

Rice Straw Management in Manipur: Challenges and Finding a Way Forward

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ABSTRACT

Burning of straw is found prominently practices in most part of the country. Smoke from burning straw contributes to increased carbon dioxide levels in the atmosphere which may affect greenhouse gas build-up. Many management alternative options and use of rice straw has developed in various part of the country that is eco-friendly and sound for organic farming. To know the management status and knowledge level of farmers on these options and use of rice straw, a study was conducted in two villages *i.e.* Kakching Khunou and Umathel of Thoubal district, Manipur. The study found that irrespective of the high awareness of the farmers regarding alternative uses, burning of rice straw is a major practice. There was a large gap between their awareness level of alternative options & use of straw and the actual practice. Further, the study also revealed that friends and neighbours of the farmers were the primary sources of information. The main reason for straw burning was of high cost & labour in removing straw from farm. Moreover, in recent years, use of machine thresher led to low quality broken straws which are not fit for various usage. There need a great role of extension activities in the study area. To fill the gap of awareness and practices on the alternative uses of rice straw, capacity building and training in various options are highly needed. Overall, this requires creation of an innovation system including all potential actors so that the farmers are benefited and there is economic and environmental sustainability.

1. Introduction

Rice (*Oryza sativa* L) is widely grown crop that leaves a substantial quantity of plant residues in the field such as roots, stubbles, and straw. After harvest, rice straw is either scattered in the field, accumulated in piles, or baled and sold for other purposes such as for mushroom production, fuel for cooking, ruminant fodder, stable bedding, and paper making. Rice residues are often burned in the field, which is a cost-effective method widely practiced, especially in Asia (Gadde *et al.*, 2009). Rice straw burning has advantages in terms of farm operations but disadvantages from an environmental perspective (Romasanta *et al.*, 2017). Rice straw can be managed in two broad ways,

in-field options or off-field options. Under in-field condition, straw can be disposed by burning openly at the field itself or either spread it in the field and incorporate it with soil. Under off-field condition, straw can be used in non-energy form *i.e.* use in compost making, as mulch materials, feeding livestock, thatching, bedding for livestock and even used in mushroom production. In energy form of used option, straw can be manage using in generating electricity, producing bio-char, biofuel, and biogas production. Burning agriculture residues has multiple negative effects including local air pollution, increase in black carbon and contributions to regional and global climate change. India generates 540 million tonnes crop residue annually. About 35 million tonnes of paddy straw is burned in Punjab and Haryana alone during winter onset.

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With labour being unavailable and the time window for preparing the field for wheat cultivation being limited, the options that the farmer has are either investing in expensive and rarely used agricultural implements, or burning the residue right on the field, the latter is both cheaper and requires less effort (Mukherjee, 2016). Rice is the staple food of people in Manipur and the crop also plays an important role in the livelihood of the people. There has been a steep rise in production of rice in Manipur even as the farm lands reduced by 10.48% in the past several years. The total area under rice is 236.71 lakh hectares with production of 607.82 lakh metric tonnes (MT) and yield is 2.57 MT/ha in year 2017-2018 (GOM, 2018). About 60% area of rice field is being burnt in the months of November-December after rice harvesting. About 4 tonnes of rice residues per ha is being burnt in the state every year. It is estimated that one tonne rice residue on burning releases 13 kg particulate matter, 60 kg CO, 1460 kg CO₂, 3.5 kg NO₂ and 0.2 kg SO₂ (IARI, 2012 and Gupta *et al.* 2004). From rice residue burning, Manipur alone is generating approx. 6864 tonnes of particulate matter, 31680 tonnes of CO, 770880 tonnes of CO₂, 1848 tonnes of NO₂ and 1056 tonnes of SO₂ every year (Anonymous, 2018).

2. Materials and Methods

By reviewing the economic potentials of rice straw, a study was conducted in Manipur. At present, Manipur has sixteen districts of which 7 districts were newly formed in December, 2016 and no sufficient data of the districts is available as of now. For the present study data record of the hitherto 9 district has been considered. For collection of primary data, Thoubal district was selected purposively as the district has highest rice yield per hectare of land as of 2016-17 (GOM, 2017). For the study, 40 rice growing farmers from the two village *viz.* Kakching Khunou and Umathel were selected randomly. The study was conducted to understand the management pattern of rice straw by the farmers and the problems faced in managing rice straw. The study followed interviews with individuals and informal interactions. Structured interview schedule with Open ended questions were asked for understanding the rice straw management and data collection.

3. Results and Discussion

Profile of farmers

Majority of the respondent farmers in the study were male (72%) and only (28%) were female. Most farmers (67.5%) were in age ranging of 38-53 years, some of them were of aged less than 37 years (17.5%) and few of them

(16%) were more than 54 years old. Half of the respondents (52.5%) were educated up to class X, one-fourth (25%) up to class XII and remaining (22.5%) up to BSc and above. Maximum farmers (70%) had medium sized family of 5 to 7 members and some (17.5%) had small family of less than 5 members. Majority of the farmers (80%) have 0.43 to 1.68 ha of agricultural land and few farmers (20%) have above 1.69 ha of agricultural land. Majority farmer (62.5%) had medium rice yield rate of 2.88 to 4.59 t/ha and some farmers have more than 4.6t/ha. This shows high yield rate in the study area. Maximum farmers (67.5%) followed mono cropping and other farmers' (32.50%) practice of double cropping by growing Watermelon, cucumber, king chilli and other vegetables. Livestock reared by the farmers were poultry birds (60%), pigs (50%), duck (15%) and cattle (12.5%). The annual income from farming for majority respondents (65%) was between ₹0,977- ₹, 24,374 and for 22.5 per cent of respondents, it was less than ₹0,976 per annum. The high variation of range in the income may be due to the income of farmers who practice double cropping as they have more income from that of mono cropping farmers.

Rice straw management activities of the farmers

The farmer respondents were asked to indicate, the ways in which they manage the rice straw and it was found that majority (80%) manage the rice straw by burning in the field in the form of heaps. Other ways of managing the rice straw were making thatches of animals shed (37.50 %) bedding for livestock as mulch materials (30%), compost making (17.5%), as animal feeds (12.5%) and incorporation of rice straw with soil (12.5%). The findings were contrary to the findings of Roy & Kaur, (2005) that burning of rice straw was not practice by the farmers of West Bengal. When asked the reason for burning the respondents mentioned the used of mechanized thresher. Nowadays, the farmers used thresher for harvesting the rice in most of the field. The Mechanized threshing is mostly done in a corner of field or along the road side and the machine cut the rice straw into pieces making it not suitable for other purposes; due to this they piled the straws and burned after threshing. Also farmer report of aphid infestation in rice, in order to prevent the next season crop from aphid the straws are burnt out in the field. The activities on rice straw management by farmers are shown in table 1.

Quantity of rice straw utilized in each activity

The farmer respondents were asked how much quantity of the rice straw generated through threshing were utilised in each of the identified activities. The responses were recorded from all respondents and the mean percentage was worked out. It was found that a large portion of the rice straw produced were burned (69.75%), some portion were use for animal feeds

(8.25%), incorporate in soil (7.50%), used for thatching of animal shed and bedding of livestock (6%), used as mulch materials (5.75%) and as compost making (2.75%). Thus, the study shows burning of rice straw in large quantity as the most easy way of managing and utilizing of rice straw by the farmers. Figure 1 below shows the distribution of rice straw in activity wise.

Table 1. Farmers status of Rice straw management (n=40)

Sl. No.	Rice straw management activities by farmers	Frequency*	Percentage (%)
1.	Burning	32	80.0
2.	Mulch materials	12	30.0
3.	Animal feed	05	12.50
4.	Compost making	07	17.50
5.	Incorporate with soil	05	12.50
6.	Thatching of animals shed and livestock bedding	15	37.50

*Multiple frequencies

Awareness on the alternative uses of rice straw

Seven different activities for rice straw management were identified for the study. The awareness of the respondents regarding these management activities was recorded. Results are presented in table 2.

It was found that cent per cent of the respondent farmers were aware about using rice straw as mulching material, in the mushroom production, making of thatches of animals shed & bedding of livestock, for compost making and incorporation with soil, followed by Biogas production (85.0%) whilst, all the farmers (100%) were found to be unaware about the use of rice straw in Paper Mill Industry & Packing materials. Almost similar finding were found reported in the study of Roy & Kaur (2005) as respondents have high rate of awareness about the various alternative

uses of rice straw but contrary to the findings of Rosmiza *et al.* (2014) which report of little knowledge or less awareness of farmers about the alternative usage *viz.* Compost, Vermicompost, crafts and nursery mats from rice straw.

Comparison of status and awareness of alternatives of Rice straw management of farmers

From the Figure 2, it was found that there exist a large gap between the awareness on alternatives of rice straw management and the actual management practices followed by the farmers. The awareness on use of rice straw as mulch material, mushroom production, thatching and as bedding of animals, compost making and incorporation with soil were high (100%), followed by in biogas production (85.0%) but their actual practice were very low. Also farmers were not aware about rice straw used as raw material in paper mill industry and packing material. The low adoption of alternative management practices by farmer maybe due to the reason that the measures were not economically suitable for the villagers. Farmer also report that they have tried for mushroom cultivation but due to less demand of mushroom in the village they faced difficult in marketing so they stop the production. This shows poor market facilities and no linkage with other market inside and outside the village. The possible reason of this gap may many of which lack of intervention by extension facilitators may be an important one.

Source of Information of the farmers

From the study it was found that the primary sources of information for the farmers were friends and neighbours (72.5%), peer farmer (62.5%), from mass media (40%) and cosmopolite source including extension officials (22.5%). Similar findings were also report in the study of Rosmiza *et al.* (2014); Roy & Kaur (2005). These shows farmers' interaction with the extension agents is very low. This highlights the need of extension activities in the villages. The farmer's source of information is presented in the figure 3 below.

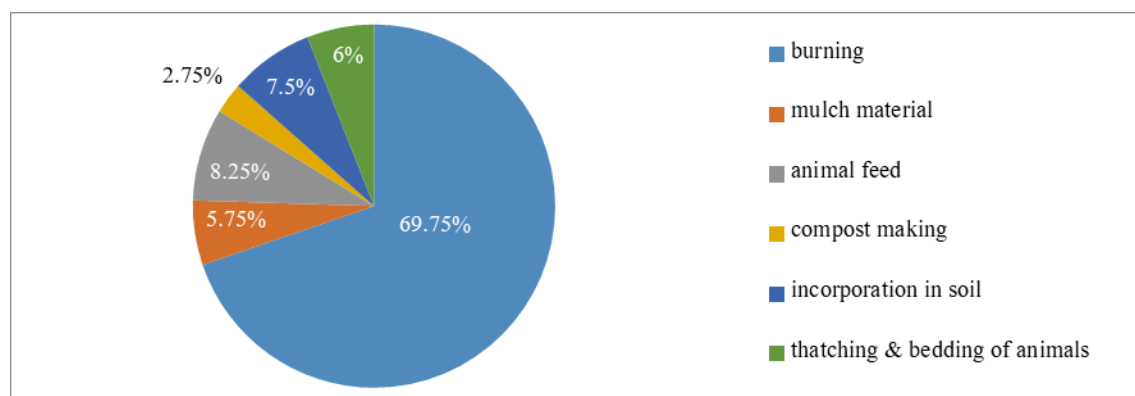


Figure 1. Distribution of quantity of rice straw utilised activity-wise

Table 2. Farmers awareness on the alternative uses of rice straw (n=40)

Sl. No.	Alternatives of Rice straw Management	Frequency*	Percentage (%)
1.	Biogas production	34	85.00
2.	Mulching material	40	100.00
3.	Mushroom production	40	100.00
4.	Thatching of animals shed & bedding of livestock	40	100.00
5.	Paper mill industry & packing materials	0	0.00
6.	Compost making	40	100.00
7.	Incorporation with soil	40	100.00

*Multiple frequencies

Problems in Management of Rice straw by Farmers

The farmers report of various problems in the management of rice straw in ranks. The problem that rank first by the majority farmers (95%) was high cost and laborious in removing rice straw from the field and transportation of it, second rank is given to reduction of straw usage due to increase use of thresher (92.5%), third rank is when incorporate rice straw in soil crop residues interfere with tillage operation (80%), fourth rank is the non-availability of suitable rice straw management technologies (72.5%), fifth rank is the incorporation of rice straw in soil make residues interfere with seeding operation for the next season crop (70%) and sixth rank is by except burning, other alternatives of rice straw management delays next crop sowing (62.5%). Almost similar problems were mention in the studies of Rosmiza *et al.* (2014) and Roy & Kaur, (2005). This shows there need to encourage the farmers to use economically viable alternative option to straw burning through concurrent use of various environmental as well as farmer friendly options with the active interventions of extension personnel so that the problems of farmers can be solved on time. The problems of farmers are stated in table 3 below-

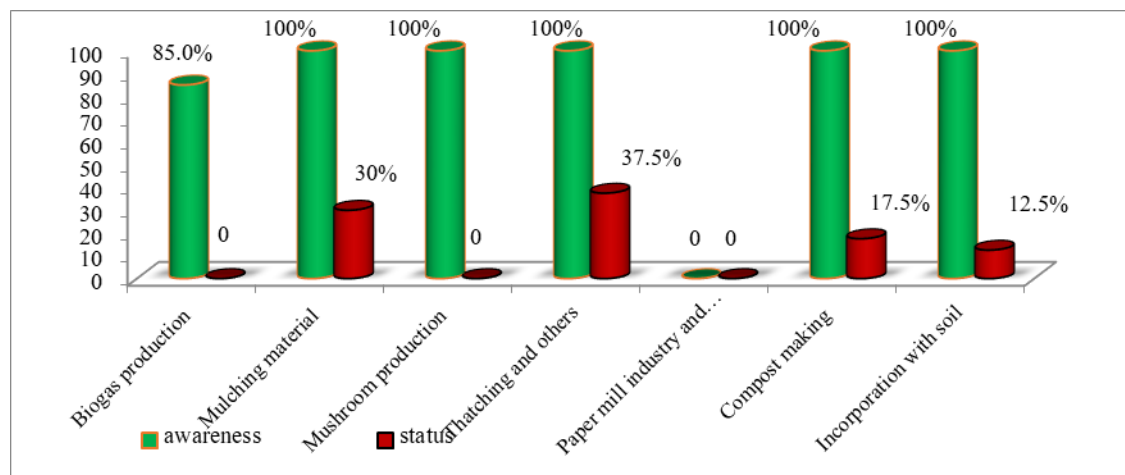


Figure 2. Comparison of status and awareness of alternatives of paddy straw management of farmers

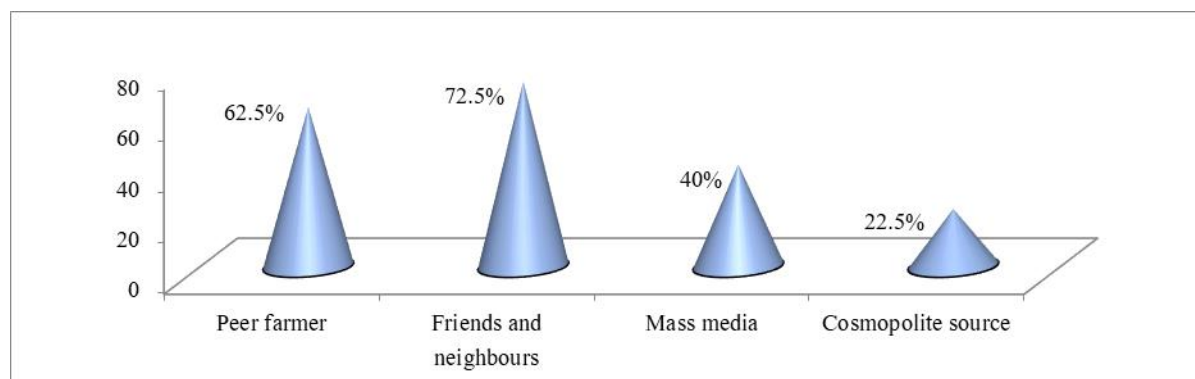


Figure 3. Source of Information of the farmers

Extension Strategies: A way forward

There is need of active involvement of extension agents, policy makers and agents for awareness and initiatives about the alternative options of rice straw in industrial sectors and also in agricultural sectors, the need to convert this residue from waste into economically beneficial materials. Generating awareness about the various uses of rice straw in industrial sector as substrate for bio-fuel, raw materials in paper mill industry, pulp board manufacturing and packing materials *etc.* is needed to be performed highlighting the economic benefits from this. Facilitation of link the farmers with the potential buyers of the straw are also required. Online platforms like Indiamart, Mushroom to market, *etc.* are available in the country which gives scope to connect both buyers and sellers to buy and sale their products. Many manufacturing industries and factories producing various products using rice straw as raw materials and sale their product using this online platform; they need to bring to the awareness of farmers to encourage them not to waste such potential by product of farm and help them to generate extra income from such residues. At the local level, local can be encourage to form group and act as middlemen for collecting straw from farmers and supply to the Agro-based industries. This will make farmers earn & reduce the burning of rice straw and also will supply raw material in cheap rate to the industries.

Local youth can be potential entrepreneurs for agri-based start up to use this waste into useful raw material and earn from it. In this, Capacity Building on Agri-based start-up like mushroom cultivation can be encouraged to the potential farmers. Providing required forward linkages to such entrepreneurs in the form of post-harvest management, formation of commodity interest groups, packaging and market linkage is also required that they reap the benefits of the enterprise.

Extension officials needed to play important role in encouraging farmers and giving awareness, training,

capacity building on the usage of rice straw and products. Market information and support needed should be given to the farmers through extension agents. Policy makers and related agents also need to intervene to suggest the industrial sector to make link between villagers or group of farmers for the raw materials from Agricultural by-products so that both the farmers and industries benefit together. This will reduce the practice of burning of rice straw; pollution will be check to some extent and farmers will get extra income from rice straw. Overall, this requires creation of an innovation system including all potential actors so that the farmers are benefited and there is economic and environmental sustainability. The extension strategies that can be followed in managing rice straw are shown in figure 4. The farmers need to be properly convinced to use rice straw in environment friendly manner. Active role of extension agents in motivating the farmers and encouraging them for economical and healthy way of practices in managing the rice straw is needed.

4. Conclusion

Rice farmers find it difficult to manage rice straw and for many, burning of rice straw is the easiest and commonly practiced management activity. The negative environmental effect of rice straw burning has been emphasised by many experts. There are many alternative strategies for rice straw management which the farmers can engage in. The need of the hour is to encourage and facilitate farmers to adopt alternative strategies many of which can promise economic benefits if properly explored. Certain constraints come in the way for farmers in adopting the strategies. It is the responsibility of extension practitioners to make sure that the constraints are explored and formulate extension strategies for the same. Capacity building of the farmers and provision of appropriate linkages which potential actors is recommended.

Table 3. Farmers problem in rice straw management

(N=40)

Sl. No.	Problems in Rice straw management	Frequency (%)	Rank
1.	High cost and labour involved in straw removing from the field and transportation	38 (95.0%)	I
2.	Increased use of thresher leads to reduction of straw usage	37 (92.5%)	II
3.	Crop residues interfere with tillage operation	32 (80.0%)	III
4.	Non availability of suitable straw management Technologies	29 (72.5%)	IV
5.	Crop residues interfere with seeding operation for the next season crop	28 (70.0%)	V
6.	Except burning, other alternatives of rice straw management delays next crops sowing	25 (62.5%)	VI

* figure in parenthesis indicate percentage to the total

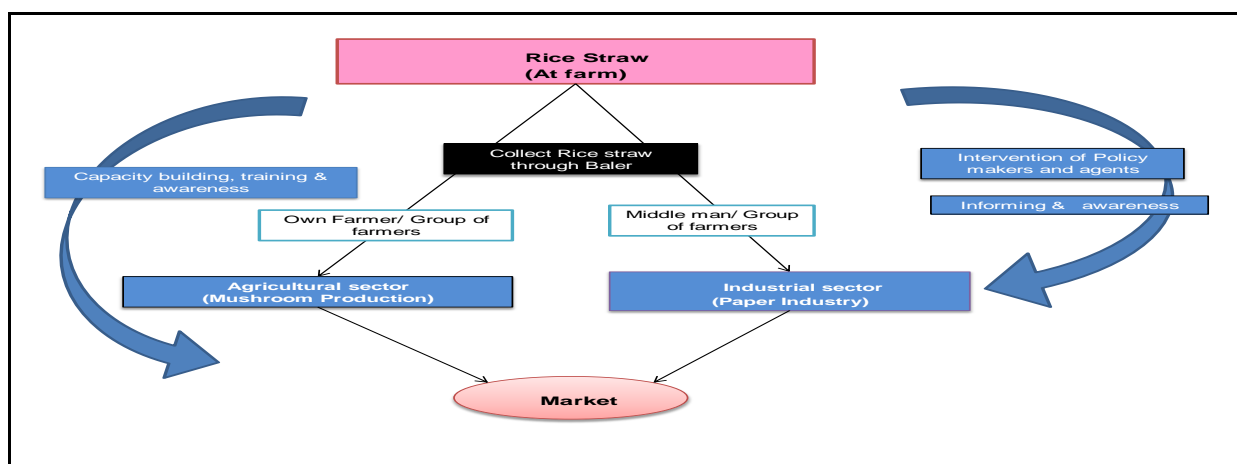


Figure 4. Extension strategies in the management of rice straw

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