



Crop Residue in Punjab Agriculture- Status and Constraints

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ABSTRACT

With 70 per cent of net sown area under paddy in kharif season and 84.6 percent of it under wheat crop in rabi season , the crop residue is generated in huge quantities. Out of this 95 per cent of paddy straw and 25 per cent of wheat straw is burnt each year. The hazardous practice has affected health, air ,road safety, soil etc. leading to massive physical as well as monetary losses. The present study has been based on primary data collected from three agri-economic zones of the state to highlight the constraints pertaining to the issue. For the state as a whole, 67.47 per cent of the total sampled farmers reported not burning the residue of the crops. Lack of buyers, shortage of time for next crop, lack of assistance by the state government and labour shortage emerged as the major reasons for the ongoing practice. Measures like utilizing it as animal feed, subsidy on machines like 'Happy seeder' generating lesser amount of straw during harvesting, use in cardboard factories, power generation, compost making, new crop varieties producing lesser residue as well as lower wages to carry on manual harvesting were suggested by the sampled farmers to deal with the issue. Creating awareness among farmers about eco-loss and significance of the problem itself at various fora along with strict implementation of the law prohibiting the burning of crop residue can be of further help in handing the major concern of the state.

Key Words: Crop Residue, Agriculture, Status, Constraints, Suggestions.

INTRODUCTION

There is a large variability in production of crop residue, and their use depends on the crops grown, cropping intensity, and productivity in different regions of India (Singh and Sidhu, 2014). Cereal crops (rice, wheat, maize, millets) contribute 70 per cent of the total crop residue (352 Mt) comprising 34 per cent by rice and 22 per cent by wheat crops. The rice-wheat system accounts for nearly one-fourth of the total residue produced in India. The surplus residue of crops (total residues produced minus the amount used for various purposes) is traditionally burnt on-farm. The amount of surplus crop residue available in India is estimated between 84 and 141 Mt per annum where cereals crops contribute 58 per cent. Of the 82 Mt of surplus of it nearly 70 MTs (44.5 Mt rice straws and 24.5 Mt wheat straws) are burnt annually.

Punjab is predominately an agrarian state and largest contributor of food grains to the central

pool. With 28 lakh hectares under wheat and paddy cultivation in the state, a total of 47.2 lakh tones of straw is generated every year. This included 25 lakh tones of wheat straw and 22 lakh tones of paddy straw. Out of this 95 per cent of paddy straw and 25 per cent of wheat straw is burnt each year. The mechanized harvesting of these crops has further added to the quantity of residue. At the time of manual harvesting, the straw was chopped into small pieces and ploughed back into the soil to improve its content. Though, a ban was imposed on stubble burning by the state government way back in 2005, but the practice is still going on due non- implementation of the ban. The problem has been highlighted by the United States National Aeronautics and Space Administration (NASA) and Supreme Court of India has also taken a serious note of it, but of no avail. Impact is manifold i.e. air as well as soil pollution, health hazards, road safety etc. Air pollution caused by the residue burning

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especially with paddy stubble is increasing every year. The air quality deteriorates during that time. The carbon dioxide level in air shoots up by 70 per cent, while concentration of carbon monoxide and nitrogen dioxide rises by 7 percent and 2.1 percent, thus causing respiratory and cardio vascular problems.

According to study conducted by centre for sustainable agriculture, Hyderabad, the burning of a tonne of straw releases 3 kg particulate matter, 60 kg. carbon monoxide, 1460 kg. carbon dioxide, 199 kg ash and 2 kg sulphur oxide in the air. Apart from this, the practice causes massive loss to the soil, both in terms of nutrients and micronutrients. As per the study conducted by Department of Soils, PAU, Ludhiana in 2010, the soil loses 6-7 kg nitrogen per tonne, 1-1.7 kg phosphorus, 14-25 kg potassium and 1.2-1.5 kg sulphur due to stubble burning. This leads to an additional expenditure of Rs. 150 crore per year to replenish the soil. Preservation of organic carbons is must as these boost the water holding capacity of the soil. About 38 lakh tones of organic carbon is lost every year due to burning of soil and 32 kg of urea, 5.5 kg diammonium phosphate and 51 kg of potash per acre is lost.

The loss of fertility leads to loss of one quintal extra yield of wheat crop and that could be obtained if the farmer ploughs back the paddy straw into the fields. So, the monetary losses attributed to this practice have been estimated at around Rs. 500 crore per annum in terms of loss of fertility, additional nutrients and loss of yield due to stubble burning. Burning of wheat/paddy straw raises the temperature of the soil in the top 3 inches to such high degree that the equilibrium of carbon: Nitrogen ratio (11:1), the percent bacteria (4:1), and the percent fungi (9:1) are rapidly changed. Keeping in view the above mentioned facts, the present study was undertaken to highlight the quantity of crop residue generated in two cropping seasons as well as constraints related to its management in Punjab.

MATERIALS AND METHODS

The study has been based on primary data collected from farm households of different

categories in Punjab and was devised on randomly selected 10 blocks from three agri-economic zones viz. sub- mountainous zone, central plain zone and south western zone of the state. At second stage of sampling, two villages were selected from each selected block and 25 farm households were selected from each village based on size of their operational holding and were divided into three categories i.e. small(up to 2 ha), medium(>2-4 ha) and large(> 4 ha). Thus, the ultimate sample consisted of 495 farm households in proportion to the size holding structure existing in that particular village. To find out the extent of generation of crop residue at farm level, its disposal pattern as well as the constraints faced by the farmers in its management, primary data were collected from selected sample of farm households across the state through especially structured and pre-tested questionnaire through personal interview method. Suggestions were also sought from the respondents to deal with the issue. The primary data were supplemented with secondary data on some parameters. Statistical techniques like percentage, average etc. were worked out for the variables.

RESULTS AND DISCUSSION

Punjab has witnessed high cropping intensity with emergence of rice-wheat system since the inception of green revolution. With 70 per cent of net sown area under paddy in kharif season and 84.6 per cent of it under wheat crop in rabi season, the crop residue is generated in huge quantities under this cropping system.

Wheat is the main Rabi crop in sub-mountainous zone of the state (Zone I). The study found that in this zone on an average 11.21 q/farm of wheat straw was generated. In kharif season, residue of paddy here was 7.43q/farm, maximum being on medium farms i.e.13 q/farm and of maize was 12q/farm. The respondent farmers when questioned about disposing pattern of the straw, majority denied burning the residue. In I zone, wheat and maize being the main crops 95.65 percent of the farmers reported not burning the stubble. Here, only one

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small and one medium farmer cultivating paddy have reported burning of crop residue in kharif season.

Central plain zone of the state (Zone II) is the wheat-paddy zone. The residue generated in this zone was estimated to be 14.96q/farm for wheat crop and 11.9q/farm of paddy. For other kharif crops it was found to be 18.23q/farm. In this zone 58 per cent of the respondents reported that they have not resorted to burning of the straw, with maximum number of small farmers denying the practice.

The third zone of the state is the cotton belt with cotton as main kharif crop. In this zone on an average residue generated of wheat crop was 13.97q/farm. With small area under paddy, the residue generated was also less i.e. 2.28q/farm. In case of cotton crop it was estimated to be 12.56 q/ farm. In this zone 77.48 per cent of the respondents denied the practice of burning the residue.

For the state as a whole, 67.47 per cent of the total sampled farmers reported not burning the residue of the crops. On the whole, residue generated of wheat crop was about 14.31q/farm, 5.78q in case of paddy and 16.37q/farm for other crops but 75.67 per cent of the small farmers, 65.32 per cent of medium farmers and 57 per cent of large farmers denied the burning of crop residues.

Residue Disposal

With mechanized harvesting residue is left in the fields. While about 75 per cent of wheat straw is collected as fodder for animals, rice straw is considered poor feed for animals due to its high silica content. Therefore, management of paddy straw is more serious problem than that of wheat (Ladha *et al*, 2000). Added to this there are factors like shorter time gap between harvesting of paddy and sowing of wheat, scarcity of labour as well as lack of proper technology of crop residue management. With lesser options available at the farm level farmers are reluctant to clear the fields with chopper as it adds to their cost. So, burning of crop residue seems the quickest and cheapest option to clear the fields in the absence of strict implementation of the law against this practice. Presently, more than 80 per cent of total rice straw produced annually is being burnt by the famers in 3-4 weeks during October-November (Singh *et al*,2010).

Reasons for Burning of Crop Residue

Sampled farmers resorted to multiple responses for justifying the practice of stubble burning. In zone 1, the reason that dominated for undertaking the practice was lack of State Government's assistance to dispose it off in any alternative way. One farmer also reported the shortage of labour and higher wages for disposing it off. Farmers also reported that there were no takers for the residue.

Table 1. Constraints regarding disposal of crop residue reported by sampled farmers.

Punjab	Small	Medium	Large	Total
Labour shortage and costly	10(4.50)	4(3.22)	2(14.09)	35(7.07)
Preparation for Next crop	27(12.16)	26(20.96)	38(25.50)	91(18.38)
Shortage of time	25(11.26)	14(11.29)	28(18.79)	67(13.53)
Lack of machinery	3(1.35)	3(2.41)	4(2.68)	10(2.02)
Costly Machines	2(0.90)	1(0.80)	5(3.35)	8(1.61)
Lack of buyers	41(18.46)	27(21.77)	25(16.77)	93(18.78)
Not easy mixing in fields	0(0)	1(0.80)	2(1.34)	3(0.60)
No Govt. help for sale of residue	19(8.55)	26(20.96)	28(18.79)	73(14.74)

Figures in parenthesis indicate the percentage to total.

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In zone 2, where highest number of farmers accepted that they are going in for burning of straw, gave the reason that they could not find the buyers for the residue especially of paddy. The haste to sow next crop was also cited as a reason by a large number of farmers. Shortage of time to clear the fields as well as shortage of labour was also quoted as the reasons for the practice. Again, lack of state help to dispose it off lucratively emerged as a major reason for burning it. Small number of respondents about, 1 per cent also found lack of proper machinery to dispose off the residue or if it is available it is very expensive.

In south-western zone (zone 3) of the state also, lack of buyers for the crop residue emerged as the major reason for burning it. Shortage of time and haste to clear the fields for next crop were the other important reasons. No assistance provided by the state government was given an important reason by the large number of farmers in this zone. They also quoted labour shortage as a reason for it. In the light of reasons quoted by respondents for stubble fires, the experts also support that mechanized harvesting has been adopted by the farmers, but when it comes to straw management machinery, they do not show any interest.

Punjab Agricultural University as well as state government has come up with machines like happy seeders, straw choppers and other harrow machines, but their prices run into lakhs of rupees. So, there is lack of technological support to the farmers in this aspect. Then, ignorance on the part of farmers regarding loss of soil fertility with this practice is also one of the major reasons. The National Farmers Empowerment Initiative (NFEI) is of the opinion that there was no short duration variety of wheat with optimum yield in the state. So, even a delay of one week in the sowing of wheat crop resulted in a loss of 375kg produce per hectare as the grain shriveled up in february-march due to rise in temperature. So, this adds to severity of problem in paddy crop, as farmers want quick clearance of their fields for wheat crop.

Suggestions regarding residue disposal

In zone I, 100 per cent of the sampled farmers were against burning to straw. The major suggestion given by about 35 per cent of the farmers was that dairy farmers should take away the residue and prepare it as an animal feed. 32 per cent opined that it should be utilized to generate energy. 28 per cent

Table 2. Suggestions regarding residue disposal by sampled farmers.

Suggestion	Small	Medium	Large	Total
It should not be burnt	222(100)	124(100)	149(100)	495(100)
Lack of buyers	8(3.60)	6(4.83)	5(3.35)	19(3.83)
Develop new variety	5(2.25)	3(2.41)	4(2.68)	12(2.42)
Subsidized machines for disposal	27(12.16)	15(12.09)	28(18.79)	70(14.14)
Industrial use like Card board factories	12(5.40)	4(3.22)	7(4.69)	23(4.64)
Power generation	21(9.45)	15(12.09)	10(6.71)	46(9.29)
Govt assistance to sell	68(30.63)	50(40.32)	62(41.61)	180(36.36)
Need for cheap Labour	2(0.90)	1(0.80)	2(1.34)	5(1.01)
Low price	0(0.0)	1(0.80)	0(0.0)	1(0.20)
Use to feed cattle	34(15.31)	16(12.90)	8(5.36)	58(11.71)
Mix in Soil	16(7.20)	18(14.51)	37(24.83)	71(14.34)
Use in dairy farms	80(36.03)	37(29.83)	25(16.77)	142(28.68)
Given free	47(21.17)	21(16.93)	17(11.40)	85(17.17)

Figures in parenthesis indicate the percentage to total

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of the respondents suggested that it should be sold to cardboard factories. 8 per cent were willing to give it without any change to any user. 6 per cent sought help of the government in disposal of straw, while 4 per cent stressed on development of new varieties generating less stubble and thus no need of burning it. The main suggestion put forward by majority of respondents i.e. 43 per cent in zone 2 was need of government assistance in crop residue disposal or the farmers showed their helplessness to dispose of the massive straw generated in this zone. About 20 per cent of the respondents were in favour of selling it to dairy farmers so that they can convert it into animal feed. 20 per cent were in favour of subsidy on the machinery that can dispose it off. In the absence of any buyers for the stubble, 17 per cent were willing to give it free if anybody can put it to same use. 14 per cent of sampled farmers favoured its mixing in the soil on scientific lines to improve the nutrient status of the soil. Nearly 3 per cent of respondents favoured the development of those varieties producing less stubble.

All the sampled farmers of zone 3 were against the burning of straw. Here also, the major suggestion given by 43.7 per cent of respondents was to convert it into animal feed by dairy farmers. 32 per cent of sampled farmers favoured government assistance to dispose it off. Due to lack of any takers more than 20 per cent of farmers were ready to dispose it off without any charge for any purpose, 20 per cent of the farmers also suggested mixing of residue in the soil as per recommendation. However, 7 per cent demanded subsidy on expensive machinery that generates lesser straw while harvesting, 6 per cent of the farmers proposed to generate energy from the straw and 3 per cent suggested that cardboard factories should utilize it.

So, it was found that all the sampled farmers were against burning of crop residue in principle, but majority of them could not find any solution at individual level and were seeking government assistance to dispose it off. About 29 per cent suggested utilizing it as animal feed and 14 per cent want subsidy on machines like 'Happy

seeder' generating lesser amount of straw during harvesting. As there was no useful alternative to the farmers, so in the absence of any buyer, 17 per cent were willing to give free to who so ever put it to any use. 4 per cent of the respondents suggested that it should be used by cardboard making factories, small proportion of respondents favour that new crop varieties should be developed producing lesser residue as well as lower wages to carry on manual harvesting rather than machined which, generates more residue.

CONCLUSION

Thus, it is clear that farmers were well aware about the environmental problems related to residue disposal and various concerns thereof. They highlighted the constraints regarding the issue on the basis of prevailing practices as well as their experience. Different suggestions were put forward by the respondents to tackle these concerns, involving government action whether co-operative or coercive. Some measures to deal with the problem can be creating awareness among farmers about eco-loss and significance of the problem itself at various fora, strict implementation of the law prohibiting the burning of crop residue, custom hiring of expensive machinery for chopping of stubble, off farm utilization as suggested by farmers in industry, power generation, compost making etc.

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