



Stubble burning: Issues, Reasons and Problems : A Study of District Ferozepur

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Abstract: *The stubble burning issue is the hot and emerging issue. It is very important to understand the reasons of burning stubble. The scenario of stubble burning basically is the outcome of prevalence of rice-wheat rotation in the Punjab state. The paddy and wheat cultivation in the Punjab state has produced abundance of crop residues which is sometimes very difficult to manage. The handling of stubbles especially in the case of paddy involves very exhaustive procedure and it needs intensive farm machinery. In order to have a better understanding of the scenario of stubble burning and it's reasons, the perception of the sample farmers regarding stubble burnings have been discussed in this research paper.*

Key Words: *stubble burning, residue, cultivation, intensive, exhaustive, scenario.*

1. INTRODUCTION:

Indian agricultural scenario has surely undergone many drastic changes and has achieved many milestones. The green revolution has transformed India from a food deficient stage to a surplus food market (Nelson et al., 2019). The major research and development efforts in the 'green revolution era' in India resulted in varietal breakthrough in crops especially rice and wheat which provided opportunities for enhancing crops' productivity and cropping intensity at farm level and attained food security at national level (Smith et al., 2019). After green revolution, Agriculture in Punjab state on the one side based on high yielding seeds, chemical using production and protection technologies and intensive use of natural resources paid rich dividends by bringing manifold increase in food grain productivity and production, enhancing farmers' income, reducing poverty and contributing significantly towards attainment of food self-sufficiency at the national level but along with it has experienced serious consequences of over exploitation of groundwater resources (Davis et al., 2018), degradation of the Punjab soils due to mining of macro as well as micro nutrients (Singh and Benbi, 2016), high levels of pesticides used causing a major health hazard, increased emissions of green-house gases (GHGs), followed by stagnant or declining grain yields, shrinking profit margins and degradation of environmental quality (Narayanan et al., 2016). At the time of harvesting major crops such as rice and wheat generates a lot of residue which is termed as stubble. There is very little time available between harvesting and sowing season of wheat and rice therefore farmers frequently choose the easiest way to get rid off the residue generated along with harvested crop is burning in the fields itself especially in Punjab and Haryana. This practice is termed as stubble burning (Gupta et al., 2004). Earlier when the harvesting was done manually, stubble so generated was less in amount and could be managed by the farmers. But now with the arrival of machines for the purpose of harvesting, a large amount of stubble is generated which is difficult to handle for the farmers. Keeping in view of taking importance of this current issue for research, there is no specific solution for this problem. So, this research paper has been written to discuss about issues, reasons and problems of burning stubble. The present study has been undertaken to examine the Stubble burning: Issues, Reasons and Problems Ferozepur district of Punjab.

2. LITERATURE REVIEW :

Kumar et al. (2014) have attempted to estimate the monetary value of health damage caused by the smoke pollution emitted by the burning of rice and wheat stubble in the open fields in Punjab, India. Higher expenses were not only in terms of higher fertilizer but also in terms of higher irrigation requirement by those who burn their field to clear the stubble. Total annual welfare loss in terms of health damages due to air pollution caused by the burning of rice straw in rural Punjab amounts to 76 million. If one also accounts for expenses on averting activities, productivity loss due to



illness, monetary value of discomfort and utility and additional fertilizer, pesticides and irrigation, the losses would be much higher.

Devi et al. (2017) found in their research that crop residues are generally classified as garbage because they are not commercially exploitable. This agricultural waste management has definitely received only a small amount of attention so far. If farmers are not aware of its detrimental effects on soil quality, crop biodiversity, ecology, etc., imposing a ban on incineration of crop residues may not make sense. Some of the alternatives to incinerating agricultural waste include collecting and transporting it, using it as boiler fuel through gasification, turning it into biomass materials, developing an appropriate cutter, enabling it to compost naturally, and mulching it with straw using cone harrows, rotavators, direct seeding, and happy seeders. There are few opportunities to use crop wastes in novel ways. However, as more sectors use crop leftovers and the cost of raw materials rises, the desire for change is escalating quickly. However, there is still a need to focus and develop each sector's potential. The government's drive to produce energy from these residues has played a major part. This supports the notion that all parties involved will gain economically.

Kaur (2017) in her research found that farmers were well aware of the environmental issues associated with waste disposal and various concerns about them. She emphasised the limitations linked to the problem on the basis of the prevailing practices and the experience of farmers. Respondents made several suggestions for addressing these issues, involving government action, both cooperative and coercive. Some of the measures proposed by the researcher to deal with the problem could be raising awareness of the economic loss, strict implementation of the law prohibiting the incineration of crop residues, modified rental of expensive stubble cutting machines, off-farm use as suggested by farmers in industry, power generation, composting etc.

Singh et al. (2018) estimated in their study that when agricultural residues are burned, various trace gases such as CO₂, CH₄, NO₂, SO₂ and large amounts of particulates (PM₁₀ and PM_{2.5}) are released which have negative effects on human health. The main problems of the inhabitants are eye irritation, dry eyes and congested chest. It has also led to chronic obstructive pulmonary disease, pneumoconiosis, pulmonary tuberculosis, bronchitis, cataracts, corneal opacity and blindness. The number of traffic accidents also increases during the stubble fire season due to poor visibility. A suitable method to reduce this threat is the incorporation of straw into the soil, which eventually increases soil fertility. The crop residue can also be used in the traditional way for composting. The most surprising way to prevent this threat is to generate energy from biomass. In addition, many conversion processes have been developed in recent decades to produce alternative biofuels in various forms (pellets, briquettes) from crop residues. To combat this anthropogenic disaster, an integrated approach to the management of crop residues is necessary.

3. METHODOLOGY:

The present study was specifically conducted in the Ferozepur district of the Punjab state in the year 2021-22. The study was based on the primary data and a sample of 300 farmers was taken by random sampling technique. The primary data was collected from the sample farmers on well prepared, pre-tested questionnaire. Simple tools such as frequencies, averages, Likert scale and percentage were used to analyse the data, but some analytical techniques such as one-sample t-test and independent t-test were applied to draw some significant implication of the study.

4. RESULTS AND DISCUSSION:

Despite legal obligations, the problems of stubble burning have constantly been rising in the state. The stubble burning has been releasing many harmful gases which are the hazards to human and animal health and also disturb the ecological balance of environment. This issue has become a serious concern of state and central government and draw attention of researchers, scientists, and policy makers etc. to manage the rising problem of stubble burning across the various parts of the country particularly in the Punjab state. Keeping in view, this research paper is designed to identify the different issues, reasons and problems of stubble burnings in the Punjab state. The results have been explained under heads stubble burning Issues, Reasons and problems as under:

4.1 Perception of sample respondents with respect to stubble burning issues

The perception of the sample respondents regarding four statements namely 'Do you think stubble burning deteriorates the soil's organic content, essential nutrients and microbial activity?', 'Do you think you have to use extra fertilizer for next crop when stubble is burnt?', 'Do you see difference on soil surface when residue not burnt?' and 'Do you think that the local community views the burning of stubble as causing serious air pollution?' have been assessed and presented in Table 1. Considering the positive side of the statements as described in the Table 1. given below, 74 per cent of the respondents in the sample presumed that the stubble burning deteriorates the soil's organic content, essential nutrients and microbial activity. Like-wise, nearly 44.33, 73.33 and 71.00 per cent of the respondents were reported that



‘there needs extra fertilizer for next crop when stubble is burnt’, ‘there observed significant difference on soil surface when residue not burnt’ and ‘agree with the local community views as the burning of stubble causes serious air pollution’, respectively. Broadly, the sample farmers in this section have been exchanging their viewpoints regarding the benefits and problems of stubble burnings issue.

Table 1: Perception of sample respondents with respect to stubble burning issues

S. No	Statement	Response	Number	Percent
1	Do you think stubble burning deteriorates the soil’s organic content, essential nutrients and microbial activity?	Yes	222	74.00
		No	78	26.00
2	Do you think you have to use extra fertilizer for next crop when stubble is burnt?	Yes	133	44.33
		No	167	55.67
3	Do you see difference on soil surface when residue not burnt/?	Yes	220	73.33
		No	80	26.67
4	Do you think that the local community views the burning of stubble as causing serious air pollution?	Yes	213	71.00
		No	87	29.00

4.2 Reasons of stubble burning

To identify various reasons of stubble burning is the primary objective of the present study. To understand the issue of stubble burning, a variety of relevant literatures have been reviewed and finally 22 important reasons of stubble burnings have been identified and their description is given in Table 2. Likert scale was used to assess the responses of the sample respondents with respect to these reasons. Based on the scales given below, an average score of each respective reason was calculated.

Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly agree	5

Hence, the interpretation of the important reasons of stubble burning has been drawn by considering the value of mean score. More is the value of mean score, more important is the reason and vice versa. Considering ‘3’ as the critical limit, the value of mean score more than ‘3’ may be considered as the important reasons, while the value of mean score lie below the critical value of ‘3’ may be regarded as less important reasons. The value mean score worked out to be more than 4 in favour of the reasons such as lack of technological support for disposal of stubble, shortage of storage space for stubble, lack of resources to buy machinery for stubble collection, machinery not sufficient to manage the entire paddy crop residue within 25–30 day time, lack of financial resources for purchase of machinery, less efforts required for sowing next crop, expenses for transportation of stubble are high, so burning stubble is an easy option, burning is more economical than residue, lack of awareness about renting CRM machines and due to increase of fuel prices increase in the operating cost of CRM machines. The mean score with respect to all other reasons such as no incentive by government to not burn stubble, shortage of time between harvesting and sowing next crop, not easy to dispose of stubble, due to delays in the availability of machines shortage of labour for manual removal of stubble, to stop more weeds in the field, no economical use of crop residue due to large size of land holding, farmers stayed away from CRM machines for inadequate training, lack of awareness about alternative uses of stubble, stubble burning positively impact sowing of next crop and lack of awareness about ill effects of burning stubble lie between 3 to 4 and hence these reasons of stubble burnings may also be considered as important reasons as reported by the farmers. As such none of reasons are showing mean value less than 3 which indicates that all reasons of stubble burning may be considered as the important ones.

The perceived reasons of stubble burnings are supposed to vary in the sample. It is also assumed that the frequency distributions of the sample respondents with regard to different reasons of stubble burnings are differ from each other in the sample. One sample t-test has been applied to examine the significant difference of different reasons as against the hypothesized mean value. The test score or hypothesized mean was fixed at ‘3’ which is the median of 1 to 5 scales. The following hypotheses are to be :



Null Hypothesis (H₀): The mean score of different reasons is similar to hypothesized mean value i.e. equal to 3.

Alternative Hypothesis (H₁): The mean score of different reasons is differ significantly from the hypothesized mean value i.e. not equal to 3.

It is evident that the responses of the sample farmers with respect to all reasons were mostly towards the ‘agree’ and strongly agree’ and therefore the calculated mean value was more than 3 in favour of all reasons. One sample t-test revealed that the calculated t-value turned out to be very high than that of table and hence, the null hypothesis stand rejected. The shows that mean score of different reasons of stubble burning differ significantly in the sample.

Table 2: Main reasons and causes of stubble burning

(N=300)

S.No	Reasons of stubble burning	SD	D	N	A	SA	Mean score	t-stat
1.	Shortage of time between harvesting and sowing next crop	18	54	27	50	151	3.87	11.14*
2.	Shortage of Labour for manual removal of stubble	9	78	42	47	124	3.66	8.67*
3.	No economical use of crop residue	17	26	105	60	92	3.61	9.08*
4.	Burning is more economical than residue	9	8	29	149	105	4.11	21.31*
5.	Shortage of storage space for stubble	3	18	23	64	192	4.41	26.11*
6.	No incentive by government to not burn stubble	15	15	42	113	115	3.99	15.86*
7.	Lack of awareness about ill effects of burning stubble	20	46	91	80	60	3.38	5.68*
8.	Lack of awareness about alternative uses of stubble	12	70	59	96	63	3.43	6.30*
9.	Less efforts required for sowing next crop	18	11	15	108	148	4.19	18.83*
10.	Lack of financial resources for purchase of machinery	9	9	18	105	159	4.32	24.37*
11.	Lack of technological support for disposal of stubble	9	6	15	78	192	4.46	27.74*
12.	Lack of resources to buy machinery for stubble collection	12	8	21	77	182	4.36	23.44*
13.	Expenses for transportation of stubble are high, so burning stubble is an easy option	21	2	21	131	125	4.12	18.29*
14.	Not easy to dispose of stubble	21	24	45	93	117	3.87	12.40*
15.	Stubble burning positively impact sowing of next crop	26	52	51	111	60	3.42	5.96*
16.	To stop more weeds in the field	23	38	40	121	78	3.64	9.20*
17.	Due to delays in the availability of machines	9	47	34	96	114	3.86	12.75*
18.	Due to large size of land holding	15	69	38	81	97	3.59	7.90*
19.	Lack of awareness about Renting CRM machines	12	24	36	88	140	4.07	16.42*
20.	Due to increase of fuel prices increase in the operating cost of CRM machines	6	29	39	89	137	4.07	17.32*
21.	Farmers stayed away from CRM machines for inadequate training	17	57	50	102	74	3.53	7.58*
22.	Machinery not sufficient to manage the entire paddy crop residue within 25–30 day time.	6	27	28	39	200	4.33	21.15*

SA= strongly agree, A= agree, N= neutral, DA= disagree, SD = strongly disagree
 Test score=3.00

*significant at one per cent level of probability



4.3 Major problems faced by the sample farmers for retaining stubble in the field

Since stubble burning is very sensitive issue, therefore an attempt has been made to cover all aspects of the stubble burnings and its management. This section was focused to highlight the major problems encountered by the sample farmers for retaining stubble in the field. It is evident that the time of sowing wheat after the harvesting the paddy is very short time. Due to this small cap of time, it is very difficult to decompose paddy stubble in the field before sowing wheat crop. This is the most important problem which was reported by majority of the farmers i.e. 83.33 per cent of the total farmers. The other next important problems were increased risk of pests such as mice and snails, more weeds, more disease, decrease in plant populations, unaccountable yield losses, decrease in seedling vigour, increase the risk of frost in frost prone area, nitrogen tie-up and reduce herbicide efficacy which were reported by 82.67, 55.00, 41.67, 40.00, 37.00, 32.33, 14.67 and 7.00 per cent of the farmers, respectively.

Table 3: Major problems faced by the sample farmers for retaining stubble in the field

S. No.	Problems	Number	Percent
1.	It is very difficult to decompose the stubble before sowing the next season's crop	250	83.33
2.	Decrease in seedling vigour	111	37.00
3.	Decrease in plant populations	125	41.67
4.	More weeds	165	55.00
5.	More disease	151	50.33
6.	Nitrogen tie-up	44	14.67
7.	Unaccountable yield losses	120	40.00
8.	Increase risk of pests such as mice and snails	248	82.67
9.	Increase the risk of frost in frost prone area	97	32.33
10.	Reduce herbicide efficacy	21	7.00
11.	Other (please specify)	24	8.00

Although, the decomposition of stubble in the field could enhance the fertility level of the soil, but the procedure of decomposing paddy stubble in the field require some time for microbial activities for its proper decomposition. The wheat sowing with happy seeder or zero till machine have been providing shelter to mice and insects which could increase the probability of pest and disease attack on the wheat crop. The efficacy of herbicides is also reported to be declined upon the control of herbs and weeds in the wheat crop as reported by the sample farmers.

5. CONCLUSION AND RECOMMENDATIONS :

On the basis of this study, it can be concluded that the major reasons of stubble burning are i. Burning stubble is more economical, ii. Lack of shortage space, technological support, iii. Non-availability and non-affordability of machinery to manage stubble, iv. Increase in cost because of increased usage of fuel, increased cost of transportation. Apart from that some of the major problems faced by farmers while retaining the stubble are: lack of time to decompose the stubble, decrease in plant population, more weeds and diseases. The rice residues can be put to various uses, if managed properly with the active support of Govt. and other stakeholders and can be used in several useful alternative ways. Various alternatives are being proposed for the use of straw instead of burning it. Retention or incorporation is the most beneficial residue management practices. It has many advantages like, it sustains the productivity of soil as it can hold and supply the nutrients, reduce soil erosion from water and wind, act as mulch to conserve soil moisture and modify soil temperature and improve physical condition of soil (Mehta et al. 2013). It can be used for a number of alternate useful purposes such as live stock feed, fuel, live stock bedding, bedding for various vegetables like cucumber, melons etc. Apart from these usage certain measures are also required at the government level such as providing subsidy for buying suitable machinery for stubble retention, technological support, machinery, storage space on rental basis etc.

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