



Assessment of Farmers' Perception about Crop Residue Burning in Haryana

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ABSTRACT

The study was conducted in 2019-2020 to assess the perception of the farmers on crop residue burning (CRB) in Haryana. A total of 180 farmers from three purposively selected districts, namely Karnal, Kurukshetra, and Fatehabad from Haryana, were chosen to collect data. Stratified random sampling was employed in the selection of blocks, villages, and respondents. For measuring farmers' perception, a scale was constructed using Likert's method of summated ratings. Farmers perceived CRB as an economical and viable option and considered it an efficient practice. Most farmers did not perceive the happy seeder as feasible since it needed a high horsepower tractor. Farmers' perception was positively and significantly correlated with education, operational land holding, and annual income ($P < 0.05$). Hence, there is a need to promote community-based approaches like custom hiring centre, bio-mass-based power plants, mushroom cultivation, etc., through extension and advisory services. It may lead to adopting alternative crop residue management options and mitigating residue burning in the long run.

INTRODUCTION

Green revolution through the introduction of improved varieties and synthesized fertilizers made Indo-Gangetic Plain (IGP) self-sufficient to fulfil food demands (Pingali, 2012; Goutam, 2021). This boom in food grain came with many negative consequences caused due to intensive mono-cropping and indiscriminate use of synthesized input (Haidar, 2013; Singh & Kaskaotis, 2014). Therefore, with a significant amount of agricultural production, naturally, a huge amount of crop residue is generated. This problem led to intentionally setting fire to crop residue in open fields which became a bottleneck for sustainable environment and agricultural production.

Asian countries account for 34 per cent of all biomass burnt in the world and India accounts for 18 per cent of the total residue burning of Asian countries (Shaik et al., 2019). In India's Indo Gangetic region, around 24 per cent of generated residues were being burned in an open field (Ravindra et al., 2019; Ram et al., 2016).

Specifically, in Haryana state 9.08 MT surplus crop residue was burned in the field (NPMCR, 2017). It gives rise to the emission of heavy metals (HM) & dioxin. The combustion of biomass emits a variety of pollutants into the atmosphere, contributing to the degradation of air quality. Punjab and Haryana alone provide 48 percent of India's 13915 Gg (Giga gram=10 billion gram) rice straw surplus, which is vulnerable to open field burning (Gadde et al., 2009).

Other than the environmental impact, it also imposes a negative impact on rural people including respiratory problems, tuberculosis, and reduced visibility. In addition, it affects soil productivity by burning the essential nutrients inside the soil (Singh et al., 2018), reduces organic carbon content in the soil, and depletes beneficial microorganism populations. There are so many management alternatives available including in-situ and ex-situ management of crop residue (Singh et al. 2020). Still, farmers perceive CRB as the easiest & most economically feasible option for quick preparation of the field for next sowing. The major drivers to CRB are the short

time interval between the harvesting of Kharif (Rice) & sowing of Rabi (Wheat) crops, Scarcity of labour, less industrial demand for crop residue, etc. (Anuradha et al., 2021). Under Section 144 of the Civil Procedure Code (CPC) crop residue burning is prohibited. Farmers are well aware of detection, ban, imposed penalties on burning activities (Anuradha et al., 2021) despite all lucrative and punitive approaches to combat residue burning; it is widely practiced in the rice wheat-growing belt of India. Hence, there is a need to understand farmers' perceptions about crop residue burning and factors that are affecting the perspective of farmers.

METHODOLOGY

The study was undertaken during 2019-2020 at purposively selected Haryana province of India. Haryana is frequently referred to as the "Food Mine" of the country. Hence, it is obvious to produce a high volume of crop residue (27.83 MT) with grain production (NPMCR, 2017).

Haryana Space Applications Centre (2018) reported that major paddy stubble burning was found in Karnal, Kurukshetra, Fatehabad, Kaithal, and Sirsa districts in the previous five years. Based on this observation report, the top three districts viz; Karnal, Kurukshetra, and Fatehabad were selected purposively for study. Further, stratified random sampling was applied; two blocks were selected from each district, i.e. Nissing and Indri from Karnal, Sahabad, and Thanesar from Kurukshetra and Fatehabad, and Ratiya from Fatehabad Districts. From each block, three villages were selected randomly. Farmers were chosen based on criteria that had at least one acre of land and had been producing rice and wheat crops for the previous five years. Then ten farmers were selected from each village, constituting a sample size of 180 for the investigation. Interview schedules for socio-personal variables were developed. Socio personnel variables were all used to categorize the respondents using the cumulative square root frequency technique. A perception scale with 19 items was designed to measure farmers' perspectives regarding crop residue burning. The reliability of the total test was worked out by applying the Spearman-Brown prophecy formula.

The split-half method was used for testing the reliability of the perception scale. The empirical type of validity determination was used to calculate the scale's validity and was worked out by using the square root of its reliability. The reliability of the scale was 0.91 and validity was 0.89 which was significant at one percent level of probability. Farmers were asked to respond on a Likert-type five-point continuum scale. The score was designed as 5=Strongly Agree, 4=Agree, 3=Undecided 2=Disagree; 1=Strongly Disagree.

$$r_{(x,y)} = \frac{N\sum XY - \sum X\sum Y}{\sqrt{[N\sum X^2 - (\sum X)^2] - [N\sum Y^2 - (\sum Y)^2]}}$$

Karl Pearson's product-moment correlation coefficient (r) was employed to assess the degree of relationship between personal variable (x) & perception of the farmer about crop residue burning (y).

RESULTS AND DISCUSSION

Perception of farmers regarding crop residue burning

Table 1 shows the weighted mean percentage of each statement. Crop residue burning is an economically viable option for the farmers followed by the farmers for efficient straw management statement had the highest weighted mean percentage followed by every farmer is not able to use happy seeders because it requires very high power tractors for functioning with comprising of 89.33 per cent and 85.89 per cent, respectively. Farmers perceived that due to crop residue burning in Punjab and Haryana is often blamed for worsening air quality in the Delhi National Capital Region, this statement ranked 3rd with an 85.33 weighted mean. Followed by the statement that farmers perceive weeds can be controlled by open straw burning ranked 4th with 83.67 weighted means. The same results were shown by Lyngdoh (2018) that 80 per cent of respondent farmers and 66 per cent of extension personnel were agreed that weeds can be controlled by open straw burning. More than three fourth (86.66%) of the respondents agreed that crop residue burning depletes essential soil nutrients. This is why farmers

Table 1. Farmers' perception regarding crop residue burning

S.No.	Statements	Weighted mean (%)
1.	Loose straw creates a microenvironment that is susceptible to pathogen infection in the field	75.22
2.	Crop residue burning is an economically viable option for the farmers	89.33
3.	The role of the state pollution control boards should be more stringent	84.44
4.	Bailing is the most common practice followed by the farmers for efficient straw management	71.22
5.	Usage of paddy straw is limited to certain uses only	58.78
6.	The burning of straw depletes the important soil nutrients	64.11
7.	Stubble burning is the leading cause that results in a decline in soil fertility	49.11
8.	Intercropping is a valuable alternative for effective crop residual management.	76.78
9.	Weeds can be controlled by open straw burning	83.67
10.	Pest and pathogens can be controlled by straw burning	77.89
11.	Additional value of the stubble will create an economic impact for the farmers	52.78
12.	Open straw burning reduces organic carbon content in the soil	76.22
13.	Giving Rs. 2500/acre as compensation for small and marginal farmers for not burning stubble is a good initiative by the Government	81.11
14.	Linking the Panchayat for claiming compensation enhances the area covered.	81.11
15.	Crop residue burning in Punjab & Haryana is often blamed for worsening air quality in the Delhi National Capital Region	85.33
16.	Biofuel plants emerging to combat stubble burning are a sustainable solution.	65.22
17.	Custom hiring centers and straw bale units can also help in recovering the operational costs of the farmers.	79.44
18.	Paddy straw can be used as an alternative fuel option to meet local energy demands.	38.22
19.	Every farmer is not able to use Happy seeders because it requires very high capacity tractors for functioning	85.89

Table 2. Overall perception regarding the effects of crop residue burning

S.No.	Items	Positive effects f (%)	No effects f (%)	Negative effects f (%)
1.	Plant health	0 (0)	12 (6.66)	168 (93.33)
2.	Air	0 (0)	10 (5.65)	170 (94.45)
3.	Human health	0 (0)	33 (18.33)	147 (81.66)
4.	Animal health	0 (0)	56 (31.11)	124 (68.89)
5.	Biodiversity	0 (0)	51 (28.33)	129 (71.67)
6.	Vehicular traffic	0 (0)	55 (30.56)	125 (69.44)
7.	Soil health	0 (0)	47 (26.11)	133 (73.89)

have to increase the dosages for fertilizers for the next crop, which has been depleted through the burning of straw in the previous season. The findings were similar to Heard et al., (2006). With an 81.11 weighted mean, nearly three of the respondents agreed that granting rupees twenty-five hundred per acre as compensation for small and marginal farmers for not burning stubble is a good government initiative. Nearly 71 per cent of the respondents agreed that bailing is the most common practice used by farmers recently. Paddy straw can be used as an alternative fuel option to meet local energy demands statement had the lowest level of weighted mean percentage followed by stubble burning is the leading cause that results in a decline in soil fertility, comprising 38.22 per cent and 49.11 per cent, respectively.

The overall perception of farmer respondents regarding effects of crop residue burning

The data in Table 2 depicted that majority of the farmer respondents agreed that crop residue burning harms plant health, air, human health, animal health, biodiversity, vehicular traffic, and soil health. The respondents mentioned that crop residue burning had no positive effect along with this it revealed that the negative effect of the crop residue burning was not constant which usually last only for a few days after rice harvesting. The study's findings were similar to Roy and Kaur (2015) reported that crop residue burning leaves a negative impact on the environment in the long run. And Dupdal et al., (2021) also revealed that Farmers have experienced a variety of climatic conditions, including decreased and erratic rainfall, rising temperatures in recent years, and frequent monsoon failures, all of which are impacting our agriculture productivity.

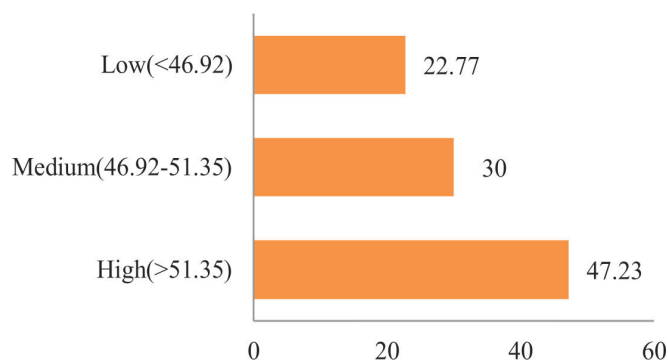
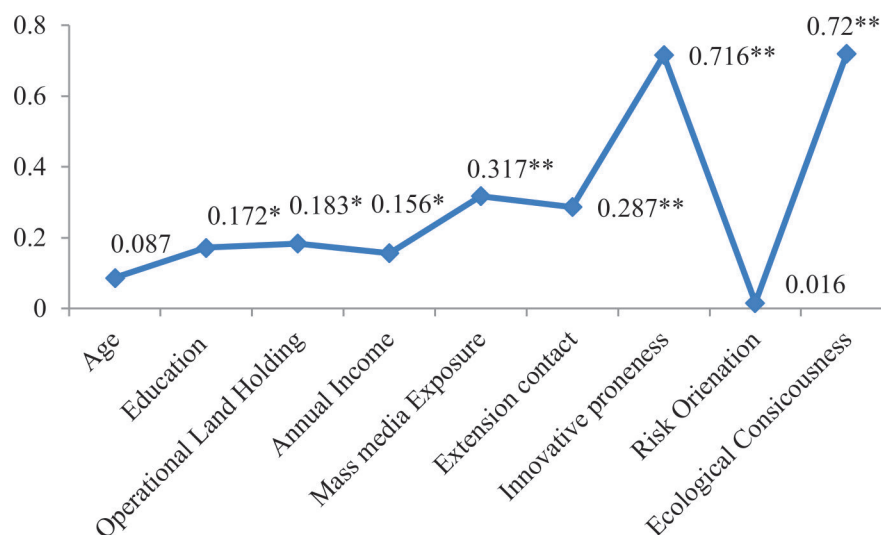
Figure 2. Relationship of various independent variables with the perception of the farmer regarding crop residue burning**Figure 1.** Perception level regarding crop residual burning
** $P < 0.01$ * $P < 0.05$

Figure 1 shows that less than half (47.23%) of the respondents had a positive perception because they know residue burning imposes a harmful effect. Out of 180 respondents, only 22.77 per cent of the farmers had a less positive perception about crop residual burning.

Factors influencing perception level of farmers regarding crop residue burning

The relationship of various independent variables with the farmer respondents' perception has been presented in Figure 2. The perception score of respondent farmers was not significantly correlated with age. Similar studies reported by Baksh et al., (2015) that the age of farmer respondents was non-significant with perception. It implies that age does not affect perception level

because perception is all about knowing or viewpoints about certain things. The respondents' perception scores were positively and significantly correlated with education, operational land holding, and the annual income of respondents at a 5 percent level of significance ($P < 0.05$). A study by Roco et al., (2015) also found that the farmer respondents' education was significant with perception. The findings revealed that more educated and more landholding had a clearer perception of the environment. A positive and significant relationship was found between the farmer respondents' perception and variables viz. mass media exposure, extension contact, innovative proneness, and ecological consciousness at 1 percent level of Significance ($P < 0.01$). The result shows that more mass media exposure had a more positive effect on perception level about the effect of crop residue burning on the environment. This result contradicts Lyngdoh (2018), who reported that operational land holding, annual income, mass media exposure, extension contact, and innovative proneness were not significantly correlated with the perception of farmers.

CONCLUSION

Farmers perceived that crop residue burning negatively affects the plant, soil, air, and human health. The majority of the farmers perceive that crop residue burning is economically feasible and requires fewer efforts to manage and burning helps to reduce weed, insect pest infestation in the field. As education was significantly correlated with perception, it is recommended for approaches that make farmers well aware of the harmful long-term effect of crop residue burning on soil environment and human health. It will lead to the adoption of alternative options to manage crop residue in their farms. Also, there is a need to provide management machinery, technical backup and financial assistance at the village or community level for better access.

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