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Full Length Research Paper

Assessment of Postharvest Losses of Rice at Different stages of Operation

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Abstract
Field performance of three different methods of threshing were assessed on a complete randomized design which included bag-beating, "bambam" and mechanical methods with five replications in which different methods of threshing was adopted. Results revealed that higher losses were recorded in mechanical threshing than manual threshing which were significant statistically ($p<0.5$) followed by "bambam" method, though improvement need to be done on the machine to curb the losses. In the view of losses reduction bag-beating method had advantage over others but little time consumption was required.

Keywords: *Faro 44(Wita 3), threshing losses, threshing time*

Introduction

Rice (*Oriza* spp) is after wheat, the most widely cultivated cereal in the world and it is the most important food crop for almost half of the world's population (IRRI, 2009a). It is estimated that rice sustains the livelihood for 100 million people and its production has employed more than 20 million farmers in Africa (WARDA, 2005).According to Harris and Lindblad (1978) postharvest losses comprise all changes in the ability ,wholesomeness or quality of food that prevents it from being consumed by people. Postharvest losses can occur during any of the stages in the postharvest operations. Whatever the source, postharvest losses represent more than just a loss of food as it ripples through the factors (including land, water, labor, seeds, time and fertilizer). The wastes indicate that postharvest food loss translates not just into human hunger and minimizing the revenue of farmers but into tremendous environmental waste as well (Earth trend, 2001).The steady increase in population and a corresponding increase in demand for food have led to increased rice imports in Nigeria. Reducing postharvest losses could help in reducing rice imports with its accompanied economic losses. However, there is insufficient data on postharvest losses of rice in Nigeria with regards to what, where and why the losses occur in the production system. For effective reduction in losses it is important to estimate the losses and the stages at which they occur. This study therefore aimed at assessing the postharvest losses that occur in rice farming, from harvesting to transportation with the aim of providing information for reducing postharvest losses and ultimately increasing rice supplies without increasing acreages under cultivation or imports. This study provides critical assessment of what, where and why losses occur, and what could be done to reduce such losses.

Materials and method

Experimental procedure

Faro 44(WITA 3), is a variety commonly grown by lowland farmers, it was assessed at an established Sawah demonstration site between 2014 & 2015 at National centre for Agricultural mechanization (NCAM), Ilorin. The record on Cultural practices carried out on the field were obtained, these include land clearing, ploughing, rotation (puddling), nursery establishment for seedlings and transplanting(number of stands, spacing etcetera).Some portion of the field were earmarked at maturity for harvesting, threshing and drying(moisture reduction), sun drying method was used the crop was left in windrows in the field to dry after reaping but before threshing, though over-drying and non-uniform drying were observed. These enable to determine the postharvest losses that involved at each stage.

Experimental design

Five(5) basins/plots were earmarked and prepared manually denote with alphabets A, B, C, D and E respectively, each basin is equivalent to 30m by 20m comprising variety Faro 44(WITA 3) and manual harvesting method was done using sickle.

Determination of harvesting losses

The rice plots were harvested separately and skilled harvesters were allowed to harvest as per farmer practice using sickle harvesting method. Left over rice grains on the harvested plots (both on the ground and on un harvested rice stalk) were thoroughly collected, cleaned, dried, weighed and stored in bags.

Percentages of harvesting losses were determined using the method described by Badawi (2003). The weight of paddy rice left on the field per basin or plot was determined by sensitive electronic scale and losses were also estimated using the formula:

Harvesting losses = left over paddy/ Total harvested paddy x 100

Determination of threshing losses

Paddy threshing involves the detachment of paddy grains from the panicles through any available method. Two different types of threshing methods, normally practiced by farmers were adopted; bag-beating and bambam. Harvested rice put in a bag and beat with stick to separate the grains from the stalks. The other method was also threshed using the *"bambam"* a locally made wooden box with a tarpaulin beneath. In the bambam method, the rice stems was held and the stems together with the panicles on them and beaten on the box. Removed grains were allowed to drop onto the tarpaulin beneath the box. After threshing, all the rice grains that fell out and found outside the wooden box were collected, cleaned, dried and weighed, all the rice grains that remain on the stalks after the beating were also collected, cleaned, dried and weighed. Threshing losses were estimated using the formula:

Threshing losses = [Weight of left over grains/ Total weight of collected grains] x 100.

Bag-beating method

Mechanical method of threshing

Determination of winnowing losses

The traditional method of winnowing was adopted, done in an open space with a tarpaulin beneath to separate paddy from broken stalks. After the operation all the rice grains that fell out and found outside the tarpaulin beneath were gathered and taken to the laboratory for weighing by electronic sensitive scale because of its quantity.

Winnowing operation

Results and discussion

Table 1. Harvesting losses

Anova: Single Factor						
	Harvesting losses					
Summary						
Treatment methods	***Plot***	***Sum***	***Average***	***Variance***		
Bag –beating	5	7.8000	1.5600	0.1880		
Bambam	5	8.8500	1.7700	0.3533		
Mechanical	5	9.5000	1.9000	0.1550		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Treatment methods	0.2943	2.0000	0.1472	0.6341	0.5473	3.8853
Error	2.7850	12.0000	0.2321			
Total	3.0793	14.0000				

Table 2. Threshing losses

Anova: Single Factor						
		Threshing losses				
Summary						
Treatment methods	***Plot***	***Sum***	***Average***	***Variance***		
Bag -beating	5	11.34	2.268	0.20087		
Bambam	5	20.74	4.148	1.27752		
Mechanical	5	29.8	5.96	0.353		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Treatment methods	34.0810	2.0000	17.0405	27.9141	0.0000	3.8853
Error	7.3256	12.0000	0.6105			
Total	41.4066	14.0000				
Anova: Single Factor						
		Time for threshing				
Summary						
Treatment methods	***Plot***	***Sum***	***Average***	***Variance***		
Bag -beating	5	9911	1982.2	562028.2		
Bambam	5	4929	985.8	39223.2		
Mechanical	5	1751	350.2	3190.2		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Treatment methods	6767041	2	3383520	16.79329	0.000333	3.885294
Error	2417766	12	201480.5			
Total	9184807	14				

Table 3. Winnowing losses

Anova: Single Factor						
		Winnowing losses				
Summary						
Treatment methods	***Plot***	***Sum***	***Average***	***Variance***		
Bag –beating	5	5.0500	1.0100	0.1243		
Bambam	5	6.2900	1.2580	0.3645		
Mechanical	5	7.3500	1.4700	0.1020		
ANOVA						
Source of Variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Treatment methods	0.5301	2.0000	0.2650	1.3459	0.2969	3.8853
Error	2.3631	12.0000	0.1969			
Total	2.8932	14.0000				

Harvesting and threshing play a significant role in realizing the full benefit of raised crop by reducing post-harvest losses as well as improving quality of milled rice.

The result from the above ANOVA table (complete Randomized Design) for assessment of postharvest losses of rice, tested at 5% level of significant for harvesting, threshing, winnowing losses and time for threshing have been presented in the Tables above.

There were no significant difference with respect to harvesting losses and winnowing losses, as shown in the figures, despite that over-drying of paddy was observed in the field. On the other hand, there were significant difference with respect to threshing losses and time of threshing ($P<0.05$), higher losses were recorded in *"bambam"* method, though involves lesser threshing time the than bag-beating method. This indicates that bag-beating method should be the preferred manual method of threshing to curb postharvest losses of rice farming based on the figures observed in this study. In comparison between the field performances of Bag-beating (manual threshing) and mechanical threshing result shows that manual threshing through bag-beating has lower postharvest losses than mechanical threshing as shown in figure 2 , however from the result obtained, if threshing is delayed, losses would be incurred during the gathering of the over dried paddy stalk.

Handling of harvested crop

The gathering and bundling of harvested crop requires careful handling, because each additional handling step causes losses which include stacking of the harvested crop. The longer the stack is left in the field, particularly where the grain moisture content is

low, the greater is the degree of loss. Harvesting Time is a great factor affecting grain losses. Proper time is important in harvesting the crop as losses increased with delay in harvesting time. Recommended harvesting time of rice is one week before the maturity date to reduce the losses.

Conclusion

The field experiment highlighted that rice postharvest losses cuts across all the operations involved, higher threshing losses recorded in mechanical method (local manufactured machine) but lesser time consumption for threshing was required while bag-beating threshing method is disadvantage in time consumption. Therefore, awareness campaign should be lunched for the rice farmers by provincial Agricultural Researchers and extension workers by adopting proper postharvest measures to improve quality and quantity of rice production in Nigeria so as to make Green revolution through SAWAH eco-technology for Rice farming a reality

Ethics

All the authors read and approved the manuscript and no ethical issues involved.

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