



## EFFECT OF EXTENSION DISSEMINATION ON THE CONTROL OF POST-HARVEST LOSS OF RICE IN WEST COAST REGION OF THE GAMBIA

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### Abstract

This study investigated contributions of agricultural extension agency in the control of post-harvest losses of rice in the West Coast Region of The Gambia. Post-harvest losses of rice have been a big threat to food security. Huge amount of rice is lost along the value chain especially during post-harvest operations that reduce the quality and quantity of rice and income of the farmers. Purposive sampling technique was used to select districts while simple random sampling technique was used to select the respondents. The research was conducted with the use of semi-structured questionnaires that were administered to the three hundred and ninety seven (397) farmers who were randomly selected for the study. Focus Group Discussions (FGD) were also conducted. Data obtained was analysed using descriptive statistics while focus group discussion was analysed by transcribing the responses. The result of the study indicated that agricultural extension agents have contributed to the reduction of these losses in various ways ranging from linking of farmers to market facilities, and provision of post-harvest losses-related trainings. These according to the findings, have contributed to increase in both rice production and income of the farmers in the study area. The study recommends that farmers should be involved in designing extension programmes that affects their needs, devise strategies for farmers to access subsidized modern storage and post-harvest technologies and follow up studies during or soon after harvesting that will enhance mitigation of post-harvest losses for increased food security and livelihoods.

**Keywords:** *Rice, Post-harvest loss, Agricultural Extension agent and The Gambia*

### Introduction

In The Gambia, Agriculture plays a key role in the economy, with nearly three quarters of the labour force employed in the sector and about 80% of the people's livelihoods depending on it (Badgie, 2018). It also accounts for 29.4% of the country's GDP (Diagne *et al.*, 2015). However, agriculture is mostly rain-fed with less than 3% of the cultivated land being irrigated (Badgie, 2018). Main crops commonly grown in The Gambia include: vegetables, fruits, legumes and cereal grains with rice as the country's staple food.

Rice (*Oryza sativa*) which is after wheat the most widely cultivated cereal in the world has become the most important food crop for almost half of the world's population (IRRI, 2015); thus, increasing its demand. Ajala (2015) noted that rice has become a major staple food crop consumed globally by more than 3.5 billion people, that is over half of the world's population. However, global production for 2012 to 2014 was at a record 480.7million, while consumption and residual for same period was at 482.2mt, an increase of 1.5% from the preceding year (Taylor, 2016). Projections by Mejia (2001) also indicated that 10 billion people will depend on rice as main staple by 2025, while demand will reach about 880mt. However, the global production still stands at about 550mt (Rose *et al.*, 2016); hence, the huge importation of rice especially by developing

countries to bridge the gap between production and consumption to meet the world food requirements.

In addition to this inadequate production of rice in most developing countries, a very significant amount from that is also lost along the value chain during post-harvest operations ranging from harvesting to consumption. Post-harvest losses which have been and continue to be a big threat to food security, loss in farmer incomes, and inefficiency in the Sub-Sahara African food system, also contributes to the huge deficit in rice supply globally and The Gambia is no exception. The issue of food losses is of high importance in the efforts to combat hunger, raise income and improve food security in the world's poorest countries (FAO, 2015). However, it is estimated that one third of food produced worldwide is lost or wasted (Wailies, 2015) through post-harvest losses. The Food and Agriculture Organization (FAO, *ibid*) estimates that the value of post-harvest loss in Sub-Saharan Africa alone is about US\$4 billion a year out of an annual grain crop value of US\$27 billion produced in the years 2012–2015. Similarly, Coffi *et al.* (2016) reported that 12.1% of annual total rice production in the sub-Saharan Africa alone was wasted due to post-harvest losses in 2015.

Similarly, FAO (2016) estimated that about 4,679mt out of the 30,000mt of rice locally produced in the Gambia were wasted due to post-harvest losses between the years of 2013 to 2016. These losses occur along the production chain of harvesting, threshing, drying, milling, winnowing, transporting, packaging and storage. Therefore, this has contributed to the huge deficit of rice in supply. Hence, the drastic increase in the importation of rice in The Gambia from 93,900mt in 2000 to about 125,000mt in 2013 to close the huge gap between demand (175,000MT) and supply (50,000MT) (The Gambia Central Statistics Department, 2016).

Due to this huge food waste threatening food security of the country, and in response to narrow down the gap between food demand and supply, the governments of most developing countries such as The Gambia which are committed to improving agricultural productivity, started proffering strategies to minimize post-harvest losses, hence, in recent years, focusing on the training of agricultural extension agents on post-harvest management strategies. In turn, the agricultural extension services units have been providing entrepreneurial training and advice to commercial farmers to enable them to move up the value chain while providing smallholder farmers technical, financial and marketing information, and assistance to help them make good decisions to mitigate post-harvest losses. This assistance came in different forms ranging from training on post-harvest losses reduction strategies such as food processing, market linkages, access to credit facilities and research linkages.

Post-Harvest technologies are developed and introduced purposely to reduce post-harvest losses and bring about improvement in crop handling. According to Qamar (2015), the objectives of applying post-harvest technology are crucial because they include: maintaining food quality (appearance, texture, flavour and nutritive value), food safety, and reducing losses between harvest and consumption. These technologies such as various processing and preservation techniques of crops and crop products are taught to the extension agents who in turn disseminate them to the farmers through farmer trainings and demonstrations in order to minimize post-harvest losses. These activities are usually funded and coordinated by Ministries of Agriculture with the collaboration of non-government organizations (NGOs) such as Food and Agricultural Organization (FAO), World Bank, and World Food Programme (WFP).

Despite all these developments in the agricultural extension sector, post-harvest losses continue to be a great threat in most developing countries such as The Gambia, Nigeria, and Benin. This according to Swanson *et al.* (2014) is because agricultural extension in most developing countries are mainly focused on providing technical information to farmers such as, which varieties of seeds to use and how to control pests and diseases or make better compost; while relegating to the background vital components like those required to reduce post-harvest losses in farm yields. The study further highlighted that extension also requires “soft

skills’ that enable farmers to generate and promote innovations, improve the management of farmer organizations and agribusinesses, and build alliances and networks of different groups and individuals along the value chain. The objectives of this study is to identify the methods extension agents use to educate farmers in the west coast region of Gambia, assess the contribution of agricultural extension agents in the control of post-harvest losses of rice in the study area and impact of the contribution of agricultural extension to the control of post-harvest losses of rice in the West Coast region of Gambia.

### **Methodology**

The study was conducted in the West Coast Region of The Gambia which is the biggest region out of the six regions of the country. The West Coast Region is located in the western part of the country comprising nine (9) districts: Kombos (East, North, South, and Central) and the Fonis (Berefet, Bintang, Kansala, Biondali and Jarrol). The region has a population of about 699, 704 with a population density of 397 (Census, 2013) of which about 75% are involved in farming as a source of living. The region has a total land area of 1764.3 km<sup>2</sup> (NASS, 2013/2014).

Purposive sampling technique was used to select four (4) districts out of the nine (9) districts. The choice of the districts selected was due to the high production of rice in these areas. The selected districts were: Kombo South, Kombo Central, Kombo East and Foni Berefet. Simple random sampling technique was used to select two (2) villages in each of the four (4) districts giving a total of eight (8) villages used for the study. Taro yamane sample size determination was used in conjunction with the Proportional Sampling Technique to get a total sample size of 397 respondents used for the study. In Basori village, 53 respondents were selected; Pirang village, 52; Kartong, 35; Jambur, 57; Penyen, 41; Darsilami, 52; Bullock, 62; and in Berefet village, 45 respondents. Two (2) sessions of FGD comprising female and male FGD group were carried out in each of the eight villages selected in the study area. Purposive Sampling procedure was used to select one extension worker from each of the eight (8) villages selected as key informants for interview. Data collected was analysed using descriptive and inferential statistics from SPSS and FGD response transcriptions.

### **Results and Discussion**

The result in Table 1 shows that majority (79.8%) of the respondents were females while (22.2%) were males. From the findings, the number of the female farmers in the study area was more than the male farmers by 57.6% indicating that women actively contribute to rice farming sector in Gambia more than their male counterparts. The age distribution of respondents indicates that, many (40%) of rice farmers in the West Coast Region were between the ages of 46-55 years. The high percentage of this age category in farming according to the respondents was due to migration of the youths to the urban areas in search of white collar jobs and tertiary education. This reason have contributed to the low rice production recorded in the study area, as

individuals within this age category are not very energetic to engage in tedious farming activities. The results also showed that majority (71.8%) of the respondents were married, which implies that marriage enhances women's access to farmlands in Gambia. Only 4.5% of the respondents who were divorced revealed that they usually find it difficult to access land for farming, as divorcees were not culturally entitled to inherit lands from their divorced husbands. They further revealed that, prevailing poverty made it difficult for them to purchase, hire or rent land on a large scale for farming. About 66.2% had non-formal education, while 13.9%, 8.8%, 5.3% and 5.8% had primary, secondary, tertiary and other forms of education (such as the adult literacy and the local language education for adult farmers) respectively. This implied that the majority of the respondents were illiterates and this affected their ability to understand or apply extension technologies and practices. This lack of understanding in the long run led to inability to effectively preserve rice and subsequently, increased post-harvest losses of rice in the study area.

Results in Table 2 shows that agricultural extension agents have contributed in the control of post-harvest losses of rice as indicated respondents by providing of farmers with improved seeds (39.4%), linked to markets (9.75%), provided with pesticides (11.05%), linked to researchers (1.55%) and provided with post-harvest trainings (38.25%). Many (39.4%) of the respondents received improved seeds of rice from extension agents. Further findings revealed that seeds were high yielding, drought, pest and disease resistant targeted at reducing post-harvest losses of rice in the study area. These seeds were however provided to the farmers through revolving schemes where after planting and harvesting of rice, the farmers returned the exact number of bags they were provided with to the agency. This practice was adopted for sustainability of the programmes. This, according to the respondents enhanced productivity and post-harvest loss reduction, because high quality of the improved seeds thrived under harsh conditions such as draught, pest and disease outbreaks and increased the shelf-life of the grains. These benefits were re-echoed by one of the farmers during a FGD sessions thus:

*'Our burden of trying to look for seeds of certain desirable characteristics have been lessened by extension agents by providing improved seeds that are tested by the National Research Institute(NARI) of The Gambia. This has gone a long way to help reduce rice lost due to the resistance of the seeds to drought; pest and disease outbreaks; and also has boosted our production'* (Female FGD/ Berefet/Foni Berefet, 2017).

The respondents noted inadequate education on use, application and lack of supervision from extension workers which were detrimental to their yields. This corroborated by FGD thus:

*'Although we are provided with improved seeds by extension agents, there is very little supervision in terms of what the cultivation requirements for good results are. This has not helped much in getting the anticipated results from the use of the seeds. In some cases, the seeds do not either germinate or die during transplanting due*

*to the wrong methods of cultivation applied. This resulted to some of us losing more rice than anticipated* (Male FGD/ Darsilami/Kombo Central, 2017).

With reference to linking farmers to market facilities, the finding revealed that only 9.75% of the respondents reported linked to markets by extension agents. However, the respondents who were linked to these markets facilities revealed that, a lot of rice had been preserved due to the availability of markets at the right time. The extension agents connect farmers to the agricultural marketing cooperatives who also help them sell their rice on time and at profitable prices. This linkage helps to minimize the amount of losses that should have been incurred during preservation of the grains especially to pest and disease attacks and/or moulds. This impact was also highlighted during one of the FGD sessions:

*'Some of us who are fortunate to be linked to markets by the extension agents have experienced very minimal post-harvest losses in those particular seasons. We either sell our grains directly to the markets or through agricultural marketing cooperatives. This has helped us to sell our rice on time and at reasonable prices. It also lessened our problems of storage to preserve our grains for the next seasons'* (Female FGD/ Jambur/Kombo South, 2017).

The result also revealed that 38.25% of the respondents were provided with trainings by extension agents. Which implies that, majority (61.75%) of the famers in the West Coast Region of The Gambia did not have access to trainings on post-harvest losses related issues. This may be due to either the limited number of extension staff or inadequate funds to organize such trainings. However, the respondents who reported that they had benefited from these trainings stated that, they were trained on proper harvesting techniques, threshing, milling and drying methods. They were also taught application of proper amounts of pesticides and processing of rice into other products such as flour, baby food and snacks. The use of new machines and techniques such as combined harvesters, threshers and millers were also taught during these trainings. These trainings have been very helpful in the reduction of post-harvest losses. Their knowledge on how to prevent losses through the use of appropriate post-harvest techniques had positive impacts in the reduction of post-harvest losses of rice in the study area; especially as they increased shelf life of grains, the benefits of extension agents was reiterated by a farmer during the FGD sessions thus:

*'We really appreciate the trainings on post-harvest losses related issues provided to us by the government through its extension agents. I, for one, have seen a lot of boost in production and reduction in the losses that I have been incurring since I started receiving trainings from the field overseers. I have even learnt how to mill rice into flour using the new milling machine introduced by WARDA'* (Female FGD/Jambur/Kombo South, 2017).

With reference to the provision of pesticides, only 11.05% of the respondents were provided with



pesticides to control pest attacks on their rice both in the field or stores. Pesticides such as Deltamethrine were freely provided to the farmers to prevent pest attack such as weevils and rodents on stored rice. This has helped the farmers to store their grains longer without losing them to pests. This indicates that a very small percentage of the respondents were provided with pesticides by the extension agents. However, they indicated that the receipt of these pesticides from the Pest Protection Services (PPS) Unit of the Department of Agriculture through Integrated Pest Management (IPM) program had significant effects on the control of post-harvest losses of rice in the study area. The pesticides had helped to mitigate insect damage both in the field and at storage. As indicated by one of the discussants:

*'We have been receiving pesticides and trainings on their use from the PPS free of charge for the past years. The unit has also been teaching us how to prepare some natural pesticides such as the neem tree solution which also serves as pesticides for the attack of insects on the rice field. These have greatly reduced the losses during post-harvest operations due to pest attack'* (Male FGD/Pirang/Kombo East, 2017).

Another contribution of extension agents to farmers was the linking of farmers to agricultural researchers by agricultural extension agents. Findings revealed that only 1.55% of the respondents were reported to be linked to researchers directly. This implies that, farmers and researchers' linkage is very weak. The implication here is that most of the problems of rice farmers are likely to be un-resolved due to this weak linkage. Farming constraints such as outbreak of new pest or disease need to be investigated by experts to be able to understand the causes in order to proffer solutions for them. This however has not been the case in the study area as farmers were reported to have no access to research, in addition to the fact that, the extension –researcher' linkage is either weak or non-existence. However, the few ones that were opportune to access agricultural researchers stated that their timely intervention has averted lots of problems that would had caused them huge losses of grains. On the contrary, respondents who were not opportune to access researchers in any way reported that some of their problems had been lingering for years without a solution. This had increased farmers vulnerability of post-harvest losses of rice in the study area

Table 2 also presents the methods used by the extension workers to communicate to the farmers. The findings showed that only 0.5% of the farmers were accessed through contact farmers, 3.3% through focus group discussions, 39.5% through Farmer Field Schools, 25.9% through group meetings, 3.5% through telephones, and 26.7% were not communicated with at all. This implies that many of the respondents that were communicated to through Farmer Field Schools (FFS) shows that the extension agents accessed the farmers in groups through the FFS. These FFSs were well organized into groups and coordinated by an assigned extension worker in the area. The activities were facilitated by Plant Protection Services Unit and West African Agricultural Productivity Program (WAAPP).

The groups of farmers attending the schools were exposed to new agricultural technologies on demonstration plots for them to get firsthand information. Other plots were also created where the traditional technologies are applied alongside the plots with the modern technologies. These plots were run concurrently for comparative purposes. This enabled the farmers to learn new technologies and compare their benefits with the old technologies. This meant that farmers were trained, and had first hand information where they saw and practised whatever they were taught. The extension agencies and other projects use these medium to provide assistance either through trainings or provision of inputs such as seeds and pesticides. This practice allowed many rice techniques and practices to be passed to many farmers at a time for the extension workers who had to attend to many farmers in the area. The method had been a success in Gambia in the spread of information to a large audience of farmers within a short time.

However, one of the problems associated with the use of farmer field schools as a way of communicating to the farmers as revealed by the study was that, if follow-up visits were not carried out, most of the farmers did not correctly apply the practices that were taught to them during the sessions. In such situations, it did not yield the desired impact of minimizing post-harvest losses of rice. This finding is in line with Adebayo *et al.* (2011) who reported that, media extension and education through different methods (e.g., training the trainers, farmer field schools, field days), and education curricula including post-harvest related issues if well implemented, can be very crucial for the control of food losses. Despite these benefits, the study also revealed that 26.7% of the respondents did not receive any form of communication with the extension agents. The respondents associated their inability to access extension agents to either the few number of extension workers or the poor work ethics of the extension agents towards farmers. This implies that, they did not benefit from any of the post-harvest losses reduction strategies disseminated by extension agents, the government or other agricultural projects.

Findings from Table 3, showed that many (49.4%) of the respondents reported that they had rice production boost and bumper harvest, while 12.38% indicated increased income. Another 7.48% reported provision with markets; 2.5% reduced expenses; 20.6% saving time/labour; and 17.64% reported that there was no impact. From the findings, about 49.4% of the respondents indicated that their adoption of the post-harvest strategies provided to them by the extension agents' boost their production of rice capacity; this indicates that farmers had realized a boost in production from the intervention of the extension agents in the provision of post-harvest losses reduction strategies. The provision of seedlings that were disease and drought resistant, and trainings on rice preservation to avoid losses to weevils and rats invasion using pesticides had been revealed by the respondents as very effective in boosting their production capacity. This shows that there was significant reduction in post-harvest losses of rice

due to the preservation strategies provided to farmers by the extension agents. This was in line with a view from the FGD:

*'Some of us have experienced significant increase in our production level recently. This is a result of the post-harvest related trainings we are getting from the extension agents. In addition to the trainings, we are privileged to be supplied with improved rice seeds and pesticides which also contribute to the reduction of losses we have been experiencing in previous years'* (Female FGD/Bullock/Foni Berefet, 2017).

In addition to the boost in production capacity, respondents reported an increase in their income due to reduced losses of rice which increased their sales. About 12.38% of the respondents revealed that their income has significantly increased. The income increase indicated in earnings had been attributed to the intervention of the extension agents in the areas of trainings, linking farming to markets, provision of improved seeds and pesticides. Trainings on how to preserve rice such as the processing of rice into other products such as flour and snacks has helped farmers process and sell the rice in various forms instead of losing the rice to storage moulds and insects. In addition, the farmers were also linked to cooperative societies which helped to facilitate the sale of the rice at reasonable price. These helped them to earn more income due to the good price and sales at the right time. This was in line with what was highlighted during the FGD:

*'With the intervention of the agricultural extension agents, we have seen significant increase in our income. Trainings were conducted on how to preserve our grains to minimize losses. We have also been linked to markets to sell our grains on time and at very reasonable prices through the cooperative societies. These have boosted our income because of the increase in both quantity and quality of the grains and the reduction in losses'* Female FGD/Jambur/ Kombo South, 2017).

About 7.48% of the respondents revealed that they were able to access market facilities as a result of adoption of post-harvest loss strategies. The farmers were facilitated and coordinated to form and join cooperative societies with the assistance of the extension agents. The activities of the cooperatives were monitored by the Agric Business Unit of the Gambia under the Ministry of Agriculture. The farmers were sensitized and provided by the extension agents who would serve as a link between the farmers and the cooperatives for the sale of their rice. The grains were also inspected first by the extension agents to confirm the quality of the grains before the farmers are being provided with the forms to

fill to effect the sales. In that vein, the farmers had highlighted that as a result of these linkages, they are able to minimize losses and increase their earnings. This finding is in line with what Hussaini (2014) that improved access to markets would accelerate trade, thereby reducing the need to store grains on the farms or stores and help reduce losses. This view is in line with what was stated during an FGD:

*'In recent years, the Ministry of Agriculture through the Department Agric Businesses has been creating avenues to sell our grains. Our rice has been sold to the Cooperatives that help to sell them at reasonable set prices. This has saved us the burden of storing the grains where a lot is lost through attacks from rats, rodents and weevils or moulds'* (Female FGD/Kartong/Kombo South, 2017).

Due to the free provision of pesticides, and drought resistant seedlings that had been provided, about 2.5% of the respondents indicated that their expenses have been reduced and costs saved, as WAAPP and FAO provided them with hermetic bags to package and store their rice which would have otherwise cost them money to purchase. The result also revealed that 10.6% of respondents reported that the intervention of the agricultural extension agents has helped them to save time and labour, as the new and improved technologies helped the farmers carry out their activities faster and with less effort. This is emphasized by one of the discussants who noted:

*'With the introduction of the new threshing and milling machines introduced by the WAAPP project, we have been threshing and milling our rice in very short period of time and with less labour. The milling machines have also saved our women from using their hands to mill the grains with the mortar and pestle. This has saved them both the time and energy they would have used in these activities. This has also saved us from the spoilage and broken seeds which would have led to great post-harvest losses of rice'* (Male FGD/Pirang/ Kombo East, 2017).

Finally, despite all the positive impacts highlighted by respondents, about 17.64% of the respondents revealed that they had not experienced any impact of agricultural extension agent on their post-harvest activities. This, they attributed to the inability to access extension agents for reasons such as inaccessible road networks to remote villages, lack of transportation facilities like buses, motorcycles and bicycles to access farmers. This poor transportation system made the extension agents reluctant to visit farmers. Bias was also mentioned by the farmers, that extension workers select who and when to make their visits based on self-convenience.

**Table 1: Socio- economic characteristics of respondents**

Variable	Frequency	Percentage (%)
<b>Gender</b>		
Male	80	20.2
Female	317	79.8
<b>Total</b>	<b>397</b>	<b>100</b>
<b>Age(Years)</b>		
21- 30	53	12.3
31 – 45	111	28.66
46 – 55	160	40.73
Above 55	72	18.31
<b>Marital Status</b>		
Single	41	10.3
Married	285	71.8
Divorced	18	4.5
Widowed	53	13.4
<b>Educational Level</b>		
Non – formal	263	66.2
Primary	55	13.9
Secondary	35	8.8
Tertiary	21	5.3
Others	23	5.8

Source: Field survey, 2017

**Table 2: Contributions of Agricultural Extension Agents in mitigating post-harvest losses of rice**

Variable	Frequency	Percentage (%)
<b>Post-harvest losses reduction strategies</b>		
Provision of improved seeds	156	39.40
Linking farmers to markets	38	9.75
Provision of pesticides	43	11.05
Linking of farmers to researchers	6	1.55
Trainings	154	38.25
<b>Total</b>	<b>397</b>	<b>100</b>
<b>Method of communication</b>		
Contact farmers	2	0.5
Focus group discussion	10	3.3
Farmer field schools	157	39.5
Group meetings	103	25.9
Telephone	14	3.5
None	106	26.7
<b>Total</b>	<b>397</b>	<b>100</b>

Source: Field survey, 2017

**Table 3: Impact of the Contributions of Agricultural Extension Agents on Post-Harvest Loss of Rice**

Variable	Frequency	Percentage (%)
Boost production	198	49.4
Increase income	49	12.38
Provision of markets	28	7.48
Reduces expenses	10	2.5
Saves time /labor	42	10.6
None	70	17.64

Source: Field survey, 2017

## Conclusion

Extension agencies through their field agents have played a great role in the control of post-harvest losses of rice in The Gambia and West Coast Region in particular. Government in their endeavours to minimize the post-harvest losses of grains to avert the threat to food security to the growing population has engaged extension agencies to mitigate post-harvest losses. Farmers

are provided with services such as provision of improved rice varieties, trainings on post-harvest related issues and linking farmers to markets. This has had some significant impact in the reduction of post-harvest losses in the study area. It is recommended that a follow up study should be considered and has to be done during or soon after harvesting and should include actual measurement of post-harvest losses.

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