



# Factors Affecting Farmers' Decision on Crops Selection with Special Reference to New Technology: Case of Sunflower Seed and Sweet Potato in Ikungi District, Tanzania

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Received 15 December 2018 Accepted 27 August 2019 (\*Corresponding Author)

**Abstract** The main objective of this paper is to investigate why the sharp decline of sunflower seed production had occurred just after the starting of modern varieties promotion policy in Tanzania. Specifically, the study aims to (1) examine the changes in production of sunflower seed crop and that of its substitutable crop (sweet potato) for ten years, (2) determine the differences in profitability between sunflower production with modern varieties and production of related crops (sunflower seed with traditional varieties, and sweet potato), (3) examine the effect of relative price changes, (4) clarify other related factors such as farmers' characteristics in the adoption of new technologies, contract farming, and limited capacities of oil processing sectors. The field study was conducted in March and September 2018, selecting 270 farmers from three villages in Ikungi District. Based on the data obtained in the 2018 field study, profitability of the three types of cultivation was calculated. The result shows that sweet potato farmers received the highest economic return in terms of gross profit (545.7 TZS/ha) than sunflower farmers with modern seed varieties (397.0 TZS/ha). Sunflower farmers using traditional varieties received the lowest (273.7 TZS/ha). Furthermore, it was confirmed that changes in the farm gate prices over time had influenced profitability of three types of farming. At the starting time sunflower production with modern technologies had its advantage against sweet potato production. Farmers' crop selection is mostly rational but institutional factors like contract farming and limited capacity of processing sector were the barrier for the change. Also, it was suggested that farmers need more education and training for more rational crop selection. Finally, from this case policy makers have to know that if the conditions are not well fulfilled the promotion of new technology may not have the desired result.

**Keywords** crop selection, new technology, sunflower seed, sweet potato, contract farming, Tanzania

## INTRODUCTION

Adoption of modern technologies such as chemical fertilizers, pesticides, and improved seeds is an effective pathway to enhance the welfare of farmers through attaining higher productivity (World Bank, 2008). Following this idea, the government of Tanzania set up new agricultural policy of promoting modern seeds for sunflower producers in 2009. Due to its low level of cholesterol, sunflower oil is highly preferred as edible and safe cooking oil for many households in the country. The crop accounts 40% of the total national cooking oil requirements (URT, 2014). The country attempted to reduce the burden of importing edible cooking oil from foreign countries by offering opportunities of high yield varieties together with aim of income generation to farmers. The government promoted the adoptions of modern varieties through extension services and contract farming (URT, 2014). Despite the efforts done by the government of Tanzania to set up new

agricultural policy of promoting modern seeds for sunflower producers, the production has been decreasing.

**OBJECTIVES**

The main objective of this paper is to investigate why the sharp decline of sunflower seed production had occurred just after the starting of modern varieties promotion policy in Tanzania. Specifically, the study aims to (1) examine the changes in production of sunflower seed crop and that of its substitutable crop (sweet potato) for ten years, (2) determine the differences in profitability between sunflower production with modern varieties and production of related crops (sunflower seed with traditional varieties, and sweet potato), (3) examine the effect of relative price changes, (4) clarify other related factors such as famers’ characteristics in the adoption of new technologies, contract farming, and limited capacities of oil processing sectors.

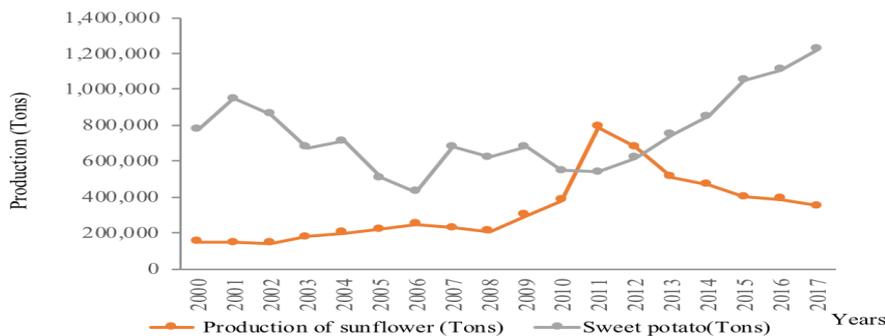
**METHODOLOGY**

The field study was conducted in Ikungi District, one of the three districts of Singida region in March and September 2018. This region is selected because new technology has been promoted through extension services and contract farming to sunflower farmers since 2018. Based on the observation, it was found that there were three types of sunflower seed related farmers; i) sunflower farmers still using new technology; ii) sunflower farmers with traditional varieties iii) and farmers who changed from sunflower production using new varieties into sweet potato. Considering this observation, a total of 270 farmers from three types of groups were selected randomly from a list of farmers in the respective three villages: Damankia; Nkwiree; and Ikulume. Among them, 90 farmers from each village were selected from each category of farmers (30 sunflower farmers with new technology; 30 sunflower farmers with traditional varieties; and 30 farmers who changed from growing sunflower with new varieties to grow sweet potato)

In the field survey in March 2018, production data were collected through interviews with farmers. Additional information was obtained from the discussion with key informants such as traders, processors, and extension workers. The major information collected included: farmers’ characteristics, cost and sales conditions of producers, and current problems and future prospects. The second interview were carried out in September 2018 in order to probe more information on the processing industries and area of contract farming that promote new technology among sunflower farmers.

**RESULTS AND DISCUSSION**

**1) Changes in Production of Sunflower Seed Crop and Sweet Potato**



**Fig. 1 Changes in production of sunflower seed and sweet potato in Tanzania (2000-2017)**

Source: Country FAO-Statistics, 2018

In 2011, sunflower seed production increased significantly to more than 790,000 tons from 380,100 tons in 2010. But, from next year sunflower seed production had sharply declined continuously to less than half in 2017, comparing its peak in 2011 as shown in Fig. 1.

## 2) Features of the Farmer-Respondents

From the field study it was found that sunflower farmers with traditional varieties was older (45.2 years) compared to sunflower farmers with modern varieties (39.4 years) and sweet potato producers who transformed production from sunflower producing (37.3 years). Furthermore, with respect to the farm size, traditional sunflower producers were relatively small (0.83 ha), sunflower farmers with modern varieties was (1.21 ha) and farmers who changed production into substitutable crop (sweet potato producers) was higher (1.52 ha) as shown in Table 1.

The study went further to observe farmers' educational background because this is one of the most important factors for farmers to manage their farms in smartly move. Educational background of heads of household was grouped based on the education system of the country. There was high improvement in education for heads of household producing sweet potato whereas more than (80%) have reached to high school level and university level. Also, more than (8%) of sunflower farmers with modern varieties have reached to high school level and university level. But, majority of heads of household (98%) producing sunflower using tradition varieties have reached to primary level and secondary level only (Table 1).

**Table 1 Features of the farmer-respondents**

Characteristics	Tradition sunflower varieties producers (n=90)		Modern sunflower varieties producers (n=90)		Sweet potato producers (n=90)	
	Mean	SD	Mean	SD	Mean	SD
Age of heads of household (years)	45.20	8.09	39.40	7.81	37.30	6.53
Average cultivated area (ha)	0.83	0.42	1.21	0.64	1.52	0.71
Gender of farmers	Number of farmers	Percentage of farmers	Number of farmers	Percentage of farmers	Number of farmers	Percentage of farmers
Male	74	82.2	58	64.4	67	74.4
Female	16	17.8	32	35.6	23	25.6
Farmers' education						
Primary level	87	96.7	40	44.4	13	14.5
Secondary level	2	2.2	42	46.8	60	66.7
High school level	1	1.1	3	3.3	8	8.9
College level	0	0.0	4	4.4	6	6.7
University level	0	0.0	1	1.1	3	3.3

Source: Field survey, 2018

Note: (1) SD refers standard deviation (2) Primary level is seven years of schooling (3) Secondary level is four years of schooling (4) High school level is two years of schooling (5) College level is two years of schooling (6) University level is three to four years of schooling.

Concerning the gender of the household head, the study shows that heads of household producing sunflower seed with tradition varieties (82.2%) were male and (17.8%) were female. In the cases of other two types, more participation of female in new sunflower varieties (35.6%) is bigger than in sweet potato production (25.6%). This suggest that more participation of female tend to move to new technology adoption; that may be because farmers' education was higher than other types of farmers.

### 3) Differences in Profitability

In order to understand the profitability of two crops, the gross income and gross profit were calculated based on the data obtained in the field survey 2018. Gross income is calculated as a gross revenue minus total production cost excluding family labor cost. Gross profit is calculated as gross income deducting family labor cost. With respect to the estimation of family labor cost, opportunity cost was applied. In the cost calculation depreciation were not considered since farmers in the studied area did not use modern machinery in agricultural activities. The result revealed that, there were significant differences in income and profit among the three types of farmers. The sweet potato farmers receive the highest economic return in terms of gross profit (545.7 TZS/ha) than sunflower farmers with modern sunflower seed varieties (397.0 TZS/ha). Sunflower production using traditional varieties received the lowest (273.7 TZS/ha) (Table 2).

**Table 2 Profitability comparison of sunflower seed and sweet potato in 2017**

Item	Tradition sunflower varieties users (a) (n=90)	Modern sunflower varieties users (b) (n=90)	Sweet Potato Producers (c) (n=90)	Comparison		
				(b-a)	(c-b)	(c-a)
Head of household						
Yield (tons/ha)	1.2	1.8	2.0	0.6	0.2	0.8
Seeds cost	10.6	18.2	10.3	7.6	-7.9	-0.3
Chemical fertilizer cost	22.7	37.9	0.0	15.2	-37.9	-22.7
Pesticide cost	0.0	10.8	9.3	10.8	-1.5	9.3
Hired labor cost	23.4	27.9	23.7	4.5	-4.2	0.3
Total variable cost	56.7	94.9	43.3	38.2	-51.6	-13.4
Family labor cost	41.6	50.1	45.8	8.5	-4.3	4.2
Total labor cost	65.0	78.0	69.3	13.0	-8.7	4.3
Total production cost	98.3	145.0	89.1	46.7	-55.9	-9.2
Gross Revenues (GR)	372.0	542.0	634.5	170.0	92.5	262.5
Gross Income (GI)	315.0	447.1	591.4	132.1	144.3	276.4
Gross Profit (GP)	273.7	397.0	545.7	123.3	148.7	272.0

Source: Survey, 2018

Unit of cost: `000TZS/ha

**Table 3 Farmgate price changes of sunflower seed and sweet potato (100 =2007)**

Year	Price index of sunflower seed	Price index of sweet potato	Relative price index of sunflower seed
2007	100.0	100.0	100.0
2008	99.4	106.7	93.2
2009	102.9	100.0	102.9
2010	113.2	103.3	109.6
2011	102.9	120.0	85.8
2012	102.6	121.7	84.4
2013	102.1	123.3	82.8
2014	97.1	124.0	78.3
2015	91.2	124.0	73.5
2016	88.2	125.0	70.6
2017	87.6	127.3	68.8

Source: SDC, 2018

Of course, the significant differences in profitability among three types in Table 2 were based on the data in 2017. Prices of sunflower seed and sweet potato had changed as shown in Table 3. Relative price of sunflower seed comparing with sweet potato has been declining as indicated in Table 3. At the starting year 2010, the profitability of sunflower seed might be better than sweet potato. In order to check this, the study simulated the comparative profitability of sunflower seed to sweet potato in various years with the following assumption: Farmers cultivated sunflower seed and sweet potato by using same technologies as in 2017 (then the cost and yield same as that in 2017), but the selling prices differ. The economic return in each year were calculated by replacing the farmgate price of 2017 by the price of corresponding year. The result shows that if the output price level was the same as that in 2010, the sunflower production with modern varieties ranks first in profitability (gross income and gross profit) and sweet potato production ranks in the second place. Profitability of sunflower production with traditional varieties was the lowest. In 2011, the price of sunflower seed sharply declined as in Table 3 and the sunflower production with modern technologies lost its advantage against sweet potato production.

#### **4) Other Related Factors**

##### **i) Limited absorption capacity of processing sector:**

Capacity building of various institutions especially in agriculture is important factor to ensure efficiency and effectiveness in service delivery. In Tanzania sunflower oil processing sector is facing a big challenge of limited capacity to absorb farmers' produce. Direct interviews with sunflower processors revealed that the three processing companies in the studied area only had total annual absorption capacity of 12,420 tons. However, this capacity could not absorb sunflower farmers' produce of 35,700 tons in (2017) in the studied area. This evidence is supported by other scholars that in Tanzania, absorption capacity of processing sector is limited and most of the local investors are not moving fast enough to invest in agricultural processing. Meanwhile foreign investment is not attracted sufficiently (Mpagalile, 2012).

##### **ii) Contract farming:**

As noted earlier in 2017, though differences in profitability was apparent among three types of farming, it observed that still some sunflower producers did not change the crop selection. Sunflower production with new technology is dominated by the production contract that established in 2010 with specific goal of promoting new technology to sunflower farmers. In this contract, the company provides agricultural inputs, agricultural extension services and sometimes credit to sunflower farmers together with new technology. Likewise, the period of contract is eight years. Major actors in the governance of sunflower contract farming are sunflower farmers with new technology, company providing contract, and the government of Tanzania. Based on the findings through direct interviews with sunflower farmers it observed that on the regularity of contract farming, farmers who want to terminate the contract before time must be punished through the contract law. This clearly show that sunflower farmers with new technology still continue the production because of the existence of contract farming.

##### **iii) Characteristics of sunflower farmers with traditional varieties:**

It has been pointed out that, although sunflower farmers with traditional varieties received the lowest profit but still continue the production. Table 1 indicated that the sampled sunflower farmers using local varieties was more aged (45.2 years), relatively small in size, and less educated. Due to these features, they may be more reluctant to changes in adoption of new technologies. This is supported by other scholars that young farmers are more knowledgeable on better practices and may be more ready to adapt to better farming techniques because of their willing to achieve more production in their fields (Abunga, et al., 2012).

## **CONCLUSION**

The main objective of this paper was to investigate why the sharp decline of sunflower seed production had occurred just after the starting of modern variety promotion policy in Tanzania. It was found that changes in the farm gate prices over time had influenced the sunflower production with modern technologies lost its advantage against sweet potato production. In other words, farmers' crop selection is mostly rational but institutional factors such processing sector and contract farming were the barrier for the change.

In relation to the finding and conclusion the following were recommended so as alleviate the existing challenges by all stakeholders of this sector. First, there is a definite need for the government of Tanzania to consider the area that absorb farmers' produce after production. Therefore, policy makers have to know that if the conditions are not well fulfilled the promotion of new technology may not have the desired result. Also, farmers need more education and training for more rational crop selection. Lastly, the area of sunflower contract farming should be revised to enhance its efficiency in new technology provision among sunflower farmers.

## **ACKNOWLEDGEMENTS**

We would like to express our gratitude to Moritani Memorial Foundation and Graduate Research Funding Program from Tokyo University of Agriculture Research Institute (NRI) for financially supporting this study.

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