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Examining the statistics on the management and burning of paddy straw in Fatehgarh Sahib, Punjab

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Abstract

Paddy straw burning is a pressing issue in Punjab, especially in Fatehgarh Sahib district. In villages like Khant, Manpur, Kajouli, Kotli, Chhoti Rauni, Bari Rauni, and Kainaur, farmers often resort to burning paddy residue because they have limited alternatives. The high cost of labour and the short window between rice harvesting and wheat sowing leave them with little choice. Unfortunately, this practice leads to severe air pollution, damages soil health, and poses serious health risks for the local communities. This research explores the current state of paddy straw management in these villages, looking at the challenges farmers face and evaluating the effectiveness of government initiatives. We gathered insights through field surveys, farmer interviews, and secondary data analysis. While policies such as subsidies for straw management machines and awareness campaigns exist, their adoption has been inconsistent. Many small and marginal farmers struggle with financial limitations and logistical barriers in accessing these solutions, to tackle these challenges, we recommend a multi-pronged approach that includes better financial incentives for sustainable straw management, setting up community-based biomass processing units, and enforcing stricter regulations against burning. Encouraging in-situ decomposition techniques, like the use of the Pusa decomposer, can be a game changer. More importantly, fostering farmer cooperatives and capacity-building programs can help spread knowledge and drive collective action. In conclusion, while steps have been taken to curb paddy straw burning in Punjab, Fatehgarh Sahib district still faces significant hurdles. Stronger policy implementation, better access to alternative solutions, and greater farmer participation are key to making a lasting impact. This research on paddy straw burning in Fatehgarh Sahib, Punjab, reveals that while government initiatives like subsidies for straw management machines exist, adoption remains low due to financial and logistical challenges. Field surveys highlight that many farmers still resort to burning due to labor shortages, high costs, and lack of alternative disposal methods. Despite awareness of the negative environmental impacts, limited access to machinery and biomass processing units restricts sustainable practices. Strengthening farmer cooperatives, enforcing policies, and increasing incentives for alternative straw management techniques like mulching and composting are essential for reducing pollution and improving soil health.

Keywords: Paddy, agriculture, management, straw, burning

Introduction

North-India at present finds itself in the midst of a paradoxical situation of prodigious production of rice and wheat (food grains) for meeting the country's food security needs, co-existing with increasing problem of straw disposal. About 85-90 per cent of this paddy straw is burnt in the fields, and to some extent, wheat straw is also being burnt during the *rabi* harvesting season. Though, the problem of paddy straw burning exists in many states, the scale is larger in Punjab and Haryana. Air pollution not only poses health risks to humans and animals, but it also depletes the top soil layer of essential elements like potassium, sulphur, phosphorus, and nitrogen, rendering the land less fertile and eventually unusable for agriculture (Mandal *et al.*, 2004; Lohan *et al.*, 2018) [8, 7].

Farmers often turn to burning rice straw because there's only a short 2-3 week window between harvesting paddy and sowing wheat. This narrow time frame doesn't allow for the lengthy process of clearing the paddy straw from the fields. While wheat straw typically meets the need for dry fodder for cattle, sometimes additional basmati straw is used when necessary. Moreover,

fodder crops are grown in ample areas across the state. However, small and marginal farmers face significant challenges because the equipment and labour required to cut, collect, and transport the straw are expensive and often out of their financial reach.

Another issue is the high silicon dioxide content in the straw, which makes it difficult to decompose when left in the soil for the next crop. Incorporating the straw into the soil is physically demanding, requiring extra tillage, which in turn increases sowing costs for wheat. Farmers also worry about the potential for diseases or infections being carried into the soil if the straw is ploughed back. On top of this, there's a severe shortage of labour for gathering and storing rice straw, which often pushes farmers to burn it as a quicker, though harmful, solution (Sing *et al.*, 2019) ^[4, 5].

Punjab is known for its rice-wheat farming system and played a crucial role in feeding the nation, contributing nearly a third of the central pool of food grains in 2016-17 (Government of Punjab, 2017) ^[4,5]. While modern agriculture in the state helped meet food demands, it also brought about some environmental challenges, including a decline in biodiversity, soil fertility, and growing water scarcity (McIntyre *et al.*, 2009; Ramesh *et al.*, 2016) ^[9, 10].

The state's main challenge today is finding ways to boost crop productivity and profitability while addressing the harmful practice of burning agricultural biomass, which leaves behind harmful residues. There is a pressing need for an alternative farming system that is efficient in terms of energy, water, and labour—one that can sustain soil health and the environment while keeping costs low (Jat *et al.*, 2011; Gathala *et al.*, 2011) ^[3]. Fortunately, there have been advancements in agriculture, such as early-maturing rice varieties like PR121, PR126, and PR127, which help ease the farming process. Additionally, technologies like the Happy Seeder have been developed to prevent residue burning without raising field preparation costs or affecting crop yields. The Happy Seeder works by cutting and lifting rice straw, sowing wheat into the soil, and then spreading the straw as mulch over the sown area. This allows farmers to plant wheat right after harvesting paddy without the need to burn the straw for land preparation (Gupta, 2012) ^[6].

The economics of wheat production using conventional methods with alternative approaches like rotaseeders, zero tillage, and Happy Seeder. These studies aim to find practical solutions that benefit both farmers and the environment.

The economics of wheat farming using different methods of managing paddy straw, focusing on the practices followed by farmers during the 2017-18 season before sowing wheat. The research also aims to assess and compare the costs and returns from various resource conservation technologies used in wheat cultivation. By examining these methods, the study seeks to understand how different approaches impact the overall profitability and sustainability of wheat farming. (Tripathi *et al.*, 2013; Gupta, 2012; Sidhu *et al.*, 2010) ^[12, 6, 11].

This research paper focuses on paddy straw management and burning practices in the villages of Khant, Manpur, Kajouli, Chhoti Rauni, Bari Rauni, and Kotli. The study aims to explore the causes, impacts, and alternative solutions adopted in these villages. It will analyze farmer perceptions, economic constraints, policy interventions, and the effectiveness of existing straw management techniques such as Happy Seeder, bio-decomposition, in-situ incorporation, and straw baling.

By examining the ground realities of these villages, this research seeks to provide insights into the challenge's farmers face and the possible strategies for sustainable paddy straw management.

The findings will contribute to policy recommendations and practical solutions to reduce stubble burning while promoting environmentally friendly agricultural practices.

Materials and Methodology

This study was conducted to understand the issue of paddy straw burning in the villages of Khant, Manpur, Kajouli, Kotli, Chhoti Rauni, and Bari Rauni in Fatehgarh Sahib, Rupnagar district, Punjab. To gather the necessary data, a questionnaire was developed based on primary sources, and interviews were conducted with 113 farmers. A series of structured sessions were held to create the questionnaire, ensuring it addressed the objectives of the study. The data collection process involved using a systematic questionnaire and conducting in-person, door-to-door interviews. Additionally, personal interviews with senior farmers and residents from nearby villages were also conducted to gather qualitative insights.

Calculations

- Total number of farmers
- Number of farmers

Percentage Formula (%) = (Number of farmers/total numbers of farmers) * 100

Total number of farmers in all six villages

This table represents that in Khant (23) there is maximum number of farmers and in Kajouli (17) there is minimum numbers of farmers in all among 6 villages

Table 1: Represent total no of farmers in different villages

S.no	Village name	Number of farmers	Farmers in percentages (%)
1	Khant	23	20
2	Kajouli	17	14
3	Manpur	18	15
4	Chhoti Rauni	21	17
5	Bari Rauni	19	16
6	Kotli	22	18
Total		113	100

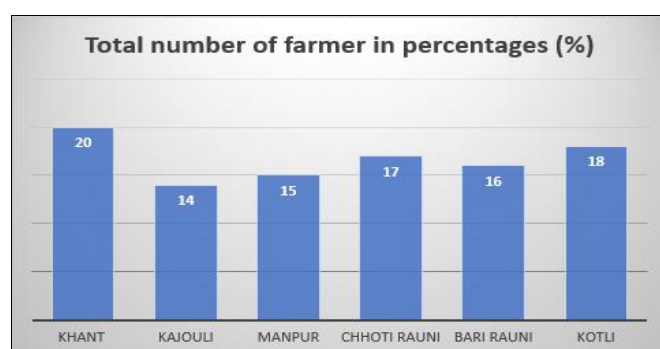


Fig 1: Graphical representations of farmers in villages

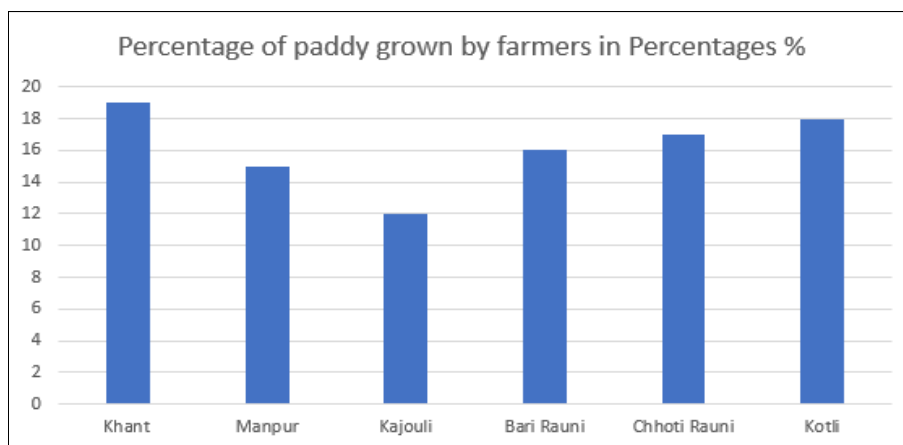
Results and Discussion

Paddy grown by farmer in village

From the data out 113 farmers, only 113 farmers grow paddy in their field. This (table 2) represents that maximum number of farmers in khant (22), and minimum number of farmer in Kajouli who grow paddy in their field as shown in (fig 2). This research examines agronomic practices in different villages, revealing that paddy is cultivated by nearly all farmers (100%), with wheat also being predominant (98%). It discusses various crop varieties and cultivation practices in the region (Bhuyan, 2023) ^[12].

Table 2: Represent data of farmer grown paddy

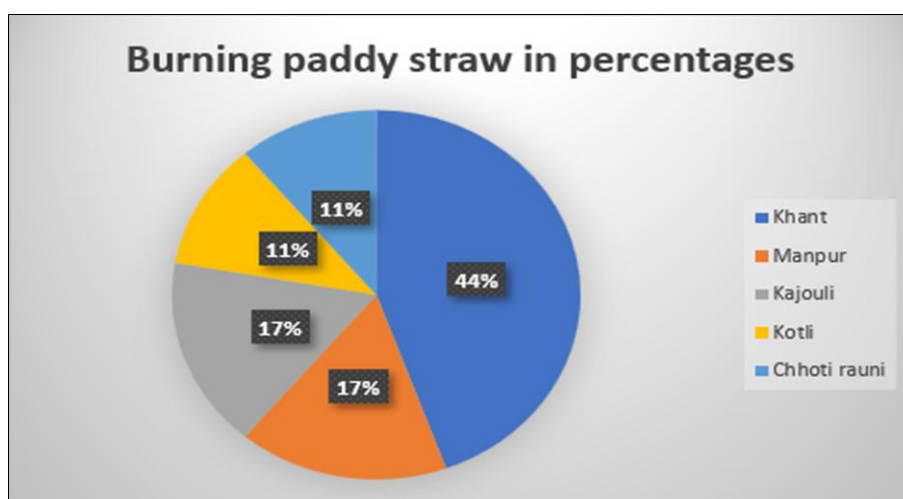
S.no	Name of villages	No. of farmers	Percentages %
1	Khant	22	19
2	Manpur	17	15
3	Kajouli	15	12
4	Bari Rauni	18	16
5	Chhoti Rauni	20	17
6	Kotli	21	18
Total		113	97

**Fig 2:** Graphical representation of farmer growing paddy**Paddy straw burning by farmers in different villages**

From the data of 113 farmers maximum number of the farmer of Khant (9) Burn paddy straw. And least number of farmer of Chhoti Rauni and Kotli (2). Burning of rice straw is responsible for emission of several gases like carbon dioxide (70%), carbon monoxide (7%), methane (0.66%), nitrous oxide (2.09%) which reduces the air quality and has negative impact on human and animal health (Krash, 2018) ^[13].

Table 3: Represent data of farmer

Sr. no	Village Name	No. of farmer burning paddy straw	Burning paddy straw in percentages (%)
1	Khant	9	8
2	Manpur	3	3
3	Kajouli	4	3
4	Kotli	2	2
5	Chhoti rauni	2	2

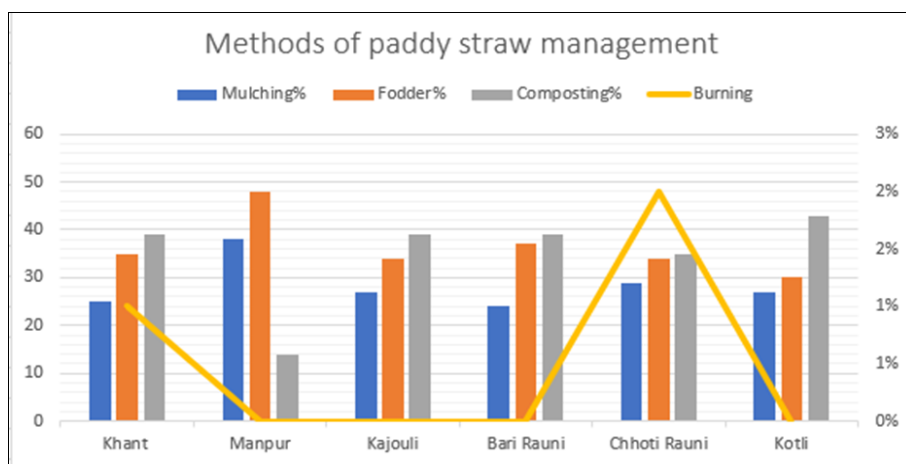
**Fig 3:** Graphical representation of burning paddy straw data**Methods of paddy straw management of different villages**

Paddy straw management is very important now a days. From the data of 113 farmers collected from different villages like in mulching as a management Manpur is maximum 38%, minimum Bari rauni 24%, as a fodder management manpur is maximum

48%, as composting kotli is maximum 43%. (Choudhary, 2020) ^[1] research entitled "Adoption of paddy straw management techniques in selected villages of Sangrur district of Punjab state and gather similar information of straw management.

Table 4: Represent data of paddy straw management from different villages

S.no	Village name	Mulching (%)	Fodder (%)	Composting (%)	Burning (%)	Total (%)
1	Khant	25	35	39	1	100%
2	Manpur	38	48	14	0	100%
3	Kajouli	27	34	39	0	100%
4	Bari Rauni	24	37	39	0	100%
5	Chhoti Rauni	29	34	35	2	100%
6	Kotli	27	30	43	0	100%

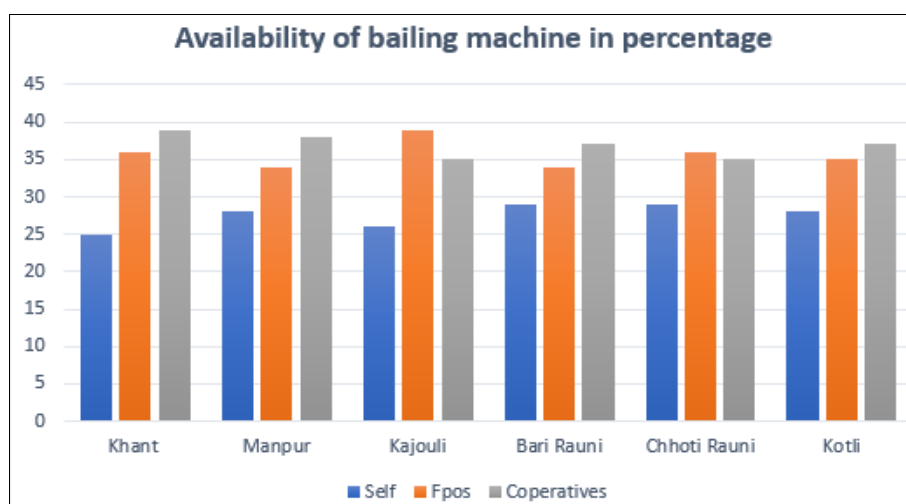
**Fig 4:** Graphical representation of paddy straw management

Availability of bailing machine

From the data of 113 farmers most of the farmers of Chhoti rauni (29%) and Bari Rauni (29%) have maximum no. of percentage of bailing machine. Bailing machine has automatic bale ejection and adjustable bale size. The use of such non-burning techniques to manage straw can have a significantly larger impact on reducing carbon emissions. The one tonne of straw is burnt, 3 kg of particulate matter (PM), 1.46 tonnes of CO₂, 60 kg of CO, 2 kg of SO₂ and 0.199 tonnes of ash are released (Gupta *et al.*, 2004)^[14].

Table 5: Represent data regarding availability

S. no	Village name	Self (%)	FPOs (%)	Cooperatives (%)	Total (%)
1	Khant	25	36	39	100%
2	Manpur	28	34	38	100%
3	Kajouli	26	39	35	100%
4	Bari Rauni	29	34	37	100%
5	Chhoti Rauni	29	36	35	100%
6	Kotli	28	35	37	100%

**Fig 5:** Represent availability of bailing machine

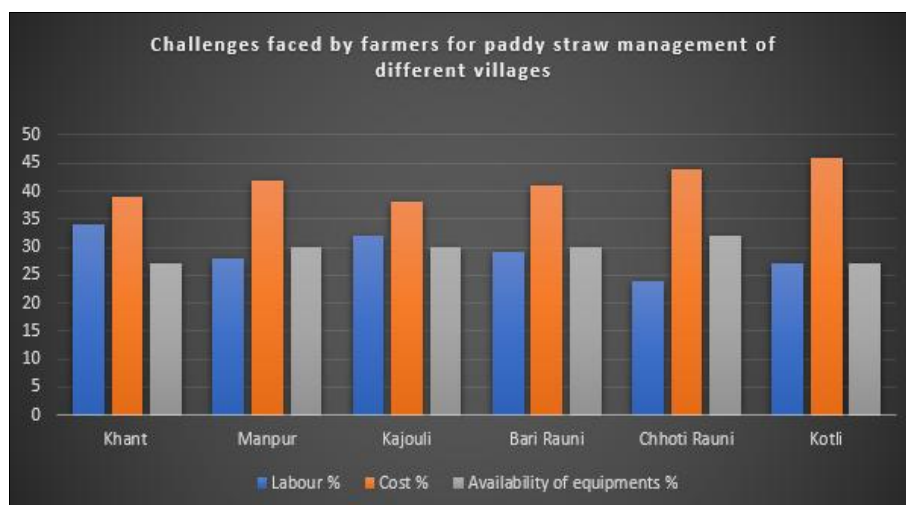
Challenges faced in adopting alternative straw management methods

This table presents data on labour availability, cost, and equipment availability in six villages. The key challenges this data highlights include: **Labour Shortages:** Labour availability is relatively low across villages, ranging from 24% to 34%. This indicates difficulties in finding sufficient workforce, which can slow down agricultural or infrastructural activities. **High Costs:**

The cost percentages are quite high, ranging from 38% to 46%, suggesting that undertaking projects in these villages is expensive. This could be due to high wages, material costs, or logistical expenses. **Limited Equipment Availability:** The availability of equipment is notably low, with the highest being just 32%. Villages like Khant and Kotli (27%) face the most significant shortages, making mechanized work more challenging and increasing dependence on manual labour.

Table 6: Represent the Challenges faced in straw management methods

S. no	Village name	Labour (%)	Cost (%)	Availability of equipments (%)
1	Khant	34	39	27
2	Manpur	28	42	30
3	Kajouli	32	38	30
4	Bari Rauni	29	41	30
5	Chhoti Rauni	24	44	32
6	Kotli	27	46	27

**Fig 6:** Graphical representation of challenges faced during straw management

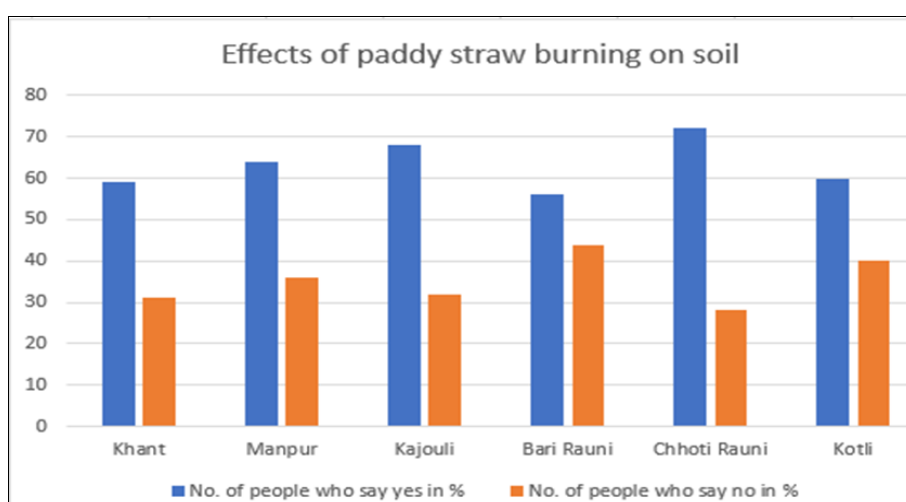
Effects of paddy straw burning on soil

From the data of 113 farmers most of the farmer agree in the chhoti rauni village that is 72% and most of the farmer deny in

the bari rauni village that is 44%. Most of the farmers are well aware about the ill effect of paddy straw burning on the soil.

Table 7: Represents the farmers data in adopting straw management

S. no	Village	No. of farmer who say yes in %	No. of farmer who say no in %
1	Khant	59	31
2	Manpur	64	36
3	Kajouli	68	32
4	Bari Rauni	56	44
5	Chhoti Rauni	72	28
6	Kotli	60	40

**Fig 7:** Represent graph of farmers regarding paddy straw effect on soil

Conclusion

Paddy straw burning remains a critical environmental and agricultural challenge in Punjab, particularly in Fatehgarh Sahib district. While various government initiatives and technological solutions, such as the Happy Seeder and Pusa decomposer, offer

alternatives to burning, their adoption remains inconsistent due to financial constraints, labor shortages, and limited awareness. The study highlights the need for a multi-faceted approach that includes improved policy implementation, enhanced financial support for farmers, and the establishment of community-based

biomass management facilities. Encouraging sustainable practices such as mulching, composting, and in-situ straw incorporation can significantly reduce the harmful effects of burning. Additionally, strengthening farmer cooperatives, increasing accessibility to modern equipment, and enforcing stricter regulations can facilitate the transition to environmentally friendly straw management methods. A collaborative effort involving farmers, policymakers, researchers, and local communities is crucial to ensuring long-term agricultural sustainability while protecting soil health and reducing air pollution. By fostering innovation and providing adequate support, Punjab can move towards a more sustainable and economically viable approach to paddy straw management.

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