ROUND POTATO (*Solanum tuberosum L*) PRODUCTION AND HOUSEHOLD FOOD SECURITY IN THE SOUTHERN HIGHLANDS OF TANZANIA

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A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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EXTENDED ABSTRACT

Round potato (*Solanum tuberosum L*) has been an important food and cash crop in the southern highlands of Tanzania since its introduction in the 1920s. However, the extent to which it contributes to household food security was empirically unknown. Therefore, this study was conducted in Mbeya and Makete Districts to contribute to this knowledge gap. The purpose of the study was to determine the contribution of round potato production to household food security. The specific objectives of the study were to: (i) determine the impact of round potato production on household food security, (ii) determine the contribution of round potato production to household income, (iii) establish the status of food security incidences based on monetary and caloric poverty lines and (iv) apply theories of food insecurity to explain food status in the southern highlands of Tanzania. Multistage sampling was used to select 233 households in Mbeya and Makete Districts. The research was a cross-sectional one and was conducted through structured interviews using a questionnaire, focus group discussions using an FDG guide and key informant interviews using a checklist of items for discussion. The Statistical Package for Social Sciences (SPSS) was used to analyse quantitative data. Multiple linear regression was used to assess impacts of independent variables on the dependent variable that was food security in terms of dietary energy consumed per adult equivalent per day and monetary values of all food items consumed. Dietary Energy Consumed from round potato showed positive significant ($p<0.1\%$) impact on dietary energy consumed per adult equivalent per day. Based on this finding, it is concluded that round potatoes are a reliable source of food in the study area. Moreover, there was positive significant ($p<0.1\%$) impact of income from round potato on household income. Based on this finding, it is concluded that round potato is a main source of income and that, if it were given due attention and care, it would contribute greatly to household income. One-way ANOVA was used to compare

levels of food status based on kilocalories consumed and monetary values of food consumed. Using the national food monetary and caloric poverty lines, 82.8% and 79.0% of the sampled households were food secure in Mbeya and Makete Districts respectively. Multiple linear regression was used to analyse the extents to which Malthusian and Anti-Malthusian theories, the entitlement to food approach by Sen, and Woldemeskel's contentions explain food security in Mbeya and Makete Districts. With respect to the Malthusian theory, population in terms of household size was the most important factor influencing food security negatively. Contrary to prior expectations, food security was not significantly different between households which used different numbers of agricultural improved technologies and different amounts of fertilizer per unit area. Moreover, entitlement to food security in terms of number of cattle owned, non-agricultural activities and farmers' group membership were found to be more important factors enhancing food security. On basis of these findings, it is concluded that addressing these factors could improve food security in the study area. Therefore, it is recommended that the government and policy makers should support farmers through training sessions on improved round potato technologies, and enhance timely availability of farm inputs at affordable prices. Moreover, policy makers, Non-Governmental Organizations and other development partners are urged to support other income generating activities so as to increase income and hence increase farmers' purchasing power and access to food.

DECLARATION

I, DORAH HIGHNESS MENDE, declare to the Senate of Sokoine University of Agriculture that this thesis is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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Prof. Kim A. Kayunze Date

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Prof. Maulid W. Mwatawala Date

(Supervisor)

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DEDICATION

This thesis is dedicated to my parents, the late Highness Lucas Mende and my mother the late Uchawoeli Zakayo Mero who gave me the chance to live and get educated. May the Almighty God rest their souls in eternal peace. It is also dedicated to my husband Mathias Lisso and our sons, Felix Mathias Lisso, Lucas Mathias Lisso and Frank Mathias Lisso.

TABLE OF CONTENTS

LIST OF PAPERS

Paper One: Impact of Round Potato Production on Household Food Security in the Southern Highlands of Tanzania: Dorah H. Mende,[1] Kim A. Kayunze,[2] Maulid W. Mwatawala.[3] Published in Journal of Food Science and Quality Management, 37 (2015): 1-9

Paper Two: Contribution of Round Potato Production to Household Income in Mbeya and Makete Districts, Tanzania: Dorah H. Mende,[1] Maulid W. Mwatawala,[3] Kim A. Kayunze.[2] Published in Journal of Biology, Agriculture and Healthcare 4 (18) (2014): 1-10

Paper Three: Food Security Incidences Based on Monetary and Caloric Poverty Lines in Mbeya and Makete Districts, Tanzania: Dorah H. Mende,[1] Kim A. Kayunze,[2] Maulid W. Mwatawala.[3] Published in Developing Country Studies 4 (26) (2014): 20-27

Paper Four: Entitlement to Food Security Approach Explaining Food Security in the Southern Highlands of Tanzania more than other Theories: Dorah H. Mende,[1] Maulid W. Mwatawala.[3] Published in Asian Journal of Agriculture and Rural Development 5 (2) 2015: 64-74

Publishable Manuscript: Community Members' Views on the Role of Round Potato Production in Household Food Security in the Southern Highlands of Tanzania: Dorah H. Mende,[1] Kim A. Kayunze,[2] Maulid W. Mwatawala.[3]

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DECLARATION

I, DORAH HIGHNESS MENDE, do hereby declare to the senate of Sokoine University of Agriculture that the papers that make this thesis summarise my independent efforts. It is my original work and will not be part of any other thesis in published papers format in any other University.

LIST OF FIGURE

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AAEU	Adjusted Adult Equivalent Unit
AEU	Adult Equivalent Unit
ANOVA	Analysis of Variance
ARI	Agricultural Research Institute
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
BoT	Bank of Tanzania
CIP	International Potato Center
COSTECH	Commission for Science and Technology
DALDO	District Agricultural and Livestock Development Officer
DEC	Dietary Energy Consumed or Consumption
DSI	Development Studies Institute
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GDP	Gross Domestic Product
HSPH	Harvard School of Public Health
IFAD	International Fund for Agricultural Development
IYP	International Year of Potato
kcal	Kilocalories
m.a.s.l	Metres above sea level
MAFC	Ministry of Agriculture Food Security and Cooperatives
MDGs	Millennium Development Goals
Mm	Millimetre
MUHAS	Muhimbili University of Health and Allied Sciences

NBS	National Bureau of Statistics
NGO	Non-Governmental Organization
NSGRP	National Strategy for Growth and Reduction of Poverty
^{o}C	Centigrade
REPOA	Research on Poverty Alleviation
SACPI	Seasonally Adjusted Consumer Price Index
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
SUA	Sokoine University of Agriculture
TFNC	Tanzania Food and Nutrition Centre
TZS	Tanzanian Shilling
UARC	Uyole Agricultural Research Centre
UN	United Nations
URT	United Republic of Tanzania
USA	United States of America
VC	Village Chairperson
VEO	Village Executive Officer
VIF	Variance Inflation Factor
WB	World Bank
WFS	World Food Summit

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information on Round Potato Production

Round potato (*Solanum tuberosum L*) is grown in all continents, in around 130 countries in the world, and under a great variety of climates. The crop ranks fourth in the world as food after maize, rice and wheat. Among root and tuber crops, round potato ranks first in terms of volume produced and consumed followed by cassava, sweet potato and yams as over a billion people worldwide eat potatoes (Martine *et al.,* 2010; CIP, 2011). Round potato provides roughly half of the world's annual output of all root and tuber crops, making it the largest non-cereal food and cash crop worldwide (FAOSTAT, 2010; CIP, 2009). The crop is currently grown on an estimated 18 million hectares area, with a global production of 314 million tons. Asia and Europe are the two major round potato growing areas (CIP, 2012). Round potato contributes energy and substantial amounts of high quality protein and essential vitamins, minerals and trace elements to the diet (Horton, 1987). A single medium sized round potato tuber contains about half the daily adult requirements of vitamin C, more protein, and twice the amount of calcium than maize (Dean, 1994; McGlynn, 2007).

Moreover, round potato provides more nutritious food per unit land in less time and often under more adverse conditions than other food crops. It is one of the most efficient crops in converting natural resources, labour and capital into high quality food with wide consumer acceptance (Horton, 1980). For low income people in both urban and rural areas, "Round potato is a buried treasure". It grows fast, is adaptable, is high yielding and is responsive to low inputs (FAO, 2009). More than one-third of global round potato output comes from developing countries, including Asia (China, India, Indonesia, Nepal,

Pakistan) and Africa (Cameroon, South Africa, Kenya, Uganda, Egypt, Algeria, Morroco and Tanzania) (FAO, 2010; Okoboi *et al.,* 2002). The major producing countries in Africa are Egypt, Algeria, South Africa and Morocco**.**

Round potatoes have been an important food and cash crop for a long time. In regions where they are relatively cheap, which is usually the case at high altitudes, a large proportion of the crop is stored in very simple ways and used for home consumption. In regions where round potatoes are relatively expensive, such as in Central America and South East Asia, the farmer sells a large proportion of them to purchase cheaper food varieties. Moreover, the earnings from round potato sales are used to improve productivity of other food crops. Owing to its short vegetative period (less than 90 days) and its high efficiency in producing energy and valuable protein, it is a favoured crop in rotations where a short growing period fits in well.

In Tanzania round potato is increasingly becoming an important food and cash crop especially in the Southern and Northern highlands of Tanzania (Mayona *et al.,* 1992). Previously, the crop was grown by highland farmers for their own food, but recently it has become a favourite of many people in rural and urban centres. The Southern highlands zone of Tanzania; particularly Mbeya, Njombe, and Iringa Regions; are the largest producers of round potato in Tanzania, supplying large volumes to other regions of Tanzania (Anderson, 1996, MAFC, 2011; URT, 2003; Kabungo, 2008). In the southern highlands of Tanzania, round potato is the third most important starchy food and cash crop after maize and rice. Moreover, the crop 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 attributed 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 (CIP, 2008; FAOSTAT, 2008).

1.2 Problem Statement

The majority of smallholder farmers in Mbeya and Makete Districts grow round potatoes and other crops, keep livestock, do some non-farm activities, and recognise food insecurity as a problem affecting them in many aspects, such as having less than three meals per day, less frequencies of protein foods intake, particularly meat and fish per week, malnutrition among children and lack of income to buy other foodstuffs (URT, 2003, 2008). However, food insecurity and low income problems are persistent in the districts. High incidences of food insecurity and poor standard of living are among the major development challenges in the southern highlands of Tanzania (Namwata *et al.,* 2010; Mwaipopo, 2005).

Since the majority of farmers in Mbeya and Makete Districts grow round potato while the crop has high potential to improve food security and income, and they do other farm and non-farm activities it would be expected that food insecurity does not exist there. A question exists on what factors lead to persistence of food insecurity in spite of the presence of potato, a high value crop and market access, and other activities. Also, empirically, little was known on the contribution of potato production to household food security and income in the study area. The study, therefore, aimed to bridge the gap in the information that existed.

1.3 Justification of the Study

Several studies have been conducted on round potato production and productivity in Tanzania. Some related studies are cited here. Mayona (1991) assessed round potato

production potentials and constraints in the Southern Highlands Zone of Tanzania; Mussei *et al.* (2000) studied the adoption of improved round potato technologies in Njombe District; Mwakasendo *et al*. (2007) assessed market for fresh and frozen round potato chips in ASARECA region and the potential for regional trade (the case of Tanzania); Kabungo (2008) studied round potato production and marketing performance in Mbeya Rural District; Namwata *et al*. (2010) assessed adoption of improved agricultural technologies for round potatoes among farmers in Mbeya Rural Districts; and Okoboi (2001) studied round potato production and marketing in Tanzania and market opportunities of Rwanda. However, none of these studies concentrated on contribution of potato to household food security and income. As a consequence, information on the contribution of potato production to the overall household food security and income is widely lacking. The current study aimed at filling this gap.

Before this study, there was no documented information in the study area on contribution of round potato production to household food security and income. The study aimed to generate empirical information which would contribute to understanding of the contribution of potato to household food security and income in the study area. Despite several efforts that have been made by government and NGOs to improve household food security and income, there is scanty empirical information on food security incidences in the study area. The study further envisaged to uncover and document entitlement to food security approach explaining food security in the study area.

This study is in line with the Millennium Development Goal Number one, which stipulates to halve the proportion of people who suffer from hunger and poverty by 2015. Additionally, in the Second Phase of the National Strategy for Growth and Reduction of Poverty (NSGRP II), in its first cluster of ensuring food and nutrition security, it is

stipulated as follows: “Ensuring food and nutrition security, environmental sustainability and climate change adaptation and mitigation (URT, 2010).

Findings from this study add new knowledge and widen the understanding of the contribution of round potato production to household food security and income in the study area. Moreover, the findings have potential to be used by different stakeholders including policy makers, development partners, academicians, farmers, and the government as a reference for decision making with regard to food security and income policies.

1.4 Objectives

1.4.1 General objective

To determine the contribution of round potato production to household food security

1.4.2 Specific objectives

The specific objectives of the study were to:

i. determine the impact of round potato production on household food security in the southern highlands of Tanzania (Paper I)
ii. determine the contribution of round potato production to household income in Mbeya and Makete Districts, Tanzania (Paper II)
iii. establish the status of food security incidences based on monetary and caloric poverty lines in Mbeya and Makete Districts, Tanzania (Paper III)
iv. apply theories of food insecurity to explanation of food status in the southern highlands of Tanzania (Paper IV)

1.4.3 Hypotheses

The two null hypotheses stated below were tested:

i. Monetary values of round potato produced have no significant impact on dietary energy consumed.
ii. Household food security does not differ significantly between households which grow round potatoes and those which do not.

1.5 Conceptual Framework

The linkage between background, independent and dependent variables was analysed hypothesizing that they are mutually related. The conceptual framework for this study (Fig. 1) shows how the background, independent and dependent variables are interrelated. The background variables include demographic factors (age, sex, household size and marital status), socio-economic factors (income, education of household head and farming experience), and farm factors (number of plots, farm area owned, farm area used, farm area lent to other people and farm area left fallow). The independent variables are mainly indicated by proxy indicators of food supply (diversity of crops grown, food amount produced, monetary value of crops produced) and potato production (acreage for potato and other crops, inputs used and their costs for potato and for other crops, amount of potato and other crops harvested, monetary values of potatoes and of other crops harvested), entitlement to food (land resources owned and accessed, agricultural inputs and technologies used, livestock species and number owned and assets owned).

Other proxy indicators were institutional factors (access to extension services, membership to farmers groups and or associations, physical access to market and market information and access to inputs) and theoretical factors (pessimistic and optimistic theories, entitlement theory and composite theory). It was assumed that the interaction between

background variables (including demographic, socio-economic and farm factors) and independent variables (including food supply, entitlement to food, institutional factors and theoretical factors) have influence on food security in terms of Dietary Energy Consumed (DEC) and monetary value of all foodstuffs consumed) which were the dependent variables.

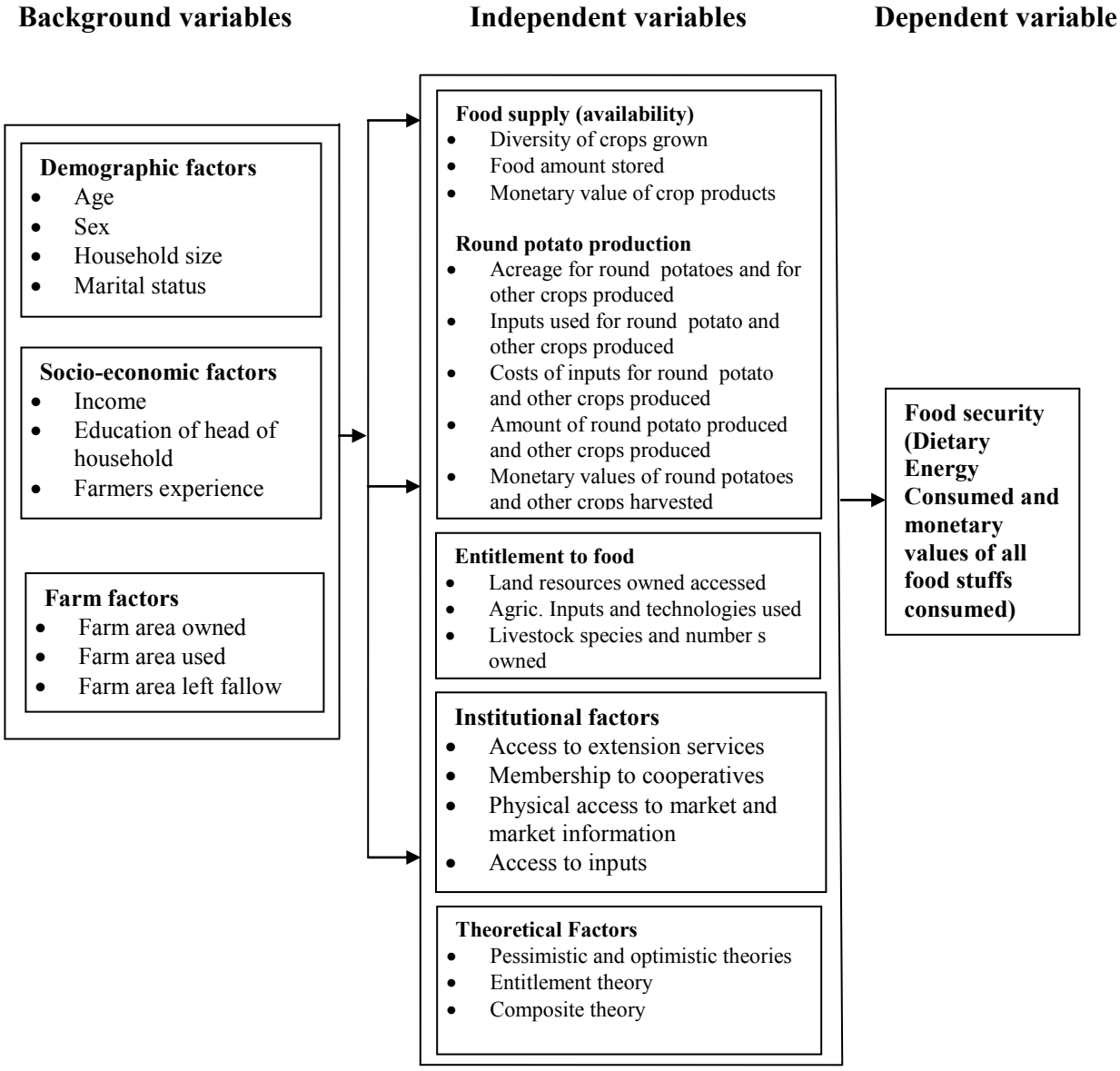

Figure 1: Conceptual framework used for the research

1.6 Food Security Definitions and Concepts

Food security as a concept is a complex issue which is still undergoing evolution with other authors trying to adopt a multi-disciplinary approach to link the subject with different fields of specialization. The food security concept started only in the early 1970s in the discussions of international food problems at a time of global food crisis. The crisis prompted the Food and Agriculture Organisation (FAO) of the United Nations (UN) to organize the world food conference in 1974, which, among other deliberations, recommended an international undertaking on World Food Security, which was adopted by the United Nations General Assembly the same year (Eide, 2005). The initial focus, reflecting the global concerns of 1974 World Food Summit was secure flows of basic food staffs at stable prices. Therefore, the Summit defined food security as: "Availability at all times of adequate world supplies of basic food stuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (United Nations, 1975, cited by Pottier, 1999).

In 1986 a World Bank report defined food security paying attention to the same challenges as those of the 1970s, that is guaranteeing access to food and hence the report defined food security as: "Access of all people at all times to enough food for an active healthy life" (World Bank, 1986, cited by Pottier, 1999). The European Union took this approach too, but emphasised the importance of household food security hence defined food security as: "The ability to acquire enough food to satisfy minimal nutritional requirements at both national and household levels" (Tuinenburg, 1987, cited by Pottier, 1999). According to Riely *et al.* (1999), food security is described under three components as follows: Food availability is achieved when sufficient quantities of food are consistently available to all individuals within a country. Such food can be supplied through household production, other domestic outputs, commercial imports or food aid. On the other hand food access is

ensured when households and all individuals within them have adequate resources to obtain appropriate food stuffs for a nutritious diet.

In 1996 the World Food Summit in Rome defined food security as follows: “Food security at the individual, household, national, regional and global levels exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 1996). Looking closely at the World Bank (1986) and the World Food Summit’s (1996) definitions, one finds that they contain the same key words which are access to food, sufficient food, and active healthy life. The main difference between the two definitions is that the 1996 definition is more detailed as compared to that of 1986. Therefore, this study adopted the 1996 food security definition.

1.7 Conceptual and Theoretical Linkages between Round Potatoes and Food Security

1.7.1 Contribution of round potato to food security

During FAO conference in November 2005, the permanent representative of Peru proposed the year 2008 to be dedicated to round potato. His proposal was adopted by the conference as a resolution to focus world attention on the importance of the potato in providing food security and alleviating poverty. With the slogan “Hidden Treasure”, the celebration of International Year of Potato (IYP) focused global attention on the often unrecognised role round potato can play in providing food security and eradicating poverty in support of achievement of the internationally agreed development goals, including the Millennium Development Goals. Celebration of the IYP raised awareness of the importance of round potato and of agriculture in general in addressing issues of global concern, including hunger, poverty and threats to the environment. Azimuddin *et al.* (2009) reported that round potato can help to widen the food supply base and thereby

helping to minimize food shortage in the tropics and sub-tropics. Round potato, being one of the most productive crops known to man can play a significant role in ensuring food security. Moreover, round potato produces more nutrients per unit area and time than major cereals. Azimuddin suggested that root and tuber crops should come to mind whenever one is thinking of crops with high productivity. Dr. W. G. Burton, an eminent round potato physiologist as quoted by Azimuddin *et al.* (2009), observed that "It is a reasonable approximation to state that the nutritive value of the produce from a hectare of round potatoes would have been about three times as great as that from a hectare of cereals."

According to Muthoni *et al.* (2009; 2013), round potatoes have the potential to release the pressure in increasing cereal prices on the poorest people and contribute significantly to food security. Moreover, in Kenya, round potato is the second most important staple food crop after maize and plays a major role in national food and nutritional security. Prakash (2010) reports that round potato is a highly recommended food security crop that can help shield low-income countries from the risk posed by rising international food prices. Countries with low levels of dietary diversity and high dependency on cereal imports could benefit greatly from expanded round potato production.

In Tanzania round potatoes demand is fast increasing from village and urban areas due to the expanding fast foods industry that is quickly developing in many urban centres. A study by Mwakasendo *et al.* (2007) revealed that Tanzanian urban and population growth is the main driving force for demand of round potato. Currently, the major production supply is in the Southern Highlands and Northern zone of Tanzania where round potatoes are produced both for cash and food. Since its introduction, production trends have been increasing positively. Between 2000 and 2008, the harvested area has increased from

50 000 ha to over 125 000 ha while the total production has increased from 350 000 tonnes to 650 000. The bulk of production is divided between the Southern Highlands zone that includes Mbeya and Njombe Regions and the Northern Zone that includes Kilimanjaro, Arusha and Manyara Regions. Minor production occurs in Mara, Kagera, Kigoma, Tanga, Rukwa and Ruvuma Regions (FAOSTAT, 2007).

A study by Okoboi (2001) showed that during 1995/96 over 73% of potato production was done in the Southern Highlands (Mbeya, Njombe, and Iringa), 14% in Northern zone, 8% in the Lake Zone and 5% in other producing areas. Okoboi (2001) added that, between 1995 and 1999, the area planted with round potatoes has increased fourfold with the production being estimated at 0.2 million metric tonnes. Although potato crop does not feature as a food staple in the diet among rural dwellers, it is prominent in the menu in hotels and restaurants in most urban areas in Tanzania. Major market places for potato include cities such as Mbeya, Dar es Salaam, Mwanza, Arusha and Tanga, and other urban centres such as Iringa, Njombe, Dodoma and Morogoro. Consumption of potato products, particularly potato chips, competes favourably with grain staples such as rice and maize meals in city hotels and restaurants, Mbeya and Njombe Regions being the major suppliers.

Mbeya and Makete Districts in Mbeya and Njombe Regions respectively are among the major potato producers in the southern highlands zone of Tanzania. It is a highly valuable crop with considerable contribution to household food security and income. The average area under round potato production per year in Mbeya District District is estimated to be 18 815 ha, second to maize which is grown on 57 000 ha (URT, 2003). In Makete District round potato ranked the second by regional standards (URT, 2007). However, the average annual production of 44.8 tons makes it the 1st crop in the district (URT, 2008).

One could expect that farmers in Makete and Mbeya Districts would increase their incomes and become food secure throughout the year due to the availability of round potato and other major crops such as maize, wheat, beans and vegetables. However, studies show that there is food insecure in many households in the districts. Therefore, the study aimed at finding out whether round potato as a second food crop may improve household food security and incomes in the study area.

1.7.2 Theoretical Perspectives of Food Insecurity

1.7.2.1 Malthusians and Anti-Malthusians theory

Malthusians contend that food insecurity is due to presence of too many people compared to the amount of food produced. This contention began during the time of a famous British Reverend called Thomas Malthus who lived from 1766-1834. Malthus was specific on the negative impact of population growth and food production; arguing, that "Population when unchecked increases in geometrical ratio while subsistence food production increases only in an arithmetical ratio". Malthus was specific on the negative impact of population growth on food production.

People who believed in the above contention were classic Malthusians, and those who believe so until today are neo-Malthusians. People who have contrary beliefs are anti-Malthusians. Classic Malthusians were opposed by Anti-Malthusians. For example Ester Boserup, who lived from 1911-1999, argued that technological development could boost food production enough to keep up with population growth for many years. Ester Boserup's is known as an optimistic theory, and she based her theorisation on the following indications: a) If population increases, there is a larger workforce and hence more food is produced; b) If population increases, mechanization occurs; more food is produced as more effective means of producing high yields of crops using mechanization

are devised; and c) If population increases there will be increase in fertilizer use and more food production for the growing population, hence more food security (Boserup, 1993). There were other anti-Malthusians who contributed to the optimistic theory, for example Julian Simon (cited by Dyson, 1996) argue as follows: “The ultimate resource is people; skilled, spirited, and hopeful people who will exert their will and imaginations for their own benefit, and so inevitably, for the benefit of us all”. Another anti-Malthusian scholar before Malthus was Marquis Condorcet (1743-94) who argued that “with high population increase, a very small amount of ground will be able to produce a great quantity of supplies of greater utility or higher quality” (Dyson, 1996). In addition, he argued that education would bring lower birth rates as rational human beings would see the value of limiting family size, giving their children the prospect for longer and happier lives.

1.7.2.2 The Entitlement to food security theory

The entitlement to food theory focuses more on possession of wealth materials which can be exchanged for food or can be used to get food through other means. Malthusians and Anti-Malthusians theories about the relationship between population growth and food security have been challenged by Sen (1981) who argued that “People do not usually starve because of insufficient supply of food at local, national or international level but because of insufficient resources, including money to acquire it”. Sen classified entitlements into three categories: (i) endowments, which are all legal resources that can be used to obtain food, including money, land, machinery and animals, but also more abstract resources such as labour power, ‘know-how’, kinship and citizenship; (ii) entitlement mapping (or E-mapping), which includes terms of trade between endowments and food, goods, and the ratio between money wages and the price of food, or the input-output ratios in farm production; and (iii) entitlement-set, which represents the basket of food, goods, and services that a person can obtain using his/her endowments. Food

security is more pronounced when some or all of the above entitlement categories are attainable to the individual or household.

1.7.2.3 Composite Theories on Food Security

Woldemeskel (1990) opposed Sen's analysis of food security in terms of food access through entitlements rather than food availability. He argued that the entitlement approach is narrow because it dwells on only possession, while food security attainment is contingent upon four determinants: (a) availability, (b) institutional elements, (c) market forces and (d) possessions. Woldemeskel (1990) continued that the entitlement approach recognises the contribution of food availability to food security but dismisses it, and completely ignores institutional elements and market forces. Examples of institutional elements include access to extension services, credit facilities and/or financial institutions, farmer groups and or associations. Moreover, market forces include food prices in market places and prices offered to farmers for their agricultural produce.

1.8 Organisation of the Thesis

This thesis is organized in three chapters. The first chapter consists of the introduction of the overall theme studied and offers a description of the commonality of concepts presented in separate papers. Chapter two contains a series of originally published papers in different journals, one publishable manuscript and the last chapter presents conclusion and overall implication of the study findings.

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CHAPTER TWO

PAPER ONE

Impact of Round Potato Production on Household Food Security in the Southern Highlands of Tanzania

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PAPER TWO

Contribution of Round Potato Production to Household Income in Mbeya and Makete Districts, Tanzania

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PAPER THREE

Food Security Incidences Based on Monetary and Caloric Poverty Lines in Mbeya and Makete Districts, Tanzania

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PAPER FOUR

Entitlement to Food Security Approach Explaining Food Security in the Southern Highlands of Tanzania more than other Theories

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Community Members' Views on the Role of Round Potato Production in Household Food Security in the Southern Highlands of Tanzania

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Abstract

Round potato (*Solanum tuberosum L*) is the third most important starchy food crop after maize and rice in the Southern Highlands of Tanzania and is gaining importance in rural and urban areas. Mbeya and Makete Districts in Mbeya and Njombe Regions respectively, which are part of the Southern Highlands of Tanzania, lead in potato production in the Southern Highlands of Tanzania. However, the extent to which the crop contributes to food security was not empirically known. The purpose of the study on which this paper is based was, among other things, to determine the contribution of the crop to household food security in Mbeya and Makete Districts, according to community members' views. The specific objectives of the paper are to: 1) Analyse major crops grown in the study area, 2) Analyse food security status from the views of community members and strategies for coping with food shortages and 3) Assess the contribution of round potato production to household food security from community members' views. This paper is mainly based on qualitative information that was collected from 8 key informant interviewees and 16 focus groups in March and April 2012, in order to supplement quantitative information that was collected through a questionnaire. The results showed that among major crops

grown in the study area, round potatoes were a reliable source of food and income. It is recommended that the government should support farmers in terms of availability of quality potato seeds, farm inputs and control of deceitful prices of potatoes offered by potato buyers.

Keywords: Round potato, food security, southern Highlands, Tanzania

1.0 INTRODUCTION

Round potatoes (*Solanum tuberosum L*) are grown in all continents under various climatic conditions. Among root and tuber crops round potato ranks first in terms of volume produced and consumed followed by cassava, sweet potatoes and yams as over a billion people worldwide eat potatoes (Martine *et al*., 2010). Round potatoes provide roughly half of the world's annual output of all root and tuber crops, making it the largest non-cereal food and cash crop worldwide (FAOSTAT, 2010; CIP, 2008). The genetic diversity of round potatoes makes it possible to produce new varieties that can grow well under a wide range of ecological conditions. Potatoes have a short growing cycle and large production per area and per time. It provides more nutritious food per unit area of land in less time and often under more adverse conditions than other food crops due to its efficient use of water (FAO, 2008).

In Tanzania, round potato is an important food and cash crop and is gaining importance both at the farm level and at urban market places (Mayona *et al.,* 1992). Since its introduction, production trends have been increasing positively (FAOSTAT, 2007). The major production areas are the Southern Highlands Zone that includes Mbeya, Iringa and Njombe Regions and the Nothern Zone that includes Kilimanjaro, Arusha and Manyara Regions. Although the potato crop does not feature as a food staple in the diets among rural dwellers, it is prominent in the menu in hotels and restaurants in most of urban areas

in Tanzania (Mwakasendo *et al.* 2007). Consumption of potato products, particularly potato chips, competes favourably with grain staples such as rice, wheat and maize meals in city hotels and restaurants, Mbeya, Iringa and Njombe being the major suppliers (URT, 2003; MAFC, 2011; Kabungo, 2008).

Mbeya and Makete Districts in Mbeya and Njombe Regions respectively are among the major potato producers in the Southern Highlands zone of Tanzania. One could expect that farmers in the districts would be food secure throughout the year due to the availability of potato and other food crops such as maize. However, food insecurity and low income problems are persistent in the districts despite the presence of round potato, which is a high value crop with relatively high productivity. High incidences of food insecurity and poor standard of living are among the major development challenges in the Southern Highlands of Tanzania (Namwata *et al.,* 2010; Mwaipopo, 2005).

Moreover, the crop has great potential in both national and regional markets due to growing demand for chips and snacks/crisps (Anderson, 2008). A question exists on what factors lead to persistence of food insecurity in spite of the presence of potato, a high value crop with good market access. Also, little was known on the contribution of potato production to household food security and income in the study area. Therefore, there was a need to: a) identify major crops grown in the study area, b) analyse food security status according to community members' views and strategies for copying with food shortages, and c) assess the contribution of round potato production to household food security from community members' views. The knowledge generated from this study can inform strategies to improve food security and income in Mbeya and Makete Districts and probably elsewhere with the same environment in Tanzania through round potatoes production.

2.0 METHODOLOGY

Data were collected from Mbeya and Makete Districts in Mbeya and Iringa Regions respectively. The two districts were selected for the study due to the main reason that they were leading districts in potato production in the southern highlands of Tanzania (URT, 2003; URT, 2007). The districts have climatic conditions that are suitable for potato production hence could offer good comparative results on potato production and its contribution to household food security. There is a possibility of the findings being applicable to other areas in Tanzania where the round potato crop is grown.

A cross-sectional research design was used, hence data were collected once. The design was chosen because it entails collection of data on a number of cases at a single point in time in order to collect a body of quantitative and/or qualitative data about two or more variables (usually many more than two), which are then examined to detect patterns of association (Bryman, 2004).

Multistage sampling was used in selection of respondents. The first stage involved selection of two divisions per district. The second stage involved selection of two wards from each division in which Tembela and Santilya wards were selected in Mbeya District, and Isapulano and Kibagalo wards were selected in Makete District, making four wards. In the third stage, 8 villages, including two villages from each ward, were randomly selected. They were Ilembo Usafwa and Shibolya in Tembela Ward, Sanje and Mpande in Santilya Ward, Isapulano and Ivilikinge in Isapulano Ward and Kitula and Iyoka in Kipagalo Ward. The last stage was sampling of respondents using systematic sampling. Purposive sampling was employed to select some members of focus group discussions and key informant interviews.

Qualitative and quantitative data were collected. For qualitative data collection, Focus Group Discussions (FGDs) were conducted using an FGD guide to obtain qualitative information from participants in the research. In each of the focus groups, the number of discussants was 8 to 10, which was within the range suggested by Bryman (2004), Fink (2009) and Barbour (2011) that a typical focus group size is 6 to 10 members. The explanation for this is that with fewer discussants, difficult topics may not be discussed effectively; with more discussants, some participants do not give their opinions. However, in some cases, smaller groups are recommended for the following reasons: a) Participants are likely to have a lot to say on the research topic, which normally happens if they are involved or emotionally pre-occupied with the topic; b) Topics are controversial or complex and pick up participants' personal accounts when involvement with a topic is likely to be low or when the researcher wants to hear numerous brief suggestions.

The information from FGDs and KI interviews was analyzed by summarizing contentions, agreements and disagreements among members of various groups and among individual key informants. Their arguments were compared with those given by individuals from structured interviews that were conducted using a household questionnaire.

3.0 FINDINGS AND DISCUSSION

3.1 Major Crops Grown in the Study Area

During Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs), participants were asked to mention the major crops grown in the study area. Besides round potato production, the participants mentioned maize, wheat, beans and vegetables, among other crops. It was found that round potato, maize and wheat were grown by the majority of farmers and had larger acreages as compared to other crops (Table 1). The participants

were asked to report which were food crops and which were cash crops; the food and cash crops they mentioned were different, depending on the agro-ecological areas of where the group participants lived. For example, the majority of Mbeya group's participants reported that maize and round potatoes were grown for both food and cash. However, round potatoes were the leading crop for their earnings. Participants from Makete reported that all major crops were used as food and cash crops and vice versa to diversify sources of income and ensure food availability throughout the year. Generally, the majority of the group participants reported that round potatoes were the leading crop for their earnings. Other studies on round potato have shown that round potato is more profitable than traditional staples as it has higher yield per unit of land, matures earlier and provides relatively high income (Kabungo, 2008; Mpogole *et al.* 2012).

However, the majority of groups' participants reported crop production levels to be low, mainly due to: lack of knowledge on improved technologies for crop production; lack of improved seed varieties; diseases and insect pests of crops, and high costs of farm inputs. Groups' participants reported that livestock keeping was also one of the income sources for the majority of the households in the study area. The main livestock types kept were cattle (mainly indigenous), goats, sheep, pigs, donkeys and poultry.

Table 1: Descriptive statistics of acreages under major crop grown

Crop	N	Minimum	Maximum	Mean	Standard Deviation
Round Potato	233	0.2	10.0	1.1	1.1
Maize	232	0.25	15.0	1.7	1.7
Wheat	133	0.25	5.0	1.0	0.8
Beans	70	0.1	2.5	0.4	0.4
Vegetables	18	0.25	2.0	0.7	0.6

The proportions of farmers who grew potatoes varied depending on agro-ecological factors of the wards and villages. In Mbeya District, participants from Tembela ward (Ilembo Usafwa and Shibolya villages) estimated the proportion of farmers that grew round potatoes to be 95%. In Santiliya ward (Mapande and Sanje villages), the participants estimated that the proportion of farmers growing round potatoes was 75%. In Isapulano ward (Isapulano and Ivilikinge villages) Makete District, the proportion of farmers growing round potatoes was estimated to be 95% while in Kipagalo ward (Kitula and Iyoka villages) it was estimated to be 85%.

Most of the farmers grew local potato varieties which included *arka, kagiri, kidinya* and *loti*. However, few farmers grew improved potato varieties which included CIP (*kikondo*), *tigoni* and *sasamua*. The participants were asked to report on average yield of potato per acre under farmers' fields, and the results showed a great variation. They claimed that, with CIP (*kikondo)* variety, yields were between 60 to 90 bags per acre, while with local varieties yields were between 15 to 60 bags per acre. The participants claimed that the yield variation was due to a number of reasons, including levels of farm inputs application, planting time and soil fertility. Other reasons mentioned by the participants were low quality of seeds used and ability to control diseases such as bacterial wilt and late blight, which are major potato diseases in the study area. Farmers generally obtained seed potato tubers from informal sources. The participants mentioned the main sources of seed potato tubers to be: Own served tubers (selected small sized tubers from previous crop), purchasing from neighbours, nearby market places, neighbouring villages and round potato ware houses. Another source of seed tubers was ARI-Uyole, though in small amounts, for those who resided close to the institute. They claimed that, unlike cereal crops, potato seeds are not sold in input supplies shops. This finding is similar to that of

Mwakasendo *et al.* (2007) who reported that there is no organization undertaking seed potato production and marketing in Tanzania hence farmers are obliged to use potato seeds from informal sources. The main implement used in potato farming was the hand hoe, using family labour.

The participants were asked to give information on extension service provision in the study area. They claimed that the extension services provision situation in the study area was fairly good as each ward had an extension officer. Moreover, some villages had village extension officers and those who had none depended on ward extension officers. The participants were also asked to give information on the input provision situation in the study area; they claimed that the situation was not good at all. Generally, all the participants claimed that inputs were too expensive for them to afford and not available in time. They also reported that, in addition to high costs and untimely availability of inputs (fertilizers and pesticides), another problem was cheating which was done by some unfaithful input suppliers. Some of them were cheating by either selling expired or low quality farm inputs. One participant claimed that… *"in order to maximize profit, suppliers of farm inputs cheat by packing minjingu fertilizer in DAP labelled bags because DAP is sold at higher prices compared to minjingu"*. The cheating by input suppliers resulted in low crop yields and consequently increased production costs.

3.2 Food Security Status and Strategies for Coping with Food Shortages

The participants were also asked to give the meaning of food security from community members' views. The meaning of food security was described differently by the groups' participants. The majority of the groups gave the following meanings: *"Food security is attained when a household is assured of having enough stock of food to eat all the year;* "*Food security is when a household has enough resources which can be used to produce*

own food or access food through purchasing until the next harvest is ready", and *"Food security is when a households is able to afford two or three meals per day"*. Those definitions show that the community members had the right information of the meaning of food security.

The participants were also asked to give information on amounts of food stocks that were enough for their households throughout the year. The results showed variations, depending on household size and agro-ecological factors of the wards and villages. All group participants claimed that for them food security crops were maize, round potatoes and beans. One participant from Mbeya District claimed that…. *"In my household of 8 people we are food secure if we have a stock of 10 bags of maize, and 4 bags of beans (six tins each) and other foodstuffs such as rice, wheat, vegetables are used as supplementary"*. One participant from Makete District claimed that… "*In my household of 5 people we are food secure we have a stock of 6 bags of maize and one bag of beans (six tins each) and a quarter acre plot of round potatoes."* He added that "*although maize is our main food, it takes too long to be ready for harvest so we sell round potato to get cash to buy maize and other foodstuffs."* The majority of the focus discussion groups had opinions that food security is attained when a household has enough stock of food to eat all the year and/or enough resources which can be used to access food through purchasing. This opinion of having enough resources which can be used to access food through purchasing is good; it can help even people who do little or no agricultural production to be food secure through purchasing food using income from other sources. This is in line with Sen's (1981) argument that: "People do not usually starve because of an insufficient supply of food at the local, national or international level, but because they have insufficient resources, including money ('entitlements') to acquire it".

The participants were asked whether there were food insecurity problems in their villages. Most of the participants responded that food insecurity was not a major problem in their villages. They claimed that they are blessed with climatic conditions which are favourable for production of various crops and doing different economic activities. On the basis of their definitions of food security, they estimated that 90% and 10% of the households were food secure and food insecure respectively. That high proportion of households which were food secure is almost the same as the incidence of food insecurity obtained in the same research using quantitative methods, particularly the percent of households whose dietary energy consumption was below the national caloric food poverty line 2,200 kCal per adult equivalent per day, which was 89.7% in Makete District (Mende *et al.*, 2014).

The main foodstuffs consumed included maize, round potatoes, wheat and rice. Those foodstuffs are normally eaten with beans, vegetables, meat, fish and milk. Adults and children eat the same types of foodstuffs at home. Food prices vary during the year depending on the season. For the crops grown in the study area, prices tend to be high before harvesting; during the harvesting months prices are fairly low and after harvesting prices start to rise. Farmers have to sell food if they have surplus of it or if they want cash to buy other family needs. Farmers also have to buy food if they have food shortage or if they need to change food types they normally eat.

Besides the above information, the participants were also asked to give information of strategies adopted by their community members against food insecurity. The main strategies were mentioned as: avoid overselling of food during and just after harvesting; grow short maturing crops such as sweet potatoes and vegetables; do casual labour work; sell small livestock such as goats and local chickens; and be involved in non-farm activities. Most of the community members did those strategies, and the strategies helped

them be food secure. These findings are similar to those obtained by Ngongi (2012), which showed that the most widely coping strategies against food insecurity by farming households are casual labour works, selling of livestock, petty business and doing non-farm activities.

3.3 Contribution of Round Potato Production to Household Food Security

From community members' views in the research, there were different opinions from different focus discussion groups about the contribution of round potato production to household food security. The majority of the groups gave the following opinions: round potatoes are eaten daily as a staple food in various dishes; round potatoes are sold and cash obtained by selling them is used to buy other foodstuffs; potatoes provide employment in terms of casual labour; round potatoes can be sold and cash obtained is used to purchase farm inputs such as fertilizers and pesticides to improve productivity of other crops. One discussant emphasized that: *"Round potato is a short maturing crop (takes 3 months) to mature and can be grown in 3 seasons in a year as compared to maize which takes up to 10 months to be ready for harvesting. While waiting for maize to mature, potatoes are harvested, sold and cash obtained from them is used to buy maize and other foodstuffs"*.

Fourteen out of sixteen focus groups had the opinion that round potatoes play important roles in food security and income. Their opinions were evidenced by results obtained from quantitative survey, which showed that income from round potato was higher as compared to income from other crops (Table 2).

Table 2: Income per adult equivalent from potato, other crops and other sources

Income sources	n	Minimum	Maximum	Mean	Standard deviation
Income from potato	219	8,000	12,000,000	722,250	1,325,210
Income from other crops	233	-285,000	6,350,000	115,410	462,495
Income from non-agricultural activities	129	-200,000	56,400,000	566,870	3,811,790
Income from livestock	117	-310,000	3,010,000	92,550	267,762

Although the majority of the groups had positive opinions on the contribution of round potatoes to food security, some individuals in some of the groups had negative opinions. Their arguments were based on the potato production constraints they were facing. They mentioned the constraints to be poor access to extension services; high prices of inputs, especially fertilizers and pesticides; shortage of improved potato seed varieties; unreliable market for potatoes; deceitful excessive filling of bags with potatoes, a practice that is locally called *lumbesa* that is used by middlemen during buying of potatoes; and poor roads infrastructure in some villages. These findings are similar to those by Godfrey *et al.* (2012) who reported that diseases and insect pests, high costs of inputs, low prices given by middlemen and low quality of potato seeds were major production constraints to most of potato farmers. They added that, unless those constraints were solved, the potato productivity potential would continue to be underutilized. They suggested that the government should remove the constraints so that they could benefit from potato production and improve their incomes and food security.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The major crops grown in the study area are round potatoes, maize, wheat, beans, and vegetables, but the production of the crops is mainly constrained by low knowledge on improved technologies, shortage of supply of improved seed varieties, crop diseases and insect pests and high costs of farm inputs. On the basis of this conclusion, the government is urged to support farmers through provision of farm inputs at affordable prices and availability of improved seed varieties.

According to community members'views food insecurity was not a major problem in the study area since 90% and 10% of the households were food secure and food insecure respectively. Moreover, the main coping strategies with food shortages included avoid overselling of food during and just after harvesting, grow short maturing crops, do casual labour work, sell livestock and be involved in non-agricultural activities. Based on this conclusion, the government is urged to support farmers in agricultural and non-agricultural activities. Moreover, farmers are urged to use improved agricultural technologies and look for more profitable non-agricultural to improve their incomes and food security status.

According to community members' views, round potatoes were a reliable source of food and income since they are short maturing, and they can be grown in three seasons per year. The major production constrains were lack of reliable source of quality potato seeds, high prices of inputs, deceitful excessive filling of bags with potatoes by middlemen during buying of round potatoes and poor roads infrastructure in some villages. Based on this conclusion, the government is urged to help farmers solve the production constraints through availability of quality potato seeds, farm inputs, improve road infrastructures and control deceitful excessive filling of bags with round potatoes by middlemen. Moreover, farmers are urged to form groups in order to have bargaining power during selling of round potatoes.

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CHAPTER THREE

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

In this chapter, conclusions in terms of implications of the findings of the research are given. Then, recommendations that are derived from the conclusions are given, specifying not only the levels at which strategies to improve round potato productivity and household food security should be addressed, but also the key stakeholders that are urged to take a lead in undertaking the strategies.

The first specific objective of the study was to determine the impact of round potato production on household food security in the Southern Highlands of Tanzania. The results for this objective are presented in the first paper of the thesis. The paper analysed round potato production and other crops, assessed food security in terms of dietary energy consumed per adult equivalent per day and determined the impact of round potato production on food security. Based on the findings, the following conclusions are made.

It was found that round potato is one of major crops grown in the southern highlands of Tanzania but that its production is mainly constrained by diseases and insect pests; lack of improved potato varieties; lack of knowledge on improved technologies and high costs of farm inputs. It was also found that 79% of the sampled households were food secure while the study area is potential for other major crops including maize and wheat, besides round potato. This implies that the productivity potential of the study area was not fully utilized. Moreover, it implies that improving productivity of round potato and other crops in the study area could improve its food security status. In view of the findings that the dietary energy consumed from round potato showed positive significant impact ($p \leq 0.1\%$) on

food security and it's so short maturing that a farmer can complete three planting seasons per year imply that round potatoes are a reliable source of food and income in the study area.

The second specific objective of this study was to determine contribution of round potato production to household income in Mbeya and Makete Districts. The results for this objective are presented in paper two of this thesis. The paper analysed round potato production and other crops, assessed household income from round potato and from other sources and determined the impact of round potato production on household income. Based on the findings the following conclusions are made. The findings that the average land sizes under round potato and other crops production were small imply that most of the people in Mbeya and Makete Districts were small-scale farmers. Moreover, the findings that among the major crops grown, income from round potatoes showed significant impact ($p \leq 0.1\%$) on household income imply that, given due attention and care, they can contribute greatly to household income.

The third specific objective of this study was to determine food security incidences based on the national monetary and caloric poverty lines in the study area. Food security was determined based on the national monetary poverty line and caloric food poverty line, and food security incidences were compared based on the two poverty lines. The results for this objective are presented in the third paper of this thesis. Based on the findings, the following conclusions are made. The findings that the majority of the households were food secure based on monetary and caloric poverty lines (82.8% and 79.0%) respectively imply that both poverty lines have good potential to give reasonable results of food security. Therefore, the government of Tanzania and other stakeholders dealing with food security should use both poverty lines almost equally since they give almost the same

results. Moreover, the findings that food security was not significantly different by land size under cultivation imply that land area under cultivation is not a good predictor of food security in the study area.

The fourth specific objective of this study was to apply theories of food insecurity to explanation of food status in the southern highlands of Tanzania. To meet the objective, proportions of food secure and insecure households were determined and compared by indicators of Malthusian, Anti-Malthusian, entitlement and Woldemeskel's contentions with regard to how they explain food security. The theoretical contentions were used to explain food security based on dietary energy consumed per adult equivalent per day. The findings on this objective are presented in the fourth paper of this thesis. Based on the findings, the following conclusions were arrived at. The finding that household size was negatively related with food security implies that household size is a factor with the highest negative effect on food security in the study area. The finding that income from non-agricultural activities and number of livestock kept showed positive impact on food security implies that entitlement to food is the most important theory explaining food security in the study area. Moreover, the findings that farmer groups and or farmer association membership were positively related with food security imply that they have a considerable role in enhancing food security in the study area.

3.2 Recommendations

In order to improve round potato productivity and improve food security in Mbeya and Makete Districts, the following recommendations, which have been derived from empirical findings of this study and the above conclusions, are worth heeding. To facilitate their consideration, the recommendations are divided into policy level, district level and household level.

3.2.1 Policy level recommendations

i. Round potatoes are a reliable source of household food and income in the study area. Therefore, the government, through the Local Government Authorities, is urged to support farmers through training programmes on improved technologies, availability of improved potato varieties and enhancing farm inputs availability at affordable prices.

ii. Round potatoes are more profitable than other major crops in the study areas, but the average land allocated for the crop and other crops production is low. Therefore, the government and policy makers are advised to support farmers in non-agricultural activities since agriculture alone may not be enough to fulfil their household needs.

iii. Caloric and monetary poverty lines give almost similar food security incidences; it is recommended that the government and other stakeholders dealing with food security should use both food poverty lines almost equally since they give almost the same results.

iv. Household size was a factor with the highest negative impact on household food security in the study area; the government and policy makers are urged to introduce training programmes on health and birth control measures to be directed to the people of Mbeya and Makete Districts. This should be aimed at controlling family size in the long run, which could have positive effects on households' food security.

v. The entitlement to food theory was found to be the most important theory explaining food security in the study area. Therefore, the government and policy makers are advised to support other income generating activities in Mbeya and Makete Districts so as to increase income and hence increase purchasing power and get more access to food.

3.2.2 Household level recommendations

i. On the basis of the conclusion that 79% of the sampled households were food secure while the study area has potential for other major crops including maize and wheat besides round potato, Mbeya and Makete farmers are urged to grow more than one crop in order to improve their food security status.

ii. Round potatoes are a reliable source of food and more profitable as compared to other crops. Therefore, Mbeya and Makete farmers should use improved technologies in potato farming in order to realize its productivity potential and improve their food security statuses and incomes.

iii. Land size cultivated was not a good predictor of food security status in the study area,. Therefore, farmers in Mbeya and Makete Districts should improve their land productivity in order to improve their food security statuses rather than increasing land size.

iv. The entitlement to food approach was found to be the theory best explaining food security in comparison with the other theories applied to food status explanation. Accordingly, Mbeya and Makete people should look for profitable non-agricultural activities so that they can get more income besides income from agricultural activities for their household needs.

3.2.3 District level recommendation

Mbeya and Makete District councils are advised to help farmers in forming farmer groups and or associations for easy access to extension services, agricultural inputs and other services related to improved agricultural production and improve their food security status.

3.2.4 Areas for Further Research

i. In view of the findings that Dietary Energy Consumed from round potato contributes significantly in food security, further research is suggested in the study area to determine nutritional value of other nutrients, for example vitamin A, iron, iodine and protein of which its deficiencies cause nutritional disorders in the country

ii. It was found that round potato is more profitable than other major crops grown in the study area. Further research is suggested to be conducted on round potato value chain in order to determine the most pressing bottlenecks and address them in a systematic manner.

APPENDICES

Appendix 1: A copy of household questionnaire for Research on Round Potato Production and Household Food Security in the Southern Highlands of Tanzania

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A. BACKGROUND INFORMATION

1. Name of interviewer----------Date----------
2. Name of respondent----------
3. Region ----------
4. District----------
5. Division----------Ward---------- Village----------

B. HOUSEHOLD COMPOSITION

Please let me ask you about all members of your household including marital status and occupation

6. Household members and their attributes

Particulars	P1 H'hold head	P2	P3	P4	P5	P6	P7	P8	P9	P10
Name (Optional)										
Age										
Sex										
Year of schooling										
Marital status										
Main occupation										

Key to Question 6

Sex	Marital status	Household head	Main occupation
Male	1. Married	Adult male	1. Crop production
Female	2. Never married	Adult female	2. Livestock keeping
	3. Widower	Orphan male	3. Salaried employment
	4. Widow	Orphan female	4. Self-employed off-farm
	5. Divorced		5. Casual labour on/ off-farm
	6. Separated		6. Student/pupil
	7. Too young to be married		7. Non school child

C. CROPLAND OWNED AND OPERATED BY THE HOUSEHOLD

7. Land allocation for crops; under all crops.....acres, under potato production.....acres.
8. Land ownership; 1= Hired ( ); 2= Owned ( ); 3= Both ( )
9. Amount of land owned.....acres; amount of land used .....acres
10. How did you obtain your land?

    1= Inherited ( ); 2= Purchased ( ); 3= Village government ( ); 4= Borrowed ( ); 5 = others (Specify) ----------

11. Land owned by all household members

Field	Area	Ownership	Rent in land	Rent out land	Major crops	Production domain
	Area of each field or plot (acres)	1= owned (idle) 2= owned (used) 3= own (rented out) 4= rented in 5= borrowed	Amount paid (Tshs)	Amount received (Tsh)	Crops	1= Dry season 2= Rain season
1						
2						
3						
4						
Total number of plots (Sum codes 1 – 3 under ownership)			Total area owned		Total area used for farming (including land rented in or borrowed	

12. What are the crops primarily grown for food, cash and both in the household? (Fill in the table below and rank the crops in relation to their importance in providing that service (food, income or both).

Food Crops	Rank	Cash crops	Rank	Food & cash	Rank

13. Of the area under cropping in 2010/2011, please provide the following information:

No	Type of crop	Area (Acres)	All costs incurred (Tshs)	No. of bags/kgs harvested from July 2010 to June 2011	Selling price/kgs/bag	Total income
1	Round potato					
2	Maize					
3	Wheat					
4	Beans					
5	Vegetables					
6	Fruits					
7	Soybean					
8	Sweet potato					
9	Pyrethrum					
10	Garden peas					
11	Others (Specify)					

14. Of the amounts of crop products, how much did you consume, give to relatives and sell?

No.	Type of crop	Amount harvested	Amount consumed at home	Amount given to relatives	Amount sold
1	Round potato				
2	Maize				
3	Wheat				
4	Beans				
5	Vegetables				
6	Fruits				
7	Soybean				
8	Sweet potato				
9	Pyrethrum				
10	Garden peas				
11	Others (specify)				

15. After harvesting how did you store your crop harvests?

Crop	**Container/bags in which the harvests were kept**	**Place where the harvests were kept**	**Whether the harvests were treated with any chemical**	**Type of chemical used to treat the harvests**
Round potato				
Maize				
Wheat				
Beans				
Soybeans				
Garden peas				
Sweet potato				
Others(Specify)				

D. LIVESTOCK KEEPING

16. Did you keep livestock in 2009/2010? Yes/No _ _ _ (if no, skip question 14)

17. Contribution of livestock to annual farm household income in 2010/2011

Livestock type	**Number**		**Sales**				**Total costs incurred**	**Gross annual income (Tshs)**
	Improved	Local	Live animals	Price (Tshs)	Livestock products	Price (Tshs)		
Cattle								
Goats								
Sheep								
Pigs								
Rabbits								
Donkey								
Chicken								
Ducks								
Pigeon								
Others (specify)								

18. Did you have any other activities than agriculture in 2009/2010? Yes/No

19. Contribution of off-farm activities to annual household income in 2009/2010?

Off-farm source of income	Total costs incurred	Gross income (Tshs)
Carpentry		
Local brew		
Petty business		
Casual labour		
Salary		
Assistance from relatives		
Loans		
Rents (house, equipment, tools)		
Pension		
Others (specify)		

E. ASSETS OWNED BY THE HOUSEHOLD MEMBERS

20. Types of assets you own this year and the one you owned two years ago

Asset	Ownership of the asset in 2010		Ownership of the assets in 2011		Has the amount 1=Increased 2=Decreased 3=Not changed 4=Not applicable	Reasons for change in the assets number	Presents value of the assets (Tshs)
	Number of assets	Owner: 1= Father 2= Mother 3= Son 4=Daughter 5= Father and mother, 6= All	Number of assets	Owner: 1= Father 2= Mother 3= Son 4=Daughter 5= Father and mother, 6= All			
Motor vehicle							
Power tiller							
Tractor							
Ox-plough							
Motorcycle							
Bicycle							
Bajaji							
Sewing machine							
Hand hoe							
Satellite dish							
Refrigerator							
Mattress							
Mobile phone							
TV Set							
Radio							
Cattle							
Sheep							
Goats							
Chickens/Ducks							
Donkey							
Modern house							
Press iron							
Wooden bed							
Generator							
Carts							
Others (specify)							

F. POTATO PRODUCTION ASPECTS

21. Do you grow round potato? 1= Yes, 2= No
22. For how long have you been growing potato……...Years?
23. What is the average distance to the potato plot from your home? ----------
    metres/kilometres
24. Of all the households in this village, what is approximate proportion of households which grow round potatoes?
25. What are the farm implements do you use to prepare land for planting round potato?
    1= hand hoe (___); 2= ox-plough (___); 3= Tractor (___); 4= others (specify)
26. Time of land preparation
    (Month)…….…….
27. When do you plant potatoes in your field? Month……?
28. How many times do you weed your potato field?
29. What was your main source of labour during the 2010/2011 season? 1= Family labour ( ); 2= Hired labour (___); 3= Both (___); 4= Others
    (Specify).....
30. During the 2010/2011 agricultural season, was your family labour adequate for potato production? 1= Yes; 2= No.
31. If family labour was not adequate for potato production where you did got additional labour?
    1= Hire labours (___); 2= Friends(___); 3= Relatives (___); 4= Others (Specify)------
32. How many labourers did you use in potato production during 2010/2011 agricultural season per acre?.....
33. What is the cost of one labourer per day?……

34. What is the source of money you paid for labour

    1= Sales of potato (__); 2= Sales of livestock (__); 3= Loan (__); 4= Sales of cereal crops (__); 5= Others (Specify).....

35. Which type of seed tubers do you use? 1. Improved (__); 2. Local (__); 3. Both (__); 4. Others (Specify).....

36. If you use improved varieties, which improved varieties do you grow?

    1 = Kikondo(__) 2 = Sasamua (__) 3 = Bulongwa (__) 4 = Baraka (__) 5 = Tigoni (__) 6 = Others (Specify).....

37. If you use local varieties, which ones do you grow? 1= Arka; (__) 2 = Kagiri; (__) 3 = Kidinya(__)

    4 = Others (Specify).....

38. Source of improved varieties; 1. Research Institute (__); 2. NGOs (__); 3. Neighbours (__); 4. Farmers; (__) 5. Traders (__); 6. Others (specify) ----------

39. If not using improved varieties, what are the reasons? 1= Not available (__); 2= Too expensive (__); 3.=Not easily accessible(__); 4 = Others (Specify)----------

40. Do you use fertilizer? 1 = Yes, 2= No

41. If yes, what type of fertilizer did you use during the 2010/2011 agricultural season?

Type	**Amount applied per acre**	**Cost (Tsh)**
CAN		
DAP		
TSP		
UREA		
SA		
NPK		
Others		

42. If you did not use fertilizer why? 1. Not available 2. Expensive 3. Not required 4. Not easily accessible 5. Others (specify) ----------

43. (a). Do you have problems with insect pests and diseases in your potato field? 1= Yes, 2= No

(b). If yes, which diseases?

1= Late Blight (___)

2= Bacterial wilt (___)

3= Viral diseases (___)

4= Others (Specify).....

(c). Insect pests;

1= Aphids (___) 2= Cut worms (____) 3= Beetles (___) 4= red spider mites (____) 5= others (Specify).....

(d). What type of chemicals did you use to control diseases and insect pests during the 2009/2010 agricultural season?

Type of Fungicide	**Amount per acre**	**Cost (Tshs)**
1.		
2.		
3.		
Type of Insecticide		
1.		
2.		
3.		
Types of herbicides		
1.		
2.		
3.		

43. What yield do you normally get from one acre of potato using;

a. Improved variety----------

b. Local variety----------

44. When do you normally harvest your potato crop? ----------Month

45. From July 2010 to June 2011, how many times did you and your household members grow potato? ----------

46. Do you normally store round potato after harvest? 1= Yes; 2 = No

47. If yes, what are the storage methods do you use----------

---

---

48. If no, why?----------

---

49. Reasons for storing round potato;

.....

.....

.....

50. For each of the time you grew potatoes, please tell me the particulars as I am going to ask you now

Season grown	**Acreage**	**Costs incurred**										**Gross sales of potatoes**
		Land rent (if applicable)	**Tillage**	**Seeds**	**Fertilizers**	**Labour**	**Weeding**	**Pesticides**	**Harvesting**	**Packaging**	**Other costs**	
1.												
2.												
3.												
4.												

51. How much of the harvested potatoes did you eat with your household members, sell, keep for seeds, give to relatives/friends? (Fill in the answers in the following table)

Season grown	**Amount harvested**	**Amount consumed with household members**	**Amount sold**	**Amount kept for seeds**	**Amount given to relatives/friends**	**Amount for other uses**
1.						
2.						
3.						
4.						

52. Would you kindly tell me the items on which you spent the income from the potatoes?

Item	**Amount (Tshs)**	**Item**	**Amount (Tshs)**	**Item**	**Amount (Tshs)**
Maize		Utensils		House construction/repair	
Tuber crop products		Health care		Ceremonies	
Protein foods		Agricultural inputs		Gifts to relatives	
Clothes		Children's education		Travelling	

53. If the income was used to purchase food, what is the proportion used in purchasing food?----------

54. Have you received any training on potato production? 1= Yes ( ); 2= No ( )

55. If yes, specify by whom? 1= Village extension officers ( ); 2= ARI researchers ( ); 3= NGOs ( ); 4= Others (Specify).....

56. What are the major constraints related to potato production?

.....

.....

57. Suggest intervention measures to improve potato production in this village

.....

.....

.....

58. Give information about round potato yield during the season July 2010 to June 2011

Total area planted	**Production/acre**	**Total production (kgs)**	**Quantity sold (kgs)**	**Price/unit**	**Total earnings (Tshs)**

G. CREDIT ACCESSIBILITY AND ORGANIZATION

59. Have you ever requested for credit from any agency in recent years? 1. YES, 2. NO

60. If yes, fill the following table

Source of credit (Informal group, Bank, Friends/relatives, government, input distributor, informal money lenders)	**Form of credit (Cash, Inputs)**	**Amount (Tshs)**	**Interest rate**	**Terms of payment (cash, in kind, both)**

61. If no, why 1. No knowledge of credit (___), 2. Not available (__), 3. Procedure is too restrictive (___) 4. Not aware of credit (__), 5. High interest rate (__), 6. High risk (__), 7. Others (Specify) .....…….....

62. How did you use credit? 1. Investing in business (___), 2. Investing in agriculture ( ), 3. Paying school fees (___), 4. Buying food for the household (___), 5. Others (Specify)

…….....

63. As a potato farmer, do you belong to any organization or farmers group? 1. YES,(___) 2. NO (___)

64. If yes, fill in the table below;

S/N	Name of organization/group	Activity	Benefits	Entry conditions
1				
2				
3				

65. Do you usually bulk your produce and sell to customers as a farmer's group member? 1. Yes (__) 2. No (__)

H. EXTENSION SERVICES

66. Do you have access to extension services? 1. YES (___), 2. NO (___)

67. If Yes, where do you get extension services 1. Village extension Officer (__), 2. NGOs (___), 3. Research (____), 4. Others Specify……..

68. Are there benefits from services provided? 1. YES (___), 2. NO (___)

69. What advices do you get from extension services? 1= Crop management (___); 2= Land preparation practices (___); 3= Diseases and insect pest problems (___);

4= Storage issues (___); 5= Marketing issues (___); 6= Others (Specify).....

70. The average number of contact you have had village extension officer per season? 1= Regularly (__); 2= Few times (___); 3= Very seldom (___); 4= No visit at all (___); 5= Others (Specify).....

71. Recommendation for improving extension services

1. ----------

2----------

3. ----------

I. HOUSEHOLD FOOD SECURITY

72. Please tell me whether various foodstuffs you ate from various sources in your household from July 2010 to June 2011 were sufficient

Food eaten and its main source **1. Your own farm** **2. Buying** **3. Work for food** **4. Food aid from relatives** **5. Food aid from government** **6. Other sources**		**Whether the food was sufficient in 2010/2011** **1= Yes** **2= No** **3 = Not applicable**	**Explanation**	**Whether the food was sufficient in 2009/2010** **1= Yes** **2= No**	**Explanation**
Food Type	Main source				
Maize					
Round Potato					
Rice					
Wheat					
Sweet Potato					
Garden Peas					
Livingstone Potato					
Cassava					
Beans					

73. Did you have food shortage during the year 2009/2010 in your household 1= Yes, 2= No

74. If the answer to question 72 is yes, which was the main cause of the shortage by ranking the causes from major cause

Reasons for having had food shortage during the year 2009/2010	
1. Big household size as compared with our food production level	4. Low food supply in nearby market places
2. Failure to use improved farm implements, improved seed varieties, fertilizers, pesticides, herbicides and improved storage facilities	5. High prices of foodstuffs in nearby market places
3. Lack of income or assets to sell to get cash to buy food	6. Lack of Government assistance

J. IDENTIFICATION OF FOOD CONSUMED AND THEIR FREQUENCIES

Beginning last week please recall all foodstuffs that were consumed at home by all members in your household and state the frequency of consumption of various food items, and the form (description) in which they were eaten by the household member in the past one week, month and year

75. Food items consumed by all household members and their frequencies per week/month/year

Food item	1= Yes 0 = No	Major source (See code)	Description (e.g. ugali-dona, stew	Frequency of consumption		
				For the past 7 days	For the past 30 days	For the past 12 months
Cereals						
Maize						
Wheat						
Rice						
Others (Specify)						
Root, tuber, plantain						
Round potatoes						
Sweet potatoes						
Cassava						
Green bananas						
Others (specify)						
Legumes						
Beans						
Garden peas						
Others (Specify)						
Nuts and seeds						
Ground nuts						
Others (Specify)						
Meat, poultry, fish, eggs						
Beef						
Goat						
Pork						
Poultry-chicken/duck						
Fish						
Others (Specify)						
Milk and milk products						
Cow's Milk (whole)						
Oils and fats						
Vegetables						
Cabbage						
Amaranth leaves						
Pumpkin leaves						
Tomatoes						
Onions						
Other vegetables (Specify)						
Fruits						
Avocado						
Bananas						
Other fruits (Specify)						

Codes: Major sources 1 = Own production, 2= Bought, 3 = Transfers (gifts, loans, remittance), 4 = Relatives' assistance, 5 = Food for work, 6 = Others (Specify----------)

K. ASSESSMENT OF DIETARY INTAKE AND MONETARY VALUES

FOODSTUFF CONSUMED BY THE HOUSEHOLDS

76. What were the monetary values of the above foodstuffs consumed?

Food item	Amount eaten by all household members (kg or litres)			Monetary value (Tshs)		
	For the past 7 days	For the past 30 days	For the past 12 months	For the past 7 days	For the past 30 days	For the past 12 months
Cereals						
Maize						
Wheat						
Rice						
Other cereals (Specify)						
Root, Tubers, Plantations						
Round potatoes						
Sweet potato						
Cassava						
Green bananas						
Other tubers etc. (Specify)						
Legumes						
Beans						
Garden peas						
Other legumes (Specify)						
Nuts and seeds						
Ground nuts						
Other seeds (Specify)						
Meat, poultry, fish, eggs						
Beef						
Goat						
Pork						
Chicken						
fish						
Other (Specify)						
Milk and milk products						
Cow's milk (whole)						
Oils and fats						
Vegetables						
Cabbages						
Amaranthus						
Pumpkin leaves						
Tomatoes						
Onions						
Other vegetables (Specify)						
Fruits						
Avocado						
Bananas						
Other fruits (specify)						

K. STRATEGIES OF COPING WITH FOOD SHORTAGE AT THE HOUSEHOLD LEVEL

77. During food shortage which of the following ways has your household used to get food?

Strategies used to cope with food shortage	**1= Yes, 2= No**	**Explanation**
1. Borrowing food		
2. Selling round potato		
3. Working for food		
4. Selling households' assets		
5. Getting food aid from relatives		
6. Getting food aid from the government		
7. Searching for wild foodstuffs and eating them		
8. Eating fewer meals per day		
9. Borrowing cash for buying food		
10. Doing casual labour work to get cash to buy food		
11. Temporary migration of some household members		
12. Temporary migration of all household members		
13. Getting food aid from neighbours		
14. Selling livestock		
15. Soliciting remittances from relatives living in town		
16. Eating foodstuffs they do not prefer		

78. Is your household food secure throughout the year? 1= Yes, 2= No

79. If yes, for how many months did your harvests last in 2010/2011? ----------

80. If no what are the causes of food insecurity at your household

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81. For how many months did you rely on food stuffs out of your harvests in 2010/2011? -

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For the past 5 years have you ever had food shortage? 1= Yes, 2= No

82. How can you describe the experience of your household with regards to its access to food? 1= Very good, 2= Good, 3= Fair, 4= Bad, 5= Very bad

83. How many meals did you take per day?

Meals per day during the last seven days	**Meals per day during the last 30 days**	**Estimate the number of days per year the meals were taken**
One		
Two		
Three		
Four		
Five		

84. What major factors affect food security in your household?

THANK YOU FOR YOUR COOPERATION

Appendix 2: A Key Informant Interview Guide for Research on: Round Potato Production and Household Food Security in the Southern Highlands of Tanzania

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1. Village population
2. Number of households in the village
3. Major food and cash crops grown in the village?
   a. Food crops----------
   b. Cash crops----------
4. Major growing seasons for the above mentioned crops
5. Proportion of farmers growing potato in the village
6. Average yield of potato/acre under farmers' fields
7. Technologies used in potato farming
8. Main potato varieties grown in the village
9. Main sources of seed potato
10. Extension services and input provision situations in the village
11. Meaning of food security in this village
12. Whether there are food insecurity problems in the village
13. Contribution of round potatoes to food security (vis-à-vis other crops) in terms of food and cash to buy other food types
14. Strategies adopted by the people in the village against food insecurity

THANK YOU FOR YOUR COOPERATION

Appendix 3: A Focus Group Discussion Guide for Research on: Round Potato Production and Household Food Security in the Southern Highlands of Tanzania

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1. Proportion of Male Headed Households in the village
2. Major crops grown and livestock kept in the village
3. Cropping calendar in the village
4. Labour constraint due to out migration and other reasons
5. How farmers ensure they have food all year round
6. When do farmers have to sell or buy food?
7. Whether they have to labour for cash
8. Main foods consumed?
9. How prices of food vary during the year
10. How food is shared among the adults and children
11. The proportion of farmers growing potato by percentage in this village
12. Contribution of round potatoes to food security (vis-à-vis other crops) in terms of food and cash to buy other food types

THANK YOU FOR YOUR COOPERATION

Appendix 4: A map of Mbeya Rural and Makete Districts showing the study area