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Round potato (*Solanum tuberosum*) production in southern highlands of Tanzania: Are smallholder farmers becoming commercial?

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The subsistence production is chosen by farmers because it is subjectively the best option. However, subsistence farming on small and fragmented plots risks not reaching even farmers' own food requirements, let alone producing a surplus. Therefore, it would have been expected that farmers would be commercialising production of profitable food crops. One of the more profitable food crops than many others as studies show is round potato (*Solanum tuberosum*). Nonetheless, the extent to which farmers have commercialised round potato production was not known. This study was then undertaken to fill this knowledge gap by analysing the proportion of land allotted to round potato production and the extent to which the crop was oriented towards the market by using the commercialisation index. A sample of 510 farmers was visited from three districts of the southern highlands of Tanzania. Results showed that round potato production was highly commercialised. This was evidenced by the proportion of land that was allotted for round potato cultivation and the commercialisation index. About 20 to 67% of the total land under cultivation was allotted to round potato production and 88% of the produce was sold. However, both the cultivated land and output per capita were small.

Key words: Commercialisation, commercialisation index, Irish potato, market based production, subsistence, subsistence farming.

INTRODUCTION

Over the past years, subsistence farming has neither improved the livelihoods of the rural population nor guaranteed food security. As a result, smallholder agricultural production has become a policy priority for the United Republic of Tanzania, which seeks to commercialise it (URT, 1997, 2008). Commercialisation of agricultural production in situations where the majority of farmers are engaged in food crops means making these crops profitable (Wolter, 2008). Food crops on which the government has focused include the major staples namely, maize and rice, for which there are restrictions on sales and export (Gabagambi, 2009).

While such restrictions lower the prospect of maize and rice as commercial engagement, opportunities do exist in other sub-staples, such as round potato (*Solanum tuberosum*) in areas of favourable climatic conditions (Kelly, 2006). Studies on round potato have shown that production and consumption of the crop is increasingly becoming popular (Anderson, 1996, 2008; Kabungo, 2008; Koizumi, 2007; Namwata et al., 2010). The potato has great potential in both national and regional markets, due to growing demand for chips and snacks/crisps (Anderson, 2008). This growth in demand can be traced to many factors, including increasing economic activities, urbanisation, tourism, and changing lifestyles, all of which are shifting consumer food preferences towards easy to cook and processed foods (Anderson, 2008; CIP, 2008; FAOSTAT, 2008).

Apart from the fact that round potato is easy to cook and to process, as studies have shown, it produces

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remarkable quantities of calories comparable to cereal crops (Blanken et al., 1994; Scott et al., 2000). This means that round potato can address both food security as well as profit. Indeed, as existing data show, this round potato is more profitable than traditional staples, as it has higher yield per unit of land, matures earlier, and provides a larger income (Blanken et al., 1994; CIP, 2008; Goossens, 2002; Namwata et al., 2010; UARC, 1990). The maturity period of round potato is about three months as compared to maize (the major staple in Tanzania), which takes about eight to ten months to be ready for harvest (UARC, 1990). Also, one acre of round potato produces up to 120 (100 kg) bags versus about 20 bags of maize. Also, prices per unit are comparable although round potato sales are often higher than maize (BOT, 2010; UARC, 1990). For the round potato, these data show that it is a good income earner, and because of its potentiality, the crop is considered to be a hidden treasure for smallholder farmers (Blanken et al., 1994; CIP, 2008).

Given the prospect and from economic point of view, smallholder farmers would have been expected to commercialise the crop by allotting more acreage to it and sell a bigger part of the produce than they keep for home consumption (Nyikai, 2003; Pingali et al., 2005; Rudra, 1983; Sokoni, 2008; von Braun and Kennedy, 1994). However, the extent to which farmers in the southern highlands of Tanzania (SHT) have commercialised their round potato production was not known. This study was then undertaken to fill this knowledge gap by analysing the proportion of land allotted to round potato production and the extent to which round potato production was oriented towards the market by using the commercialisation index (CI).

The study has both descriptive and normative aims. Firstly, it is aimed at increasing knowledge on the commercial orientation of smallholder farmers. The prospect here is often overlooked because subsistence farming on small and fragmented plots generally risks not reaching even farmers' own food requirements, let alone producing a surplus. Secondly, this study is aimed to show policymakers and stakeholders in agriculture who can develop policies and strategies to help smallholder farmers with the commercialisation process. Commercialisation of smallholder production is essential in improving the income and livelihoods of these farmers and assuring their food security (Ahmed, 1994; Blanken et al., 1994; Nyikai, 2003; OECD, 2008; Sokoni, 2008; von Braun and Kennedy, 1994). It is not the aim of this study to provide a normative formula to help subsistence farmers commercialise, but rather, to develop a deepest understanding of their commercial orientation.

Study area

This study was conducted in Njombe, Mbeya Rural and Nkasi districts in Iringa, Mbeya, and Rukwa regions,

respectively. These three districts are all found in the southern highlands of Tanzania. Njombe and Mbeya Rural districts were purposively selected because they were the leading producers of round potato in their respective regions (URT, 2007), and the characteristics of their farmers and farming practices differ. Njombe produces predominantly one variety of round potato, which is *Kikondo*. Mbeya Rural district produces a number of varieties including *Kikondo*, *Arka*, *Kidinya*, *Kagiri*, and *Tigoni*. Also, Mbeya Rural district is wet almost throughout the year, making it possible to cultivate round potato more than once, while this is not the case in Njombe.

Njombe and Mbeya Rural districts are within or close to better transport networks than Nkasi district. They have more access to input and output markets as well as to extension services than Nkasi district. Although farmers in Nkasi produce only small quantities of round potato, the district was taken for comparison purposes because this makes it possible to compare levels of commercialisation in areas with high potential (in terms of access to input and output markets) with low potential areas.

METHODOLOGY

Sampling and data collection

A pilot survey to test data collection instruments and to gain familiarisation with the study areas was conducted in two villages, one in Njombe district and another in Mbeya Rural district. This main survey was conducted in two seasons, from March 2010 to June 2011. Data was collected from 15 villages, which were purposively selected based on the volume of production of round potato. In those villages, respondents were randomly selected from farmers' meetings called by village executive officers (VEOs). The VEOs were informed at least a day prior to the visit of our request that they call for round potato farmers' meeting on the day of the visit. In total, 510 farmers were included in this study. However, the proportion of women who showed up for the meetings was relatively small. This phenomenon is not uncommon for it has been well documented that the gender division of labour which allocates all childcare, household activities, and water and wood carrying to women, constraints their capacity to participate in the market based production irrespective of opportunities (Ellis, 1988; Kaaria et al., 2007; World Bank, 2009).

Data was then collected on general characteristics of round potato farmers, varieties of round potato produced, land ownership, relative acreage allotted to round potato production, reasons for acreage allocation to various crops, input use, output per acre, volume sold, volume consumed and/or stored, and average selling price.

Analytical technique

Commercialisation of subsistence agriculture can take place on the output side as well as on the input side (von Braun and Kennedy, 1994). On the output side of production, commercialisation is manifested by the increased marketed surplus while on the input side, it is shown by the increased use of purchased inputs. This study assessed the commercialisation of round potato production from the output side. According to von Braun and Kennedy (1994),

commercialisation on the output side is defined as in Equation (1):

$$\text{Commercialisation of agriculture} = \frac{\text{Value of agricultural sales in markets}}{\text{Agricultural production value}} \quad (1)$$

The commercialisation index (CI) was used to determine the extent of commercialisation of round potato production. Deriving from Bekele et al. (2011), Strasberg et al. (1999), and von Braun and Kennedy (1994), the commercialisation index (CI) for round potato production can be defined as:

$$CI = \frac{\text{Gross value of all round potatoes sales}}{\text{Gross value of all round potato production}} \times 100\% \quad (2)$$

Commercialisation index measures the extent to which round potato production is oriented toward the market, so, a value of zero would signify a totally subsistence-oriented farmer while the closer the index is to 100%, the higher the degree of market orientation (Strasberg et al., 1999). Since CI depends on the output Y , and assuming that farmers consume a fixed amount, c , of round potato, then:

$$CI = \frac{Y - c}{Y} \times 100\% \quad (3)$$

This assumption is realistic since farmers' consumption of a particular food crop cannot increase indefinitely with increasing production, for instance, if a farmer or rather a household consumes an amount equal to c , then any excess above c should be sold. The relationship in Equation (3) is desirable since the higher the production (Y) the higher the CI, that is:

$$\lim_{Y \rightarrow \infty} (CI) = 100\% \lim_{Y \rightarrow \infty} \left(\frac{Y - c}{Y} \right) = 100\% \lim_{Y \rightarrow \infty} \left(1 - \frac{c}{Y} \right) = 100\% \quad (4)$$

Equation (4) means that as Y becomes very large, relative to c , CI approaches 100%.

It is noteworthy that this study was descriptive in nature aiming at obtaining a general picture of the market orientation of round potato farmers by analysing the proportion of land allotted to round potato production and the commercialisation index.

RESULTS AND DISCUSSION

Description of round potato farmers visited

Results showed that the percentage of male respondents was 62, 79, and 67% in Njombe, Mbeya Rural, and Nkasi respectively (Table 1). On average, 69.6% of the all respondents were male while 30.4% were females. As aforementioned, more men showed up to the round potato farmers' meetings than women. However, statistics show that in Tanzania, female constitute about 51% of the total population. Thus, it can be inferred that the higher percentage of men in this study might be a

reflection of the commercial nature of round potato production in the study areas. In this situation, it is likely that more men would be involved in it, leaving women with other food crops for home consumption and other household activities. It has widely been shown that in Africa, when a crop is perceived as commercial, men are more likely to take over from women (Kaaria et al., 2007; World Bank, 2009).

Majority of the respondents were in the 30 to 44 years age group (Table 1). This age group accounted for about 58% in Njombe and Nkasi districts and about 54% in Mbeya Rural district. Also, the 45 to 64 years age group accounted for about 31, 26, and 22% in Njombe, Mbeya Rural, and Nkasi districts respectively. The proportion of respondents in the 14 to 29 years group and the 65 years and above was relatively small. This result indicates that few youths, for example, primary and secondary school leavers were involved in round potato production. Quite often, age is used as an indicator of farming experience. This experience makes certain informational and search costs easier (Luh, 1995).

The survey results on the educational level of respondents indicated that about 82, 85, and 92% of respondents from Njombe, Mbeya Rural, and Nkasi districts respectively had primary education (Table 1). Also, about 14, 5, and 4% of respondents from Njombe, Mbeya Rural, and Nkasi respectively had secondary education. The proportion of respondents with secondary education was nearly 3 times those of Mbeya Rural or Nkasi, but the trend is similar. Educational level is said to affect market orientation and productivity. Other studies such as Hawassi (2006) and Nkumba (2007) find that educational level influences productivity and market access. It also influences the cost of information seeking and negotiating, and hence, market orientation (Asrat et al., 2009; Pingali et al., 2005; von Braun and Kennedy, 1994).

Results on marital status showed that about 86% of respondents from Njombe district, 87% from Mbeya Rural district, and 96% from Nkasi district were married while the rest were living single, widowed or separated (Table 1). Also, marital status is said to influence farm practices (World Bank, 2009). For instance, Kilima et al. (2010) indicated that married household heads had significantly less maize area under improved technologies than single household heads.

Cultivated land and the proportion for round potato production

The average land sizes under cultivation in the three districts were small (Table 2). In itself, this is unsurprising, given that it has often been reported that smallholder farmers in Tanzania farm on small and fragmented plots (Wolter, 2008; Sokoni, 2008). For instance, Wolter (2008) shows that land sizes for smallholder farmers in Tanzania range from about 2.0 to

Table 1. Characteristics of round potato farmers visited.

Variable	Njombe		Mbeya Rural		Nkasi	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Sex						
Female	64	37.6	35	20.6	56	32.9
Male	106	62.4	135	79.4	114	67.1
Total	170	100.0	170	100.0	170	100.0
Age						
14-29 years	14	8.2	32	18.8	33	19.4
30-44 years	99	58.2	91	53.5	98	57.6
45-64 years	52	30.6	44	25.9	38	22.4
65 years and above	5	2.9	3	1.8	1	.6
Total	170	100.0	170	100.0	170	100.0
Education level						
No formal education	6	3.5	13	7.6	6	3.5
Primary education	139	81.8	145	85.3	157	92.4
O-level secondary education	24	14.1	9	5.3	7	4.1
A-level secondary education/certificate	1	.6	3	1.8	0	0.0
Total	170	100.0	170	100.0	170	100.0
Marital status						
Married	146	85.9	148	87.1	157	92.4
Single	7	4.1	9	5.3	6	3.5
Separated/widowed	17	10.0	13	7.6	7	4.1
Total	170	100.0	170	100.0	170	100.0

Table 2. Acreage allocation for round potato and maize.

District	Land description	Minimum	Maximum	Mean
Njombe	Total land under cultivation (acres)	1.00	13.00	4.71
	Proportion of land under cultivation (ratio of total)	0.17	1.00	0.82
	Land size under maize production (acres)	0.50	6.00	2.17
	Land under round potato production (acres)	0.25	7.00	1.99
	Land under round potato per total under cultivation	0.08	0.67	0.42
Mbeya Rural	Total land under cultivation (acres)	1.00	40.00	3.74
	Proportion of land under cultivation (ratio of total)	0.13	1.00	0.96
	Land size under maize production (acres)	0.50	10.00	1.69
	Land under round potato production (acres)	0.50	40.00	2.63
	Land under round potato per total under cultivation	0.10	1.00	0.71
Nkasi	Total land under cultivation (acres)	3.00	21.00	7.08
	Proportion of land under cultivation (ratio of total)	0.20	1.00	0.71
	Land size under maize production (acres)	1.00	14.00	3.87
	Land under round potato production (acres)	0.50	3.00	1.14
	Land under round potato per total under cultivation	0.03	0.75	0.20

Table 3. Commercialisation index (CI).

District	Total output (100 kg bags)		Amount consumed (100 kg bags)		Amount stored (100 kg bags)		Amount sold (100 kg bags)		CI	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Njombe	91.4	84.0	0.5	1.2	10.6	10.7	80.6	79.1	0.864	0.135
Mbeya rural	67.6	80.1	0.4	1.2	5.3	9.5	62.3	74.2	0.913	0.147
Nkasi	12.9	13.4	0.5	0.8	0.9	2.1	11.6	12.4	0.875	0.168
Total	57.1	74.8	0.5	1.1	5.5	9.2	51.3	69.2	0.884	0.152

7.5 acres (or about 0.9 to 3 ha). What is surprising, however, is the proportion of land that is allotted to round potato production. This was 20% of the total land under cultivation in Nkasi, 42% in Njombe and 67% in Mbeya Rural.

Mbeya Rural had the highest proportion of land allotted to round potato production but its per capita land size was small. This was due to the fact that land in Mbeya Rural is characterised by mountain slopes and valleys, making producers farm on small and fragmented plots. Also, in this area, maize for instance, takes too long to be ready for harvest compared to Njombe and Nkasi districts. This makes round potato a potential crop around this area.

The proportion of land under round potato production at Nkasi was relatively small. This could be due to the remoteness of the district, as it is very far from potential market centres and has poor transport infrastructure. This gives farmers in this area impetus to produce more of maize than round potato because maize does not require heavy inputs as compared to round potato. Also, maize can be stored for a longer time compared to round potato, which is highly perishable.

From the commercial point of view, the average acreage under production was too small to provide any meaningful output for business purposes. However, in the theory of peasant economics, there appears to be an inverse relationship between farm size and productivity (Carter, 1984; Ellis, 1988). The gross output or income per unit of land for a small farm has been shown to be higher than that of a bigger farm. The farm size used in this context is, as defined by Ellis (1988), the strict area size of the farm (as opposed to farm scale which refers to the overall economic size of farms). The proposition that Ellis (1988) develops to explain this is that small farms generally make more efficient use of resources than large farms, an argument which is similar to Schumacher (1989), who also advocates for small farms.

Although, the total land sizes under cultivation were comparable to previous studies, the proportion of land devoted to round potato production in the current study was high especially in Njombe and Mbeya Rural districts. This is so because the study locations are considered to be the major cereal producers in Tanzania (URT, 2006). Hence, having between 20 and 67% of the land allotted

for round potato production is by any means high. This high proportion of land allotted to round potato is consistent with our expectation that since the crop is more profitable than (for example) maize, which is popular in SHT, farmers would increasingly allocate more land to it. Therefore, this indicates a movement towards commercial round potato production, a conclusion that does not disregard the inverse relationship between farm size and productivity as discussed by Carter (1984) and Ellis (1988). However, our argument is that commercially-oriented farmers would allocate more acreage to a crop that, subject to probabilities, promises to yield higher profits.

Commercialisation index (CI)

The findings showed that CI for round potato was 86% in Njombe, 88% in Nkasi and 91% in Mbeya Rural (Table 3). On average, 88% of all round potato produce was being sold. The remaining output was either consumed or stored as seed tubers for the following season. The CI of 88% found in this current study is surprisingly high. According to Bekele et al. (2011) and Strasberg et al. (1999), a crop commercialisation index greater than 50% signifies a commercial oriented farmer for a crop under consideration. Since the commercialisation index for this study is about 88%, then round potato production is highly commercialised in the study areas. Since farmers in these areas did not grow a single crop, it is likely that they produced other crops for home consumption and the round potato for the market.

Although no studies have assessed the commercialisation index of farmers in Tanzania, Nyikai (2003) argues that the majority of smallholder farmers in sub-Saharan Africa are neither purely subsistence nor purely commercial. They are either semi-commercial or semi-subsistence. Some farmers usually produce certain crops for home consumption and some specific crops for sale (Bekele et al., 2011). In this case, the commercial orientation of farmers should be measured with reference to a specific crop rather than the farmer in general.

Despite the fact that the commercialisation index was very high, the per capita output of round potato was very small. This is due to two main reasons. Firstly, the small

and fragmented plots that farmers cultivated, and secondly, due to low productivity. Low productivity is a result of little or non-use of agricultural inputs. Therefore, given that only about 20% of all arable land is cultivated in Tanzania (URT, 2009), then opportunities exist in terms of land expansion by mechanisation and improved productivity. The current land holdings among farmers are too small to provide meaningful commercial outputs.

Conclusion

This study found that round potato production in Southern highlands of Tanzania is highly commercialised. This was evidenced by the proportion of land that was allotted for round potato cultivation and the commercialisation index. About 20 to 67% of the total land under cultivation was allotted to round potato production and about 88% of the produce was sold. This means that farmers produced round potato primarily for the market. However, both the cultivated land and the output per capita are very small. This calls for both land expansion and improved productivity. Since commercialisation of agriculture directly generates income, creates employment and increased agricultural labour productivity, recommendation for extension services that are directed towards training of rural farmers on the use of appropriate farm inputs, agronomic practices and access to markets is envisaged.

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