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Farmers' Knowledge on the Sweetpotato Cultivars Grown in the Teso Sub-Region, Uganda

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Abstract

The farmers' knowledge of the cultivars to use in increasing sweetpotato productivity is critically important. A study was carried out in the Teso Sub-region to investigate the role of education in sweet potato production. Using an ex post facto design, 24 out of 51 sub-counties were purposively selected applying district-county strata and used to determine the perceptions of sweetpotato farmers and of their agricultural advisers. Through interviews, observations and questionnaires, the survey covered 288 farmers randomly selected and a whole population of 33 agricultural advisers, while 329 community leaders purposively selected and farmers randomly selected were engaged in focus group discussions. A total of 650 persons participated. Data were collected on farmers' knowledge of sweetpotato cultivars grown capturing selected attributes. Analysis of data was done qualitatively using open and axial coding and quantitatively using means, frequencies, percentages, ANOVA and multiple regressions at a confidence level of 0.05 (α). Using selected attributes, farmers identified 139 cultivars grown. The best performing cultivar was *Araka* yielding a range of 19,001-29,000 kg/ha but was susceptible to the sweetpotato weevil and drought. *Araka* also stores poorly as dried chips or sliced. The least performing cultivars were *Elany ikokolak, Epaku & Ocaka amani* with yields below 5,000 kg/ha but less susceptible. Commercialising the crop with value addition, farmers need up-scaling of their scientific knowledge of cultivars and production as basis for better multiplification & selection of vines for higher yields needed in processing the crop for its several uses.

Keywords: agricultural advisers, educational factors, farmers' knowledge, productivity indicators, sweetpotato cultivars, vines, yields

1. Introduction

Sweetpotato (*Ipomoea batatas* (*L.*) *Lam*., 2n=90), which has many uses especially to the poor at all times, is ranked the seventh among the food crops produced in the world with an annual production of over 138 million metric tonnes (Food and Agriculture Organization, 1997; Purseglove, 1982). China is the world leading producer. Nigeria and Uganda are the leading producers in Africa. In Uganda, the sweetpotato is ranked third after banana and cassava (Otieno, 1999; Scott & Maldonado, 1999; Scott et al., 2000). The sweetpotato is one of the key crops that Teso farmers, in the traditional Eastern Uganda, rely on for food and income in addition to beans, cassava, cowpeas, finger millet, groundnuts, sorghum, maize and some cotton (World Bank, 1993). Indeed, Teso Sub-region of 8 districts remains one of the leading sweetpotato producers in Uganda where annual production was estimated at 2.52 million metric tonnes on 560,000 ha (Food and Agriculture Organisation, FAO, 2000) in Mwanga et al. (2001). Per capita production of sweetpotatoes in Uganda is about 125 kg against the per capita consumption of 85 kg (Epeju, 2005; Mwanga & Ssemakula, 2011; Woolfe, 1992). However, sweetpotato productivity is constrained by a number of factors including weather, pest and disease conditions among others. Although the Ugandan Variety Release Committee periodically releases improved cultivars, many farmers grow a large number of landraces (local cultivars) most of which are low yielders, not widely adapted, and not so resistant to pests and diseases (Bashaasha et al., 1995; Mwanga et al., 2001, 2011). The selection of cultivars to plant depends on the farmers' knowledge most of which is based on experience and available indigenous technical knowledge on the crop reinforced by contact with extension agents, researchers and fellow farmers. Level of schooling adds to the farmers' knowledge. Low production known on farms dictates strengthening of farmers' knowl*edge* on cultivars (Mwanga & Ssemakula, 2011).

2. Origin of the Sweetpotato Crop

History portrays that the sweetpotato (*Ipomoea batatas* (*L.*). *Lam*) originated in South America between 8,000 and 6,000 B.C in the present countries of Guatemala, Colombia, Ecuador and Peru (Austin, 1983, 1988; Purseglove, 1982; Odongo, 1999). It spread to the tropics missing the temperate areas of North America and Europe (O'Brien, 1972; Brand, 1971) but during the early 1500s Europeans who colonized Africa and some traders introduced it to Eastern and Western parts of Africa. Later on it spread to Uganda where it has become a very important food crop in areas of 1,000 to 2,000 m above sea level (Greenway, 1944; Nye, 1938; Macdonald, 1970). The crop presently fits very well into the Ugandan farming and food systems as a major staple in the diet along bananas, Irish potatoes, cassava and beans. Expansion of its production has benefitted from research of 1984 led by Serere Agricultural Research Institute (located in the Teso Sub-region). In 1986, sweetpotato research work was moved to the present National Crops Resources Research Institute (NaCCRI) at Namulonge, in Central Uganda, as the headquarters thus starting the National Sweetpotato Programme. The first improved cultivars were officially released in 1995 (Bashaasha et al., 1995) giving the modern commercial sweetpotato cultivars grown in Uganda especially in the Teso Sub-region (Table 1). A cultivar is an agricultural or horticultural crop variety which has originated and persisted under cultivation, as distinct from a botanical variety (Purseglove, 1982). Farmers' local cultivars are also called landraces. A cultigen is a wild form of a cultivated variety which is important in plant breeding for crop improvement.

Tables 1 shows improved cultivars hitherto released to Ugandan farmers since 1984. Figures in parentheses show results of possible ranges of yield in metric tonnes of fresh root tubers per hectare (ha^{-1}) while stark figures shown against cultivars are mean yields in metric tonnes ha^{-1} under experimental and on farm conditions carried out under the auspices of Serere and Namulonge research stations. Research station yields are generally higher than on farms. The orange fleshed sweetpotatoes (OFSP) reported are good for health as they supply vitamin A needed by large numbers of children and women in sub-Saharan Africa who are deficient in the vitamin and in Uganda 20% of children and 19% of women are estimated to be vitamin A deficient (Hagenimana et al., 1999; Mwanga and Ssemakula, 2011). The OFSPs are shown by research to be susceptible to weevils. Several cultivars known are noted susceptible to both sweetpotato virus disease (SPVD) and *Alternaria* blight. Table 1 describes the findings which the farmers need to use. Indeed, research efforts domestically, regionally and globally do add value to the farmers' knowledge of the crop to benefit users (Mwanga & Ssemakula, 2011).

Table 1. Sweetpotato cultivars (varieties) released to farmers in Uganda

Variety	Root yield (t/ha)		Root Flesh Colour[1]	Pest/disease resistance[2]		
	On-station	On-farm		Weevils	SPVD	Alternaria
Released 1995						
Bwanjule	21 (7-49)	17	W	Moderate	Resistant	Resistant
New Kawogo	23 (6-45)	17	W	Moderate	Resistant	Susceptible
Sowola	26 (9-41)	18	C	Highly susceptible	Moderate	Resistant
Wagabolige	24 (6-79)	16	W	Moderate	Resistant	Highly susceptible
Tororo-3	21 (5-52)	16	C	NA[3]	Moderate	NA[3]
Tanzania	23 (5-58)	21	PY	Susceptible	Moderate	Moderate
Released 1999						
NASPOT1	29 (7-45)	20	PY	Susceptible	Moderate	Susceptible
NASPOT2	21 (7-33)	18	C	Susceptible	Resistant	Susceptible
NASPOT 3	25 (5-29)	17	C	Moderate	Resistant	Resistant
NASPOT 4	21 (5-38)	18	PY	Moderate	Moderate	Resistant
NASPOT 5	23 (7-28)	16	O	Moderate	Moderate	Resistant
NASPOT 6	24 (7-28)	18	W	Moderate	Moderate	Resistant
Released 2004						
Ejumula	19 (2-32)	15	O	Susceptible	Susceptible	Moderate
Kakamega	15 (4-36)	12	PO	Susceptible	Moderate	Moderate
Released 2007						
NASPOT 7	25	12	PO	Susceptible	Moderate	Moderate
NASPOT 8	20	16	PO	Susceptible	Moderate	Moderate
NASPOT9 ('Vita')	20	13	O	Susceptible	Moderate	Moderate
NASPOT10 ('Kabode')	18	12	O	Susceptible	Moderate	Moderate
Dimbuka-Bukulu la	30	16	C	Susceptible	Susceptible	Moderate
Released 2010						
NASPOT 11	38	20	C	Susceptible	Moderate	Resistant
Released 2013						
NASPOT 12	43	16	O	Susceptible	Moderate	Moderate
NASPOT 13	25	11	O	Susceptible	Moderate	Moderate

Source: Mwanga et al. (1995); Mwanga, Odongo, Alajo, Kigozi, Niringiye, Kapainga, Tumwegamire, Makumbi, Lugwana, Namakula, Lemaga, Nsumba and Yencho (2007) and National Crops Resources Research Instituite (NaCRRI) and National Agricultural Research Organisation (NARO) (2010, 2013). Submission to the Variety Release Committee for Release of Sweetpotato Varieties

[1]Root flesh colour ranges from white (W) through cream (C), pale yellow (PY), pale orange (PO) to dark orange (O). [2]Generally, most of the released OFSP varieties are susceptible to weevils, and to both SPVD and *Alternaria* blight. [3]NA= Not available.

3. Methodology

This paper is based on findings from a wider study that investigated the role of education in sweetpotato production in the Teso Sub-region in Uganda covering the districts of Kaberamaido, Katakwi, Kumi and Soroti. Using an *ex post facto* design, 24 out of 51 sub-counties were purposively selected based on district-county strata, farmers' level of engagement in sweetpotato growing which was used to determine the perceptions of sweetpotato farmers and of their agricultural advisers (Cashwell, 2002; Edwards, 2002; Kothari, 1992; Wiersma, 1986).

Through interviews, observations and questionnaires, the survey covered 288 farmers randomly selected and a whole population of 33 agricultural advisers, while 329 community leaders purposively selected for their knowledge on the crop and farmers randomly selected were engaged in focus group discussions. A total of 650 persons participated. Literature was reviewed to get insights into factors such as farmers' knowledge of cultivars used in production for sustainable productivity. Qualitative and quantitative data were collected on farmers' knowledge of sweetpotato cultivars grown capturing local names, official release names, yield estimates in kilogrammes ha^{-1} and selected characteristics. Field estimates were done to determine yields, incomes and observations were recorded. Data were analysed qualitatively using open and axial coding where themes, categories and subcategories were used; and quantitatively using means, frequencies, percentages, ANOVA and multiple regressions at a confidence level of 0.05 (α) (Strauss & Corbin, 1990; SAS Institute, 1989; Microsoft SPSS, 1998; Stevens, 1990).

4. Results and Discussion

4.1 Language of the Farmers and Agricultural Advisers

The basis of the farmers' knowledge of anything done on the farm depends on personality, mother tongue or local/area language known and used (Table 2), work environment, experience, the level of education attained and contacts enjoyed. All these factors including the types of education attained (educational factors) do help determine the qualities that a person may possess namely *knowledge, ability to think rationally, practical skills, moral values and problem solving abilities* (life skills) to improve knowledge for work & living (Mills, 1985). Schooling reinforces and consolidates those qualities in a person to constitute positive attitudes. Production has increasingly become knowledge based.

Table 2. Languages that Teso sweet potato farmers can speak, read and write (n= 288)

Language	Speaking	Reading	Writing
Ateso	97.0%	91.0%	90.0%
Kumam	27.0%	21.0%	18.0%
Lwo	7.0%	6.0%	6.0%
Luganda	12.0%	8.0%	7.0%
Lukenye	1.7%	0.7%	0.7%
Lugwere	1.0%	0.7%	0.7%
Lusoga	0.7%	0.7%	0.7%
English	74.0%	71.0%	70.0%
Kiswahili	58.0%	38.0%	31.0%

Therefore, literacy and numeracy in nine different languages used by farmers in the Sub-region are pertinent in the context of farmers' knowledge (Table 2). For the 288 farmers who responded, percentages of those who could speak, read, and write each language in the area were determined as shown in the table. *Ateso* and *Kumam*, the mother tongue languages of the area are most widely used by the farmers but English and Kiswahili are very important for local, regional and international trade, social interactions and communication. These were among the several aspects including indigenous technical knowledge that shaped the farmers' knowledge.

The cultivars which farmers know are so against this language background. Farmers argue that the sweetpotato was known many years before the advent of foreigners as cited much earlier in the literature. As claimed, foreigners introduced the crop to Africa where it never existed but there is *Ateso* word for the crop, *Acok,* which has been in use since the genesis of human life in the area. Besides, there are many local names used to identify and group sweetpotato cultivars in the region. However, knowledge of the modern cultivars has been the work of research and the limited agricultural extension services on the crop that farmers have accessed. Indeed, the best communication strategy to consolidate the farmers' knowledge is for the extension agents and researchers to understand and use the language of the farmers (Table 3).

Table 3. Languages agricultural advisers in Teso can speak, read and write (n=33)

Language	Speaking	Reading	Writing
Ateso	94%	97%	97%
Kumam	24%	18%	18%
Lwo	12%	9%	9%
Luganda	0%	0%	0%
Lukenye	0%	0%	0%
Lugwere	3%	0%	0%
Lusoga	0%	0%	0%
English	100%	100%	100%
Kiswahili	39%	15%	9%

4.2 Educational Factors and Sweetpotato Productivity

From non-formal education which was largely through agricultural extension, 48% of the 288 farmers neither attained any training nor got advice from extension on sweetpotato production. However, 52% farmers were exposed to agricultural extension for an average of 507 days (17 months) only by June 2003. Also, the farmers had farmed for an average of 24 years and grown sweetpotatoes for an average of 20 years.

Table 4 shows the duration by age category in years that 288 farmers had taken farming and growing sweetpotatoes on their farms. This showed the experience they possessed in growing the crop which also indicated how much ITK (Indigenous Technical Knowledge) they had acquired while growing the crop.

Table 4. Duration in years taken by Teso farmers studied growing the sweetpotato crop (n=288)

Age Category in Years	Farming Percentage %	Growing Sweetpotatoes Percentage %
1 to 20	-	59%
21 to 60	-	41%
1 to 24	58%	-
25 to 60	42%	-
	100%	**100%**

Whereas 58% had done farming for 1 to 24 years, 42% had done it for between 25 and 60 years. As far as growing sweet potatoes was concerned, 59% of the farmers had done it for 1 to 20 years, while 41% had done it for 21 to 60 years. Generally, the age seemed to determine the amount of exposure one had to agricultural extension and the resources they owned for production. The quantity of community wisdom (indigenous technical knowledge in agriculture, ITK) attained in growing sweetpotatoes reflected exposure and age. It was also significant to note that even the labourers were hired because of their indigenous technical knowledge in specific tasks such as making mounds, cultivar identification, vine selection, cutting and planting, weeding, peeling, and slicing. From Table 4, experienced farmers with good ITK grew sweetpotatoes. Accordinly, indigenous technical knowledge was found to be the chief source of knowledge and skills farmers used in growing sweet potatoes and often in some combination with schooling shown in Table 5, which presents the levels of formal education attained by farmers surveyed.

Of the 288 farmers surveyed, 4% had no formal education at all, and 1% had university education. In analyzing the education attained by farmers, the highest academic qualifications attained by the farmers were in the following proportions; None at all by 31%; Primary Leaving Certificate (PLE) by 35%; Junior Leaving Certificate by 13%; Uganda Certificate of Education (UCE) by 19%; and Uganda Advanced Certificate Education (UACE) by only 2%. Those who attained College training and University education were reflected in the professional agriculture and non-agriculture qualifications attained. Responses from farmers on professional agriculture qualifications were in the following proportions; Certificate in Agriculture, 0.7%; Diploma in Agriculture, 1.4%; Bachelor's Degree in Agriculture, 0.3%; Farming Certificate, 3.1% and None at all, 94.5%. A very large percentage (94.5%) of the farmers had no agricultural qualifications. Of the farmers who had training in non-agricultural occupations, 18% had training in various trades and occupations for the private sector and civil service while 82% had none at all. Majority of the farmers had neither training in agricultural occupations nor in non-agricultural occupations.

Table 5. Formal education attained by Teso sweetpotato farmers by June 2003 (n=288)

Educational Level	Mean Education Years	Attained	Not attained
No formal education	0.00	0%	4%
Primary	6.00	96%	4%
Secondary	1.00	32%	68%
College training	0.40	15%	85%
University	0.03	1%	99%
Farm school	0.07	5%	95%
School agriculture	0.80	22%	78%

Schooling increases farmers' knowledge (Eisemon et al., 1992; Mills, 1985). It adds to Indigenous Technical Knowledge (ITK) and experience that many sweetpotato farmers in Teso largely depend on. In fact, knowledge based production in agriculture such as in sweetpotato business is the basis for success in commercial farming embraced in the modernization of agriculture in Uganda through skilling programmes (Uganda's Ministry of Education and Sports, BTVET, 2011).

Table 6 shows a summary of the one-way ANOVA results obtained through testing six sweetpotato productivity indicators of output and income indicators are shown. In the differences shown, five categories of farmers by educational attainment described earlier were used.

Results of the six indicators are shown with means of three indicators for output shown in kilogrammes and in Uganda shillings (UGX) showing means of three income indicators giving sweetpotato productivity for each category of farmers. At the time of the study, 1 US dollar was exchanging for UGX 1,750/=. The means were compared using Duncan's multiple range test of comparison using analysis of variance (ANOVA) results on them.

On output indicators: output per hectare increased from 5,143 kg for farmers without any formal education to 9,081 kg for farmers with 13-18 years of formal education. The differences in yields show increasing output ha^{-1} with the rise in the level of formal education farmers attained but they were not significant at 0.05α. Farmers without formal education relied on their experience and indigenous technical knowledge only for production. The output per person rose from 270 kg for farmers without formal education to 278 kg for farmers with 8-12 years of formal education and thereafter fell. The output per person was lowest among the most educated because of their least engagement in production personally. Few graduates produced sweetpotatoes to provide adequate data as they had other employment opportunities.

Table 6. Differences in sweet potato productivity shown by mean output and income indicators by farmers' educational attainment in years of formal education attained as perceived by Teso farmers (n=288)

Formal Education Years	Number of farmers	Output per ha in kg	Output per person in kg	Output per shilling spent in kg	Income per ha in UShs	Income per person in UShs.	Income per shilling spent
0	11	5143*a*	270.54*a*	0.09*ab*	129,506*b*	6,462*a*	2.62*b*
1-4	48	6853*a*	371.22*a*	0.15*a*	261,759*ab*	12,759*a*	6.28*a*
5-7	99	7459*a*	318.01*a*	0.08*ab*	302,581*ab*	13,221*a*	2.56*b*
8-12	94	6852*a*	278.40*a*	0.06*ab*	325,886*ab*	14,241*a*	2.39*b*
13-18	36	9081*a*	263.56*a*	0.05*b*	389,236*a*	14,563*a*	2.12*b*
P-value		0.3019	0.8995	0.0259*	0.3195	0.6422	0.0013**
Coefficient of variation, (C.V.)		11.3%	19%	0.18%	27.6%	28%	5%
n	288	288	284	275	283	284	276

*P<0.05. **P<0.01. Means with the same letter are not significantly different at 0.05α using Duncan's multiple range test of comparison.

The differences of increasing output per person were neither on the smooth rise nor significant at 0.05α. The output per shilling spent in production was significantly higher for farmers with 1- 4 years of primary schooling than other categories of farmers which corroborated the findings of Eisemon et al. (1992). These farmers produced cheaply as they owned resources for production especially land, labour, simple tools and some little schooling.

Regarding income indicators: income per hectare ranged from UGX 129,506/= (US dollars, 74) for farmers without formal education to UGX 389, 236/= (US dollars, 222) for farmers with 13-18 years of formal education whose income was significantly higher than that of other categories of farmers at 0.05α. It was three times higher. Although there were no significant differences in income per person at 0.05α, there was arise from UGX 6,462/= (US dollars, 4) for farmers without formal education to UGX 14, 563/= (US dollars, 8) for farmers with 13-18 years of formal education. Both income per hectare and income per person indicators were higher for educated farmers especially those with higher levels of formal education concurring with Watts (1973) and Yang (1997). Income per shilling spent in production was significantly higher at 0.05α for farmers with 1-4 years of primary schooling than other categories of farmers which corroborated the findings of Eisemon et al. (1992) obtained in Kenya and Burundi.

The reasons for the differences were seen as caused by the type and level of education farmers had, which determined farmers' knowledge and skills needed in production attained from informal, non-formal and formal education or intuition. These results are significant in getting insights into the farmers' knowledge of cultivars important in production. Farmers without formal education achieved least while those farmers with the highest formal education achieved highest (two or three times higher). Farmers with 1-4 years of primary schooling or none at all were generally older and owned resources for production while the most educated were often younger, hired land and labour, invested more money in production. The need for food security and income motivated different categories differently and especially for the married. In conclusion, the farmers' increased educational attainment (educational factors) influenced positively sweetpotato productivity among Teso farmers as shown in Table 6. This has implications on the farmers' knowledge regarding many things done on the farm.

From multiple regressions analysis at 0.05α on the six indicators against five selected sets of factors needed in sweepotato production namely: land, labour and capital used as set; farmers' personal characteristics such as age, marital status and income level; farmers' indigenous technical knowledge; farmers' formal education; and farmers' agricultural extension education. The latter three were actually the farmers' educational factors. The results were: land, labour and capital as a set significantly accounted for 16-63% variation in only four indicators namely output per hectare, income per hectare, income per person and income per shilling spent in production. The farmers' personal characteristics accounted for 6-30% variation in only three indicators: output per hectare, income per hectare and income per person. Educational factors which have implications on knowledge directly only accounted for 0-14% variation and significantly only on income per hectare as explained by agricultural extension education. Knowledge of cultivars by farmers especially improved ones can be boosted by agricultural extension education which also benefits from other forms of education.

4.3 Farmers' Knowledge of the Sweetpotato Cultivars Grown in the Teso Sub-Region

To all intents and purposes, the sweetpotato farmers in Teso are smallholder farmers, each operates a farm of less than 2 hectares. They are generally led in the activity by women who selected the vines for planting. Therefore, the farm business for years to come may only be run commercially through intelligent and differentiated policies addressing access to markets, jobs in non-farm economy and social transfers to improve welfare of the poorest (Dorward et al., 2009; Hazzell & Rahn, 2014; Höffler, Funch, & Melchers, 2014), Farmers' knowledge enhancement is one of those critical socio-economic processes in farming. Table 7 shows cultivars & some traits.

Most farmers could best use the following attributes to identify sweetpotato cultivars namely: local name, maturity period, tuber skin colour, flesh colour, storage quality, yield level, drought/weevil resistance and market acceptability. However, the farmers did not find it consistent to use the leaf characteristics for identification. The leaf shapes and colours were so frequently overlapping and highly variable for differing reasons even for the same cultivar as such not so consistent for identification. Table 7 gives some results of the farmers' knowledge of the cultivars. Using the farmers' knowledge and information, 139 cultivars were identified in the Teso sub-region covering the four districts. Districts in some cases differed in their identifications.

Names of cultivars were based on things such as the location from where they were obtained, names of people who introduced them into the community, names of breeders and names given by breeders. However, some names refer to one same cultivar as a result, which reduces the number purported to be known distinctly.

Table 7. Sweetpotato cultivars grown in Teso Sub-region, Uganda based on the farmers' knowledge by yield level

Yield Levels	**Cultivars**	**Maturing Period**
Excellent, 29,001 kg/ha & above	None reported (0%)	Not applicable
Very High, 19,001-29,000 kg/ha	One cultivar (1%) *Araka*	3-4 months
High, 9,001-19,000 kg/ha	104 cultivars (75%) *Adee; Akeje Akiai; Akeje ikapa; Akit ikapa; Akobo; Alayo; Aleso; Alweo; Amado; Ameke; Amin ebong; Amito; Amongin; Anyara; Arubo; Ateseke; Ayula; Busintina; Ebang; Ebegu; Ebokor; Ebwan aterak; Ecici; Eculu; Ecuru; Egang amalayan; Egau; Ejenero; Ejibi; Ejumula; Ekanu; Ekasira; Ekido; Eleke; Eliok; Emadirait; Emakabali; Emasu; Enenua; Engolet; Engoratonon; Enikaloni; Epeet; Epokoci; Erimu; Eritu; Erogoit; Esamiat; Esilim; Esolotait; Esowola; Esulu; Etemoki edula; Ewela Agora; Ibiolot; Idaweri; Igang Oula; Ikala; Imede; Inait; Inego; Ipot irikaa; Isipu; Isirairi; Itomon; Iwodo; Lira-lira; Lozira; Mary; Mwalimu; Nakalolo; NASPOT 1 (52); NASPOT 2 (178); NASPOT (316); Obuje; Obure; Ocailap; Odiolot; Odiopelap; Odongo; Odupa; Ogola; Ogweite edula; Ojae; Ojumula; Okotol; Okungurudere; Olato; Omagino; Omiidu; Onapa; Onyami okweniei; Onyum; Ookot; Oos; Opeilam; Orode; Osapat; Osepu; Osukut(Tanzania); Socadido; Teresa & Welwel.*	1-5 months
Medium, 5,001-9,000 kg/ha	31 cultivars (22%) *Abokoro; Acom; Amidu; Amodoko; Biibi; Chipa; Egadumire; Ekawogo; Eletes; Emolu; Enailon; Enyoru; Epuramojong; Erengetau; Etengu; Imalakany; Kampala; Obeeyoit; Obotol; Oceger; Odioko; Oduc; Ogwapit; Okoromit; Oliam; Ololo; Omokoka; Omwogo; Opaku; Osipoeleng; & Otiono.*	3-6 months
Low, Below 5,000 kg/ha	3 cultivars (2%) *Elany ikokolak; Epaku; Ocaka amani*	5-6 months

Nye (1938) in Jameson (1970) indicated that it was difficult to determine the exact number of varieties of the sweetpotato in use in Uganda. He recorded 47 varieties in one village in Buganda. However, Macdonald (1970) reported to have found 27 varieties in the immediate vicinity of Makerere University Farm at Kabanyolo. Gasura and Mukasa (2010) reported their evaluation of 1, 320 sweetpotato cultivars evaluated for SPVD severity from 3 major growing regions of Uganda. Elsewhere, Gooding (1964) reported to have found at least 88 distinct cultivars in the West Indies. Cultivars are obtained from selections of existing clones, mutations, chance seedlings, and deliberate hybridization (Abidin & Carey, 2001; Gibson et al., 2009; Purseglove, 1982). Cultivars are also self-incompatible, but self-fertile. Macdonald (1970) pointed out that yield declines in sweetpotatoes may be due varietal decline or abandonment of varieties due to poor acceptability by farmers or continual new varieties resulting from mutations but recognized that through seeds the breeding potential of swetpotatoes is enormous which can lead to those seeds germinating and producing seedlings readily. Yields are generally low on farms (4-14 tonnes ha^{-1}) because of effects by pests and diseases especially weevils, viruses, some fungi and drought (Gasura & Mukasa, 2010; Gibson et al., 2009; Macdonald, 1970; Mwanga & Ssemakula, 2011; Odongo et al, 1999).

The yields under farm conditions are reported for 139 cultivars identified using farmers' knowledge shown in Table 7. They were put at five levels namely: Low: Below 5,000 kg/ha, three (3) cultivars: *Elany ikokolak, Epaku* and *Ocaka amani* (2% of reported); Medium: 5,001-9,000 kg/ha, thirty one (31) cultivars (22% of reported); High: 9,001-19,000 kg/ha, one hundred and four (104) cultivars (75% of reported); Very High: 19,001-29,000 kg/ha, one (1) cultivar: *Araka* (1% of reported) fell at this level ; Excellent: 29,001 kg/ha and above, no cultivar was named under excellent yields.

However, compared to improved cultivars (Table 1), these yields are low. Under the farmers' conditions even the best improved cultivars may yield low which calls for up-scaling of the farmers' knowledge through research, education, and extension so as to improve productivity.

It was also observed that the early maturing cultivars (1-4 months) were top yielders but tended to be susceptible to weevils, drought, sweetpotato virus and *Alternaria* blight concurring with Mwanga et al. (1995, 2013) and Gibson et al. (2009) which may explain lower yields of cultivars on farms where crop management was relatively poorer in crop protection than on research stations. They also tended to keep poorly in storage when dried. *Araka* and *Osukut* (Tanzania) rotted easily in store when dried. Many of the OFST cultivars tended to rot easily. However, the late maturing cultivars tended to be resistant to drought, weevils, SPVD and *Alternaria* blight. *Engoratonon*, *Epuramojong*, and *Esamiat* were the best keeping cultivars when dried. Majority of the cultivars were fairly well accepted in the market for consumption but the popular ones were *Ejumula, NASPOT 5 (316)/Osapat;* and *Osukut (Tanzania)*. They were the most popular for their yellowness and sweetness. They had very good qualities for consumption. It was remarkable knowledge from the farmers.

5. Conclusions and Recommendations

The findings show that the farmers know many things they practice in sweetpotato growing save for limitations in their education & training, investment, input supply, access to markets and value addition. Majority of the farmers (82%) had neither training in agricultural occupations nor in non agricultural occupations and so relied more on their experience and indigenous technical knowledge to operate. Educational factors increased sweetpotato productivity indicators and helped farmers benefit from extension. There is great need to upscale farmers' knowledge through education, research and extension by stakeholders. Agricultural extension education seems to boost farmers' knowledge on improved cultivars that improved productivity indicators.

Using farmers' knowledge and information, 139 cultivars were identified by farmers themselves in the Teso Sub-region covering the districts of Kaberamaido, Katakwi, Kumi and Soroti. The farmers identified the cultivars they grew using the local name, maturity period, tuber skin colour, flesh colour, storage quality, yield level, drought/weevil resistance and market acceptability.

Early maturing varieties were the top yielders but tended to be susceptible to drought, weevils, sweetpotato virus, and *Alternaria* blight and also rotted easily under storage. The best performing cultivar was *Araka* with a yield range of 19,001-29,000 kg/ha which was higher than the expected maximum of 14,000kg/ha under farmers' conditions. Besides, the findings indicated that *Araka* stores poorly when processed or dried as chips or sliced.

The least performing cultivars were three namely: *Elany ikokolak, Epaku* & *Ocaka amani* found under the late maturing cultivars.whose yields were below 5,000kg/ha. Nonetheless, they were reported less susceptible to weevils and diseases and more resistant to drought. They also stored better when processed. Of them, *Engoratonon, Epuramojong* and *Esamiat* stored best when processed under farmers' conditions.

Majority of the cultivars produced roots which were generally acceptable in the domestic market. More value addition is necessary on the crop through creation of industries to commercially produce Vitamin A, confectionery, pastries, flour, animal feed and laboratory alcohol for export. The orange fleshed cultivars for their yellowness and sweetness were most the popular in the market.

Farmers need more familiarity with the use of other botanical features to characterize the cultivars they grow and their requirements to get higher yields. Multipliers of vines for planting need to register businesses to coordinate steady supply of the required prime ones.

The example of farmers' knowledge of cultivars in Teso suggests that more empowerment is needed considering the finding that increased educational attainment positively influenced sweetpotato productivity indicators. In order to commercialise the crop and for its value addition, farmers need to know more of its scientific base so as to realize higher yields and processing. Through training by extension workers, quality education from schooling including skilling programmes and the release of potent cultivars by breeders with expanded multiplication of prime vines, the farmers' knowledge shall be strengthened to supply raw materials adequately to factories opened for processing the crop's great potential products for domestic use and export.

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