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Stubble Burning: A Challenging Issue in Punjab

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ABSTRACT
Beautiful hills are the main attraction point of North India. Not only of citizens of India also the visitors from foreign countries come there to enjoy snowy hills but stubble burning is curse for this beauty of north India. Environment Protection Act 1986, The Air (Prevention and Control of Pollution) Act, The water (Prevention and Control of Pollution) Act are established to provide safety to environment and the living and non-living species of environment. But farmers violate the established laws and act and they burns the stubbles and agriculture waste which cause many health issues as well as harms environment. The main aim of this study is to enlighten the causes, problems and suggestions to avoid and control stubble burning.

Keywords: stubble burning, Pollution, health issues, eco-friendly.

1.1 INTRODUCTION

1.1.1 STUBBLE BURNING

Stubble burning is the process to fire off the waste material that remains after harvesting of seasonal crops like cereal plants. On the other hand, Stubble burning means deliberately is destroying the residuals of seasonal crops. Stubble burning is specifically done in the month of October-November. This leads to many health problems or issues.

1.1.2 REASON BEHIND STUBBLE BURNING

Time Saving: One of the main reasons for Stubble burning is time saving process. Because of Time period between two cultivating crops is less. So they prefer to burn the cuts stalks remain on the field after the crops harvest
Economical: Another reason is that stubble burning is economical other methods. Large numbers of farmer are belonging to economic weaker section due to which it is difficult for them to arrange machinery for further processing of stubbles.

1.2 REVIEW OF LITERATURE

Stubble Burning: A Challenging Issue in Punjab
The issue of stubble burning has gained significant scholarly attention due to its widespread environmental, health, and socio-economic implications. Research has consistently highlighted its persistence and the challenges involved in mitigating its effects. This section reviews key studies from the past 25 years, organized in descending chronological order, to provide a comprehensive understanding of the problem and potential solutions.

1. Recent Studies (2021–2023)
Singh and Sharma (2023) emphasize the growing severity of air pollution in northern India, attributing a significant portion of particulate matter to stubble burning during the post-harvest season. They recommend increased policy focus on mechanized in-situ residue management.
Bhardwaj and Basera (2022) explore the impact of government subsidies for eco-friendly agricultural equipment, finding a direct correlation between financial incentives and reduced burning practices.
Kumar et al. (2021) advocate for scaling bioenergy plants as a sustainable ex-situ solution, although logistical challenges remain a concern.
2. Studies from 2016 to 2020
Gupta et al. (2020) examine the effectiveness of the Happy Seeder technology in Punjab and Haryana, noting a reduction in burning incidents where the machine was widely used. However, they point out that the high cost of machinery limits adoption among smallholder farmers.
Mishra and Yadav (2019) discuss the health burden of air pollution from residue burning, linking it to increased cases of respiratory ailments.
Sharma and Gill (2018) critique the enforcement mechanisms of anti-burning laws, arguing that weak governance undermines their impact.
3. Studies from 2011 to 2015
Bhatia (2015) investigates the economic motivations behind stubble burning, revealing that time and labor constraints are primary drivers.

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Kumar and Singh (2014) highlight the limited success of educational campaigns, attributing it to poor dissemination of alternative residue management techniques.
Mishra (2013) suggests that traditional methods of residue recycling were more sustainable but lost favor with the advent of mechanized harvesting.
4. Studies from 2000 to 2010
Early research by **Gupta and Singh (2010)** provides a foundational analysis of air quality deterioration in Punjab due to agricultural fires. They call for integrated farming practices that prioritize residue reuse.
Sharma (2007) explores farmer perceptions of residue management technologies, noting a preference for traditional practices over mechanized solutions due to cost considerations.
Bhardwaj (2003) analyzes policy frameworks, finding that early anti-burning initiatives lacked enforcement mechanisms and adequate farmer support systems.
5. Studies Prior to 2000
Singh (1999) offers a historical perspective on the adoption of mechanized farming in Punjab and its unintended consequences, including increased residue production and burning.
Earlier work by **Kaur and Singh (1995)** identifies crop residue as a valuable byproduct in traditional farming systems, used for fodder and composting before the rise of large-scale paddy cultivation. These studies highlight the transition from sustainable practices to more environmentally harmful techniques driven by economic and technological changes.
Additional Sources
The Free Encyclopedia explains stubble burning as the intentional act of setting fire to leftover straw stubble after the harvest of grains like rice and wheat. This common practice contributes significantly to air pollution, specifically particulate matter, and underscores the urgent need for sustainable management practices. The article emphasizes the need for farmers to engage in discussions with the government to adopt alternative methods.
Earth Observatory (NASA, 2014) details the agricultural practices in Punjab, where rice and wheat are primarily grown. Farmers often resort to burning plant debris, particularly paddy stubble, after the rice harvest to quickly prepare fields for the next crop. This practice, although time-efficient, is a major contributor to air pollution, especially during the post-harvest months.
The Hindu Business Line (2023) discusses the innovative measures taken in Haryana to combat stubble burning. Farmers are shifting from burning crop residue to selling paddy fodder and using super seeder machines to convert crop residue into manure. This change is driven by growing awareness of the environmental harm caused by stubble burning, with positive long-term implications for both the environment and agriculture.
Muhammad Isa Abdurrahman (2020) examines the environmental issues associated with stubble burning, particularly its impact on air quality. The study highlights stubble burning as a major source of air pollution, contributing to smog and respiratory issues. The paper proposes several solutions, such as composting crop residue and converting it into bioenergy, to mitigate environmental damage.
The reviewed literature collectively emphasizes the significant environmental hazards posed by stubble burning, particularly its contribution to air pollution and poor air quality. Despite its widespread prevalence in regions like Punjab, various alternative strategies are being explored, including the adoption of machinery that converts crop residue into useful products and better management practices. Growing awareness among farmers about the negative consequences of stubble burning has led to a gradual shift towards more sustainable practices. However, the success of these efforts relies on strong government support and active collaboration with farmers to implement effective solutions.

1.3 RESEARCH METHODOLOGY

The conceptual research method was used to collect data for this study. A Google Form was employed to distribute the questionnaire, and a total of 184 responses were collected. "From 200 targeted respondents, 184 complete responses were received (92% response rate). 16 responses were excluded due to incomplete data. "Both primary data and secondary information were gathered for this investigation. Secondary sources included books, journals, newspapers, websites, conferences, and other relevant materials.

1.3.1 OBJECTIVES OF THE STUDY

1. To highlight the problems associated with stubble burning.
2. To provide suggestions for mitigating the issue of stubble burning.

1.3.2. Data Collection
A structured questionnaire was used to examine how stubble burning affects our ecosystem. Data for this study was collected via a Google Form from 200 people. A total of 184 responses were recorded, with the questionnaire consisting of 13 questions.

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1.4. **DATA ANALYSIS AND INTERPRETATIONS**

The collected data has been analyzed and presented in the form of tables, pie charts, histograms, and trends. These visualizations have been interpreted appropriately, and values have been rounded to the nearest whole number where applicable.

1.4.1. Demographical and Geographical Representation of Respondents

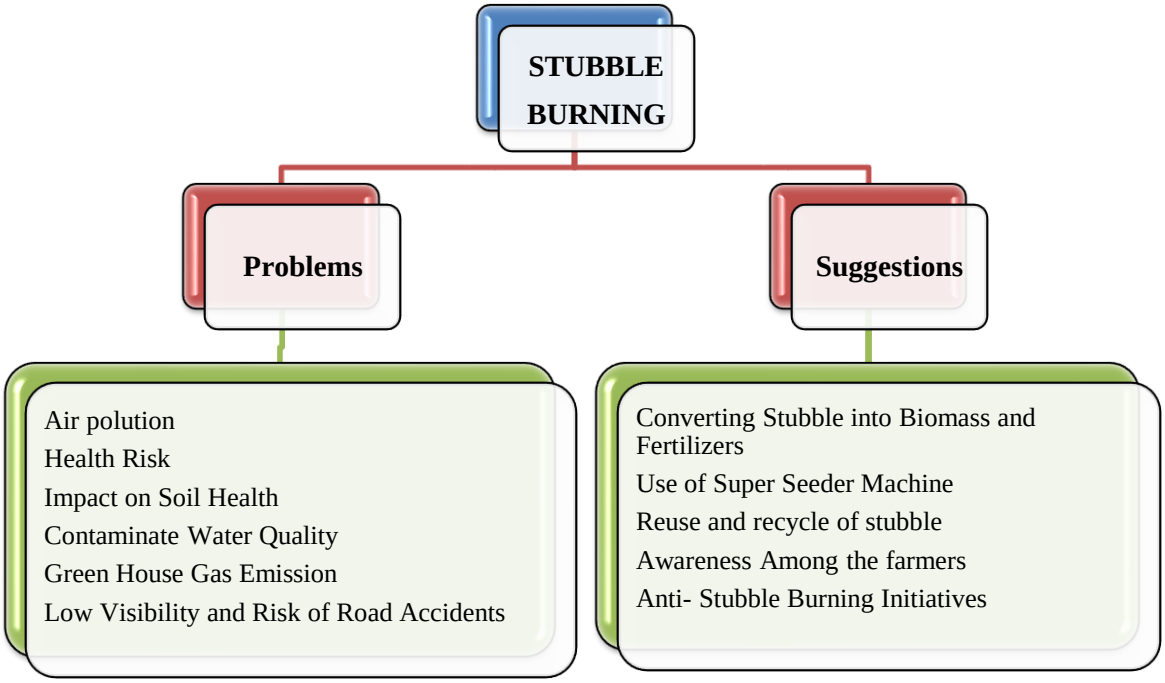
Particulars	**No. of Respondents**	**Percentage**
Gender		
A) Female	114	62%
B) Male	70	38%
C) Others	0	0%
Total	184	100%
Area		
A) Rural	38	20.9%
B) Urban	146	79.1%
Total	184	100%

Interpretation

The demographic and geographical distribution of the 184 respondents reveals that 62% were female (114 respondents) and 38% were male (70 respondents), with no respondents identifying as other genders. Geographically, 20.9% of the respondents (38 people) were from rural areas, while the remaining 79.1% (146 respondents) were from urban areas. This distribution highlights the gender and geographic diversity of the sample, which is crucial for understanding the perspectives of different groups on stubble burning. The higher proportion of urban respondents likely indicates greater awareness and visibility of the issue in urban settings.

STUBBLE BURNING: PROBLEMS AND SUGGESTIONS

Stubble burning poses numerous problems that not only threaten human health but also have a detrimental impact on the environment. This paper aims to highlight these problems and provide suggestions for addressing them. The following sections discuss the key issues associated with stubble burning and the potential solutions to mitigate its adverse effects.



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PROBLEMS CAUSED BY STUBBLE BURNING

Punjab, often referred to as the "Sone Di Chidi" (Golden Sparrow) due to its high agricultural productivity, is a major producer of rice and wheat. However, the large-scale cultivation of these crops leads to a significant issue with crop stubble, which creates major challenges for Punjab as well as neighboring states and union territories such as Haryana, Himachal Pradesh, and Delhi. Every year, a large amount of this stubble is burned, resulting in various environmental and health problems. Some of the key issues caused by stubble burning include:

Air Pollution: Stubble burning releases harmful pollutants such as methane, carbon dioxide, and other particulate matter into the air. These pollutants severely affect air quality and pose significant health risks, particularly for individuals with respiratory conditions. This includes symptoms like coughing, chest tightness, and wheezing, which can worsen chronic lung diseases.

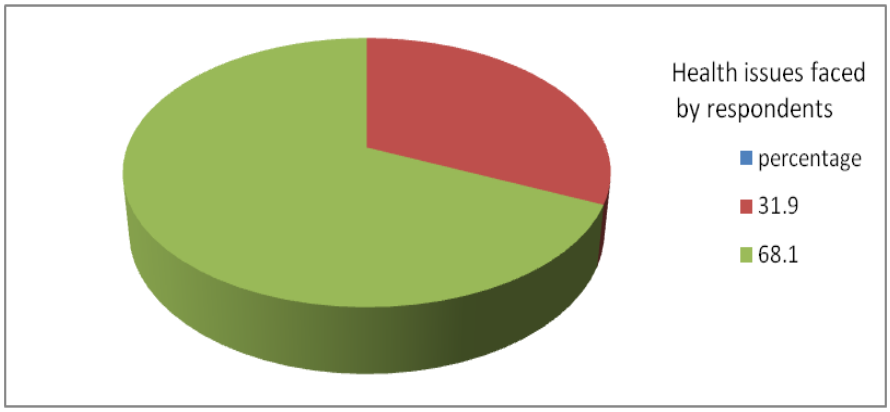

Figure No. 1: **Health issues faced by respondents**

Health Risks: The smoke produced by stubble burning contains harmful substances that pose significant health risks to both humans and animals. Exposure to this smoke can lead to eye irritation, skin allergies, and breathing issues, especially for individuals with pre-existing respiratory conditions. The toxic pollutants in the smoke can exacerbate asthma, bronchitis, and other respiratory disorders, contributing to long-term health problems.

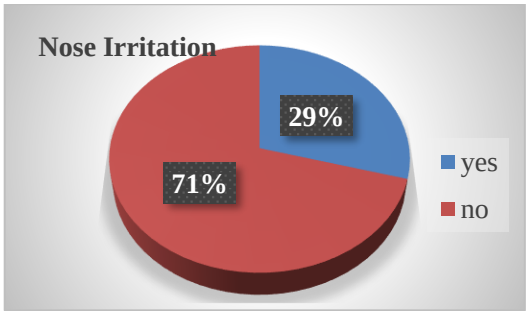

Figure No.3**: Nose irritation**

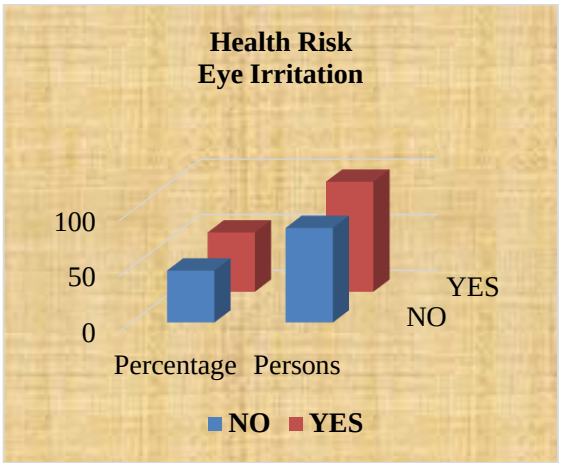

Figure No. 2: **Health risk eye Irritation**

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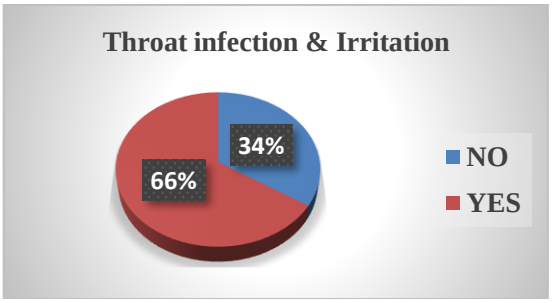

***Figure No. 4*: Throat risk eye Irritation**

Impact on Soil Health: Burning stubble reduces soil fertility by depleting essential nutrients, which negatively affects long-term agricultural productivity. As a result, farmers often resort to using strong chemicals to compensate for the lost fertility. The intense heat produced from stubble burning can also harm soil-dwelling organisms, disrupting the delicate balance of the ecosystem. For example, when rice stubble is burned, approximately 0.445 metric tons of NPK (Nitrogen, Phosphorus, and Potassium) may be lost from the soil.

Contamination of Water Quality: The ash and pollutants released during stubble burning can contaminate water bodies, causing harmful effects on aquatic life and deteriorating water quality. In Punjab, local farmers are increasingly drawing groundwater from deeper geological strata, which are often enriched with heavy metals and, in some cases, radioactive materials. This increased demand for groundwater poses significant health risks. Instances of deteriorating water quality are especially prevalent in the southwest region of Punjab. Once known as the 'Bread Basket of India,' Punjab is now unfortunately referred to as the 'Cancer Capital of India.'

Greenhouse Gas Emissions: The burning of stubble releases greenhouse gases (GHGs) such as carbon dioxide (CO2), carbon monoxide (CO), methane (CH4), and nitrous oxide (N2O) into the atmosphere. These emissions contribute to global warming and climate change. Between 2003 and 2019, exposure to particulate matter (PM) from stubble burning has been linked to approximately 44,000 to 98,000 deaths, with Uttar Pradesh, Punjab, and Haryana being the primary contributors.

Low Visibility and Risk of Road Accidents: The dense smog caused by stubble burning severely reduces visibility, hindering drivers' ability to see clearly and increasing the risk of accidents. In Punjab and Haryana, road accidents have become more frequent due to poor visibility caused by thick smoke from stubble burning. For instance, on a Friday afternoon, nine vehicles collided on the Bathinda-Chandigarh Highway near Lehra Mohabbat village in Bathinda due to reduced visibility from smoke. Seven vehicles were damaged, and five people were injured.

Figure:4.5 Low Visibility and Risk of Road Accident

SUGGESTIONS FOR STUBBLE BURNING

Stubble burning has undeniably become a major issue in North India, and many farmers believe it to be a necessary practice. However, this is a misconception, as there are several viable alternatives to solve the problem of stubble burning. The following suggestions can help address this issue:

Converting Stubble into Biomass and Fertilizers: Rather than burning the stubble, it is more beneficial to convert it into biomass and fertilizers. Pellets made from stubble can be used as fuel in thermal power plants and other industries. This not only has environmental benefits but also provides an opportunity for commercial use.

Use of Super Seeder Machines: The Indian agricultural sector is continuously evolving. Super seeder machines are becoming increasingly popular as they allow for both cultivation and harvesting processes to be more efficient. These machines are designed to cut and manage stubble in the fields, reducing the need for burning.

Reuse and Recycle of Stubble: Stubble can be repurposed for various uses, such as animal fodder, making cardboard, egg trays, organic products (like mattresses, baskets, and doormats), hot water boilers, industrial applications, and product packaging.

Awareness among Farmers: Several programs have been launched to raise awareness among farmers, such as the Crop Residue Management Scheme (2022), seminars, workshops, and campaigns aimed at educating them about the harmful effects of stubble burning and the alternatives available.
Anti-Stubble Burning Initiatives: Both the central and state governments have taken initiatives to combat stubble burning, including:
A 50% subsidy on super seeder machines, announced by the Punjab government.
Financial assistance of Rs. 100 per quintal to small and marginal farmers for the management of paddy stubble.

CONCLUSION

Rice-wheat crops are produced on a large scale in India, which leads to the generation of a significant quantity of stubble. A minimal portion of this stubble is processed for reuse, while the majority is burned each year, resulting in numerous problems such as air quality deterioration, environmental pollution, health issues, ecological imbalances, and the depletion of natural resources. According to the Indian Penal Code, Section 188, stubble burning is considered a crime. It is also classified as an offense under The Air Prevention and Control of Pollution Act, 1981. Despite these negative consequences, the Government of Punjab has implemented several measures to control stubble burning. These include imposing fines on farmers who burn stubble or violate environmental safety regulations. Additionally, the government organizes workshops to educate farmers about the adverse effects of stubble burning and provides information on how to reprocess stubble in an eco-friendly manner instead of burning it.The study found that while the Indian government has been working to curb the burning of agricultural leftovers since 2014, stubble burning remains a common practice in India (Deshpande et al., 2023). According to reports, the total agricultural area burned in the country increased from 3 million hectares in 2011 to 4.5 million hectares in 2020, with states along the Indo-Gangetic plains witnessing a 21% increase.

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