal or cattle feed in few parts, a greater portion of this is left unused. This results in the unhealthy practice of setting the farms under fire as a measure of combating the waste generated. The act of stubble burning involves *intentional fire setting* to the residues after the economic crop parts have been harvested. Along with it has grown the practice of burning the residues which is exercised for crop rotation. This has aggravated air pollution along the regions where the practice is in existence. The other effects of stubble burning are seen to be heat penetration and loss of soil fertility over the environment. There are also severe health impacts posing grave threat to the human health and wellbeing, including various respiratory, cardiovascular problems, irritation of eyes, skin, etc. The effects extend even to the agricultural productivity directly and indirectly.

This paper will formulate towards the claim whether the stubble burning poses a serious threat to the environment and the human race, lacking proper attention from the Government and justify whether it remains an isolated issue which lacks proper attention from the State and the Centre despite having consolidated and collective impacts or not. It will also deal in detail regarding the concept of stubble, its impacts on environment, human and agriculture along with the Government interventions to regulate the practice and technological inventions to reduce the practice and the measures to mitigate the practice sustainably.

(A) Objectives of the Study

The objectives of the study include:

- To summarise the concept of stubble burning.
- To study the impacts of stubble burning to the environment, human and agriculture.
- To discuss the Government interventions in order to regulate the practice along with the technological aspects.
- To suggest ways by which it could be combated both sustainably and lawfully.

(B) Scope

A critical study is provided which explains the process of stubble burning along with the

[3] Census Report, 2011; www.censusindia.gov.in
[4] Economic Survey of India, 2020 -2021; www.indiabudget.gov.in

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impacts over the environment, agriculture and the human race. An analysis over the technological alternatives along with sustainable management is provided while discussing the government action plans.

(C) Research Methodology

The research undertaken is a *doctrinal method* of study. The study is focused mainly on primary and secondary data from articles, journals, websites and other such sources. This study uses analytical, critical, comparative and other necessary methods to obtain the conclusion and also derive valid suggestions.

The study is ***limited*** by proper government legislations, though the practice is a traditional and older one in existence over years.

II. STUBBLE BURNING - REASONS BEHIND THE PRACTICE

Stubble burning is a common practice followed by farmers to prepare field for sowing the *next crop for harvesting.* This is generally followed along the *north western regions* of the country where the farmers after the harvest of their Kharif crop i.e. rice in order to sow wheat follow this practice of setting fire to the residues of crop left behind. It's usually required in areas that use the *'combine harvesting'* method which leaves crop residue behind. According to the Indian Ministry of New and Renewable Energy (MNRE), India generates on an average 500 Million tons of crop residue per year. The same report shows that a majority of this crop residue is in fact used as fodder, fuel for other domestic and industrial purposes. However, there is still a surplus of 140 Mt out of which 92 Mt is burned each year.[5]

The farmers in order to plant next winter crop (Rabi crop) remove the existing crop residues in a *very short interval*, due to short winter these days failing which they might face considerable losses follow the burning of the residues. Therefore, burning is considered to be the *cheapest and fastest* way to get rid of the stubble. When the residues are left behind they would be attacked by pests which may also attack the upcoming crops. The *feeble economic state* of farmers push them to follow such method instead of the recent technological methods to remove the stubble. Also since they are ill-equipped to deal with waste as they cannot afford the new technology that is available to handle the residues generated. Hence one predominant reason for stubble burning seems to the narrow time available between the cropping patterns in existence, which also involves the *far reaching alternatives* available.

The growing *demand of food* globally has also urged the need of food production in almost all

[5] NPMCR, www.agricoop.nic.in

the developing. Therefore in order to increase food production certain major agrarian states along the north western region namely Punjab, Haryana, Uttar Pradesh and Maharashtra adopt residual burning to make their field ready for their next harvest.[6] This has increased the complexity in waste generation where there is lack of proper management, with regard to such bulk residual created consequently.

Also the other reason behind this improper method of burning crop residue is posed to be the *lack of management measures* from the public entities. The waste disposal with regard to the agricultural sector is left unaddressed over years which has aggravated the management of residues. This is related to the fact that the agricultural sector is not regulated with the waste management as in any other sector, leaving the land owners to handle the agricultural waste themselves. The waste management of the agricultural waste involves minimal public interventions thereby leading to such unhealthy measures of disposal.[7]

III. AFTERMATH OF BURNING THE CROP RESIDUES

A significant amount of waste is generated after harvesting the economic parts of crops. As mentioned earlier this waste is at times used as the fodder to cattle, thatching roofs for houses, sheds or as fuel for domestic cooking and at rare cases is used serve as raw material to pulp or board industries and biogas generation, while a major portion of the crop residual is still unutilized. Such huge amounts of the stubble are set fire to plan for the subsequent harvesting. This serves as aggravated threat affecting the environment, potential source affecting the agriculture alongside proving to be a valid parameter to affect human health and wellbeing.

(A) Impact on Environment

A study estimates that crop residue burning released 149.24 million tons of Carbon dioxide, over 9 million tons of Carbon monoxide, 0.25 million tons of oxides of Sulphur, 1.28 million tons of particulate matter and 0.07 million tons of black carbon,[8] these directly contribute to environmental pollution posing very serious effects on it. Despite stubble burning not being a major source of pollution, it remains a significant contributor to air pollution in India. The air quality becomes austere mostly in November across the north Indian states. The air quality of the urban areas is more affected by stubble burning emissions because of the presence of the accumulated pollutants from vehicular and industrial emissions leading to severe air

[6] Dr. Jitendra Bisht "Stubble Burning in North India: Defogging the facts", 32 Social and Political Research Journal 53 (2018), 2018.
[7] S. Bhunaneshwari, *"Crop Residue Burning in India: Policy Challenges and Potential Solutions"* 163 International Journal of Environmental Research and Public Health 178 (2019).
[8] The study based on *NAAPS* (Navy Aerosol Analysis and Prediction System) model was published in Down To Earth article "India's burning issue of crop burning takes a new turn" published on November 21, 2020.

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quality damage.[9] The emission of such greenhouse gases (GHGs) hence contribute to the further global warming, increased particulate matter (PM) and smog. The PM emitted from such stubble burning in Delhi depicted to be 17 times that from all other sources such as vehicle emissions, garbage burning and industries.[10] It was reported that 80% of the stubble was burnt on field post-harvest period of April-May and November-December. The reason behind it leads to severe smog during the winter causing a greater difficulty with poor AQI in and around.

Thus the burning of crop residues causes a negative externality in form of emissions, with implications on *climate change and weather*. This could be felt directly were it is reported that India has lost 36% of its expected wheat production in 2018, which is linked to the poor air quality due to change in weather patterns.[11]

(B) Impact on Agriculture

The effects of burning crop residue has even extended to the agricultural sector. These pollutants gradually affect the food production in both ways. Direct effects could be observed on injury to leaves, grains and heavy metal assimilation likewise where nitrogen oxide excess in air could lead to *discolouration* of the greener parts also causing tissue damage. Excessive sulphur dioxide causes acid rain which has severe effects on the flora and fauna as well. Indirect effects could be said as the favourable condition for the increased reproduction of *pests and diseases*.

This also releases excessive VOCs (Volatile Organic Compounds) and nitrogen oxides to the atmosphere which combine to form *ground level ozone*. Ozone is produced thereby immediately in the open atmosphere due to the above said oxides, damaging and posing serious threat to the natural plant metabolism, penetrates and destroys the vegetative parts of plants which are also affecting those who consume it.

Apart from this the soil productivity is also affected greatly. This also burns the essential *nutrients inside* the soil thereby raising the soil temperature to about 42°C, killing the important microorganisms in the soil at a depth of about 2.5 cm.[12] Due to loss of these *crop friendly microbes* from the upper layers of soil, there is a drastic change in the organic quality of the soil. This causes an additional task of using fertilizers or compost, which could ne other

[9] Gaurav Saini, "Stubble Burning: Effects on air quality" Environmental Advances (2020).
[10] Jitendra and Others, "Greenhouse emissions from Agricultural Crop residue burning reaching a heap" published in the Quint on November 30, 2020.
[11] Ghosh, P. Sharma, "*Scoping study for South Asia air pollution" Energy Resource 153. (2019;) www.gov.uk.research- outputs.in*
[12] The Indian Express, 2017."Can't have another gas chamber", September 23, 2019.

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factor aggravating the soil fertility, if they are chemical fertilizers. In total the agriculture is greatly affected collectively due to *atmosphere variations and soil fertility depletion*.

IV. IMPACT ON HUMAN WELLBEING AND HEALTH

Human health is no exception to the effects of stubble burning. There are number of studies[13] which have established the link between air pollution and health risks among human. There are severe effects among children, pregnant women, elderly people and persons with pre-existing ailments. Exposure to air pollution also has caused skin and eye irritations, severe neurological disorders, cardiovascular and respiratory problems. In some cases it has led to chronic cases due to exposure of high level of air pollution causing permanent health injuries such as development of asthma, COPD (Chronic Obstructive Pulmonary Disorder), bronchitis, cancer, etc. The farmers who are *directly involved* in such activities have shown serious ill effects with eye irritations, lung disorders and similar illness. The PM also affects the blood stream of those who are exposed to the burning, causing cardiac arrest or stroke.

The *mortality rate* also seems a rise with deaths caused due to air pollution. It has increased from 1.1 million to 1.2 million between the years 1990 and 2015.®[14] This traditional practice is seen to release certain *lethal oxides* into air when burnt releasing higher levels of PM causing pre mature deaths when exposed for a prolonged period.

This was worsened and lead to adverse conditions during the *pandemic situation*, when people around were suffering with respiratory ailments due to COVID-19, regions of northern India had to manage further difficulty where they had to combat the effects of stubble burning. From October to December 2020, air quality index (AQI) in New Delhi and other cities in North India reached up to 20 times higher than the safe threshold levels defined by the World Health Organization.[15] A recent study cited direct link between 15 percent of the total COVID deaths in the world are due to air pollution.[16]

In order to sum up, stubble burning is a ***"sole issue with collective concerns"*** which are to be addressed to combat the threats. Thus it remains a single source of various issues left behind causing serious threat to the environment, agriculture, human health and as a consequence affect the basic model of climate and weather. It is also proven that stubble burning is an

[13] Study conducted by the Institute for Social and Economic Change, Bengaluru with people of Punjab rural areas as their target for the study during the year 2019.
[14] Report by the Energy Policy Institute at the University of Chigago (EPIC), 2020.
[15] Rita Pandey, "*The impact of stubble burning and poor air quality in India during the time of COVID-19"* 27 July, 2020; www.teriin.org
[16] Taran Deol, *"Air pollution could be linked to 15% of COVID deaths globally, new study says"* published at Science, the Wire, November 10, 2020.

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important factor, but not the only factor[17] to all such harmful impacts, however has aggravated the situation. Also it affects the life patterns of the human beings inclusive of the animal species. This at the end of the system has altered the *economic system* of the nation also, primarily affecting the development at the lower scale of villages and having a chain sequence over cities and towns.

V. MEASURES TO MITIGATE

The mitigation measures are essential to tackle the problem at its base through adoption of precautionary and preventive techniques. In order to defy the impacts caused by stubble burning various government interventions are involved along with technological developments. There were provisions introduced to reduce the traditional practice which was followed over years. The government tried adopting the *Polluter Pay Principle*, as one of its measures. Also the *technological aspects* were on the hand involved actively to combat the ill effects caused due to stubble burning. These involve the use of Happy Seeders, Pusa microbes to decompose, etc.

VI. GOVERNMENT INTERVENTIONS AND POLICY FAILURES

A number of attempts were made by the Government of India to introduce and educate the agricultural community about the best practices of agricultural waste management through Government-initiated projects. Various forums and proposal were formulated by environmentalists and Government officials to curb crop residue burning and to promote the usage of alternative substantial management methods. Some of the laws with regard to the crop residue burning are:

- Section 144 of the Civil Procedure Code (CPC) to ban the burning of stubble of paddy
- Air (Prevention and Control of Pollution) Act, 1981
- Environmental Protection Act, 1986
- National Green Tribunal Act, 1995
- National Environmental Appellate Authority Act, 1997, etc.

The core administrative bodies regulating such emissions and promoting air quality in India are the Ministry of Environment, Forest and Climate Change (MoEF&CC), the Central Pollution Control, Board (CPCB), and its subsidiaries at the state level. Also the Indian government,

[17] Bismee Taskin, *"All about stubble burning, its alternatives and steps taken by Centre and State governments"* November 8, 2020 published at The Print

through the MoEF&CC has implemented the *Environmental Impact Assessment* which also covers the air quality and levels of pollution control. The *National Air Quality Monitoring Scheme* (NAQMS) was also established in the year 1967 to monitor the level of pollutants and the AQI- air quality index by establishing a number of stations. The Indian government established the *National Clean Air Program* (NCAP) which is to be implemented in the fore coming years. This mandates a collaborative and participatory approach between the agencies and stakeholders at various levels. In addition to the above, the *National Policy for Management of Crop Residue*[18] (NPMCR) was introduce by the Ministry as a mitigation method. Its objectives were to

- Promote the technologies for optimum utilization and in-situ management of the residues
- To prevent environmental harms caused due to the practice
- Develop and promote proper methods to manage the stubble from the crops
- Usage of the remote sensing measures by the CPCB to control the burning of crop waste
- Also to provide financial assistance and fund mobilization to innovations over the practice. However no significant developments were advanced over this formulation which leave the method unnoticed.

The National Green Tribunal also recommended *penalizing the farmers* who burn the crop residues, following this Punjab attempted to implement this but failed miserably. This was an additional burden to the farmers who were *already in debt* and it also had political reasons as the farmers formed the majority of the *vote bank* along the region,[19] it was later dropped.

The Union government also recently issued an Ordinance with respect to the management of Stubble burning which was known as the *Commission for Air quality Management in National Capital Region and Adjoining Areas Ordinance, 2021*.[20] This was applicable to the National Capital along with the regions of north western India vested with power to prohibit activities that are likely to increase or cause air pollution in and around those regions.

Despite various laws and policies being formulated to combat the effects of crop residues, the laws at the basic level fail to address the root cause of all such issues. The country actually

[18] In 2014, the Ministry of Agriculture developed the policy which developed objectives to combat the stubble burning and its effects.
[19] Suhasini Krishnan, *"With winter ahead, how do we tackle the stubble burning?*"Published at the Quint on October 16, 2020.
[20] www.prsindia.org/billtrack, passed on April 13, 2021.

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fails to enact a *full-fledged proper law* with regard to the issue of stubble burning. The Acts which are in existence also look air pollution as a collective issue but *fails to address the aspects* of stubble burning in particular. It still ***remains an isolated issue*** lacking the attention which is actually needed. Though it seems to be one of the causes of air pollution and related harms caused, it remains one major issue which is wide spread in existence and is also practiced over years and years. The legislations at primary level have to address the difficulties of farmers over the access to the alternatives and implementation of these have a major drawback of lack of attention towards farmers' economic conditions to follow alternative methods. Also there is a need of proper formulations towards the mitigations for stubble burning.

VII. TECHNOLOGICAL ASPECTS AND PITFALLS

In order to control the significant amount of waste produced from crop residue more radical measures involving the technology were introduced. Few of them involved the Happy Seeder, Zero tillage method and conventional tillage, along with these the Rotavator, Baler, Reaper Binder, Paddy Straw Tiller were also employed to an extent. These were various equipment used as a package to manage the waste generated at various states.[21]

The conventional tillage was one of the tillage methods were the residues are buried at a specific place considering it to be cost effective. The zero tillage or no-tillage was a method were the crop seed for the next harvest would be sown through drillers without disturbing or tilling the previously cultivated land with the crop stubbles present over it. Though these two methods seemed to be cost effective, both were considered to be *time consuming*. Due to the *Green revolution and increased food production* demand the farmers had to adapt for other measures. One of the effective technological inventions is considered to be the *Turbo Happy Seeder*. It is a tractor operated machine for the in-situ management of the crop residues. This is considered to an effective method were the *moisture* of the soil is retained and *controls erosion.* However the farmers are reluctant towards the use of such methods since they are not cost friendly to all the farmers. The farmers who are already in low economic level with debts find it difficult to either buy or hire such machines. Hence they *fail to be recognized* as an effective alternative to stubble burning. The technological developments hence remain *far reaching* to the farmers in general proving to be a failure among masses.

The other scientific invention developed as a decomposer technique is the *PUSA Decomposers*. This converts the stubble into compost. This is a form of capsule made from the

[21] Former Agricultural Minister Radha Mohan Singh said the government would provide subsidy on the usage of such machines at a rate of 50-80%, but still remains null making it tougher to farmers.

fungi strains which help in faster decomposition of the residual waste from farms. It takes around 20 days for the process to be completed. This decomposer is considered to be a boon to farmers since they leave the nutrients and fertility of the soil unaltered rather nourishes it. It is claimed to be an effective, cheaper and simple technique to control stubble burning.[22] Since this method *awaits approval*, there exists the enforcement gap with regard to its usage.

VIII. PROSPECTS FOR SUSTAINABLE MANAGEMENT OF CROP RESIDUES

As posed in various issues sustainable management is seen as a bright and much needed one in the awake of recent trends, much focus is provided to sustainability. Few best alternatives to the burning of crop residue foreseen would be composting, bio-char, and in situ management.

Composting is no way new method to India, it is a *natural process of decomposition* which retains the raw nutrients[23] of the stalk and forming a rich source of organic compost. This method is mediated by various microbes at aerobic condition which could be a valid alternative to burning and could also be used as a replacement to chemical fertilizers.

Bio-char is a carbon rich porous product obtained as a result of *pyrolysis* at higher temperature at oxygen free environment. This could be effectively implemented in the stubble management method. This bio-char could be used as a component to ament the nature of the soil with *high water retention capacity* and increased soil surface area. Many researches have reported the use of bio-char could help to *increase the earthworm population*, thereby causing minimal use of fertilizers.[24] *In-situ application* of the crop residue is yet another natural process which could involve no tilling or less tilling of farms, enhancing the soil nutrients.

These are few methods which could be employed sustainable to combat the waste generated due to agricultural practices, thereby cutting down the stubble burning method. However these methods when employed at larger scale could initially have certain difficulties but could yield better results gradually with the objective of development sustainably. There are other measures also like the production of Bio-fuel from the agricultural waste, which could be a renewable form of energy, certain raw materials like bagasse from sugarcane could be used in alcohol production which has multiple uses, bio-lubricants, etc.,

[22] Chief Minister Arvind Kejriwal said 'Pusa bio decomposer' was successful in Delhi and recommended for further research to the Supreme Court on November 4, 2020. www.thehindu.com

[23] Beck-Friss, *"Lessons from Denmark and Austria on the Energy Valorization of Biomass", European Commission; Brussels, 2012.*

[24] Marjanovic, *"The best practice for using Plant Residues",* Agrivi 2016, www.blog.agrivi.com

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IX. SUGGESTIONS AND CONCLUSION

The large scale production of food crops in India have resulted in larger amount of agricultural residue generation. This seems to be significantly greater in amount on comparison to the grains produced actually, also magnanimous amount of these agricultural waste is left utilized causing it to be burnt. This age old practice has hence posed serious threat on the environment, agriculture, human health and the economy also. The severity is realized through the air pollution resulting along with the smog causing alterations to the level of pollutants, GHGs, climate changes. Also the impacts over agricultural section on depleting the soil fertility, plant diseases, heat penetration etc. are realized. The pollutants from the stubble burning has also caused grave illness to human race along with various chronic and respiratory diseases, whereby its seriousness was aggravated during this pandemic situation causing number of deaths and severe complications.

- It has therefore the need of the hour to implement stringent policies analyzing the *ground realities and possibilities* to curb the menace from its base. India is in need of *proper and separate formulations* of policies and legislation to restraint the impacts of stubble burning.
- Also these Government interventions must *actualize the situation* among farmers and draw up an effective mitigation policy. The stakeholders must be well educated of the causes and impacts of their deeds.
- The proper methods of *waste management* must also be formulated, as in the Bio-medical waste, Plastic waste, Construction waste, etc. legislations and rules exclusively for Crop Residual waste is also the need of the hour. Stubble burning pose very severe impacts on the inclusive environment which makes its alarming for such a separate legislation. Also strict adherence to the Polluter Pay principle could be made, however owing to the financial status of the farmers, such principles could be altered accordingly. Also *incentives* could be provided to those who follow such positive methods of disposal.
- Though there are few legislations with address the air pollution which is a consequence of stubble burning, the *implementation gap* must be erected for effective results.
- They must be enlightened with the alternative methods which could be used and the government with regard to the technological inventions like the Happy Seeder, where

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the financial inability plays a greater role, the farmers could be *provided subsidy* on utilizing such methods. Also the alternatives must be *made accessible* to them as in case of the Pusa Decomposer which is still not in use. Also the *MSP regime* must be taken in to consideration.

- The Government could establish *fodder feed markets* so that a greater amount of the stubble could be sold here which could be utilized in dairy industry as animal feed. Also initiatives towards *biogas plants* could be made, where these crop residues and agricultural waste could be used as the raw material.
- Above all these there must be *proper education* among the farmers who involve in such practices, making them aware of its consequences to the environment and to themselves.

The paper has thus explained the concept of stubble burning and reasons behind it for which they were followed, the impacts on the environment, agriculture, human well-being and health along with the interventions formulated by the Government to combat them and the policy failures; technological inventions along with the sustainable management methods. The impacts of Stubble burning unanimously demonstrate grave risk to the environment, agricultural sector, human health and wellbeing. Simultaneously there is obvious dent in the legislations and policies on the side of the government, treating it as a secluded issue with miniscule attention, despite its established oblivions. Therefore Stubble burning could be concluded as an isolated issue which has collective concerns which are to be addressed both legally and sustainably for a better future.

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