

Research Application Summary

Attitude and experience of smallholder farmers towards potato crop intensification in southwestern Uganda

Ainebyona, R.R.,¹ Agea, J. G.,¹ Nasirumbi, S.L.,¹ Karubanga, G.¹ & Mugisha, J.²

¹Department of Extension and Innovation studies, Makerere University P.O Box 7062 Kampala, Uganda

²Department of Agribusiness and Agricultural Economics, Makerere University P.O. Box 7062 Kampala, Uganda

Corresponding author: ainebyoonar@yahoo.com

Abstract

In Uganda, potato (*Solanum tuberosum* L) is a growing lucrative crop particularly in the densely populated rural areas of the country, whose production considerably limited the supply to markets owing to conservative production methods. The objective of this study was assessing the influence of attitudes and experiences of smallholder farmers on uptake of innovations towards potato crop intensification in Southwestern Uganda. The study was conducted in Rubanda, Rukiga and Kabale districts in southwestern Uganda using 3 focus group discussions (FGDs). Results indicate that potato farmers had a negative attitude towards Kachwekano Zonal Agricultural Research Institute (Ka-ZARDI), a government facility mandated to promote foundation seed of potato and to promote uptake pathways of proven technologies. Consequently, they have continued to use low quality potato recycled from local sources, especially own-saved seed source and fellow farmer seed sources. Farmers lack knowledge and experience on use of crop production intensification practices such as use of fertilisers and certified seed. Kachwekano Zonal Agricultural Research Institute needs to engage more rigorously with the farming community in order to accelerate uptake of innovations towards potato production intensification. It is also imperative that clear extension messages are disseminated in order to ascertain production intensification impact on the ground.

Key words: Certified seed, foundation seed, *Solanum tuberosum*, Uganda

Résumé

En Ouganda, la pomme de terre (*Solanum tuberosum* L) est une culture lucrative en pleine croissance notamment dans les zones rurales densément peuplées du pays, dont la production a considérablement limité l'approvisionnement des marchés en raison de méthodes de production conservatrices. L'objectif de cette étude était d'évaluer l'influence des attitudes et des expériences des petits exploitants agricoles sur l'adoption des innovations en matière d'intensification de la culture de la pomme de terre dans le Sud-Ouest de l'Ouganda. L'étude a été menée dans les districts de Rubanda, Rukiga et Kabale dans le Sud-Ouest de l'Ouganda à l'aide de 3 discussions de groupes (FGD). Les résultats indiquent que les producteurs de pommes de terre avaient une attitude négative envers l'Institut zonal de recherche agricole de Kachwekano (Ka-ZARDI), un établissement gouvernemental mandaté pour promouvoir les semences de base de la pomme de terre et pour promouvoir les voies d'adoption des technologies éprouvées. Par conséquent, ils ont continué à utiliser des pommes de terre de mauvaise qualité recyclées à partir de sources locales, en particulier, des sources de semences conservées par eux-mêmes et des sources de

semences d'autres agriculteurs. Les agriculteurs manquent de connaissances et d'expérience sur l'utilisation des pratiques d'intensification de la production agricole telles que l'utilisation d'engrais et de semences certifiées. L'Institut de recherche agricole de Kachwekano doit s'engager plus rigoureusement auprès de la communauté agricole afin d'accélérer l'adoption d'innovations en faveur de l'intensification de la production de pommes de terre. Il est également impératif que des messages de vulgarisation clairs soient diffusés afin de déterminer l'impact de l'intensification de la production sur le terrain.

Mots clés: Semences certifiées, semences de base, *Solanum tuberosum*, Ouganda

Introduction

Crop intensification features prominently as a policy strategy to meet Sustainable Development Goals (SDGs) (Dawson *et al.*, 2019). Crop intensification is defined as increasing use of farm inputs and/or cropping intensity per unit of land (Pretty and Bharucha, 2014). It is an innovation that enhances farmers' welfare, particularly household nutrition security and incomes.

In Uganda, potato (*Solanum tuberosum* L) is a growing lucrative crop, particularly as a major component in the fast-food industry, which is blossoming in the densely populated urban centres of the country. The most constraining factor on the supply side, is low commercial value tuber yields, which are barely 7.14 tha^{-1} against the potential on-station yield of up to 20 tha^{-1} (Okello *et al.*, 2016), mainly attributed to low uptake of innovations (Priegnitz *et al.*, 2019) and limited access to new and current knowledge by smallholder farmers (Mohammad, 2017). Accelerating the rate uptake of potato production intensification initiatives is, therefore, expected to improve farmers' potato production as well as household welfare. The objective of this study was assessing the influence of attitudes and experiences of smallholder farmers on uptake of innovations towards potato crop intensification in Southwestern Uganda.

Methodology

The study was conducted in the districts of Rukiga, Kabale and Rubanda in southwestern Uganda; where 60% of total potato output is reportedly produced (Namugga *et al.*, 2017). Data were collected qualitatively using focus group discussions (FGDs), each consisting of 12 potato farmers. The respondents were purposively selected basing on their participation in potato intensification trials, demonstration and training activities organized by Community Action Research Programme Plus (CARP+). An interview guide was used to guide a discussion during the FGDs. Data were analysed using descriptive statistics and thematic content analysis.

Results and Discussion

Farmers' attitudes and experiences towards potato crop intensification. Findings from FGD revealed that potato crop intensification was perceived by smallholder farmers differently, ranging from potato seed source to farm practices, such as spacing and fertiliser application (Tables 1 and 2). This may partly be the reason behind the slow take off of the potato intensification drive in the region. It is therefore, imperative that clear extension messages are disseminated in order to ascertain production intensification impact on the ground.

Common sources of potato seed. Own-saved seed source was the commonest source of potato seed among the smallholder farmers in the region (Table 1). Own-saved potato seed source refers to a situation whereby farmers keep part of the seed from previous harvests to use as seed in the next planting season. This source was common because it did not involve costs of purchase of seed and transportation. A farmer is also able to sort for variety of preference, size, remove cut and bruised which ensures uniformity. The other reason was guaranteeing availability at the time of next planting and not being cheated by traders in the market while buying seed for the next season. Similarly, some farmers believed that the local potato seed (recycled potato seed) commonly used by smallholder farmers was more acclimatised to the local soil conditions in the area and so were reluctant to buy new seed from other sources. Own-saved seed source was also common because during emergencies such as times of food scarcity, part of it (potato seed) was prepared for a meal. These unverified conservative beliefs, attitudes and practices, which were purely consequent to absence of proper extension education messages, could be presumed to be responsible for the slow uptake of innovations that would otherwise bolster potato intensification and increased production in the region. For instance, Meijer *et al.* (2014) argued that extension education and training significantly shape the farmers' experiences, attitudes and knowledge about new farm practices. Hence, Kachwekano-ZARDI the mandated institution for research and extension service in the region has an immense role to play in overturning the non-enterprising farmer beliefs, attitudes and practices towards potato production intensification.

Potato crop production intensification practices. Findings from FGD indicated that potato was grown both as a sole/mono crop and intercrop (Table 2). Whereas potato as a sole/mono crop was mainly preferred because it aided movement in the garden during field operation, especially spraying and weeding; and to maximise yield as was most common in Rubanda district, intercropping potato with other crops particularly beans mainly in Kabale and Rukiga districts was preferred because of self-soil fertilisation requiring less or no fertiliser application. This is in agreement with Ajayi *et al.* (2011) who argued that self-soil fertilization tree systems are inexpensive innovations that significantly improve crop yields and environmental services. Potato-maize intercrop was preferred because maize grows taller leaving space for potato; hence, avoiding competition for space and light. Potato-bean and potato-maize combinations were commonly practiced; whereby potato was grown on ridges and flat bed. A wider spacing was used for potato-maize intercrop on flat beds while beans were planted on ridges where potato-bean intercrop was applied. Competition is a major factor that significantly influence growth rate and crop yields in intercropping compared to monocropping (Yang *et al.*, 2016).

Table 1. A pairwise comparison matrix of potato seed sources commonly used by farmers in Southwestern Uganda

District	Rubanda	Kabale	Rukiga
<i>Commonly used Potato seed source</i>	<i>Ranking (1-5, 1 being highest)</i>		
Own saved seed	1	1	1
Famer group	4	None	5
Other farmers	3	4	4
Research station (Ka-ZARDI)	2	2	3
Local market	3	5	4
Extension Agent	5	None	None
local stores	2	3	4

Table 2. Potato crop production intensification practices used by farmers in districts southwestern Uganda

Potato intensification Practice	Main reason for application
Sole/mono cropping	Easy to move in garden
Intercropping	Self-soil fertilisation
Fertilizer	Improve yield
Farmyard Manure	Less expensive
Wider spacing	Improve yield

In Rubanda district, most potato farmers apply fertilizers to improve potato yields. It was revealed that potato farmers do not ably identify the inorganic fertilizers they apply. For instance, farmers described a fertilize commonly used as "black crystals" which was later found to be DAP (black granules). Other commonly used inorganic fertilizer was NPK (small pink granules). Sometimes applied DAP and NPK are applied as a mixture in a ratio of 1:2 at planting. Different methods of fertilizer application were used. For instance, whereas some farmers applied fertilizers by making holes along the ridges, put potato in the hole and put the fertilizer on top and then cover with soil, other farmers applied a fertilizer one week before planting by broadcasting while others broadcasted the fertilizer before weeding to ensure thorough mixing with soil during weeding. Hence, insufficient knowledge and experience on use of chemical fertilizers could result to high risk exposing farmers and their families because of frequent mixing chemical fertilizers which may be toxic, unsafe storage, unsafe application and unsafe disposal of empty bags could lead to fatal results. Usually, the knowledge that farmers acquire by experience and through field training is insufficient to fill the space of knowledge that is known to be obtained from the accumulation of information through education (Lana, 2021). Hence, there is need for knowledge-based training programs to help farmers address simple protective methods to protect themselves and the environment around them.

It was further discovered that potato farmers in Rukiga and Kabale districts used organic manure in potato production. This was applied by intentionally tethering livestock particularly cows and goats on the plot reserved for potato prior to growing so that as livestock animals graze, they randomly drop their waste on the soil surface. This method is not sustainable not only due to the little amounts of manure that can be potentially added to the soil in each period, poor distribution of the manure to the soil but also the exposure of the manure to environmental factors such as rain and high temperature. There is a high possibility that nutrients in the manure are lost by leaching or eroded away by rain or by the process of volatilization due to much exposure to high temperature (Bouwman *et al.*, 2002 and Rocha *et al.*, 2019). Such farmers need information on proper preparation of FYM that is more sustainable for better yield. There was also a claim that amongst some farmers pinning farmyard manure that it harbors pests especially "kanyarugongo" (Thrips) which climbs up the potato shoot and feeds on the leaves at night, hence avoided using it (FYM) in potato production.

The attitude farmers have about a farm practice is closely related to the knowledge and skill they have about it (Meijer *et al.*, 2014). According to Meijer *et al.* (2014), whereas experience is the factual information, knowledge and understanding of how an innovation works and what it can achieve, attitude relate to beliefs and behaviors farmers hold about it based on their experience

and both (attitudes and experiences) do not necessarily align to reality. Therefore, the farmers' experience about a farm practice determines their attitude towards it. In such a case, a positive attitude towards a farm practice increases a likelihood uptake and a negative attitude reduces the possibility of uptake. Similarly, the farm practice itself affects the farmers' attitudes and experiences depending on the costs and benefits associated with the new practice, for instance, its contribution to household food security and income, soil fertility enhancement but also the costs such as cost of inputs or labour involved directly affects attitude and experiences.

Conclusions

There is clear lack of efforts to equip farmers with knowledge and skills to be able to transit from subsistence to commercial production, thus, to yearn for innovations towards potato production innovation. Kachwekano-ZARDI the mandated institution for research and extension service in the region has an immense role to play in overturning the non-enterprising farmer beliefs, attitudes and practices towards potato production intensification. It is therefore, imperative that clear extension messages are disseminated in order to ascertain production intensification impact on the ground.

Acknowledgements

The Mastercard Foundation through the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) funded this study. This paper is a contribution to the Seventh Africa Higher Education Week and RUFORUM Triennial Conference held 6-10 December 2021 in Cotonou, Benin.

References

- Ainembabazi, J. H., and Mugisha, J. 2014. The role of farming experience on the adoption of agricultural technologies: Evidence from smallholder farmers in Uganda. *The Journal of Development Studies* 50 (5):666–679. doi:10.1080/00220388.2013.874556
- Bouwman, A., Boumans, L.J.M. and Batjes, N. 2002. Estimation of global NH₃ volatilization loss from synthetic fertilizers and animal manure applied to arable lands and grasslands, *Journal of global biogeochemical cycles* 16 (2): doi: 10.1029/2000GB001389
- Dawson, N., Martin, A. and Camfield, L. 2019 Can agricultural intensification help attain sustainable development goals? *Evidence from Africa and Asia, Third World Quarterly* 40 (5): 926-946. doi: 10.1080/01436597.2019.1568190
- Kajunju, N.H.B., Atukwase, A., Tumuhimbise, G.A. and Mugisha, J. 2021. Potato processing in Uganda: A technical review. *Makerere University Journal of Agricultural and Environmental Sciences* 10 (1): 60-81.
- Lana, M. J. A. 2021. Limited knowledge and unsafe practices in usage of pesticides and the associated toxicity symptoms among farmers in Tullo and Finchawa rural Kebeles, Hawassa City, Sidama Regional State, Southern Ethiopia, *Emerging Contaminants, Aurel Nuro, Intech Open*. doi: 10.5772/intechopen.96093.
- Larkin, R.P. 2017. Incorporating soil health management practices into viable potato cropping systems. In *Proceedings of the Northeast Potato Technology Forum Conspectus*, Fredericton, NB, Canada, 15–16 March 46–47.
- Meijer, S. S., Catacutan, D., Ajayi, O. C., Sileshi, G. W. and Nieuwenhuis, M. 2014. The role

- of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International Journal of Agricultural Sustainability* 13 (1): 40–54. doi:10.1080/14735903.2014.912493
- Mohammad, K.M. 2017. Characterization potato farmers and traders in selected innovation platforms (IPs) on the basis of potato volumes and varieties traded. *Journal of Advances in Agriculture, Food Science and Forestry* 5 (1): 1–11.
- Namugga, P. Melis, R., Sibiya J. and Barekye, A. 2017. Participatory assessment of potato farming systems, production constraints and cultivar preferences in Uganda. *Australian Journal of Crop Science* 11(08): 932-940. doi: 10.21475/ajcs.17.11.08.pne339
- Pretty, J. and Bharucha, Z.P. 2014. Sustainable intensification in agricultural systems. *Annals of Botany* 114: 1571-1596. <https://doi.org/10.1093/aob/mcu205>
- Priegnitz, U., Lommen, W. J. M., Onakuse, S. and Struik, P. C. 2019. A farm typology for adoption of innovations in potato production in Southwestern Uganda. *Frontiers in Sustainable Food Systems*, 3. doi:10.3389/fsufs.2019.00068
- Rajiv, K. P.G. 2016. Enriched potato for mitigating hidden hunger. 433–457. In: biofortification of food crops; Springer: New Delhi, India,
- Rehman, T., McKemey, K., Garforth, C., Huggins, R., Yates, C.M., Cook, R.J., Tranter, R.B., Park, J.R. and Dorward, P.T. 2003. Theory of reasoned action and its integration with economic modelling in linking farmers' attitudes and adoption behaviour. An illustration from the analysis of the uptake of livestock technologies in the Southwest of England, Farm Management Congress.
- Rocha, A.A., Araújo, E.D.S., Santos, S.D.S., Goulart, J.M., Espindola, J.A.A., Guerra, J.G.M., Alves, B.J.R. and Rouws, J.R.C. 2019. Ammonia volatilization from soil-applied organic fertilizers. *Revista Brasileira de Ciência do Solo* 43pp. doi:10.1590/1809657rbc20180151, ISSN 1806-9657
- Yang, F., Liao, D., Fan, Y., Gao, R., Wu, X., Rahman, T., ... Yang, W. 2016. Effect of narrow-row planting patterns on crop competitive and economic advantage in maize–soybean relay strip intercropping system. *Plant Production Science* 20 (1):1–11. doi:10.1080/1343943x.2016.122455