

Full Length Research Paper

Factors influencing commercialization of sweet potato in Mosocho Subcounty, Kenya

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Received 2 June, 2016; Accepted 10 October, 2017

Sweet potato is a traditional crop grown in most parts of Kenya. In Nyanza Region, Kisii County and Mosocho sub-county in particular are major producers of the crop. However, only less than half of the produce is marketed and the growers are largely poverty stricken. This paper investigates why so little of the produce is marketed. Using primary data collected from a survey of 108 farmers in Mosocho, the study estimates a logit model to explain the factors that influence commercialization of sweet potatoes in the area. Results show that poor market information for the many farmers who are not members of any cooperative society, limited non-farm incomes, and urbanization are the major factors constraining commercialization of the root crop. Interventions that promote cooperatives and rural industrialization could go a long way in boosting trade in sweet potatoes.

Key words: Sweet potato, commercialization, smallholder farms, logit model, Mosocho, Kenya.

INTRODUCTION

Sweet potato (*Ipomoea batatas*) is a root crop within the morning glory family (Convolvulaceae). Its origin is thought to be Latin America and it is believed to have been brought to Africa by slave traders. The exact date of its arrival is unknown. The crop has, however, been in the food system in Africa for a long time, and it is widely considered as an indigenous or traditional crop in the region.

Sweet potato is ranked fifth among the most important food crops (Scott et al., 1999). It is rich in energy, carbohydrates, fiber, minerals (especially potassium) and vitamins (especially vitamin A). A serving of 100 g (about half a cup) of boiled sweet potato (especially the

orange fleshed type) supplies 50% of vitamin A daily requirement (Hagenimana and Low, 2000).

Potato is a promising plant remedy for vitamin A deficiency and Uganda has been trying this option. The International Potato Research Center has developed sweet potato varieties richer in beta carotenes that the body uses to synthesize Vitamin A and with high dry matter content (Bachou and Labadarios, 2002). This is an example of bio-fortified crop varieties with increased mineral and vitamin content that can raise nutritional standards in people.

According to FAOSTAT data, 80 to 85% of the total world production of sweet potatoes is from Asia with

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China on the lead (Bruinsma, 2009). In 2010, Asia produced about 90 million metric tonnes of the crop while Africa produced about 15 million metric tonnes. In Africa, Uganda is the leading producer of the crop followed by Tanzania (Bruinsma, 2009). The report also shows that in 2010, Uganda produced about 2.75 million metric tonnes of the crop compared to Kenya's 950,000 metric tonnes.

In Kenya, sweet potato is grown in several areas including Siaya, Homa Bay and Kisii in Nyanza region; Kiambu and Kirinyaga in Central region; Meru in Eastern region; Bungoma, Kakamega, Busia in Western region; and Shimba Hills in the Coast region. Notably, 60% of the households in these areas are poor (Qaim, 1999). Woolfe (1992) observes that the potential of the crop to address issues of income generation, nutritional deficit and food security is yet to be fully realized in less developed countries. The marketing and value addition of the crop are poor, yet these are measures that could uplift the wellbeing of the farmers.

The local as well as the export market for sweet potatoes is on the increase. At the local level, perceptions towards traditional foods are improving. The consumption of sweet potatoes as well as cassava, arrow roots and yams is increasing in both rural and urban areas. Both the affluent and the poor are increasing their consumption of the root crop. Crops that were once thought to be 'poor man's crops' are slowly gaining popularity due to their health benefits. In urban areas, sweet potato is increasingly becoming an alternative breakfast food while in rural areas it is variously used to prepare meals and in baking.

The crop is also used to feed animals. Sweet potato root and vines are feed for poultry, rabbits, pigs, cattle, sheep and goats. In some parts of Papua New Guinea, farmers slice up the sweet potatoes and mix them with vines to improve digestion. In Philippines, boiled sweet potatoes are used to fatten pigs. In poultry farming, sweet potatoes improve the dressing and can substitute up to 50% of maize (Loebenstein, 2009). Its dual nature as a food as well as a feed makes sweet potato an attractive crop in areas where landholding is declining.

In industries the starch obtained from sweet potato is used to manufacture sweeteners, and as a stabilizer and thickener in the textile industries. Sweet potato can be harvested in bits. This flexibility affords households a continuous supply of the crop, and income in case of marketed harvests. To improve the marketing of the crop, Andrade et al. (2009) observe that there is an urgent need for capacity building on postharvest management, better storage facilities, and to designate specific areas in markets as display points for sweet potatoes to easily connect sellers to buyers.

Sweet potato crop has the potential to address poverty, wealth creation, diversification of smallholder agriculture and food security. In recognition of its

nutritional and potential benefits the United Nations declared 2008 as the year of sweet potato (Joel et al., 2009).

Nevertheless, sweet potato has been an orphan crop. There are only a few empirical studies on the crop worldwide. On commercialization of the crop, there are even fewer studies. It is against this background that this paper explores the determinants of sweet potato commercialization focusing on Mosocho Sub-county of Kisii County. Mosocho is a leading producer of sweet potatoes in Kisii. Sweet potatoes from Kisii are particularly appealing and tasty. They are a favorite in the Kenyan market.

LITERATURE REVIEW

Bouis and Haddad (1990) define commercialization as the total percentage value of output that is marketed. However, according to Pingali (1997) agricultural commercialization is more than just marketing agricultural products. Agricultural commercialization is attained when input use decisions and product choice are made on profit maximization basis. Von Braun and Kennedy (1994) add that agricultural commercialization entails an increase in market transactions in order to gain the benefits from commercialization.

Commercialization of agriculture has the potential to reduce poverty and food insecurity. To reduce poverty through commercializing agricultural produce, farmers must consider adding value to what they sell (Ayako & Hernandez, 2017).

Sweet potatoes are largely grown by smallholder farmers. According to Leavy and Poulton (2007), small scale farmers fall into two categories: non-commercial farmers and commercial farmers. The non-commercial farmers mainly practice subsistence production but they may sell a portion of their produce to the market. Their livelihoods are not drawn from agriculture. The commercial small scale farmers are largely market-oriented. They produce agricultural outputs primarily for the market but the output may also meet household consumption. This category of farmers tends to specialize on highly valued agricultural activities. The small-investor farmer is the "emerging" commercial farmer. According to Gebreselassie and Kay (2007), the small-investor farmer includes the educated and urban based individuals who engage in agriculture exclusively on commercial basis. All the produce of a small-investor is marketed.

Pingali and Rosengrant (1995) identify three levels of market participation and which are elaborated by Leavy and Poulton (2007). They are the subsistence system, semi-commercial system and fully commercialized system. The different levels are differentiated on the basis of the farm household's objective in production, its source of inputs, product mix and income sources. Table 1 shows these classifications and the associated

Table 1. Level of market participation and farm-household characteristics.

Level of market participation	Farm-household's objective	Source of inputs	Product mix	Household income sources
Subsistence agriculture	Food self-sufficiency	Generated by the household	Wide range of produce	Mostly from agriculture
Semi-commercial	Surplus generation	Mix of traded and non-traded inputs	Semi-specialized	Both agriculture and other sources which are not agriculture-based
Fully commercial	Profit maximization	Highly tradable inputs	Highly specialized	Predominantly non-agricultural

Source: Pingali and Rosegrant (1995).

characteristics of farm-households.

Von Braun and Kennedy (1994) specify three modes of commercialization indices at household level. These include commercialization of the rural economy, commercialization of input and output, and the degree of a household's involvement in the money or cash economy. The index of commercialization of input and output is the ratio of input acquired from market or output sold to the market to the total value of agricultural produce. The index of household involvement in money/cash economy is the proportion of value of services and goods acquired in monetary terms to total household earning (von Braun and Kennedy, 1994). Govereh et al. (1999) use the ratio of the gross value of all crop sales by a household per year to the gross value of all crops produced within the year as the household commercialization index (HCI). A major weakness in this ratio is that it excludes livestock output which could be an important factor in some farming systems. Bernard et al. (2007) measure household commercialization variously by sales to income ratio, sales-to-output ratio, income diversification, level of specialization in agricultural production, and net or absolute market position of a household either as a net buyer, net seller or autarkic/self-sufficient.

According to Govereh et al. (1999), increased market participation is associated with rising farm productivity and income. They assume that commercialized farmers largely specialize on production of high value cash crops that yield high returns to labor and land. Timmer (1997) has similar views when he argues that agricultural commercialization is associated with benefits that include high level of specialization and production, and higher earnings from produce sales.

However, the benefits of commercialization depend on market efficiency. If markets are efficient, commercialization leads to separation of production from consumption (Bernard et al., 2007). Gebreselassie and Kay (2007) argue that even though greater involvement in output markets results in higher productivity which is an intermediate outcome, agricultural commercialization is a bridge through which small scale commercial farmers

could achieve welfare goals.

At a micro level, distance to the market and output price (Omiti et al., 2009), farm size and the number of workers employed are crucial determinants of marketed output or sales volume in a smallholder farm. Balint (2004) in a study of the effect of institutional factors on agricultural sales in Romania finds that farm size, production costs, farming assets, transaction costs and cooperation among farmers significantly contribute to agricultural sales volume. Lerman (2004) find similar results in a study of farm produce marketing among small scale farmers in transitional economies. Martey et al. (2012) in a Tobit regression of commercialization of agriculture in Ghana find farm size, output price, and households' access to extension service, market information and distance to market to be important determinants.

Baisa (2009), in a research of why some smallholder farmers in Ethiopia sell more output than others, used a multivariate linear regression analysis to identify the relationship between the gross value of all crops sold and the socio-economic characteristics of households. The study found that farm and household characteristics are the main determinants of the phenomenon. Other determinants of commercialization in value terms according to this study include market information, access to credit and access to transport. In a similar study of determinants of commercialization of smallholder tomato and pineapple farms in Ghana, Asuming-Brempong et al. (2013) found that the key determinants of commercialization among tomato farmers are land and labor productivity while the main determinants of commercialization among pineapple smallholder farmers are land productivity and savings. The study favors commercialization arguing that commercialization comes with several benefits that include higher household incomes and improvement in household food security.

Using the Tanzanian National Panel Survey data compiled by FAO, Nobeji (2015) analyzed the determinants of market participation by smallholder rice farmers in the five major rice producing regions of Tanzania. Quantitative analysis involving estimation of

Weighted Least Squares (WLS) and Tobit regression to establish factors affecting volume of sales and determinants of market participation found that household socio-demographic characteristics of smallholder rice farmers influence production and market participation. Results of the Tobit regression model indicate that household consumption, area cultivated, livestock owned and location significantly influence volume of sales and market participation while nonfarm income, Mbeya and Tabora regions significantly but negatively influence market participation. Further, low rice production, underdeveloped transport infrastructure and lack of reliable markets closer to higher rice producing regions and inadequate access and use of improved seeds and input were found to be the main problems associated with smallholder farmers in the study area.

In a research carried out by Kirui and Njiraini (2013) on determinants of agricultural commercialization among the rural poor in Kenya using the Tobit regression, they found that farmer-specific characteristics, farm-specific and capital endowment variables influence the commercialization process. Female farmers are constrained from market participation; however, collective action initiatives (farmer groups) as well as use of information and communication technology (ICT) tools (mobile phones) significantly and positively influence their commercialization.

Omiti et al. (2009) use truncated regression to study factors influencing the intensity of market participation between rural and peri-urban smallholder farmers in Kenya. Results show that farmers in peri-urban areas sell higher proportions of their output compared to their counterparts in rural areas. Distance from the farm to sale point is a major constraint to the intensity of market participation. Better output price and market information are key incentives for increased sales.

The various studies show that different constraints limit smallholder farmers' participation in the market. Thus, crop or area specific research is required to identify the specific commercialization constraints that can inform specific policy.

METHODOLOGY

To determine the level of sweet potato commercialization in a household, the household commercialization index (HCI) is used as in Govereh et al. (1999). The index is a ratio of gross value of crop sales by a household in a period to gross value of crop output within the same period expressed as a percentage.

$$HCI = \left[\frac{\text{(Gross value of sweet potatoes sold in a period)}}{\text{(Gross value of sweet potatoes produced in the period)}} \right] \times 100$$

The commercialization index ranges between zero and one hundred percent. A value of one hundred percent signifies full commercialization while zero indicates pure subsistence

production. The following model could capture the relationship between commercialization and its covariates.

$$HCI^* = X B + \epsilon \quad (1)$$

where HCI^* is the household commercialization index, X is a vector of covariates and B is a vector of parameters. ϵ is an error term. The covariates include household characteristics, institutional factors and village characteristics.

Given that sweet potato farmers in the study area are small scale producers for both the market and household consumption on less than a hectare of land, it may be argued that a household with a HCI^* of 50% or more is highly commercialized while a household with an index below 50% is lowly commercialized.

Thus, Equation 1 could be rewritten as a binary response index model of sweet potato commercialization with $HCI = 1$ if [$HCI^* \geq 0.5$] and $HCI = 0$ if [$HCI^* < 0.5$]. Following Wooldridge (2002), the latent variable model in Equation 1 can be transformed into a response probability function.

$$HCI = 1 [HCI^* \geq 0.5] \quad (2)$$

and

$$P(HCI=1|X) = P(HCI^* \geq 0.5|X) = G(XB) = p(X) \quad (3)$$

The function G maps the index HCI into the response probability. Assuming that the error term followed a standard logistic distribution, the estimated response probability function was to be a logit model. If the error term followed a standard normal distribution, the response probability function was to be a probit model. Since the results from estimating either model would not be much different, the study took the first option and estimated a logit model of the form:

$$\text{Logit } L_i = \ln [P_i/(1-P_i)] = X B + \epsilon \quad (4)$$

The data used in the estimation were collected through face-to-face interviews with 108 farmers randomly picked from Mosocho sub-county with the help of Kenya National Bureau of Statistics household listing. Table 2 describes the variables used and their measurement.

RESULTS AND DISCUSSION

The results that follow were generated using STATA 12 software. Table 3 shows the summary statistics of the variables considered in the estimation of the logit model of sweet potato commercialization.

Table 3 shows that only less than half of farmers interviewed were commercialized. The farmers were middle-aged and of lower secondary. They farmed not far from market centres and majority of them belonged to a cooperative society that fed them with market information. Sweet potato farming in the study area was largely a family activity with men dominating. Despite the activity, household incomes were largely drawn from non-farm sources and loans. The average farm size was less than half a hectare and expansion of family units through leased land was not a readily available option. Table 4 shows the maximum likelihood estimates of the logit parameters, while Table 4 shows the corresponding

Table 2. Variable description and measurement.

Variable	Description	Measurement
HCI	Gross value of total sweet potato sales per week/Gross value of total sweet potato output per week	HCI=1 if highly commercialized, 0 otherwise
age	Age of household head	Number of years lived
agesq	Age of household head squared	Number of years lived squared
marsta	Marital status of the household head	1 if married, 0 if otherwise
gendr	Gender of the household head	1 if male, 0 otherwise
educ	Highest level of education attained by household head	Number of years of formal education
educsq	Highest level of education attained by household head squared	Number of years squared
labrfrce	Adult equivalents in a household who are active in own farm activities	Number
famsize	Size of the farm owned by the farmer	Hectares
landaces	Whether household has hired land	1 if yes, 0 if otherwise
creditaces	Household access to credit	1 if a household took a loan in the last one year, 0 if otherwise
info	Whether household is a member to a cooperative Society	1 if yes, 0 if otherwise
distmkt	Distance from the farm to the nearest market	Kilometers
nonfinc	Proportion of non-farm annual income to total annual household income	Ratio of non-farm to farm income

Source: Authors.

Table 3. Summary statistics of the variables.

Variable	Mean	Std. dev.	Minimum	Maximum
hci	0.44	0.23	0.12	1
age	38	10.18	21	75
marsta	0.63	0.49	0	1
gendr	0.65	0.87	0	1
educ	9.69	2.97	5	16
educsq	102.75	58.95	25	256
labrfrce	3.54	2.07	1	13
famsize	0.46	0.38	0.13	2
landaces	0.46	0.50	0	1
creditaces	0.51	0.50	0	1
info	0.56	0.50	0	1
distmkt	3.86	2.81	0	15
nonfinc	0.56	0.50	0	1
No. of obs.			108	

Source: Authors computations from field data.

odds.

From Table 4, membership to a cooperative society substantially increased the log-odds of a household being highly commercialized. Indeed, Table 5 confirms that households being a member of a cooperative

increased the odds in favor of commercialization by over 100%. Table 5 shows that a sweet potato farmers' decision to join a cooperative of any kind increased his probability of producing for the market by about 17%. Unfortunately, only about half of the sweet potato

Table 4. Logistic regression results of sweet potato commercialization.

hci_st	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
age	-0.17904	0.161793	-1.11	0.268	0.49615	0.138069
agesq	0.002669	0.001916	1.39	0.164	0.00109	0.006423
marsta	0.469901	0.552264	0.85	0.395	0.61252	1.552319
gendr	0.618256	0.537969	1.15	0.25	0.43614	1.672655
educ	-0.03703	0.540158	-0.07	0.945	1.09572	1.021658
educsq	0.006143	0.02699	0.23	0.82	0.04676	0.059041
labrfrce	0.166105	0.129724	1.28	0.2	0.08815	0.420359
landaces	-0.09233	0.513858	-0.18	0.857	1.09947	0.914811
credav	-0.12027	0.525375	-0.23	0.819	1.14998	0.909449
info	0.98397	0.542121	1.82	0.07	0.07857	2.046508
distmkt	0.182251	0.094776	1.92	0.054	0.00351	0.368008
nonfinc	1.553932	0.621906	2.5	0.012	0.33502	2.772844
_cons	-2.08404	4.086615	-0.51	0.61	10.0937	5.92558
Number of observations				108		
Iteration 4: log likelihood = -52.248483				-		
LR $\chi^2(12)=23.12$				P=0.0267		
Pseudo R ²				0.1812		

Source: Authors computations from field data.

Table 5. Odds ratios of sweet potato commercialization.

hci_st	Odds ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
age	0.836073	0.135271	-1.11	0.268	0.608871	1.148055
agesq	1.002672	0.001921	1.39	0.164	0.998915	1.006444
marsta	1.599836	0.883532	0.85	0.395	0.541985	4.722407
gendr	1.855688	0.998303	1.15	0.25	0.646525	5.326292
educ	0.963645	0.520521	-0.07	0.945	0.334298	2.777797
educsq	1.006161	0.027156	0.23	0.82	0.95432	1.060819
labrfrce	1.180697	0.153164	1.28	0.2	0.915625	1.522507
landaces	0.911803	0.468537	-0.18	0.857	0.333046	2.496304
credav	0.886684	0.465841	-0.23	0.819	0.316642	2.482953
info	2.675054	1.450203	1.82	0.07	0.924439	7.74082
distmkt	1.199915	0.113723	1.92	0.054	0.996499	1.444854
nonfinc	4.730032	2.941633	2.5	0.012	1.397968	16.00409
_cons	0.124427	0.508485	-0.51	0.61	4.13E-05	374.4958
Number of observations				108		
Iteration 4: log likelihood = -52.248483						
LR $\chi^2(12)=23.12$				P=0.0267		
Pseudo R ²				0.1812		

Source: Authors computations from field data.

farmers in Mosocho were members of a cooperative society. This limited their information flow and capacity to produce for the market. Any policy that promotes the growth and development of cooperatives is likely to influence commercialization of sweet potatoes positively.

In spite of sweet potatoes being bulky, the distance from the farm to the market was found to influence

commercialization of the crop positively. One kilometer increase in distance from the farm to the market increased the odds in favor of high commercialization by nearly 20%. Farmers close to a market centre had more economic options and only grew sweet potatoes as a side activity. The area near markets was actually densely populated with little land for cultivation.

However, farmers further away from a market had fewer economic opportunities, the population density was lower and the farmers had a higher likelihood of growing and selling more sweet potatoes. Table 5 shows that 1 km increase in distance from the farm to the market above the average of 3.9 km increased the probability of high commercialization by 3.2%.

This finding differed from that of Barrett (2008) and Omiti et al. (2009) that households far away from markets have low market orientation and commercialization. However, the finding was consistent with Jemimah et al. (2011) and Ruhangawebare (2010).

Non-farm income increased the odds in favor of high commercialization. A farming household that had nonfarm income was almost likely to be highly commercialized. Non-farm income increased the probability of high commercialization by an average farmer by nearly 26%. Households without non-farm income to purchase food items were more likely to consume more of the homegrown foodstuffs including sweet potatoes. This left them with little marketed output. Thus, opportunities for non-farm incomes such as rural and urban industrialization and non-farm businesses could have important implications on commercialization of sweet potatoes without endangering household food security. The finding is in line with Von Braun and Kennedy (1994), Jemimah et al. (2011), Ruhangawebare (2010) and Agwu and Ibeaabuchi (2011). These works find non-farm income to promote commercialization of farm output. The finding is, however, at variance with Barrett (2008), Martey et al. (2008) and Omiti et al. (2009) who argue the opposite.

That non-farm income increased the probability of high commercialization has wide implications on household nutrition too. Households without external sources of income were likely to be poorer, consume much of their farm output, and probably miss out on other nutritional foods available in the market. Rural industrialization and growth policies that offer opportunities for non-farm incomes have the likelihood to not only influence commercialization of farm output positively, but also household nutrition.

Farmers should be encouraged to diversify into non-farm and particularly non-agricultural activities. Alternative income sources have the likelihood to reduce dependency on homegrown crops for household consumption and to increase market participation.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Agwu NM, Ibeaabuchi JO. (2011). Socio-economic determinants of

- commercialization among small holder farmers in Abia State, Nigeria. *Greener Journal of Agricultural Sciences* 2(8):392-397.
- Andrade M, Barker I, Cole D, Fuentes S, Gruneberg W, Kapinga R, Low J (2009). Unleashing the potential of sweet potato in Sub-Saharan Africa: Current challenges and way forward. *International Potato Center*. <http://www.sweetpotatoknowledge.org/files/unleashing-the-potential-of-sweetpotato-in-sub-saharan-africa-current-challenges-and-way-forward-2/>
- Asuming-Brempong S, John KA, Samuel A, Seth A (2013). Determinants of commercialization of smallholder tomato and pineapple farms in Ghana. *American Journal of Experimental Agriculture* 3(3):606.
- Ayako E, Hernandez M (2017). Linking smallholder farmers to markets on extensive and intensive margins: Evidence from Nicaragua. *Food Policy* 73:34-44.
- Bachou H, Labadarios D. (2002). The nutrition situation in Uganda. *Nutrition* 18(4):356-358.
- Barrett C (2008). Smallholder market participation: Concepts and evidence from Eastern and Southern Africa. *Food Policy* 33:299-317
- Baissa GA (2009). Commercialization of smallholder farming: determinants and welfare outcomes: a cross-sectional study in Enderta district, Tigray, Ethiopia. Unpublished Master's thesis, Universitetet i Agder: University of Agder.
- Bernard T, Gabre-Madhin E (2007). Smallholders' commercialization through cooperatives. *International Food Policy Research Institute (IFPRI)*. Discussion paper 722.
- Bouis HE, Haddad LJ (1990). Agricultural commercialization, nutrition, and the rural poor. *Rienner*. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.146.4066&rep=rep1&type=pdf>
- Bruinsma J (2009). The resource outlook to 2050: by how much do land, water and crop yields need to increase by 2050. *Expert meeting on how to feed the world 2050*:24-26.
- Gebreselassie S, Kay S (2007). Commercialization of Smallholder Agriculture in Selected Tef-Growing Areas of Ethiopia. *Ethiopian Journal of Economics* 16(1):55-86.
- Govere J, Jayne TS, Nyoro J (1999). Smallholder commercialization, interlinked markets and food crop productivity: Cross-country evidence in eastern and southern Africa. *Michigan State University*. Department of Agricultural Econ. Department Economics. Discussion paper 39.
- Hagenimana V, Low J (2000). Potential of orange-fleshed sweet potatoes for raising vitamin A intake in Africa. *Food Nutrition Bulletin* 21(4):414-418.
- Kirui OK, Njiraini GW (2013). Determinants of agricultural commercialization among the rural poor: The Role of ICT and Collective Action Initiatives and gender perspective in Kenya. In *GI-Jahrestagung* pp. 1747-1754.
- Leavy J, Poulton C (2007). Commercialisations in agriculture. *Ethiopian Journal of Economics* 16(1):1-37.
- Lerman Z (2004). Policies and institutions for commercialization of subsistence farms in transition countries. *Journal of Asian Economics* 15(3):461-479.
- Loebenstein G, George T (2009). *The sweetpotato*. Springer Science & Business Media. <https://www.springer.com/gp/book/9781402094743>
- Martey E, Al-Hassan RM, Kuwornu JK (2012). Commercialization of smallholder agriculture in Ghana: A Tobit regression analysis. *African Journal of Agricultural Research* 7(14): 2131-2141.
- Nobeji SB, Nie F, Chen F (2015). An analysis of smallholder farmers' socio-economic determinants for input use: A case of major rice producing regions in Tanzania. *RJOAS* 2(38). <https://cyberleninka.ru/article/v/an-analysis-of-smallholder-farmers-socio-economic-determinants-for-inputs-use-a-case-of-major-rice-producing-regions-in-tanzania>
- Joel N, Remans R, Karuti S, Fanzo JC (2009). Integrating a broader notion of food security and gender empowerment into the African Green Revolution. *Food Security*, 1(3):351-360.
- Jemimah N, Kaaria S, Chamunorwa A, Chiuri W (2011). Linking smallholder farmers to markets, gender and intra-household dynamics: Does the choice of commodity matter? *The European Journal of Development Research* 23(3):426-443.
- Omiti J, Otieno D, Nyanamba T, McCullough E (2009). Factors

- influencing the intensity of market participation by smallholder farmers: A case study of rural and peri-urban areas of Kenya. *African Journal of Agricultural and Resource Economics* 3(1):57-82.
- Pingali PL, Rosegrant MW (1995). Agricultural commercialization and diversification: Processes and policies. *Food Policy* 20(3):171-185.
- Qaim M (1999). The economic effects of genetically modified orphan commodities: projections for sweetpotato in Kenya. ISAAA. <https://www.isaaa.org/resources/publications/briefs/13/download/isaaa-brief-13-1999.pdf>
- Ruhangawebare GK (2010). Factors affecting the level of commercialization among cattle keepers in the pastoral areas of Uganda. Unpublished Collaborative Masters Program in Agricultural and Applied Economics.
- Scott GJ, Otieno J, Ferris SB, Muganga AK, Maldonado L (1999). Sweet potato in Ugandan food systems: Enhancing food security and alleviating poverty. CIP Program Report 1997-1998. 11 P. <http://www.sweetpotatoknowledge.org/files/sweetpotato-in-uganda-food-systems-enhancing-food-security-and-alleviating-poverty/>
- Timmer CP (1997). Farmers and markets: The political economy of new paradigms. *American Journal of Agricultural Economics* 79(2):621-627.
- Tudor M, Borbala B (2006). Off-farm employment and agricultural sales: Evidence from Romania. *Post-Communist Economies* 18(2):243-260.
- Von Braun J, Kennedy E (eds). (1994). *Agricultural commercialization, economic development, and nutrition*. Johns Hopkins University Press. Baltimore.