

# Status and Problems of Paddy Straw Management in West Bengal

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**Abstract**—West Bengal is the highest paddy producing state in India with a large portion of paddy straw being generated in West Bengal. In the states like Punjab and Haryana, a large portion of paddy straw is subjected to burning in field primarily to clear the field prior to sowing of the wheat crop. On the contrary, West Bengal is such a state where there is no burning of paddy straw. The authors felt it important to highlight the status and awareness of the farmers regarding paddy straw management in West Bengal who were not burning paddy straw and the factors behind this status. Also, the study elucidated the problems of farmers regarding paddy straw management. The study was conducted in the major paddy growing district in West Bengal i.e. Burdwan and a total of 60 farmers were selected for this study. The result revealed that 100 per cent farmers were using paddy straw as animal feed followed by thatching purpose. All the farmers were aware about use of paddy straw as animal feed, cooking and packing purpose whereas very few farmers were aware about use of paddy straw as material of paper mill industry and power mill industry. Henceforth, it is important to create awareness among the farming community about various alternatives of paddy straw management by constantly enriches its genetic resources by tapping the biodiversity and utilizes them for utilizing traditional and innovative technologies. Capacity building of human resources including scientists, farmers and other stakeholders in this regard needs to be a priority concern in extension and government agencies. It is also necessary to focus on the problems faced by the farmers regarding paddy straw management with due attention on extension services and fostering linkages and collaborations with public, private, national and international organizations are other important areas of consideration.

**Keywords**—Status, Awareness, Problems, Paddy Straw Management.

## I. INTRODUCTION

**R**ICE- WHEAT cropping system is the most prominent in India and India ranks second in paddy production in the world after China (Anonymous 2015a) and West Bengal is

the major paddy growing state in India with a production of 15023.68 thousand tonnes (Anonymous 2015b) and at the same time a huge amount of paddy straw i.e. 35.93 million tonnes is also generated in this state (Anonymous 2009a). Depending on the crops grown, cropping intensity and productivity in different regions of India, there is a large variability in generation and end use of these crop residues. In the northern states of India, a large portion of paddy straw is subjected to burning (Sood 2013) in fields primarily to clear them prior to the sowing of wheat crop. Out of 82 Mt surplus crop residues from the cereal crops, 44 Mt is from rice crop which is mostly burnt on-farm (Derpsch and Friedrich 2010 and Pathak et al 2010). Contrary to this, there is no burning of paddy straw in West Bengal and it is used for various other purposes such as cattle feed, thatching for rural houses, fuel for residential cooking and industry, mulching material, etc. (Anonymous 2014a). Paddy straw can also be used for gasification, bio char production, power generation, paper mills etc. (Anonymous 2013a). Paddy straw and husk is used as domestic fuel or in boilers for parboiling rice in West Bengal (Anonymous 2014 b). Farmers use residue either themselves or sell it to other landless households or intermediaries, who in turn sell the residues to industries (Anonymous 2014 c). There are several productive techniques for paddy straw management that can be used such as composting (Truc et al 2012), input for generation of energy (Anonymous 2009 b), production of biofuel (Anonymous 2009 b) and recycling in soil (Gadde et al 2009). Conservation agriculture (CA) also offers a good promise in using these residues for improving soil health, increasing productivity, reducing pollution and enhancing sustainability and resilience on agriculture (Pathak et al 2010). The resource conservation technologies (RCTs) involving no-or minimum-tillage, direct seeding, bed planting and crop diversification with innovations in residue management are possible alternatives to the conventional energy and input intensive agriculture (Anonymous, 2013a). Worldwide about 105 Mha land is under CA (Anonymous 2013b) and the area is increasing. Permanent crop cover with recycling of crop residues is a prerequisite and integral part of CA, which is advocated as alternative to the conventional production system for improving productivity and sustainability (Pathak et al 2010, Liu et al 2008). The Resource Conservation Technologies (RCTs) with innovations in residue

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management avoid straw burning (Derpsch and Friedrich 2010), improve soil organic Carbon (Singh et al 2010), are input efficient and have potential to reduce GHG emissions (Anonymous 2013 a). A series of challenges exist with higher level uses of paddy straw in Conservation Agriculture. These include different disease, insect or weed problems ( Anonymous 2013 b, Liu et al 2008) and difficulties with more residues on the surface to proper seed, fertilizer and pesticide placement ( Pathak et al 2010, Gadde et al 2009). Nutrient management may become complex because of higher residue levels (Anonymous 2012) and reduced options with regard to method and timing of nutrient applications (Derpsch and Friedrich, 2010).

The crop residues play an important role in amelioration of soil acidity through the release of hydroxyls especially during the decomposition of residues with higher C: N ratio (Liu et al 2008), and soil alkalinity through decomposition of residues from lower C: N ratio from crops including legumes, oilseeds and pulses (Pathak et al 2010). The role of crop residues on carbon sequestration in the soil would be an added advantage in relation to climate change effects and its management (Derpsch and Friedrich, 2010). Although there are several alternatives available but farmers lacked of awareness regarding these. Thus paddy straw is of tremendous value to the farmers and this paper tries to explore the status of paddy straw management in West Bengal and the awareness if the farmers in the state regarding various alternatives of paddy straw management.

## II. MATERIALS AND METHODS

### A. Selection of the Respondents

The study was conducted in West Bengal which were purposively selected as it is the major paddy growing states of India. A multistage random sampling design was followed to select the study area and respondents for the study. At the first stage, a major rice growing district i.e. **Burdwan** was selected on the basis of highest productivity of paddy. At the second stage, two blocks i.e. **Kalna I and Jamalpur** were selected randomly from this district. At the third stage, two villages from each block i.e. **Sultanpur** and **Nandai** from **Kalna I and Ajhapur and Bagila from Jamalpur** were selected randomly. Thus a total of four villages were selected for the study. Further, from each village fifteen farmers were selected randomly, thus making a total sample of 60 farmers for this.

### B. Data collection and instrumentation

The data were collected personally by the researcher by visiting the study area and interviewing the respondents. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions after explaining the objectives of the study. In addition, discussions were also held with the farmers for in depth

probing and understanding of various aspects under study. The data were analysed with the help of common statistical tools, appropriate to the nature of data and for the purpose of the study.

## III. RESULT AND DISCUSSIONS

### A. Status of paddy straw management in West Bengal

Status refers to the prevailing situation of the paddy straw management in state i.e. West Bengal and is presented in Table 1

In West Bengal, the operational land holding of the farmers being lower, manual harvesting of rice is mostly prevalent and thereby it does not lead to the presence of long stubbles in the field. Hence the farmers don't require extra efforts or expenses to prepare the field for the next crop and hence there is no burning of paddy straw and it is used various other purposes.

All the farmers in West Bengal used paddy straw as basal a diet of animal feed which is a part of the roughage component of cattle to maintain their energy level. Moreover the farmers add supplements in form of wheat straw, banana leaves, vegetable waste, and oil seed with paddy straw to increase the protein levels. The discussion with the farmers revealed that using paddy straw as animal feed reduced milk yield in milch animals as it contains high silica content which makes it unpalatable (Owen 1994). The straw is treated with a pinch of Sodium hydroxide (NaOH) to increase the palatability of the milch animals.

Table 1 also showed that more than 90 per cent of the farmers in West Bengal used paddy straw for thatching of cattle sheds as it involved less expenses and the light weight of roof also provides good insulation. Apart from various utilities, it was also observed that 80 per cent of farmers used paddy straw for fuel purposes to save the high cost of LPG gas and reduce their expenses. LPG gas is used only under certain unavoidable circumstances in rural areas. A little less than 60 per cent of the farmers used paddy straw for mushroom production. It was observed that paddy straw mushroom has a good market in West Bengal and is also consumed domestically. The cultivation of paddy straw mushroom was found to provide additional income to the rural households and employment opportunities to the rural women as they are mainly engaged in its production. As shown in the Table 1, more than 40 per cent in West Bengal of the farmers used paddy straw as a packing material which is useful for transportation of fruits and eggs in the local market. The data clearly indicated that only 25.55 per cent of the farmers in the West Bengal were incorporating paddy straw in their fields as it incurred extra cost.

TABLE I  
STATUS OF PADDY STRAW MANAGEMENT IN WEST BENGAL

State	West Bengal(n=60)	
	Frequency (f)*	Percentage (%)
Activities regarding Paddy straw management		
Burning	0	0
Mulch materials	8	13.33
Animal feed	60	100
Compost making	10	16.66
Mushroom production	35	58.33
Happy seeder/Zero tillage	1	1.66
Incorporation	10	16.66
Thatching	55	91.66
Packing material	25	41.66
Fuel purpose	48	80

\*Multiple response

In West Bengal, 17 per cent of the farmers were making compost from paddy straw which may be used as an organic manure in their field, followed by 13.33 per cent of them who used paddy straw as mulch material in their kitchen and flower garden to avoid picking of seed by birds or other animals and to reduce surface run off. Only about 2 per cent West Bengal farmers were managing paddy straw using zero tillage technique in their field. The main limitation of this method was the non-availability of zero-till machine resulting in its low adoption among the farmers. It also involves high expenses on machine hiring, require extra labour to operate the machine, diesel charges, inappropriate seed depth while sowing, and more requirement of nitrogen fertilizer which again incurs extra cost to the farmers (Krishna *et al* 2012).

It can be concluded that lower annual income and standard of living in West Bengal resulted use of the paddy straw for other purposes such as animal feed, thatching, mushroom production, and fuel purposes. It was also observed that tendency of the farmers in spending money for their daily chores is lower as a consequence farmers in West Bengal prefer to save their earnings for future expenditures and mostly use locally available materials for daily requirements.

*B.Awareness among farmers regarding various alternatives of paddy straw management in West Bengal*

The data in Table 2 revealed that, all the farmers in West Bengal were aware about the use of paddy straw as animal feed, thatching, fuel purpose and packing material. Nearly 93 per cent of them were aware about the use of paddy straw in mushroom production as well as its in situ incorporation followed by 80 per cent and 70 percent of them who knew about the use of paddy straw in bio char production and as mulch material respectively. More than 50 per cent of the farmers were heart about using paddy straw in bio gas production and for composting. Only 10 per cent of them were aware about the use of paddy straw for char coal production. None of the farmers had any awareness regarding the use of paddy straw in paper industries and for power generation.

TABLE II  
AWARENESS AMONG FARMERS REGARDING VARIOUS ALTERNATIVES OF PADDY STRAW MANAGEMENT IN WEST BENGAL

State	West Bengal(n=60)	
	Frequency (f)*	Percentage (%)
Alternatives of Paddy straw management		
Production of energy	0	0
Charcoal production	6	10
Methane gas production	17	28.33
Biogas production	31	51.66
Animal feed	60	100
Mulching material	42	70
Mushroom production	56	93.33
Thatching	60	100
Paper mill industry	0	0
Compost making	33	55
Fuel purpose	60	100
Packing material	60	100
Bio char production	48	80
Incorporation	56	93.33
Happy seeder/Zero tillage	12	20

\*Multiple response

It was found during discussion with the farmers in West Bengal that they were mainly using localite sources of information i.e. peer group local input dealers, and the fellow farmers who often lacked consciousness regarding various alternative paddy straw management techniques because these techniques are not commonly practiced in the community. This has also found in the study that farmers had low mass media exposure and extension contacts and their cosmopolite contacts were low. Cosmopolite sources can induce awareness among the farmers and build capacity regarding the use of various available alternative paddy straw management techniques. Figure 1 shows a comparison of the status and awareness regarding paddy straw management among the farmers. It clearly revealed that under West Bengal conditions, there are many paddy straw management techniques about which the farmers are aware but are not practicing them for one or more reasons associated with these techniques like paddy straw as mulching materials incurs extra cost.

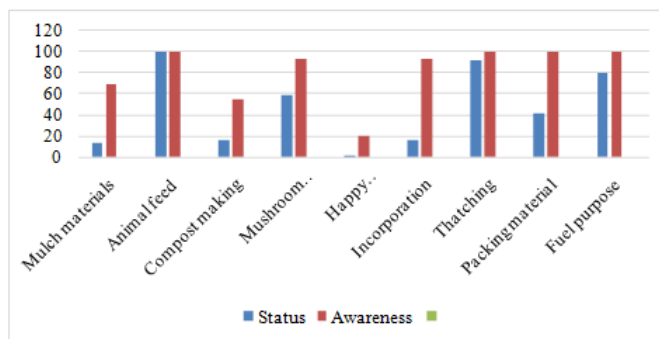


Fig. 1: Comparison of the status and awareness regarding paddy straw management among the farmers in West Bengal

*C.Problems regarding paddy straw management in Punjab and West Bengal*

The various problems faced by the farmers regarding paddy straw management were studied under different heads such as technical problems, management problems, financial

problems and problems in domestic usage. The information so collected has been placed in Table 3

*a. Technical problems*

The data presented in Table 3 revealed that although many alternatives are available for paddy straw management but these are not adopted by the farmers. As perceived by the farmers, these alternative management techniques are not suitable and economically feasible for them.

More than 90 per cent of the farmers in West Bengal are doing manual harvesting of paddy and use the paddy straw for various purposes such as animal feed, thatching, mushroom production material, etc. They did not perceive any technical problems for straw management. A little less than one-third of the farmers (30%) perceived that they faced problem in terms of interference of crop residues with tillage operations followed by 16.67 per cent of the farmers who faced problems of interference of crop residues during seeding operation.

*b. Management problems*

Regarding management problems, it can be observed from the data given in Table 3 that only 3.33 per cent farmers faced the problem in transportation of straw. As harvesting is done manually by them and all the family members are involved in this operation, they don't hire labour for harvesting rice or managing of paddy straw. Also they use bullock carts to transport paddy straw. As the operational land holding is less, the operations are not that laborious and no problems are perceived by the farmers of West Bengal regarding management of straw.

TABLE III  
PROBLEMS REGARDING PADDY STRAW MANAGEMENT IN WEST BENGAL

Problem	West Bengal(n=60)	
	Agree	Disagree
	f* (%)	f* (%)
<b>a) Technical problems:</b>		
i) Non availability of suitable straw management technologies.	0 (0)	60 (100)
ii) Increased use of combine harvester for crops leading to long stubbles in the field.	0 (0)	55 (100)
iii) Crop residues interfere with tillage operation	18 (30)	42 (70)
iv) Crop residues interfere with seeding operation for the next season crop.	10 (16.67)	50 (83.33)
<b>b) Management problems:</b>		
i) Non availability of labour to manage paddy straw.	0 (0)	60 (100)
ii) Except burning, other alternatives of paddy straw management delays wheat sowing	0 (0)	60 (100)

Problem	West Bengal(n=60)	
	Agree	Disagree
	f* (%)	f* (%)
iii) Transportation is laborious	2 (3.33)	58 (96.67)
<b>c) Financial problems:</b>		
i) High cost involved in straw removing from the field.	0 (0)	60 (100)
ii) High labour wages	0 (0)	60 (0)
iii) Transportation cost is high	10 (16.67)	50 (83.33)
<b>d) Problems in Domestic use:</b>		
i) Generally residues from rice varieties are not palatable with milch animals.	8 (13.33)	52 (86.67)
ii) Feeding of rice residue reduces milk yield.	17 (28.33)	43 (71.77)
iii) Paddy residues are high in silica content.	52 (86.67)	8 (13.33)
iv) Paddy residues are coarse in nature.	52 (86.67)	8 (13.33)
v) Poor fuel at higher temperature	32 (53.33)	28 (46.67)
vi) Paddy residue has no local economic use	0 (0)	60 (100)

\*Multiple response f = frequency, (%) =Percentage

*c. Financial problems*

It is evident from the data in Table 4 that only 10 per cent of the farmers in West Bengal perceived a higher cost of transportation of paddy straw. Rest of the farmers reported that no such problems are being faced by them as because they do not depend upon hired labour for any agricultural activities and are using animal labour for transportation thus avoiding diesel costs.

*d. Problems in Domestic use*

It is clear from Table 3 that in West Bengal a little less than 90 per cent of the farmers also believed that straw is high in silica content and coarse in nature but still they use it for feeding their animals. They are treating paddy straw with NaOH to increase its palatability and thus it does not pose much problem to the animals. They also add supplement products such as banana leaves, oil seeds, etc. with the straw to maintain optimum energy level and protein content of the milch animals.

Generally milk produced in West Bengal is only for home consumption purpose not for commercially sold at the dairy cooperative societies. The average milk yield is 8-10 lit/day in West Bengal which is also low (Anonymous 2015c). The dairy cooperative societies are less in number in West Bengal and milk is mainly used for home consumption. More than 50 per cent of the farmers agreed that paddy straw is a poor fuel at high temperature but they used it as fuel to cut their expenses on LPG cylinder.

*e. Overall ranking of the problem areas as faced by the farmers in paddy straw management*

The four problems areas as perceived by the farmers regarding paddy straw management have been ranked and presented in Table 4.

TABLE IV  
OVERALL RANKING OF THE PROBLEM AREAS AS FACED BY THE FARMERS IN PADDY STRAW MANAGEMENT

Problems Area	West Bengal		
	Total score	Mean score	Rank
Technical problems	66	16.5	4
Management problems	4	1	2
Financial problems	20	5	3
Problems in Domestic usage	322	64.4	1

In West Bengal, the problems related to the domestic usage of straw ranked first with an average mean score of 64.4 followed by management and financial problems at second and third rank with an average mean score of 16.5 and 5 respectively. The technical problems were at last rank with an average mean score 1. In West Bengal, paddy straw is mainly managed through domestic and local use. So the farmers of West Bengal are facing more problems in terms of its domestic usage. It is obvious that more problems are faced in areas which are more in practice.

IV. CONCLUSION

Paddy straw has immense economic potential for the farmers but their lack of awareness regarding various alternatives of paddy straw management is a being constraint that lowers their economic benefit. So it is necessary to increase their mass media exposure and extension contacts in this context. There is an urgent need of modernizing the methods by new innovations and popularizing the new innovations and new alternative techniques of paddy straw management such as use for ethanol production, bio char production, and use as raw material for power generation as well as paper mill industry. It is also necessary to develop and strengthen farmers' organizations at village, district and state level to promote location specific management of paddy straw and build the capacity of the farmers regarding various uses of paddy straw management among the farmers through various extension strategies such as demonstration, field days and exposure visits.

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