

Farmers' perceptions and their implications on the use of rice postharvest handling technologies and practices in eastern Uganda

Lusiba Ssebagala, G., Kibwika, P. & Birungi Kyazze, F.
Department of Extension and Innovation Studies, College of Agricultural and Environmental Sciences, Makerere University, P. O. Box 7062, Kampala, Uganda
Corresponding author: seba.godfrey@yahoo.com

Abstract

Attempts to enhance food and income security among smallholder farming households in the sub-Saharan Africa region have focused on increasing production and productivity with limited attention to reducing Postharvest losses (PHL). Therefore, investing in postharvest loss reduction provides an opportune avenue for significantly enhancing food security in the region. This study was conducted in Eastern Uganda to examine farmers' perceptions about use of postharvest handling technologies and practices. A cross sectional survey involving 150 household interviews and 83 farmers in focus group discussions was conducted. Results indicate that farmers had positive perceptions towards use of knife, tarpaulin and mechanized winnowing. However, 60% of the farmers' perceived mechanized threshers and moisture meters as irrelevant. This implies that farmers need to be sensitized about these technologies besides addressing the barriers to their availability, accessibility and use. Noticeable proportions of farmers had favorable perceptions towards the bad practices of early harvesting (77%) and prolonged heaping (50%). These type of practices may continue into the foreseeable future. Efforts should focus on sensitizing farmers and customizing the technologies that suit farmers' situations.

Key words: Perceptions, postharvest loss reduction technologies, rice postharvest losses, smallholder farmers, Uganda

Résumé

Les tentatives visant à améliorer la sécurité alimentaire et financière des ménages des petits exploitants agricoles dans la région de l'Afrique subsaharienne ont mis l'accent sur l'augmentation de la production et de la productivité avec une attention limitée à la réduction des pertes post-récolte (PPR). Par conséquent, investir dans la réduction des pertes post-récolte offre un moyen opportun pour améliorer considérablement la sécurité alimentaire dans la région. Cette étude a été menée en Ouganda orientale pour examiner les perceptions des agriculteurs sur l'utilisation des technologies et des pratiques de manutention post-récolte. Une enquête transversale portant sur 150 entretiens avec des ménages et 83 agriculteurs organisés en groupes de discussion a été menée. Les résultats indiquent que les agriculteurs

avaient des perceptions positives à l'égard de l'utilisation du couteau, la bâche et du vannage mécanisé. Cependant, 60% des agriculteurs ont perçu les batteuses mécanisées et des compteurs d'humidité comme hors de propos. Cela implique que les agriculteurs doivent être sensibilisés au sujet de ces technologies en plus de surmonter les obstacles concernant leur disponibilité, accessibilité et utilisation. Les proportions notables des agriculteurs avaient des perceptions positives à l'égard des mauvaises pratiques de récolte précoce (77%) et entassement prolongé (50%). Ce type de pratiques peut continuer dans un avenir prévisible. Les efforts devraient se concentrer sur la sensibilisation des agriculteurs et la personnalisation des technologies qui conviennent à la situation des agriculteurs.

Mots clés: perceptions, technologies de réduction des pertes post-récolte, les pertes post-récolte de riz, Ouganda

Introduction

Rice is a major staple for about half of the world's population (EUCORD, 2012). Rice has become a priority cereal crop for enhancing household food and income security in Uganda (National Planning Authority [NPA], 2015). Introduction of high yielding varieties including New Rice for Africa (NERICA) varieties have increased Uganda's production from 132,000 Metric tons in 2003 to 233,000 Metric tons in 2011 (FAO, 2014). However, high Post Harvest Losses (PHL) remain a key challenge (Candia and Masette, 2012; MAAIF, 2012; Nakazi and Sserunkuuma, 2013). The PHL are in both quantity and quality with smallholder farmers being the most affected. Farmers are in dire need to reduce PHL however how farmers perceive PHL is at the core of their practices and uptake of technologies for reduction of PHL. The limited uptake of appropriate post-harvest technologies promoted by the research system and extension agencies (Odogola, 2006; MAAIF, 2012) could be associated with the perceptions of farmers.

Postharvest losses are an integrative phenomenon that results from interactions between farmers, technologies/practices and the context in which they operate (World Bank, 2011) and perceptions are central to this phenomenon. The poor performance of technologies (including post-harvest technologies) is not only driven by the weak delivery systems but also the users' perceptions (Affognon *et al.*, 2015), however, the influence of perceptions on use of such technologies and practices has been less studied (Martins *et al.*, 2014). This paper explores farmers' perceptions towards PHL in rice to provide a sound understanding of the context in which PHL occurs. The study focused on two key research questions; 1) what are farmers' perceptions on post-harvest loss reduction technologies and practices that have been promoted in their area? 2) What are the implications of these perceptions on mitigation of rice post-harvest losses?

Literature summary

Providing food for the ever increasing world population is still a challenge (World Bank, 2011). It is estimated that agricultural production will have to increase by at least 60% by 2050 to meet the food demands (AGRA, 2014; Kiaya, 2014; Martins *et al.*, 2014). This

estimate is however based on the assumption that whatever is produced is available in the food systems. Efforts to meet food demands in Sub-Saharan Africa (SSA) have mainly focused on increasing agricultural production and productivity with limited attention to reduction of the high post-harvest losses especially in cereals (Hodges *et al.*, 2011; Affognon *et al.*, 2015; Kiaya, 2014). For example, an estimated 14% of the total cereal production in SSA is lost during postharvest handling and distribution (FAO, 2011). Accordingly investing in postharvest loss reduction is regarded as a quick impact intervention for enhancing food security (GIZ, 2013; Affognon *et al.*, 2015).

In addition, postharvest losses are known to be a result of technologies and practices used. Adoption and subsequent use of technologies and practices is strongly linked to perceptions (Ajzen, 1991). In the theory of planned behavior, Ajzen (1991) argued that farmers' behavioral intentions (e.g. deciding to take up technologies and practices) is dependent on perceptions in form of attitude towards the behavior, subjective norms and behavioral control beliefs. Adesina and Baidu-Forson (1995) for instance noted that farmers' subjective preferences for characteristics of new agricultural technologies as being important determinants of adoption of technologies in Burkina Faso and Guinea. Similar studies by Ndumani and Watanabe (2015), Mabe, Sienso & Donkoh (2015) found out that farmers' perceptions that climatic conditions were changing had driven them to adopt various strategies to mitigate and/or adapt to the impacts of change.

Study description

The study was conducted in Iganga and Namutumba districts in Eastern Uganda, which according to MAAIF (2011) are the leading producers of rice, but also account for 63% of the total grain loss in Uganda (APHLIS, 2012). Data were collected using a cross-sectional survey and Focus Group Discussions (FGDs). Whereas 150 (91 males and 59 females) were engaged in the survey, a total of 83 farmers (43 males and 40 females) participated in the FGDs. Individual semi-structured interviews were conducted during the survey. A five-point likert scale was used to score farmer perceptions based on statements framed from information obtained from the FGDs. A score of 1 meant that the farmer strongly disagreed with the statement and 5 meant that the farmer strongly agreed with the statement. A panel of experts comprising of four scholars from Makerere University checked the survey instruments for content validity. Prior to its use, the instrument was pre-tested on 15 farmers from Namuwondo village in Namutumba sub-county (not included in survey) for reliability. The qualitative data from FGDs were analyzed using content analysis to synthesize the emergent issues. The qualitative information is used to provide additional explanations and anecdotal evidence to complement the quantitative data. Data from the survey were analyzed using Statistical Package for Social Sciences (SPSS) version 16 to generate descriptive statistics including frequencies, percentages and means.

Research application

Mitigation and reduction of postharvest losses requires adoption and consistent use of technologies and practices by farmers and other downstream actors including millers and

stockists along the rice value chain. Tailoring the technologies and practices to knowledge, experience, social, economic and physical context of users is paramount for optimal uptake and use. Therefore by examining farmers' perceptions towards the technologies and practices that have been promoted in the study area will inform efforts by various developers (Agriculture Engineering and Appropriate Technology Research Institute-AETRI) and promoters (e.g. International Fertilizer Development Corporation -IFDC, Sasakawa Global 20000- SG2000, Japanese International Cooperation Agency- JICA) aimed at customizing, up scaling and out-scaling such technologies and practices in Uganda and elsewhere.

Results and discussions

Perceptions towards rice postharvest handling technologies. In an effort to reduce PHL in terms of both quantity and quality, various technologies have been promoted by government and non-government development agencies. Figure 1 shows the perceptions of the farmers towards selected technologies including; knife for harvesting, mechanized threshers, tarpaulins, moisture meter, manual winnowing technologies and storage containers.

About 84% of the farmers perceived the serrated knife as being an appropriate tool for ensuring production of good quality rice. This is because using a knife to harvest ensures selective harvesting. Selective harvesting allows for harvesting of only mature rice, of the same variety and without weeds. Despite this positive perception towards the knife, only 25% of the farmers interviewed were using it to harvest rice. During FGDs, farmers noted that those who used the knife did so to harvest 'Supa BC' rice variety which is considered a high value variety but without uniform maturity. Almost all the interviewed farmers used a sickle for harvesting. The limited use of the knife in harvesting is due to its perceived slowness to accomplish the harvesting activity. Our findings agree with those of Appiah *et al.* (2011) who noted that farmers in Asante region of Ghana were not using the knife to harvest rice despite their awareness about its ability to reduce losses because it was much slower than

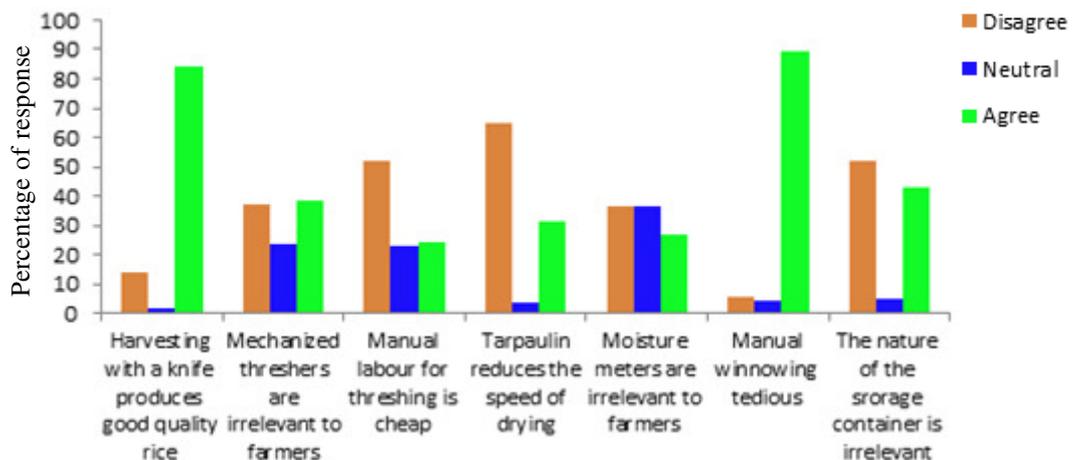


Figure 1. Farmers' perceptions towards selected rice PHH technologies in Iganga and Namutumba districts

the sickle. These findings imply that technology developers should come up with a harvesting a technology that is fast without compromising the quality of rice.

Concerning mechanized threshers, farmers expressed relatively mixed perceptions about the relevance of this technology to smallholder farmers. This is indicated by the substantial proportions of farmers (about 38%) who agreed or disagreed with the statement about the relevance of the threshers to smallholder farmers. Farmers that hold a positive intuition that a mechanized thresher was relevant to smallholder farmers had the feeling that the technology would quicken the process and reduce drudgery. However, during the field observations, there were 38% of the farmers who considered the thresher to be irrelevant to smallholder farmers. They argued that the technology was not aligned to their circumstances in terms of farm size and layout, marshy conditions in the field and low rice output. For example, farmers noted that the available threshers were too big and heavy to be transported and moved through narrow, marshy/waterlogged paths in the fields. The farmers noted that use of the threshers was associated with various costs including transportation and fuel to run the machine. The above diverse perceptions about mechanized threshers and their justifications have adverse implications for farmers' uptake of the technology even it were readily available. Farmers who perceive mechanized threshers to be too costly to acquire and use and those who perceive them (threshers) as being incompatible to their circumstances are unlikely to adopt them. Cases of farmers who could not adopt available technologies because they perceived them to be expensive or simply unsuitable for their circumstances have been documented elsewhere. Levai *et al.* (2015) for example found that 62% and 18% of the farmers in Fako division of southwest Cameroon were not using fertilizers because they perceived them to be expensive and irrelevant respectively.

Production of quality rice is indispensable. Thus, drying rice on a tarpaulin by farmers is intended towards achieving this by minimizing contamination with dust, sand, stones and other foreign matter. Results indicate that most of the farmers (65%) had a positive attitude towards tarpaulin use. They also disagreed that use of a tarpaulin reduces the rate of drying. This implies that such farmers can take up the tarpaulin technology if other conditions like availability and cost permit. Cases where farmers' positive perceptions are associated with high levels of use have been documented for example by Joshi and Pandey (2005). Joshi and Pandey found that farmers in Nepal who had positive perceptions about selected characteristics of rice varieties had proceeded and adopted such varieties. Conversely, 31% of the farmers agreed that use of tarpaulins to dry rice reduces the speed of drying. The latter perception may prevent farmers from using the tarpaulins. Accordingly, it is therefore not surprising that only 57% of the farmers were using a tarpaulin or its close substitutes especially locally fabricated polyethylene sheets. Conversations with farmers during the FGDs revealed that use of a tarpaulin was driven by the farmers' perceived market value of the variety and intended use of rice. For example, varieties such as *Supa BC* perceived to be of higher market value are dried on tarpaulin whilst *Kaiso* which are perceived to be of low market value are dried on bare ground. Relatedly, most households endeavor to dry rice meant for home consumption on the tarpaulin and/or other improvised materials as expressed by one of the female FGD participants;

I never dry the rice for home consumption on bare ground. Even if I don't have a tarpaulin I would rather use my 'Gomesi' (Gomesi is a traditional women's dress which has a lot of value and prestige) or a bed sheet because the stones in the rice can destroy my teeth (FGD at Kibale sub-county, Namutumba district 24 April, 2015)

Giving preference to rice for home consumption during drying implies that rice meant for marketing is likely to be dried on bare ground and thus compromising its quality. It is therefore not surprising that 42% of the farmers were found drying their rice on bare ground. This explains the high levels of foreign matter in rice produced in Uganda. Similar findings were confirmed by Candia and Massete (2012) who reported that 6% of rice produced and sold in Uganda had foreign matter in form of sand, stones and dust.

Farmers indicated mixed discernments about the use of a moisture meter. Equal proportions of the farmers (37%) considered the moisture meter as being relevant while 26% deemed the technology as being irrelevant. This mixed perception towards the use of a moisture meter was attributed to the lack of knowledge and experience by farmers in using it. Besides some farmers perceiving this technology as being relevant, none of them used it. They instead employed the local methods including biting rice between teeth (92%), rubbing rice grains between the palms of hands (4%) and walking through the rice on bare feet (2%). However, these local methods are relatively subjective and less accurate in determining the moisture content of rice.

With regard to winnowing, a high proportion of farmers (89%) were dissatisfied with manual winnowing technologies and expressed a feeling that given other alternatives, they would abandon it. This signals a discontent with existing manual winnowing technologies such as the winnowing basket (locally known as *olugari*) and the basin. For example, the *olugari* is considered to be slow, heavy and female-based technology. The basin on the other hand is disapproved because it spills a lot of rice in circumstances of strong wind of unpredictable direction. In addition, two technologies are associated with health hazards to the users through inhalation of the dust from the winnowing process. Such a widely spread discontent with the prevailing manual winnowing technologies opens space for innovations initiated by farmers themselves and technology developers and promoters.

Farmers' perceptions towards selected rice PHH practices. Farmers' perceptions towards selected practices in rice PHH are presented in Figure 2. The selected practices cover the processes of harvesting, heaping and drying which were identified during FGDs as key stages where PHL occur.

Figure 2 highlights farmers' perceptions towards the different rice post-harvest handling practices. The practices of early harvesting was perceived by 77% of the farmers to have been triggered by the expectation of hailstones. Conversations with farmers during FGDs revealed that this practice of harvesting rice before its full maturity results into fragile grains; susceptible to breakage at milling. This accounts for a higher proportion of broken and chalky grains in the locally produced rice. A study by Candia and Massete (2012) indicated that the proportion of broken grain in rice produced and sold in Uganda was 64%. Holding

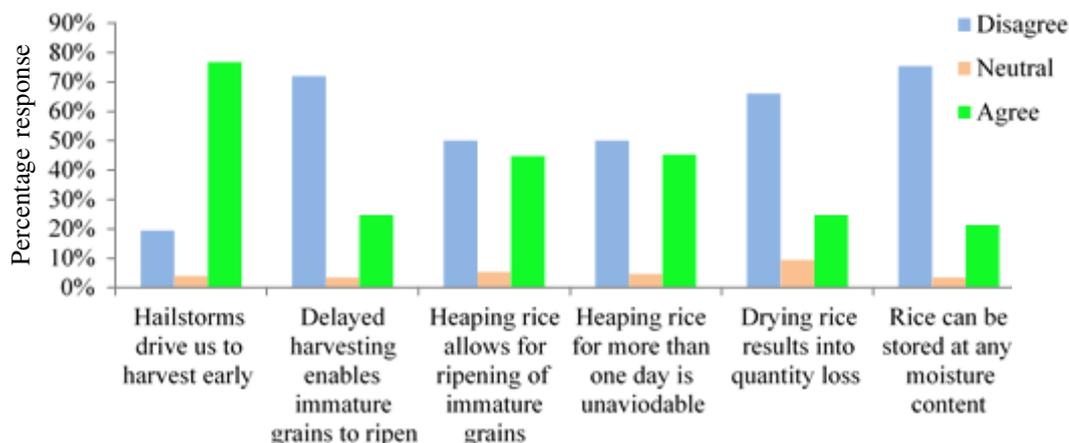


Figure 2. Farmers' perceptions towards selected rice PHH practices

a positive perception towards the practice by farmers, indicate that this practice is likely to continue with detrimental effects for PHL especially quality.

On the contrary, 72% of the farmers disagreed with the notion that delayed harvesting enables immature grains to ripen. This indicates a negative perception towards late harvesting. Conversations with farmers during FGDs indicated that they were aware that late harvesting leads to postharvest losses through spillage, shattering and exposure to unpredictable weather. The negative perception towards the bad practice of late harvesting implies that the practice is likely to be less common in future.

Further, Figure 2 reveals that an average proportion of the farmers (50%) were opposed to the thinking that heaping enables ripening of rice. Similarly, they were in disagreement that heaping rice for more than a day could not be avoided. Nonetheless, 45% of the farmers felt that prolonged heaping enables immature grains to ripen and could therefore not be avoided. These mixed perceptions among farmers imply that prolonged heaping of rice is likely to continue resulting into quality deterioration. Field observations revealed most of the grains from rice that had been heaped for more than three days were yellow or multiple coloured (yellow, black and brown). Yellow and multi-coloured rice is unappealing to consumers because it is considered to be of low quality.

Finally, majority of farmers (66%) disagreed with the notion that drying rice to the recommended moisture content is undesirable. This perception shows that farmers are aware that rice should be dried to the recommended moisture content of 13-15% to support storage (Kiaya, 2014). This implies that with the availability of the moisture meters, farmers are likely to dry their rice to the recommended moisture content.

Conclusion

Farmers' perceptions towards postharvest loss reduction technologies and practices were diverse at different stages of rice postharvest handling. The positive attitudes towards some

of the technologies and practices such as knife, tarpaulin and mechanized winnowing seem to provide a fertile ground for new innovations customized to the local social, economic and physical situation. The noticeable proportion of farmers who were in favour of the postharvest loss enhancing practices like early harvesting and prolonged heaping implies that such practices are likely to continue. It is therefore recommended that analysis of farmers' perceptions and mindset change for farmers with negative perceptions towards the usefulness of such technologies and practices are undertaken prior to their introduction in the area.

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