

Research Application Summary

Determinants of adoption of potato production in the low land areas of Uganda

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Abstract

Potato (*Solanum tuberosum*) is an important food and cash crop for smallholder farmers, giving more food, more nutrition and more cash per unit of area and time. Adoption of the crop is therefore seen as a pathway to improved smallholder farmer livelihoods. However, the crop has not been widely adopted especially in the low land areas of Uganda. A survey involving 424 farmers selected using stratified random sampling method was conducted in Isingiro, Rakai and Lyantonde districts of Uganda to: i) characterize farmers in the low land districts of Uganda by adoption status, and ii) determine the factors that influence adoption of potato production in the lowland areas of Uganda. The study used Chi-square tests, t-tests and a Tobit model. Findings of the study showed that potato adopters owned 2.21 ha on average and it was significantly larger than the land owned by non-adopters (1.40 ha). A significantly higher proportion of potato adopters accessed credit (25.40 %) and also had contact with extension agents (25%) in the previous 12 months compared to the proportion of non-adopters who accessed credit (17.05%) and visited by an extension agents (17.61%) in the previous 12 months. Variables that significantly influenced adoption and intensity of adoption of potato production included sex ($p < 0.01$), access to credit ($p < 0.1$), distance to market ($p < 0.1$), information access from fellow farmers and from a radio ($p < 0.01$) and location specific variables ($p < 0.01$).

Key words: Lowland areas, potato cultivation, Uganda

Résumé

La pomme de terre (*Solanum tuberosum*) est une culture alimentaire et commerciale importante pour les petits agriculteurs, fournissant plus de nourriture, de nutrition et d'argent par unité de superficie et de temps. L'adoption de la culture est donc considérée comme un moyen d'amélioration des conditions de vie des petits agriculteurs. Cependant, la culture n'a pas été largement adoptée, particulièrement dans les régions rurales de l'Ouganda. Une enquête sur 424 agriculteurs sélectionnés à l'aide d'un échantillonnage aléatoire stratifié, a été menée dans les districts d'Isingiro, Rakai et Lyantonde afin de: i) caractériser les agriculteurs dans les régions basses/plaines de l'Ouganda par statut d'adoption et ii) déterminer les facteurs qui influencent l'adoption de la production de pommes de terre dans les zones de plaine. Des tests du Chi-carré, les tests t et un modèle Tobit ont été utilisés. Les résultats ont montré que les adoptants possédaient des superficies en moyenne 2,21 ha, qui étaient significativement plus élevées que celles appartenant aux non-adoptants (1,40 ha). Une proportion nettement plus élevée d'adoptants de pomme

de terre ont l'accès au crédit (25,40%), et ont également des contacts avec les agents de vulgarisation (25%) au cours des 12 mois précédents. Les variables ayant influencé de manière significative l'adoption et l'intensité de l'adoption de la production de pommes de terre comprenaient le genre ($p < 0,01$), l'accès au crédit ($p < 0,1$), la distance au marché ($p < 0,1$), l'accès à l'information des agriculteurs et de la radio ($p < 0,01$) et les variables spécifiques à la localité ($p < 0,01$).

Mots clés: zones de plaine, culture de pommes de terre, Ouganda

Background

In Uganda, potato (*Solanum tuberosum*) has been a crop for the highland districts of Kabale and Kisoro in South Western Uganda and Mbale and Kapchorwa on the slopes of Mt. Elgon in Eastern Uganda. However, with the introduction of more adaptable varieties, production of the crop has expanded to lower altitude (1,200 to 1,600 masl) districts (Ferris *et al.*, 2002). Although the crop is considered an important food and cash crop for smallholder farmers, giving more food, more nutrition and more cash per unit of area and time (Kaguongo *et al.*, 2008; FAO and CFC, 2010), adoption of the crop and area allocated to its production is very low in these lower altitude districts (UBOS, 2010). Therefore, understanding factors that influence farmers' choice to adopt potato and intensity of its production is important for design of appropriate strategies to improve farmers' livelihoods, productivity of the crop and improvement of the potato sector in Uganda. This study aimed at filling the knowledge gap by addressing the following specific objectives; i) characterize farmers in the low land districts of Uganda by adoption status, and ii) determine factors that influence potato adoption in the low land districts of Uganda.

Literature Summary

Increasing agricultural productivity is critical for economic growth and development (Doss, 2006). One of the important ways to increase agricultural productivity is through introduction and adoption of improved agricultural technologies. Improved technologies like high yielding varieties, if adopted are expected to increase farm-level productivity and improve livelihoods of farm households in developing countries (World Bank, 2008). Despite the expected increase in farm-level productivity and evident improvement of household wellbeing from agricultural technology adoption (Kijima *et al.*, 2008; Kassie *et al.*, 2011), adoption rates have remained low especially in sub-Saharan Africa. The case is not different for potatoes in lowland areas of Uganda. Yet evidence available in Uganda indicates that there is limited information on why adoption rate is still low. A few studies on potato in Uganda have largely focused on market performance (Bonabana-Wabbi *et al.*, 2013), improving production (Gildemacher *et al.*, 2009) and adoption of improved varieties (Kaguongo *et al.*, 2008). Worth noting, these studies have only concentrated in the traditional highland districts with limited focus on lowland areas. This study set out to fill this knowledge gap.

Study Description

The study was conducted in Isingiro, Rakai and Lyantonde districts of Uganda. The three districts are the largest potato producers in the low land districts of Uganda, and were therefore purposively selected for the study. Four sub-counties were randomly selected in each of Isingiro and Rakai districts. For Lyantonde district, there are two sub-counties that are mainly engaged in crop production and they were both selected for the study. Three parishes were randomly selected from each sub-county in all the three districts and farmers were stratified into two strata; adopters and non-adopters. This was then followed by systematic random sampling of farmers from each stratum. In Isingiro, 15 farmers were selected per parish while in Rakai, 12 farmers were selected per parish. This is because potato production is more concentrated in Isingiro than Rakai district. In Lyantonde district, the number of farmers selected per parish was increased to 18 in order to raise a representative sample since only two sub-counties were selected from the district. The sampling yielded a total of 432 respondents selected for the study. However, due to non-responses, analysis is based on a total sample size of 424 respondents. A survey method was used to collect primary data using semi-structured questionnaires. Interviews with key informants (district production officer and parish chiefs) were carried out to provide an understanding of the environment and they also guided in the sampling process. To characterize farmers by adoption status, descriptive statistics including means, percentages and cross tabulations were used while t-tests and chi-squares were used to test the significance of the variables. To determine factors that influence adoption of potato, a Tobit model was used. The Tobit model specified as;

$$Y^* = X\beta + \varepsilon \dots\dots\dots(1)$$

Where, Y^* is a latent variable that is unobservable, β is a vector of unknown coefficients, X is a vector of independent variables, and ε is an error term that is independently distributed with mean zero and a variance of σ^2 . The observed variable y_i is equal to the latent variable if the latent variable is greater than zero and equal to zero otherwise.

$$y_i = Y^* \text{ if } Y^* > 0 \text{ and } y_i = 0 \text{ otherwise} \dots\dots\dots(2)$$

Where, y_i is the dependent variable measured as the proportion of land allocated to potato to the total farm size.

Research Application

Results in Table 1 show that there was a significant difference in access to credit, extension visit contact and farm size between adopters and non-adopters of potato. On average, potato adopters owned larger parcels of land compared to non-adopters. Further, a significantly ($p < 0.05$) higher proportion of adopters accessed credit than non-adopters. Results from Table 1 further show that a significantly ($p < 0.1$) higher proportion of potato adopters received extension visits in the past 12 months compared to non-adopters. There was also a significant ($p < 0.1$) association between sex of the farmer and adoption of potato production (Table 1).

Table 1. Characteristics of farmers by potato adoption status

Variable	Pooled sample (n=424)	Adopters (n=248)	Non adopters (n=176)	p-value
Sex Male (%)	56.37	52.82	61.36	0.08
Female (%)	43.63	47.18	38.64	
Household size (number)	6.01	6.05	5.96	0.61
Age of the farmer (years)	40.95	41.33	40.43	0.77
Education (years)	5.61	5.49	5.76	0.22
Farm size (ha)	1.87	2.21	1.40	0.03
Distance to produce market (km)	6.91	6.63	7.32	0.14
Work off farm (%)	37.50	34.27	42.05	0.10
Received extension visit in previous year (%)	21.93	25.00	17.61	0.05
Membership to a group (%)	54.72	56.05	52.84	0.51
Accessed credit (%)	21.93	25.40	17.05	0.04

Table 2 shows empirical results of a Tobit model used to determine factors that influence adoption and intensity of adoption of potato production. The results show that access to credit was significant ($p < 0.1$) and positively influenced adoption and intensity of adoption of potato production in the lowland areas. This is in agreement with other studies like Awotide *et al.* (2014) which showed that adoption of agricultural technologies can increase if farmers access credit required to meet the cost of production required to adopt the technology. Results in Table 2 further show that all farmers' information access sources (from fellow farmer (INFO_farmer), from radio (INFO_radio) and from extension agents (INFO_extension) positively influenced adoption and intensification of potato production. The results are in line with those of Langyintuo and Mekuria (2008), Aremu *et al.* (2015) and Tahirou *et al.* (2015) which show that farmer to farmer interactions, radios and extension agents greatly disseminate information about a technology and consequently influence farmers' decisions to adopt the technology. District dummies of Isingiro and Rakai were also included to capture institutional and geographical differences. Results showed that farmers in Isingiro and Rakai district were more likely to adopt and intensify potato production than farmers in Lyantonde district (the base district in the model) (Table 2).

Results further show that being a male, household size and distance to produce market negatively influenced adoption and intensification of potato production (Table 2). The study therefore recommends wide use of radio programs to disseminate agricultural information, and for enhancement of farmer to farmer learning and strengthening of agricultural extension system. Further, when disseminating agricultural information, special attention should be given to female farmers and geographical differences should also be put into considerations.

Table 2. Empirical results of the Tobit model

Variable	Coefficient	Standard error	p-value
Household size	-0.014	0.008	0.085
Age of the farmer (years)	-0.001	0.002	0.635
Sex of the farmer (1=Male)	-0.163	0.045	0.000
Completed primary education (1=Yes)	-0.068	0.046	0.136
Works offfarm (1=Yes)	-0.075	0.047	0.112
Farm size (ha)	-0.002	0.002	0.320
INFO_farmer (1=Yes)	0.380	0.052	0.000
INFO_radio (1=Yes)	0.314	0.068	0.000
INFO_extension (1=Yes)	0.191	0.099	0.054
Distance to produce market (km)	-0.006	0.003	0.065
Membership to association (1=Yes)	-0.002	0.046	0.967
Accessed Credit (1=Yes)	0.100	0.053	0.060
Isingiro	0.266	0.065	0.000
Rakai	0.176	0.060	0.003
No. Observations	424		
Left censored observations	176		
Uncensored observations	248		
Log likelihood	-243.51		
LR chi2 (14)	102.84		
Prob>chi2	0.000		

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References

- Aremu, P. A., Kolo, I. N., Gana, A. K. and Adelere, F. A. 2015. The crucial role of extension workers in agricultural technologies transfer and adoption. *Global Advanced Research Journal of Food Science and Technology* 4: 14–18.
- Awotide, B., A., Abdoulaye, T., Alene, A. and Manyong, V. M. 2014. Assessing the extent and determinants of adoption of improved cassava varieties in south-western Nigeria. *Journal of Development and Agricultural Economics* 6 (9): 376–385.
- Bonabana-Wabbi, J., Ayo, S., Mugonola, B., Taylor, B.D., Kirinya, J. and Tenywa, M. 2013. The performance of potato markets in south western Uganda. *Journal of Development and Agricultural Economics* 5 (6): 225-235.
- Doss, C. R. 2006. Analyzing technology adoption using microstudies: Limitations, challenges, and opportunities for improvement. *Agricultural Economics* 34 (3):

207-219.

- FAO and the Common Fund for Commodities. 2010. Strengthening potato value chains: technical and policy options for developing countries. Cromme, N., Prakash, A.B. Litaladio, N. and Ezeta, F. (coordinators). Rome, 148 pp.
- Gildemacher, R.P., Kaguongo, W., Ortiz, O., Tesfaye, A., Woldegiorgis, G., Wagoire, W.W., Kakuhenzire, R., Kinyae, M.P., Nyongesa, M., Struik, C.P. and Leeuwis, C. 2009. Improving potato production in Kenya, Uganda and Ethiopia: A system diagnosis. *Potato Research* 52 (2): 173-205.
- Kaguongo, W., Gildemacher, P., Demo, P., Wagoire, W., Kinyae, P., Andrade, J. and Fuglie, K. 2008. Farmer practices and adoption of improved potato varieties in Kenya and Uganda. International Potato Center (CIP), Lima, Peru. Social Sciences Working Paper 2008-5.
- Kassie, M., Shiferaw, B. and Muricho, G. 2011. Agricultural technology, crop income and poverty alleviation in Uganda. *World Development* 39 (10): 1784-1795.
- Kijima, Y., Otsuka, K. and Sserunkuuma, D. 2008. Assessing the impact of NERICA on income and poverty in Central and Western Uganda. *Agricultural Economics* 38 (3): 327-337.
- Langyintuo, A. S. and Mungoma, C. 2008. The effect of household wealth on the adoption of improved maize varieties in Zambia. *Food Policy* 33 (6): 550–559.
- Njuguna, M.I., Munyua, N.C. and Makal, K.S. 2015. Influence of demographic characteristics on adoption of improved potato varieties by smallholder farmers in Mumberes Division, Baringo County, Kenya. *Journal of Agricultural Extension and Rural Development* 7 (4): 114-121.
- Simtowe, F., Kassie, M., Diagne, A., Asfaw S., Shiferaw, B., Silim, S. and Muange, E 2011. Determinants of agricultural technology adoption: the case of improved pigeonpea varieties in Tanzania. *Quarterly Journal of International Agriculture* 50 (4): 325-345.
- Tahirou, A., Bamire, A. S., Oparinde, A. and Akinola, A. A. 2015. Determinant of adoption of improved cassava varieties among farming households in Oyo, Benue and Akwa Ibom States of Nigeria. *HarvestPlus Working Paper* 20: 1-17.
- World Bank, 2008. Agriculture for Development. World Development Report 2008, Washington, DC.