Adoption of Improved Cassava Varieties in Uganda: Implications for Agricultural Research and Technology Dissemination

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Abstract

Improved germplasm from the cassava-breeding program has generated new varieties that are increasingly being grown by farmers in Uganda. In this study, the socio-economic and demographic characteristics of cassava farmers in different regions of Uganda, adopted cassava varieties, their adoption rates, desirable and undesirable attributes, and factors that have influenced the speed of adoption of the most adopted variety were determined. The negative binomial model was used to analyze the determinants of the speed of adoption of the most widely adopted cassava variety. NASE 1, NASE 2, NASE 3, NASE 4, NASE 10 and NASE 12 are the varieties so far adopted. NASE 3 is the most widely adopted, to adoption levels as high as 77% in central Uganda. Farmers consider disease resistance, maturity period, taste, dry matter content, cyanide content, inground storability and diversity in forms of utilization in their decision to adopt new cassava varieties. From the Negative Binomial model, speed of adoption of NASE 3 was positively and significantly influenced by age of household head, household size and access to extension services. However, it was negatively and significantly influenced by number of hoes owned by a household. The considerable variability within the crop can be exploited to ensure that each variety has a fair blend of all desirable quality attributes. There is need to continue breeding for adaptability to biotic stresses such as diseases while improving on attributes that influence palatability and nutritive value of the crop. With respect to technology dissemination, strengthening the link between farmers and agricultural extension agents/service providers and improving the targeting of extension services will enhance the adoption of new cassava varieties.

Key words: Food security, cassava mosaic disease, protein, vitamin A

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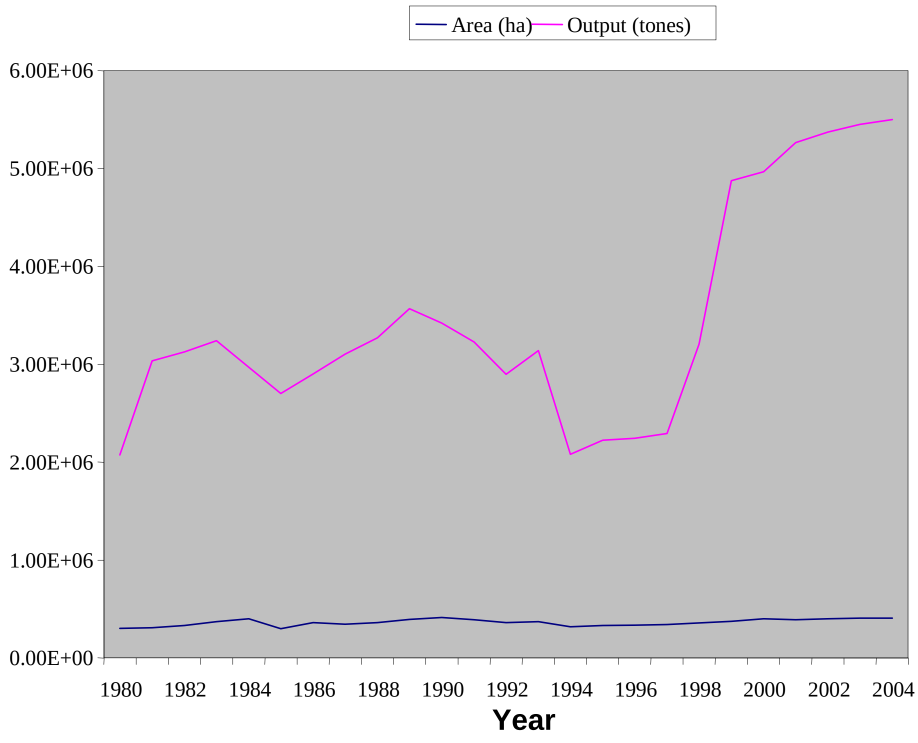
Background

Cassava is one of the most important food crops in Uganda (Otim-Nape and Bua, 2000), with production of the crop ranking amongst the top eight in the continent (IITA *et al*., 2004). It is primarily grown as a subsistence crop although it is increasingly being transformed into a semi-commercial crop. Trading of fresh cassava roots is characterized by relatively few transactions and low prices due to the short shelf life (Collison, *et al.*, 2003). With respect to industrial utilization, animal feed and bakery products account for 98% of the potential annual demand for cassava (Graffham *et al.*, 2003). However, despite its importance in national food security, contributing about 15% of the average daily dietary energy intake per person (Nweke *et al.*, 1999), its yields have remained critically low, averaging 9.3 MT/ha (MAAIF, 2005). Area under production has remained fairly constant but output has fluctuated considerably, as shown in figure 1.

Figure 1: Area and output of cassava in Uganda, 1980-2004



Source: MAAIF statistics, 2005

Most notable was the decline in production from 1988 to 1998, which was caused by a severe outbreak of the Cassava Mosaic Disease (CMD) in most parts of the country. Between 1992 and 1997, losses accruing from the epidemic were estimated to be USD 60 million per year (IITA, 2000). Besides, poor extension services, shortage of agricultural inputs, the northern insurgency, and re-emergence of CMD contributed to fluctuation in production (Bua *et al.*, 1999, Otim-Nape and Bua, 2000). In an effort to improve and stabilize production, the National Agricultural Research Organization (NARO) in collaboration with its partners mainly the International Institute of Tropical of Agriculture (IITA) and the East Africa Root Crops Research Network (EARRNET) has to-date developed and officially released a total of 12 improved cassava varieties, which are high yielding and resistant to major pests and diseases (NARO *et al.*, 2004). This has led to a steady increase in production since 1998 as shown in figure 1. These varieties and their attributes are shown in table 1.

Table 1: Improved cassava varieties released by NARO and their attributes

Variety	Clone	Year of release	Attributes
NASE 1	TMS 60142	1994	Matures in 14 months, yields 23 t/ha, resistant to CMD, low in CNp
NASE 2	TMS 30337	1994	Matures in 14 months, yields 27 t/ha, resistant to CMD, low in CNp
NASE 3	TMS 30572	1994	Matures in 12 months, yields 26 t/ha, resistant to CMD
NASE 4	SS4	1994	Matures in 12 months, yields 50 t/ha, resistant to CMD
NASE 5	SS5	1999	Matures in 12 months, yields 40 t/ha, resistant to CMD, low in CNp
NASE 6	TMS 4 (2) 1425	1999	Matures in 12 months, yields 35 t/ha, resistant to CMD, low in CNp
NASE 7	CE 85	1999	Matures in 12 months, yields 45 t/ha, resistant to CMD, low in CNp
NASE 8	CE 98	1999	Matures in 12 months, yields 40 t/ha, resistant to CMD, low in CNp
NASE 9	TMS 30555-17	1999	Matures in 12 months, yields 45 t/ha, resistant to CMD
NASE 10	00063	2000	Matures in 12 months, yields 35 t/ha, resistant to CMD, low in CNp
NASE 11	TC 1	2000	Matures in 12 months, yields 35 t/ha, resistant to CMD, low in CNp
NASE 12	MH95/0414	2000	Matures in 12 months, yields 40 t/ha, resistant to CMD, low in CNp

SOURCE: NARO, 2002

The varieties were released on the basis that they are relatively high yielding, resistant to Cassava Mosaic Disease (CMD) and low in Cyanogenic potential (CNp). It is also noteworthy that these varieties were found to be adaptable to various farming systems including but not limited to West Nile, Eastern savanna (Acholi, Lango, Teso), Lake Albert and mid western zone, Busoga and Lake Victoria Crescent. This breeding effort is arguably one of the most successful by NARO against low cassava productivity and hence food insecurity in Uganda. Although these varieties mature within 12-14 months, they can stay longer in the soil before being harvested. This characteristic has made the crop an excellent famine reserve and source of food security. Farmers are also able to harvest the crop depending on factors such as price, need for cash and food.

In order to monitor the adoption of these varieties, Bua *et al.* (1999) conducted a study, whose main objective was to evaluate the diffusion patterns and adoption levels of these varieties and to assess their impact on production and consumption of cassava. Their study revealed that the adoption level of improved varieties increased from about 20% in 1993 to about 80% in 1999. This was attributed to the ability of the varieties to tolerate CMD, which was the biggest constraint to production at the time. This pointed to the yield advantage they had over local ones where CMD pressure was high. Further, the study showed that among the surveyed districts, Lira, Luwero and Masindi had the highest adoption levels in 1993 but by 1999, Kumi and Soroti districts were in the lead. It was thought that since Lira, Luwero and Masindi were, by 1999, in the post-epidemic stage of CMD, they were the hub for improved varieties hence the decline in adoption levels.

However, several questions remain unanswered, for instance, (i) What improved varieties have so far been adopted in the different regions/farming systems and at what rate? (ii) Why have these varieties been adopted? Is it because of the attributes shown in table 1 or other highly variety-specific attributes yet unknown to breeders? (iii) What factors have influenced the speed of adoption of the most popular variety? This study aimed at answering these questions.

Objectives of the study

The major objective was to examine the extent of adoption of improved varieties that have so far been released by NARO. Specifically, the study aimed at:

(i) Determining the adoption rates of adopted varieties in different regions

(ii) Examining the technology attributes that were considered important in the adoption of these varieties in different regions

(iii) Determining the factors that influenced the speed of adoption of the most popular variety in all regions.

Methodology

Study area

The study was conducted in 16 districts of Uganda representing different regions and agroecological zones. These included Arua and Nebbi in north-western Uganda; Apac and Lira in northern Uganda; Masindi, Nakasongola, Luwero, Wakiso and Mukono in central Uganda; Iganga, Bugiri, Tororo, Busia, Soroti, Pallisa and Kumi in eastern Uganda. Cassava is widely grown in these districts and is regarded as a staple crop by over 50% of the farmers (Otim-Nape and Bua, 2000). Iganga, Apac, Lira, Tororo and Kumi are among the leading producers of cassava. In central Uganda, production has been increasing on an ever-greater scale due to a decline in the relative importance of banana as a staple crop. Comprehensive surveys have indicated that all these districts were affected by CMD though its incidence varied from one district to another. In response, the Uganda Cassava Program multiplied and distributed improved planting materials to farmers in these districts.

Sampling and sample size

Sub-county, village and farmer selection in each district was done using a multi-stage sampling procedure, involving a combination of purposive and random sampling methods. The first stage was sub-county selection, which involved purposive sampling of 3 sub-counties in each district. The selected sub-counties were those that had a relatively high level of cassava production from improved varieties. The second stage was selection of sample villages from the list of villages in a sub-county. Two villages were purposively selected from each sub-county, taking into consideration their physical separation. The villages selected were at least 15 km apart to ensure a wider coverage of each sub-county. The final stage was the selection of cassava farmers to be interviewed. From each village, 5 farmers were randomly selected. This gave a total of 30 farmers from each district making a total sample size of 480 farmers in the entire study area.

Data collection

Primary cross-sectional data were collected in October 2005 through face-to-face interviews with farmers using a structured questionnaire. They were obtained on farmers' demographic and socioeconomic characteristics such as household composition by age and gender, marital status, occupation and education level of household head, land holding, acquisition and tenure, labor availability, income sources and farming enterprises, cassava production history, current practices and constraints, awareness and adoption of cassava varieties as well as sources of information pertaining to the management of cassava varieties.

Data analysis

SPSS and STATA statistical packages were used to compute descriptive statistics and estimate regression model, respectively. Prior to examining the adoption rates of cassava varieties, the study determined the socio-economic and demographic characteristics of cassava farmers. The negative binomial model was used to determine the factors that influenced the speed of adoption of the most popular variety.

Negative binomial model specification

The negative binomial model is a count data econometric model. In this model, the dependent variable takes on only non-negative integer values. It is a compound derivative of the Poisson regression model. Following Edriss and Mangisoni (2004), the negative binomial model is given as

$$\Pr(Y = \gamma / \chi) = [\mu^{\gamma}\Gamma(\gamma + \alpha)(1 / (\alpha + \mu))^{\gamma+\alpha}] / \gamma!(\alpha)\Gamma(\alpha).(1 / \alpha)^{\alpha} \text{ …………… (1)}$$

where Γ is the gamma distribution. This form of the negative binomial model is widely known as Negbin II and its parameters are estimated using the Maximum Likelihood technique. The simplified log-likelihood function[3] is given as

$$\ln L_i = \ln \Pr(Y = \gamma_i) = \sum_{n=0}^{\gamma_i - 1} \ln(\alpha + n) - \ln \gamma_i ! + \gamma_i \ln(1 - \theta_i) + \alpha \ln \theta_i \text{ ………………….. (2)}$$

where, $\theta_i = \alpha \ /(\alpha + \mu_i)$

Since μ_i > 0 and α > 0, this implies that the variance is greater that the mean. The negative binomial model therefore allows for over-dispersion, unlike the Poisson regression model. Several factors may be responsible for influencing the time it takes a farmer to adopt a technology. For example, extension advice creates awareness about the existence of the technology as well the appropriate agronomic practices required to achieve maximum output from the technology. It is therefore expected that a farmer who obtained this advice adopted faster than one who did not. In this study, the following explanatory variables were included in the model: distance of household from major town (km); age of household head (years); education level of household head (number of years in school); farm size (acres); household size; number of household members working on farm full-time; number of hoes owned by household; access to extension services, where 1 = household ever obtained extension services and 0 otherwise.

Results and discussion

Socioeconomic characteristics of cassava farmers

Table 2 summarizes the distribution of key socioeconomic variables of cassava farmers in different regions of Uganda. The mean age of the household head ranged from 42 years to 45 years. Farmers were within the productive age group (20-49 years) but only those in central Uganda and west Nile were still below the life expectancy for Uganda, estimated at 45.7 years (UNDP, 2005). Being within the productive age group, farmers are expected to be enthusiastic about better performing cassava technologies. In all regions, the average number of years in school of the household head shows that they had attained at

[3] See Mangisoni (1999) for derivative details of the negative binomial model.

least primary school education. This might well be adequate for them to comprehend and appreciate agricultural extension advice regarding adoption of improved technologies. With respect to distance of farming household from a major town, farmers in eastern Uganda had the lowest average (17.8km) whereas those in northern Uganda had the highest (40.4km). Distance of a household from a major town has important implications on access to produce markets, market price information, agricultural extension services and other economic and social infrastructure. Access to markets and such services is considered to positively influence adoption of improved agricultural technologies.

Table 2: Socioeconomic characteristics of cassava farmers

Variable	**Central Uganda**	**Eastern Uganda**	**Northern Uganda**	**West Nile**	**All regions**
Age of head (years)					
Mean	43.9	45.7	45.7	42.5	44.7
SD	14.3	13.9	15.7	12.9	14.2
Education of head (yrs in school)					
Mean	7.5	7.8	8.5	7.9	7.8
SD	3.9	3.9	4.0	3.5	3.9
Distance from major town (km)					
Mean	23.0	17.8	40.4	28.7	23.7
SD	15.2	11.5	39.4	16.8	20.3
Household size					
Mean	8.3	10.8	10.0	9.4	9.7
SD	4.8	6.7	4.6	4.7	5.8
Farm labor full-time					
Mean	2.3	3.2	2.8	3.0	2.9
SD	1.7	2.6	1.7	1.6	2.2
Farm size (acres)					
Mean	6.3	7.3	8.3	6.5	7.0
SD	12.1	14.3	8.7	5.9	12.2
Acres under improved varieties					
Mean	0.7	1.5	0.9	1.2	1.2
SD	0.7	3.8	0.7	2.2	2.9
Cassava cropping system (%)					
Monocrop	22	37.1	28.3	36.2	31.2
Intercrop	78	51.9	51.7	55.2	60.5
Relay crop	0.0	11.0	20.0	8.6	8.4
Ever got extension advice (%)					
No	59.1	59.3	65.0	58.6	59.9
Yes	40.9	40.7	35.0	41.4	40.1

SOURCE: IITA cassava adoption survey, 2005

Central Uganda had, on average, households of smaller size than the other regions. This is expected since the region is relatively more urbanized than the rest. Demand for food usually increases with household size. Therefore the size of a household is likely to influence the speed of adoption as well as the preference of one variety for another. A relatively large household is expected to adopt an improved variety much faster than a small one and may consider the yielding ability of a cassava variety as an important attribute, which may not be the case with a small household. There is a positive correlation between family labor and household size. Central Uganda has the lowest number of family members working on farm full-time while eastern Uganda has the highest. However, in all regions, available family labor is only a small fraction of the total household size. The size of farm labor relative to household size reflects, *inter alia*, the importance of farming as a source of livelihood for the household and hence the extent to which it will adopt improved agricultural technologies.

The average farm size in all regions was 7 acres. The averages for farms in Central Uganda and west Nile were below this average whereas those in eastern and northern Uganda were slightly above 7 acres. Farm size dictates the amount of cassava a household can grow. With respect to area under improved varieties, the overall average was 1.2 acres. The average for farmers in eastern Uganda was 7.3 acres well above the overall average. The larger the area under improved varieties, the more interested a farmer might be in new technologies. Farm size has an implication on cassava cropping system. The most predominant cropping system for cassava in all regions was intercropping. This result is consistent with the observation by Mbwika *et al.* (2001) that cassava is largely grown under smallholder farming with intercropping being the main production system. Also, notice that intercropping was most practiced in central Uganda, which, on average, had the smallest farms. It can thus be argued that preference for intercropping is due to limited arable land. This could be a hindrance to adoption of new agricultural technologies. Further, preference for a particular cropping system and new agricultural technologies have a direct bearing on farmers' access to agricultural extension services. More than half of the farmers in all regions have not had extension advice in the last five years, majority being those in northern Uganda. This may be due to the armed conflict that has created insecurity in the region.

Improved varieties adopted

Overall, 6 varieties have so far been adopted, to varying levels, out of the 12 that were released by NARO. These are: NASE 1, NASE 2, NASE 3, NASE 4, NASE 10 and NASE 12. Overall, NASE 3 (locally known as Migyera) was the most adopted variety, a result consistent with that obtained by Abele *et al.* (2005), who found that the same variety was the most adopted in western Kenya. In Uganda, the highest adoption rate (77%) was observed in central Uganda. In west Nile, northern and central Uganda, NASE 4 was the second most adopted variety but was equally as popular as NASE 12 in northern Uganda. In eastern Uganda, NASE 2 was the second most adopted. The adoption rate for NASE 1 was consistently low in all regions, not exceeding 6%. Farmers in central and eastern Uganda adopted one variety more (NASE 10) than those in west Nile and Northern Uganda. However, its adoption rate was a mere 2% in both regions.

Generally, the 6 varieties had 3 desirable attributes in common, namely: high resistance to diseases (especially to CMD), high storage root yields and short maturity period compared to local ones. With the exception of yield, NASE 3 was considered to have these qualities in relatively high levels hence its superiority. In addition, it was reported by majority of the farmers to have a high dry matter content and high market demand. However, it has high cyanide content, poor taste when eaten fresh and short period of underground storage.

Table 3: Improved varieties adopted by region

Variety	Central (%)	Eastern (%)	Northern (%)	North Western (%)
NASE 1	6	6	6	3
NASE 2	6	8	12	3
NASE 3	77	75	46	75
NASE 4	7	6	18	13
NASE 10	2	2	0	0
NASE 12	2	3	18	6

SOURCE: IITA cassava adoption survey, 2005

In both regions, NASE 4 and NASE 12 were reported to have multiple uses and good taste, respectively. The poor performance of NASE 1 in the two regions was mainly due to its short period of underground storage and poor quality flour whereas that of NASE 2 was due to its poor taste. The corollary therefore is that in these two regions, taste, period of underground storage, flour quality and the different forms in which a variety can be utilized are important in influencing a farmer's decision to adopt new cassava varieties, in addition to yield, disease resistance and maturity period.

In the 2 regions, equal adoption rates were obtained for NASE 1 (6%) and NASE 10 (2%). The 2 varieties were associated with high dry matter, low cyanide content and good taste but a short period of underground storage. In both regions, NASE 4 was reported to have a good taste and a long period of underground storage. The adoption rates for NASE 2 were almost similar in the two regions. Its advantages included high dry matter content and the many forms in which can be utilized. Its major disadvantages included its short period of underground storage and poor taste. The adoption rates for NASE 12 were consistently low in the 2 regions. This was mainly due to its lack of market demand and short period of underground storage. Therefore there is visible consensus that farmers in eastern and central Uganda, just like their counterparts in west Nile and Northern Uganda, consider yield, disease resistance, maturity period, taste, dry matter content, cyanide content, period of underground storage and diversity in forms of utilization as pertinent attributes in adoption of new cassava varieties.

However, quality of flour was not important in central and eastern Uganda, as was the case in northern Uganda and west Nile. Anecdotal evidence suggests that cassava in eastern and central Uganda is mainly consumed in its fresh form unlike in northern Uganda and west Nile where it is usually processed into flour before consumption. On the other hand, market demand was considered important in eastern and central Uganda but not in northern Uganda and west Nile. This may be on account of the fact that although cassava production is predominantly subsistence throughout the country, commercial production exists more in eastern and central Uganda than in west Nile and northern Uganda. According to Mbwika *et al.* (*op cit*), Kampala is the major market for cassava whose main source includes Kumi, Pallisa and Soroti districts in eastern Uganda. Table 3 summarizes the cassava varieties that have been adopted, their desirable and undesirable attributes as perceived by farmers.

Table 4: Cassava varieties adopted, their advantages and disadvantages

Attribute	**NASE 1**	**NASE 2**	**NASE 3**	**NASE 4**	**NASE 10**	**NASE 12**
High yield	√	√	√	√	√	√
High disease resistance	√	√	√	√	√	√
Short maturity period	√	√	√	√	√	√
Good taste	√	*X*	*X*	√	√	√
Low cyanide content	√	√	*X*	√	√	√
Long underground storage	*X*	√	*X*	√	*X*	*X*
Multiple uses	*X*	√	*X*	√	√	√
High quality flour	*X*	*X*	√	*X*	*X*	√
High market demand	*X*	*X*	√	*X*	*X*	*X*
High dry matter content	√	*X*	√	*X*	√	*X*

SOURCE: IITA cassava adoption survey, 2005. **Key:** √ = variety possesses attribute, *X* = variety does not possess attribute

Factors influencing speed of adoption of NASE 3

Explanatory variables thought to potentially influence the speed of adoption of NASE 3 were fitted into the model, the results of which are presented in table 5. The log-likelihood value suggests that the model adequately explained the data. Out of the 8 variables, 4 were statistically significant. These were: age of household head, size of household, number of hoes owned by a household and access to agricultural extension advice. With a negative binomial model, a negative sign implies that the variable encourages adoption. It means that an increase in the variable reduces the number of years it takes a farmer to adopt a given technology. The relationship between age of household head and number of years of adopting NASE 3 cassava variety was negative and statistically significant at 10%. Older farmers were more likely to adopt faster than young ones.

Table 5: Factors influencing speed of adoption of NASE 3

Dependent variable is log of the number of years taken to adopt NASE 3

Variable	Coefficient	z-statistic	p-value
Distance	0.00091 (0.00077)	1.19	0.233
Age of household head	-0.0076 (0.0045)	-1.69	0.091
Education of household head	0.00085 (0.00067)	1.28	0.202
Acreage	-0.010 (0.028)	-0.37	0.709
Household size	-0.0034 (0.0010)	-3.37	0.001
Full-time labor	-0.0030 (0.0024)	-1.23	0.217
No. of hoes	0.0024 (0.00087)	2.83	0.005
Extension advice	-0.0038 (0.0022)	-1.72	0.086
Constant	4.36 (0.33)	13.00	0.000

No. of obs = 216 LR chi2(8) = 26.20 Prob > chi2 = 0.0010 Pseudo R^2 = 0.0158 Log likelihood = -813.58

Figures in parentheses are standard errors

Age of household head can be taken as a proxy to farming experience. According to Nkonya and Featherstone (2001), if farming experience is viewed in terms of accumulation of knowledge, then it stimulates improved technology use. Older farmers may have had the opportunity to experiment with other improved varieties of cassava and observed their superiority over local ones. They may also know better methods of seed selection than the relatively young farmers. Consequently, they will be quicker to accept new cassava technologies than younger farmers. The parameter estimate for household size had the expected negative sign and was significant at 1%. This result implies that household size was very influential in farmers' adoption behavior and increased the speed of adoption of the variety. This study postulates that a larger household has a higher demand and consumption of food than a smaller one. Faced with food insecurity, a larger household is likely to adopt improved agricultural technologies faster than a smaller one.

The parameter on number of hoes owned by a household was positive and statistically significant at 1%. Number of hoes owned by a household was used as an indicator of either availability or the lack of farm implements. It was expected that households with adequate farm implements would adopt the variety much faster than those that are implement-constrained. However, the effect of this variable was positive implying that an increase in number of farm implements would increase the number of years it would take to adopt the variety. Though the result is seemingly counter-intuitive, the logical explanation is that a household, which is not constrained by farm implements, may be less food insecure than one, which is constrained. As a result, the former may not be in a hurry to adopt new agricultural technologies.

As expected, access to agricultural extension services increased the speed of adoption of NASE 3. The coefficient was significant at 10%. Households that had received extension advice were assumed to be knowledgeable about the agronomic requirements of the variety as well as identification of its planting material. Households in possession of this knowledge found it easier to cultivate the variety hence adopting it earlier than those devoid of this knowledge.

Summary and conclusions

Summary

The study determined the socio-economic and demographic characteristics of cassava farmers in different regions of Uganda, improved varieties of cassava that have been adopted in these regions, their adoption rates, their desirable and undesirable attributes and factors that have influenced the probability and speed of adoption of the most adopted variety. In examining the factors that have influenced the speed of adoption of the most popular variety, the negative binomial model was estimated.

The varieties that have so far been adopted are: NASE 1, NASE 2, NASE 3, NASE 4, NASE 10 and NASE 12. Overall, the most adopted variety was NASE 3, with the highest adoption rate of 77% being registered in central Uganda. There was consensus among farmers from the 4 regions that yield, disease resistance, maturity period, taste, dry matter content, cyanide content, period of underground storage and diversity in forms of utilization are generally important attributes to consider in the decision to adopt new cassava varieties. Estimation of the Negative Binomial model revealed that the speed of adoption of NASE 3 was positively and significantly influenced by age of household head, household size and access to extension services. However it was negatively and significantly influenced by number of hoes owned by a household.

Conclusions

Improved germplasm from the cassava-breeding program has generated new varieties that are increasingly being grown by farmers in Uganda. Twelve varieties have been released by NARO in a period of 11 years and half of these varieties have already been adopted by farmers. This is evidence to a fairly successful research effort. It appears that the rapid gains in crop performance have led to the popularity of these varieties among farmers. However, in order to enhance the adoption of new cassava technologies, the considerable variability within the crop can be exploited to ensure that each variety has a fair blend of all desirable quality attributes. There is need to continue breeding for better adaptability to biotic stresses such as diseases while improving on attributes that influence palatability of the crop, e.g. cyanide and dry matter content.

With respect to technology dissemination, government policies, which are being implemented through the National Agricultural Advisory Services (NAADS), should aim at strengthening the link between farming households and agricultural extension agents/service providers to enhance the adoption of new cassava varieties. In addition, there is need to improve the targeting of technology dissemination efforts. The adoption patterns of the different varieties reveal the need to disseminate technologies according to preferences by regions/agro-ecologies, rather than distributing them indiscriminately to different regions. For instance, varieties that give good quality flour are preferred in west Nile and northern Uganda while those that are consumed fresh are preferred in central and eastern Uganda. Better targeting of technology dissemination by region could enhance adoption as well as reduce the costs involved in technology dissemination. Further, targeting of relatively large households, households with relatively young heads and those that are constrained by farm implements will significantly increase the adoption of improved varieties. A logical extension of this study is to determine factors that influence intensity of adoption of the most popular cassava variety and its output. This will enable policy makers and researchers to design interventions necessary to increase cassava production from improved varieties thereby encouraging their adoption.

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