

## Perception and Acceptability of Rice Straw Baler for On Farm Residue Management

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### ABSTRACT

*Rice is the major crop grown in 2/3<sup>rd</sup> of the cultivated area in Krishna district. Majority of the rice growing farmers go for mechanical harvesting of the crop (90.00%), out of which only 40.00 per cent farmers manually bail the rice straw and transport them for further use. While the remaining 60.00 per cent burn the straw in the field itself due to its non-bailing quality due to mechanical harvesting and also due to increased labour, transport costs, unavoidable climatic conditions. Such burning of on farm waste not only kills the soil microbes but promotes environmental pollution adding to the release of greenhouse gases. Further resulting in increased demand for rice straw for milch animals. Through demonstrations in farmers fields it was recorded that the cost of bailing with rice straw baler was Rs.2500/ha and for manual bailing it was Rs.3500/ha. The time taken for machine bailing was 2.5 hour/ha while manual bailing took 20 hours/ha i.e., three working days. Positive perception and acceptability of the technology is a pre-requisite to pave way to adoption. In a survey conducted among 200 farmers in the demonstrated area, found that the demonstrations made a significant impact on the perception of the farmers towards rice straw baler in a positive direction paving way for acceptability of the technology.*

**Key words:** Rice straw baler; Residue management; Open field burning; Perception;

Increased trend of migration of rural population to urban areas to seek better job opportunities and lifestyles resulted in decrease of agricultural workers in rural areas over the years. The decrease in number of manual workers, increased labour wages has necessitated the move towards increased mechanisation in agriculture. Rice is the major crop grown in Krishna district in about 2/3<sup>rd</sup> of the total cultivated area. It is observed that majority of the rice growing farmers go for mechanical harvesting of the crop with combine harvesters. The combine harvesters leaving behind straw in the form of standing stubbles and loose straw.

Following harvesting of rice, the straw has to be cleared to prepare the land for sowing of the next crop. There are various ways to clear this straw from fields namely, bailing the straw and transporting it for further use, incorporating it into the soil and burning on the field. But majority of the farmers go for burning the straw on

farm, rather than bailing and transporting it for further use. During burning carbon is released into the air in various forms. Burning of rice straw in the field releases pollutants in the atmosphere and contributes to enhanced global problems such as climate change.

Major fractions of carbon released from crop burning consists of carbon dioxide, carbon monoxide, total carbon and methane. These air pollutants contribute to enhance climate change. Although biogenic carbon is emitted in the atmosphere as a result of open burning, the carbon dioxide fraction is reabsorbed via photosynthesis in the next cultivation in the form of carbon biomass. However this is not the case for other carbon forms such as carbon monoxide, total carbon and methane, thus adding to greenhouse effect. Hence, there is a need to motivate farmers to stop burning paddy straw and adopt eco-friendly and economically viable option to utilize the valuable bio-resource. At this

juncture demonstrations promoting commercially available rice straw baler were organised in the district with an objective to encourage efficient management of on farm residues through a cost reduction technology.

## METHODOLOGY

Rice straw baling using baler was popularised through demonstrations in farmer's fields. They were conducted in Krishna district of Andhra Pradesh. For the purpose of the study two treatments (T1: Baling of rice straw using tractor operated straw baler after combined harvester in rice) and (T2: Farmers practice of manual baling after combine harvester in rice) were considered. The economic viability of the baler, time taken for baling were worked out. Perceived attitude of farmers towards mechanical baling over manual baling was studied before and after the demonstration using a schedule prepared for the purpose. The acceptability of the technology was also studied. paired t-test were worked out.

## RESULTS AND DISCUSSION

The study recorded that 60.00 per cent of the farmers burn the rice straw in the field itself, while the remaining 40.00 per cent of the farmers go for manual baling of the rice straw and then transport it for further use. None of the farmers opted incorporation of rice straw on farm as indicated in Table 1. The burning of the rice straw on farm was due to its non-baling quality because of mechanical harvesting with combine harvester, also due to increased labour, transportation costs and many a times unavoidable climatic conditions. The common practice is burning, which is the most convenient, cheapest and fastest way to eliminate rice straw, especially in irrigated paddy fields. The farmers who opted for manual baling were those who had livestock at home. However a part of the baled straw was used for the livestock and the remaining was sold to fellow farmers and others for additional revenue. Incorporation of the straw into the field was not followed by the farmers as it is energy consuming and time taking process.

**Table 1. Disposal of rice straw by farmers (N=200)**

Item	No.	%
Burn the rice straw on the field	120	60
Manually bail rice straw	80	40
Incorporate the straw in the field itself	—	—

Through demonstrations in farmers fields over three years, it was recorded that the average cost of baling with rice straw baler was Rs.2500/ha and for manual baling it was Rs.3500/ha as indicated in Table 2. The average time taken for machine baling was 2.5 hour/ha while manual baling took 20 hours/ha i.e., three working days. While the number of bales (125/ha) and each bail weight (25kg) is constant for both manual and mechanical methods. An amount of Rs.1000/ha could be saved through mechanical baling compared to manual baling. Mechanical baling is the fastest and easiest method compared to manual baling.

**Table 2. Comparison of mechanical baling with manual baling of rice straw**

Item	T1	T2
Cost of baling per ha	2500	3500
No.of bales per acre	50	50
Bale weight (kg)	25	25
Unit Cost(Rs.)	20	24
Time of operation hr/ha	2.5	20 (3 working days)
Mode of baling	Machine	Manual

\*\* The cost of baling depends on labour wages and is easy during labour shortage.

T1 (demo) :Baling of rice straw using tractor operated straw baler after combined harvester in Rice

T2: Farmers practice of Manual baling after combined harvester in Rice

**Table 3. Perception of farmers on the effects of onfarm burning of rice straw**

Item	No.	%
Causes pollution	200	100
Results in respiratory problems	110	55
Causes increased demand of rice straw	98	49
Kills the soil microbes	86	43
May lead to road accidents on highways	42	21
Observed increase in temperatures in the surrounding areas of burning	18	09

Cent per cent of the farmers are aware that burning of straw on the farm causes pollution, while 55.00 per cent expressed that burning results in respiratory problems in human and animals, causes increased demand of rice straw for milch animals (49.00%), kills the soil microbes (43.00%), may lead to road accidents on highways due to haze created by the smoke (21.00%), observed increase in temperatures in the surrounding areas after a few days of burning (9.00%) (Table 3).

The results indicate that farmers are aware of the pollution caused by burning but are ignorant of the side effects caused by it on soil, human and animal health. The plumes of smoke caused by burning rice straw in the fields near by highways and roads forms a thick blanket in the air hindering smooth driving of the vehicles leading to traffic and road accidents. The field burning of paddy straw is a major contributor to reduced air quality as they release particulates and greenhouse gases namely, carbon dioxide, carbon monoxide, total carbon and methane. These particulates and gases cause human respiratory ailments in intensive rice production areas. The heat generated by the straw burning leads to loss of useful microbes in soil, adversely affecting soil properties. Substantial loss of plant nutrients and organic carbon also occurs during burning of rice residues. Continuous burning of straw leads to a reduction of nitrogen and carbon as well as soil aggregation. The greenhouse gases released cause greenhouse effect in the surrounding areas in about 15-20 days after burning, thus leading to climate change. The burning of the straw also cause shortage of the animal feed thus creating demand for it. Burning of rice straw on farm also decreases the efficiency of some herbicides used for controlling the weeds.

Positive perception and acceptability of the technology is a pre-requisite to pave way to adoption. Hence, the perceived advantages of mechanical bailing over manual bailing were studied before and after the demonstration.

Before the demonstration, the farmers' perceived advantages were recorded as low cost by 7.50 per cent; followed by easy and time saving (14.00%); bales are more compact (9.50%); transportation losses are less (5.50%); bailed straw is not prone to fire accidents easily (4.50%); bailed straw occupies less space for storage (27.50%); bailed straw can be easily transported (45.50%); bailed straw has more keeping quality (40.50%); bailed straw does not get wet easily (8.00%) as indicated in Table 4.

After the demonstration, majority of the farmers perceived that the technology was of low cost (98.00%); followed by easy and time saving (96.00%); bales are more compact (95.50%); transportation losses are less (95.00%); bailed straw is not prone to fire accidents easily (91.00%); bailed straw occupies less space for storage (88.00%); bailed straw can be easily transported

**Table 4. Farmers' perceived advantages of mechanical bailing over manual bailing**

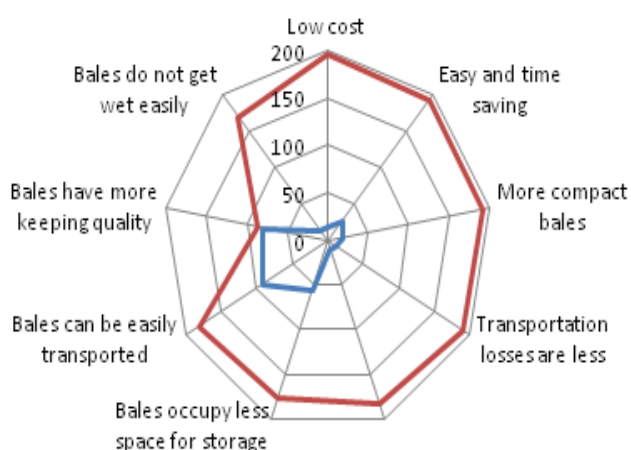
Item	Before demo.		After demo.		Difference F
	No.	%	No.	%	
Low cost	15	7.50	196	98.0	181
Easy and time saving	28	14.0	192	96.0	164
More compact bales	19	9.50	191	95.5	172
Transportation losses are less	11	5.50	190	95.0	179
Not prone to fire accidents easily when bailed	9	4.50	182	91.0	173
Bales occupy less space for storage	55	27.5	176	88.0	121
Bales can be easily transported	91	45.50	180	90.00	89
Bales have more keeping quality	81	40.50	87	43.50	13
Bales do not get wet easily	16	8.00	170	85.00	154
t-value-2.306*					

(90.00%); bailed straw has more keeping quality (43.50%); bailed straw does not get wet easily (85.00%). The results are in conformity with that reported by *Halakatti et al. (2007)*, *Dubey et al. (2008)*, *Dipti et al. (2015)*, *Narayan et al. (2015)*, *Mahalakshmi et al. (2018)*, *Jyothi and Venkata Subbaiah (2019)*.

**Table 5. Acceptance of the technology (Mechanical Rice Straw Baler) by the farmers**

Item	No.	%
Conviction with the technology	198	99.00
Forgo open field burning with the availability of mechanical balers	195	97.50

Paired t-test was worked out and found the t-value as 2.306 significant at 5 per cent level of significance indicating that there was significant difference in the farmers' perceived advantages before the demonstration and after the demonstration (Table 5). The study reveals that, after the demonstrations the farmers in the surrounding areas are well aware of the advantages of the bailed straw. Positive perception of the technology is a good step to pave way for adoption of any technology. Greater majority of the farmers were also convinced with the technology & are ready to adopt it (99.00%) and 97.50 per cent of farmers agreed to forgo open field burning with the availability of mechanical balers.



**Fig 1. Graphical representation of perception of the respondents towards rice straw baler before and after the demonstration**

*Note:* Inner radar represents the farmers' perceived advantages before the demonstration, outer radar represents the farmers' perceived advantages after the demonstration and the gap between the radars represent the impact of the demonstrations on farmers' perceived advantages.

The farmers' perceived advantages before and after the demonstration is graphically presented in Fig 1. In the figure the inner radar represents the farmers' perceived advantages before the demonstration; outer radar represents the farmers' perceived advantages after the demonstration and the gap between the radars represent the impact of the demonstrations on the farmers' perceived advantages.

## CONCLUSION

Agricultural mechanisation in India is growing rapidly. The state government is also supplementing and supporting the penetration of farm mechanisation through subsidies for single ownership or for formation of self help groups or co-operative farming institutions. But the introduction and availability of equipments like rice straw balers for farmers is still at a nascent stage. Now it is a big challenge on the extension agencies to cater the rice straw bailing needs of the farmers with a very few available commercial balers.

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