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Research Application Summary

Farmer learning through on-farm Cassava Demonstration Sites: the case of Kiryandongo district, Uganda

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Abstract

A comparative study was conducted among demonstration users and non-users where a cross-sectional survey was preceded by holding three focus group discussions and complemented with field observations to establish how the National Agriculture Research Organization (NARO) enhanced farmer learning about cassava production practices and technologies in Kiryandongo district, Uganda. While thematic-content analysis was applied for qualitative data, quantitative data were analyzed using SPSS version 18.0. Our results indicate that over 81% of the farmers approved the use of on-farm demonstration sites as being vital in influencing farmer learning especially if well-facilitated by competent extension staff. Paired samples t-tests indicate statistically significant differences in creating awareness, knowledge gain and retention, application and sharing of the acquired knowledge and experiences about cassava production practices and technologies. However, its effectiveness in fostering farmer learning would be much higher if it is integrated with other participatory extension methods and approaches such as Information and communication technologies.

Keywords: Cassava farmers, demonstration sites, farmer learning, Uganda

Résumé

Une étude comparative était menée parmi les producteurs accueillant des champs de démonstration et ceux qui n'en avaient pas où une enquête transversale avait été précédée par la tenue de trois groupes de discussion et complétée par des observations sur le terrain pour établir comment l'Organisation nationale des recherches agronomiques (NARO) a amélioré l'apprentissage des agriculteurs sur les pratiques et technologies de production de manioc dans le district de Kiryandongo, en Ouganda. Alors que l'analyse thématique du contenu était appliquée pour les données qualitatives, les données quantitatives étaient analysées à l'aide de la version 18.0 du logiciel SPSS. Nos résultats indiquent que plus de 81 % des agriculteurs ont approuvé l'utilisation de sites de démonstration à la ferme comme étant essentiels pour influencer l'apprentissage des agriculteurs, en particulier s'ils sont bien gérés par un personnel compétent de vulgarisation. Le test t de Student des échantillons appariés indiquent des différences statistiquement significatives dans la sensibilisation, l'acquisition et la rétention des connaissances, l'application et le partage des connaissances et des expériences acquises sur les pratiques et technologies de la production de manioc. Cependant, son efficacité dans la promotion de l'apprentissage des agriculteurs serait beaucoup plus élevée si elle était intégrée à d'autres méthodes et approches de vulgarisation participative telles que les technologies de l'information et de la communication.

Mots clés : Producteurs de manioc, sites de démonstration, apprentissage des agriculteurs, Ouganda

Introduction

Efforts to enhance agricultural productivity require use of participatory methods and learning approaches that trigger and sustain farmer learning behaviour. For example, Farmer Field Schools (FFS), on-farm demonstrations (OFDs), agricultural shows and fairs, field days, exchange visits and mass media are reported to enhance interactive farmer learning if well facilitated by a trained and competent personnel. Besides, such approaches are critical especially where extension worker to farmer ratio is low. Learning is defined as the ability of extension method and approaches to foster awareness creation, acquisition and retention of knowledge, application and experience sharing about the acquired knowledge (Karubanga *et al*., 2019). Globally, use of on-farm demonstrations was first recognized nearly a century ago by Knapp, an extension pioneer in 1903. The purpose is to ensure change in methods and practices of farmers as they observe and learn from farms operated at public places, in this case demonstration sites being facilitated by competent extension staff (Karubanga *et al*., 2017). Farmers are expected to implement what they observe and learn on their own farms (Ssebaggala *et al*., 2017); through making necessary modification and adaptation (FAO, 2014; Danielsen *et al*., 2015).

In Sub-Saharan Africa, use of demonstration sites has gained momentum as one form of promoting learning about new technologies among smallholder farmers (Sanya *et al*., 2015). Particularly, in Uganda, the Ministry of Agriculture, Animal Industry and Fisheries [MAAIF] through the National Agricultural Research Organization [NARO] invested substantial amount of resources in cassava variety research, development and dissemination through the Agricultural Technology and Agribusiness Advisory Services [ATAAS] Project (NARO, 2012). This was intended to address farmers' technological and farming needs (such as planting materials) for boosting their income and food security (FAO, 2014; MAAIF, 2015; Sanya *et al*., 2015). However, Ogisi *et al*. (2013) notes that whereas cassava is a staple food crop in several countries in Africa (including Uganda), farmers knowledge about the recommended cassava production practices and technologies is still low. This is perhaps due to fact that farmers are not exposed to participatory methods and learning approaches (Ogisi *et al*., 2013).

Along the same line, the essential knowledge required by farmers about improved cassava production practices and technologies include, among others, seed selection, site selection, timely planting, land preparation, recommended spacing, weeding, weed control, pest and disease control and timely harvesting (NARO, 2012). Thus, acquisition of this essential knowledge requires a well-facilitated interactive learning methods and approaches (Isubikalu, 2007; Kagbu *et al*., 2016; Karubanga *et al*., 2017).

Establishment of demonstration sites as a method to engage farmers in processes of learning about production practices and technologies has been widely used in Uganda (Sanya *et al*., 2015). However, how this method has enhanced farmers learning in terms of creating awareness, acquisition and retention, application and sharing of knowledge remains largely unknown. Therefore, this study assessed how farmer learning was enhanced through on-farm cassava demonstration method using the case of Kiryandongo district Uganda.

Materials and methods

A cross-sectional study was conducted in Kiryandongo district, in Uganda with demonstration users and non-users. Demonstration users refer to those cassava farmers who attended and learnt from the established plots while non-users were those farmers who did not participate and learn from the demonstration plots and these were used as control or counterfactual. The demonstration sites which were assessed were established by NARO purposely to equip farmers with new knowledge and skills in cassava production and management. The cross-sectional survey was preceded by conducting three Focus Group Discussions (FGDs) with 24 demonstration participants and 12 non-demonstration participants to gain deeper understanding on how OFD enhanced farmer learning about cassava production and management practices and technologies. Focus group participants were selected based on their experience in participating in demonstration activities.

A survey involving administration of a semi-structured questionnaire to 66 demonstration participants and 66 non-demonstration participants to assess the extent of farmers learning about cassava production practices and technologies was also undertaken. The essence was to assess the knowledge levels and farmers' awareness of acquired and retained knowledge, and how they applied and shared the acquired knowledge within their networks. To assess this, a knowledge test was administered following the procedure highlighted by Karubanga *et al*. (2016):

- Awareness creation was measured by the difference in awareness regarding the new practices and technologies between the demonstration users and non-users. Farmers indicated how many new practices and technologies they were aware of regarding cassava production prior to coming to the demonstration. However, as stated by Karubanga *et al*. (2016) it should be noted that demonstration sites could have enabled more awareness of even the practices and technologies the farmers knew before.

- Knowledge acquisition and retention was measured by the details on relevance and application of the specific practices and technologies performed by the demonstration users and non-users. The difference between the two groups of farmers was an indicator of the knowledge acquired and retained.

- Knowledge use was measured by the number of practices and technologies different categories of farmers were able to apply in their own context.

- Knowledge and experience sharing were measured by farmers' confessions on sharing what they were practicing in their own context.

In nutshell, the knowledge test covered aspects of site selection, timely planting, land preparation, recommended spacing, weeding, weed control, pest and disease control and timely harvesting. The extent of application of recommended practices and technologies by farmers was assessed by observing what kind of practices were applied by farmers (Karubanga *et al*. (2017). Through field observations and interactions with the respondents, challenges faced by the farmers in applying the recommended practices and technologies in their context were identified.

Data analysis

The qualitative data generated through field observations and FGDs were analyzed through thematic-content analysis and coding by extracting, and relating information on the major themes of the study. Quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) version 18.0 to generate means and percentages of socio-economic attributes of cassava farmers and extent of farmer learning about cassava practices and technologies. Inferential statistics such as Paired Samples T-test were used to determine the mean differences in awareness creation, knowledge acquisition and retention, its application and knowledge and experience sharing about cassava production practices and technologies.

Findings

Majority of the respondents in the sample were females (52%) for demonstration users and for non-users more males (54%) were interviewed. The difference in gender participation across males and females for those involved in demonstration sites was as a result of selection bias which was based on group belonging. For example, the studied groups were basically women based as they perceived cassava to be a female-based enterprise. This motivated fellow women to join and learn from the same demonstration site in the locality. On the other hand, more than half of the non-users (54%) were male. This was basically attributed to the selection of respondents based on the household.

Table 1. Description of socio-demographic features of respondents

Variable (%)	Demonstration users	Non-users (%)
Sex of respondents		
Male	48	54
Female	52	46
Age of respondents		
10-20 years	5	9
21-30 years	28	26
31-40 years	15	30
41-50 years	14	11
Above 50 years	39	24
Level of education		
No formal education	11	14
Primary	52	76
Secondary	33	11
Tertiary	5	0
Group membership		
Yes	100	59
No	0	41
Occupation of respondents		
On-farm activities	92	97
Off-farm activities	8	3

Table 1 further shows that most of the demonstration users were above 50 years while the non-users were in age group of 31-40 years. This implies that the farmers who get actively involved in agriculture and get involved in demonstration trainings are mostly old members and this has implications on the implementation of the acquired knowledge and skills as old people are deemed to be weak to perform heavy chores (Ssebaggala *et al*., 2017). Regarding the level of education, across the two farmer groups, most respondents had attained primary level education (51% for demonstration users and 76% for non-users). This implies that farmers can easily interpret and apply the information they get about cassava production practices and technologies more especially through there interaction networks and platforms (Danielsen *et al*., 2015). Regarding the status of farmer organization, all demonstration users p (100%) belonged to locally organized farmer groups as compared to 59% of their counterparts. This implies that organizing and running demonstration sites based on farmer groups would enhance more interactive learning among a mix of diverse groups and this works in circumstances where extension work and farmer ration is low (Karubanga *et al*., 2016).

How farmer learning occurred through on-farm demonstration sites

Awareness creation. Survey results indicate that about 19% of the demonstration users cited site selection, land preparation and timely planting as the most practices they got to know from the established On-farm Demonstration sites (OFDs). About 10% of the demonstration users said that selection of desirable varieties and timely weed control were some of the most important practices and technologies that they got to learn from the OFDs while only 4% got to learn about timely harvesting. Planting in lines was perceived as being key by about 5% of the demonstration users and because of line planting, farmers learnt about the correct spacing of cassava plants (1 m x 1 m) they said eased movement through the field while performing other subsequent agricultural processes such as thinning (Karubanga *et al*., 2019). In their opinion, farmers in the FGDs acknowledged that the demonstration sites created more awareness about how better practices and technologies can be incorporated into their farming practices.

On the other hand, the non-users indicated that despite the existence of demonstration sites in their locality, there was no much awareness created about the new improved cassava production practices and technologies. This was partly attributed to the fact that site and host farmer selection were not clearly undertaken and this explained why farmers continued to practice local ways of producing and managing cassava. One of the male non-demonstration participants in Masindi port sub county opined that; We (the farmers) were not aware that the cassava demonstration plot in our community was meant for all farmers. We thought it was established by the host farmer and besides that it was always fenced off with a gate and as such we could not access it. How then could we access the demo plot and be in position to know and learn about these improved cassava varieties and the associated practices and technologies? (Key informant interviews, June 2018).

Results of a paired samples t-test indicates a statistically significant mean difference in awareness about improved cassava production practices and technologies between the demonstration users and non-users at 1% level of significance ($t=2.383$, $p<0.05$). This implies that if OFDs are well located in appropriate sites and facilitated by the competent extension worker, more awareness creation about the new cassava technologies and practices could be enhanced especially in those aspects perceived to be important in cassava production. Conversely, through OFDs farmers got to know about key attributes of new cassava such pests and disease resistance, drought tolerant and quick maturing. Farmers indicated that they did not know about these attributes before, making a key attribute for demonstration sites in creating awareness among farmers. This was evident where majority of demonstration users (84%) became aware about these new cassava varieties and their associated production practices and technologies.

Knowledge acquisition and retention. Learning does not end with awareness creation, but how easily the farmers can retain, recall and be able to apply the acquired knowledge and skills (Danielsen *et al*., 2015; Karubanga *et al*., 2017). Survey results indicate that about 18% of the demonstration users acquired and remembered information on timely planting that was demonstrated to them through demonstration sites Furthermore, About 16% of demonstration users indicated that they had learnt about timely weed control as this minimized pest and disease infestation as well as avoiding nutrient and water competition between the plants and weeds. Conversations with demonstration users indicated that retention of the acquired knowledge about particular cassava production practices and technologies was attributed to their relevance and hope of being applied in the near future on their own fields. On this basis, it is possible to conclude that the acquisition and retention of knowledge and skill is associated with the farmers possibility to apply the acquired knowledge (Bentley *et al*., 2014; Karubanga *et al*., 2019). Other practices such as correct spacing and pests and disease management were less acquired and retained because farmers perceived them as being difficult to undertake, time consuming, and have cost implications (Bentley *et al*., 2014). Therefore, the mean difference in knowledge acquisition (gain) and retention between the demonstration users and non-users was highly significant at 1% level of significance (t=3.158, p<0.01). Higher acquisition and knowledge retention by demonstration users compared to their counterparts was partly attributed to the fact that the trainings conducted at the demonstration sites were facilitated by the well-trained and competent extension staff who step-wise clearly demonstrated the cassava production practices and technologies. In this regard, the users were able to see and try out the practices and technologies being demonstrated; thus, enhancing their capacity of knowledge gain and recall.

However, knowledge acquisition (gain) and retention would be much higher if the trainings were frequently organized, undertaken and guided through more structured technical backstopping provided by the extension staff (Karubanga *et al*., 2018). For example, about 56% of the users indicated that the trainings through demonstration sites were only conducted two times in a quarter; which in their opinion was inadequate to master all the promoted cassava production practices and technologies. For more facilitated and self-directed learning to occur, technical backstopping through constant follow-up and training are paramount as this paves way for effective adaptation and implementation of the acquired knowledge and skills (Karubanga *et al*., 2017).

Knowledge application. All demonstration users (100%) and 86% on non-users perceived that good cassava production practices and technologies are imperative for enhanced food and income security. This partly explains why a paired samples t-test results between users and non-users were statistically significant regarding the level of application of the acquired and retained knowledge about improved cassava production practices and technologies at 1% level of significance (t=2.985, p<0.01. It is on this basis that some farmers applied the acquired knowledge and skills with some form of modification and adaptation (Karubanga *et al*., 2017; Karubanga *et al*., 2018). The findings indicate that out of eight practices and technologies, the demonstration users were able to apply only three. The results also indicate that the knowledge which the farmers had acquired and retained was not fully applied because of some specific reasons including; unavailability of clean cassava cuttings, inadequate labour, and costs involved in implementing the practices and technologies (also see Danielsen *et al*., 2015). To avert the situation of lack of clean planting materials, with application of knowledge gained from the demonstrations on selecting good planting materials, farmers instead resorted to acquiring the cassava cuttings/planting materials from their own home gardens, neighbours and friends, which was the common practices performed by non-users.

Knowledge and experience sharing. Like in any other group-based training and learning approaches, interactive sharing and learning is vital. The survey findings indicated that OFDs initiated enhanced farmer interactions and learning about improved cassava production and management practices and technologies unlike in the case of their non-participating counterparts. The interactions mainly focused on the critical aspects which farmers perceived to be important in cassava production. On average, majority of the demonstration users (98%) shared acquired knowledge and experience with others as compared to 56% of the non-users on aspects related to cassava production practices and technologies. This explains why a paired samples t-test was significantly different in sharing information and knowledge about cassava production practices and technologies among the demonstration users and non-users at 1% level of significance (t=2.305, p<0.05). The most common avenues for sharing knowledge and information about the improved cassava practices and technologies included group meetings, friends who visted their homes and at the demonstrationsites. However, only 17% and 6% of the demonstration users and non-users respectively said that they shared knowledge and information with other fellow farmers. Sharing involved critial and collective reflection and discussion about what they knew with regard to casava production practices and technologies (Karubanga *et al*., 2018). For example, through field observations, farmers at Kaduku demonstration site collectively monitored and observed pest and disease infestation in their site and this was association with interactions and shared learning which is critical for self-discovery learning (Bentley *et al*., 2014; Karubanga *et al*., 2017). For example, the Kaduku village demonstration farmers indicated that;

We (Kaduku demonstration participants) identified this cassava plant and we suspected it to be either sick or could have been affected by the herbicide which was applied during weeding. We got to know about it when the leaves started yellowing and we brought the case to the attention of the extension worker. We want to see whether this affected plant can as well produce some tubers (Participant observations, June 2018).

This finding means such interactions among the farmers enhanced their critical reflection and sharing for collective efforts in addressing common challenges; of-course drawing from their own past experiences. Such interactions open dialogue among farmers for shared through seeking clarity from technical extension staff (Karubanga *et al*, 2017). In the process, farmers become experts.

Conclusion

The study was set out to investigate farmer learning through on-farm cassava demonstration sites using Kiryandongo district as the case in Uganda. Results have revealed that off-farm demonstration sites significantly influenced farmer learning about cassava production practices and technologies by creating awareness, enhancing knowledge acquisition and retention, application, and triggering and sustaining experience sharing among farmers. However, such interactive learning through off-farm demonstration sites would have been even more effectiveness if integrated with other participatory extension approaches such as Information and communication technologies being facilitated by technically competent extension staff. This would deepen more interactive learning and sharing as farmers would be able to relate what they observe being demonstrated in the video and those practiced in the demonstration plots. This as well requires documenting particular processes and practices taking place at the demonstration sites for scaling out to other stakeholders using other robust means such as radio and television. This paper, therefore, provides insights for future design and implementation of similar demonstration sites for farmer learning.

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