ATTITUDE TOWARDS THE CULTIVATION AND UTILISATION OF INDIGENOUS LEAFY VEGETABLES IN RURAL COMMUNITIES

by

NYARAI MUNGOFA

Submitted in accordance with the requirements

for the degree of

MASTER OF CONSUMER SCIENCE

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: DR F. T. TABIT

CO-SUPERVISOR: MS F MALONGANE

DECEMBER 2016

DECLARATION

I declare that "**Attitude towards the cultivation and utilisation of indigenous leafy vegetables in rural communities**" is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.

_____

Signed by: N MUNGOFA

Student Number: 44581998

Date: 29 December 2016

DEDICATION

This dissertation is dedicated to my Lord Jesus Christ who has been my shield, my strength and my very present help in time of need. Thank you, my Lord, for giving me hope beyond hopes, for seeing me through this study, for placing your angels along the way that everything may be easier.

ACKNOWLEDGEMENT

My sincere and deepest appreciation goes to Dr FT Tabit, my supervisor, for thorough guidance, patience, commitment and diligence in his supervision throughout this study. Miss F Molongane, my co-supervisor for support and motivation. I especially thank you for taking time to read my work and for seeing this project to its completion.

Many thanks to the Department of Research at the University of South Africa for providing the funds required for this study. Without funding I would not have come this far.

I would also like to thank my husband for his patience and support. I am grateful for all the people that God has put on my way while doing the degree to support me emotionally, financially, prayed with me and prayed for me.

ABSTRACT

Study background

Food insecurity remains a major challenge affecting the rural poor households in South Africa. The consumption of green leafy vegetables is important to address micronutrients deficiency in rural communities and, at the same time, it contributes to fibre intake. This study investigated the people's attitude towards the cultivation and utilisation of ILVs in rural communities. A cross-section survey study was conducted among 1 000 respondents in randomly selected households in communities. The majority of respondents were not willingly consuming ILVs. This is because most consumers were black and of the low-income group. ILVs that are consumed grow mainly in the wild. The regular consumption of these vegetables as indicated in this study is interesting, as this will help in mitigating micronutrient deficiency. Furthermore, these vegetables could be incorporated in formulated food to improve iron and zinc, especially in infant foods formulation. Based on the findings of this study it would be important to find ways of encouraging cultivation of ILVs for both nutrition and as income generating activities.

Key words:

Indigenous leafy vegetables; morogo; food security; malnutrition; poverty

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AIDS Acquired Immune Deficiency Syndrome

CAES College of Agriculture and Environmental Sciences

DAFF Department of Agriculture Forestry and Fisheries

FAO Food and Agriculture Organization

FBDG Food Based Dietary Guidelines

GTM Greater Tubatse Municipality

HIV Human Immunodeficiency Virus

IAV Indigenous African Vegetables

ILVs Indigenous leafy Vegetables

NGO Non-Governmental Organization

PFAF Plants for a Future

PSPPD Programme to Support Pro-Poor Policy Development

RDP Reconstruction and Development Programme

SPSS Statistical Package for the Social Science

STATSSA Statistics South Africa

TALV Traditional African Leafy Vegetables

TAV Traditional African Vegetables

TLV Traditional Leafy Vegetables

UNICEF United Nations Children's Fund

US United States

USDA United State Department of Agriculture

WV Wild Vegetables

PH Potential Hydrogen

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Ensuring adequate human nutrition for all is a significant challenge faced by many governments despite global efforts to increase food production and distribution through policy interventions (FAO, 2012:23). Food insecurity and malnutrition can be alleviated in many rural communities if the cultivation and consumption of indigenous leafy vegetables (ILVs) are encouraged. Furthermore, if these vegetables can be made available during off-season, this would increase access all year round (Bvenura and Afolayan, 2015: 5).

ILVs, also called "traditional leafy vegetables or African spinach" comprise "the collective of leafy vegetable species that form part of the culinary repertoire of particular contemporary African communities" (Motsa, Slabbert, Van Averbeke & Morey, 2010:29). ILVs have been found to be as good as conventional vegetables for providing essential nutrients like vitamins for human health (Van der Hoeven, Osei, Greef, Kruger, Faber & Smuts, 2013:2). There is a general agreement among several researchers that indigenous vegetables are good sources of micronutrients such as vitamin A, vitamin C and iron, and some can have superior nutritional composition to some conventional vegetables (Ramos, Miller, Brandao, Teixeria & Silva, 2013:2). In addition, in many rural communities, these ILVs are not only used as food, but some such as leroto (cleome gynandra) and Jute (corchorus spp) are also used as medicine for the treatment of diseases (Ezebilo, 2010:3).

The consumption of ILVs has always been a traditional practice in many African communities (Faber, Olefofse & Wenhold, 2010). In the past, ILVs used to be the principal source of food for households in many rural communities, but the introduction, production and consumption of conventional vegetables has led to the underutilisation of ILVs and changes in the dietary pattern of many people in rural communities (Van der Hoeven et al., 2013:2). Although these vegetables have been utilised as food by many rural communities for centuries and, in spite of their good nutritional value, they have are not been widely produced and consumed on a larger scale (Mavengahama, 2013:3). In South Africa, ILVs are underutilised and have received little attention from stakeholders in the fight against food insecurity and malnutrition (Seeiso and Materecha, 2014:398). However, many authors have reported the cultivation of ILVs in many communities in the Limpopo and

KwaZulu-Natal provinces of South Africa (Faber et al., 2010; Hart and Vorster, 2006; Uusiku, Oelofse & Duodo, 2010; Van Rensburg, Van Averbeke, Beletse, Slabbert, Faber, Van Jaarsveld, Van Heerden, Wenhold, Oelofse, 2007; Vorster, Van Willem and Sonja, 2007).

The consumption pattern of ILVs in many rural communities in South Africa is highly variable and depends on factors such as poverty status, degree of urbanisation, distance to fresh produce markets and the season of the year (Van Rensburg, Cloete, Gerrano & Adebola, 2014:1111). Poor households have been found to utilise ILVs more than their wealthier counterparts (Van Rensburg et al., 2007:318). Other reasons for the consumption of ILVs are that they are perceived to be tasty, healthy, nutritious, cheap and readily available (Kruger, Van der Hoeven & Matenge, 2011:2). An increase in the productivity of ILVs, alongside post-harvest techniques and supply chains, will enhance smallholder farmers' income and therefore, help fight poverty and secure better food and nutrition (Aworh, 2015:1). Furthermore, ILVs can be used to fight food insecurity and malnutrition during periods of drought and hunger, considering that they are usually sun dried and preserved. This is a cost-free means of preserving these vegetables; hence making them available during the dry season, when vegetables are scarce in rural communities, would be beneficial (Djuikwo, Ejoh, Gouado, Mbofung & Tanumihardjo, 2011:799; Dweba and Mearns, 2011:569-570).

Despite the potential of ILVs in alleviating food insecurity, malnutrition and poverty, they are still unrecognised, unappreciated and undervalued (Babalola and Akinwande, 2014:250; Aju & Popoola, 2013:667). The aim of this study is therefore to investigate attitudes of households in rural communities in Greater Tubatse Municipality in Limpopo, South Africa, towards the cultivation and utilisation of ILVs.

1.2 PROBLEM STATEMENT

The problem of food insecurity and malnutrition affects many households in both urban and rural areas worldwide and the high levels of chronic malnutrition among infants and young children are evidence of this (Mavengahama, 2013). Sub-Saharan Africa has some of the world's highest rates of chronic malnutrition (Uusiku et al, 2010). In surveys done in Niger, Mauritania, Nigeria, Rwanda and Mali, chronic malnutrition is the major cause of death among children under the age of five (UNICEF, 2013). In South Africa, incidences of nutritional deficiencies and poor diets have also been reported in rural communities (DAFF, 2013). Severe cases of malnutrition have been reported in rural communities of the Eastern Cape Province, which is one of the poorest provinces in South

Africa, with a high percentage of the population living in rural areas linked to poverty, inequality, food insecurity and under-nutrition (Chopra, McCoy, Sanders, Jackson, Karaolis, Sogagula & Schofield et al., 2014; Puoane, Alexander & Hutton, 2012).

The importance of ILVs in alleviating food insecurity and malnutrition has been noted, but these vegetables have remained unrecognised, unappreciated and undervalued (Aju, 2013). The decline in knowledge of the importance of ILVs leading to low or no consumption of these foods has been observed in some parts of Africa (Van der Hoeven, 2013). The current manner of production and utilisation of ILVs relies on harvesting without cultivation. This may be observed as exploitative and, therefore, difficult to sustain in view of the growing population, which could lead to loss of indigenous species as well as possible loss of biodiversity (Masarirambi et al., 2010).

The unexploited economic potential of ILVs amounts to the loss of economic benefits, such as income generation in rural communities, considering that they can be sold at high prices during dry seasons, especially with the view that little monetary input is required for their production (Mwaura, Muluvi & Mathenge, 2013, Dweba and Mearns, 2011). The lack of economic activities in rural areas has created rural unemployment, hence an increase in the migration of people from rural to urban areas, thereby giving rise to changes in diets and, in some cases, malnutrition (Uusiku et al., 2010). Rural communities miss out on the obvious empowerment opportunity for women through the production of indigenous vegetables, especially those who pick them to generate money for the upkeep of their families (Aju, 2013). If all the above problems are not resolved, the knowledge of ILVs and their potential would be completely lost to future generations (Van Der Hoeven, 2013).

1.3 MOTIVATION

This study seeks to investigate attitudes toward the cultivation and utilisation of ILVs by households in rural communities. This research will provide information on the attitudes of rural communities concerning the utilisation and cultivation of ILVs. The findings from this research will be relevant in the creation of rural nutrition programmes regarding their utilisation and cultivation, leading to commercial benefits of ILVs.

1.4 LAYOUT OF THE DISSERTATION

This dissertation has been arranged into seven chapters.

Chapter One: Introduction

Chapter One consists of the introduction, which gives the background to the research, the problem statement, motivation and the layout of the dissertation.

Chapter Two: Literature review brief

This chapter provides a background to knowledge on ILVs and its significance to the subject matter under discussion. Some of the most common ILVs in South Africa are also discussed.

Chapter Three: Aims and objectives

This chapter gives an overview of the possible outcomes of the study, it also provides the layout of how these aims were accomplished.

Chapter Four: Research methodology and overview

Chapter Four gives detailed information on the research area, data collection and the outline of the research instrument employed in the study. The shortcomings of the study are also outlined in this chapter.

Chapter Five: Research results

Chapter Five presents the main findings of the study, which are well analyzed and considers all the research aims and objectives that are part of a paper prepared for publication in a peer-reviewed journal.

Chapter Six: General discussion

A discussion of the key findings of the study with respect to literature, is contained in this chapter. This includes the three sections on the questionnaire instrument used in the study.

Chapter Seven: Conclusions and recommendations

The chapter presents the conclusions drawn from the results of the study and possible recommendations. The dissertation ends with a list of references of cited articles in the work and appendices.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

2.1.1 What are ILVs?

ILVs are crops that grow in the wild, or are cultivated and gathered, or harvested for food within a particular African ecosystem (Seeiso and Materecha, 2014). Furthermore, ILVs can be considered categories of plants whose leaves, fruits or roots are acceptable and used as vegetables by rural and urban communities through custom, habit and tradition (Muhanji, Roothaert, Webo & Mwangi, 2011). These vegetables are edible plant species with succulent stems, flowers and fruits used as sustenance (Taleni & Goduka, 2013). ILVs can also be defined as food-medicine, due to the presence of different classes of natural products or active compounds, such as, carotenoids and polyphenols found in them (Guarrera and Savo, 2013). ILVs are also viewed as those edible plants that are biologically indigenous to an area, while introduced vegetables are those vegetables that have been introduced in a particular area and have not physiologically adjusted to the local conditions and, subsequently, require many agricultural inputs (Dweba and Mearns, 2011; Van der Hoeven et al., 2013; Phillips, 2013). There are two main groups of ILVs, namely, the cultivated indigenous vegetables like pumpkins (Cucubita maxima) and cowpeas (vigna unguiculata), and the uncultivated ones like black jack (Bidens pilosa) and spider flower (cleome spp), which mainly grow naturally in cultivated fields, roadside, sandy shade and grasslands. The main method through which these vegetables are brought to households is by gathering them from these places (Mavengahama et al., 2013). There are over 7 000 plant species of ILVs across the world that are cultivated or harvested from the wild for food (Schonfeldt and Pretorius, 2011), and the Sub-Saharan Africa region is a natural habitat for more than 4 000 species (Muhanji et al., 2011).

ILVs are known by many names, including: Traditional leafy vegetables (TLV), traditional African vegetables (TAV), African leafy vegetables (ALV), indigenous African vegetables (IAV), wild vegetables (WV) and traditional African leafy vegetables (TALV) (Babalola and Akinwande, 2014; Van Jaarsveld, 2014; Faber et al., 2010; Mavengahama et al., 2013; Seeiso and Materecha, 2014). Different ethnic groups in South Africa have their own names for the ILVs and these differ from place to place, collectively they are called morogo (Sesotho, isiPedi), imifino (isiZulu, isiXosa) or mihoro (Tshivenda) (Mavengahama et al., 2013).

According to Dweba and Mearns (2011), South Africa alone has more than 100 different species of plants used as ILVs. Examples of the most popular species in South Africa are: black jack (Bidens pilosa), common lamb's quarters (Chenopodium album), dandelion (Taraxacum officinale), bastard mustard (Cleome gynandra), common purslane (Portulaca oleracea) and pigweed (Amaranthus). Taleni et al. (2012) listed the following as the most important species in South Africa: Amaranth (Amaranthus), spider plant (Cleome gynandra), chinese cabbage (Brassica rapa subsp), nightshade (Solanum retroflexum), Jew's mallow (Corchorus olitorius and tridens), cowpeas (Vigna unguiculata), pumpkins (Cucurbita maxima) and melons (Cucumis melo). Table 2.1 shows a list of some examples of indigenous vegetables, their location, method consumption and common names used in different languages.

Table 2.1: Examples of ILVs, their location and method of consumption

Scientific name	Common name	Family	Location	Method of consumption	Reference
Corchorus olitorius L	Jews Mallow in English, wild jute in Afrikaans, thelele and ligusha in Sepedi, Sesotho and Setswana, Delele in Tshivenda and Guxe, ligushe in Xitsonga and Shangaan.	Tiliaceae	Native to Southern Africa. Found in gardens, on roadsides, cultivated and uncultivated land.	Boiled in salted water to produce a thick liquid. Can also be eaten raw.	Nierenburg (2013); DAFF (2012)
Solanum retroflexum	Nightshade in English, nastergal, galbessie and nagskade in Afrikaans, ixabaxaba in isiNdebele,	Solanaceae	Originally from South Africa. Found in vacant residential land, along fence lines, neglected garden beds and	Boiled and used like spinach or any other vegetables.	Abukutsa (2013)

	umsobosobo in isiXhosa, lethotho in isiPedi, momoli in Sesotho, muxe in Tshivenda and musaka in Shona.		roadsides.		
Momordica balsamina	Balsam pear in English Motangtang in Sepedi.	Cucurbitaceae	Native to Southern Africa, found in all provinces of South Africa (except the Western Cape) in grasslands, river banks and coastal dune.	Cooked and eaten as spinach, mixed with porridge.	Welman, 2004
Cleome Gynandra	Spider wisp in English, morotho, leroto, spider plant, spider flower, African cabbage and cat's whiskers marudi in Tshivenda.	Cleomaceae	Native to Africa. Found in agricultural land and near human settlements.	Cooked and eaten like spinach.	Mutshinyalo, 2011
Bidens Pilosa	Black jack, Spanish needle, farmer's friend, pitchforks, cobbler's pegs and Hairy beggar ticks in English, mothagaraga in Sepedi and Gewane,	Asteraceae	Found in many African countries. Grows mostly in cultivated land and roadsides.	Boiled or stir fried like spinach.	Taleni and Goduka, (2013); DAFF, (2011)

	Knapsekerel in Afrikaans.				
Brassica rapa spp, chinensis	Chinese cabbage, rape or chinese mustard cabbage in English, sjinese koo in Afrikaans, mutshaina in Tshivenda.	Brassicacea	Found on cultivated land.	Stir-fried or added to soup, curry or casserole.	Rudrappa (2014); Van Rensburg et al. (2012)
Amaranth	Misbredie, hanekam and varkbossie in Afrikaans, pigweed, cockscomb and hell's curse in English, unomdlomboyi, imbuya, umifino umtyuthu in isiXhosa, imbuya, isheke, indwabaza in isiZulu, thepe, theepe in isiPedi, Sesotho and Setswana, umbuya, isheke in siSwati, mohwa in Shona and imbuya, tyutu in Pondo.	Amaranthus	Mainly found around gardens, stop signs and vacant lots.	Cooked and eaten like spinach.	(Van Rensburg et al., 2007); Greogory, (2013); Rhoades, (2014)
Vigna unguiculata	Akkerboontjie, koertjie in	Fabaceae	Originated from South Africa.	Cooked just like spinach and	Nabulo, (2010); Van

	Afrikaans, cowpea, caritas, black-eyed pea, alacin, caupi, southern pea, tuadam, niebe and rope bean in English, dinawa in isiNdebele, iimbotyi in isiXhosa, imbumba, indumba, isihlumanya in isiZulu, monawa in Sepedi, monawa, dinawa in Sesotho, nawa-ea-setswana in Setswana, dinaba, munaoa, tinyawa in Xitsonga and muriwo we nyemba in Shona.		Found on cultivated beds.	added to soups and stews.	Rensburg et al (2007).
Ipomea batata	Sweet potato in English.	Convolvulacae	Found on cultivated beds.	Young leaves are cooked like spinach.	DAFF, (2012)
Chenopodium album	Lamb's quarters, melde, goose foot, fat hen, white goosefoot in English and Lehlanya in Sepedi.	Chenopodiaceae	Originated in Southern Africa. Found in vacant residential land, along fence lines, garden beds, roadsides.	Boiled or stir fried and used as a vegetable in stews.	Lanini, 2014; Nierenburg and Ahearn, (2013).

Portulaca oleracea	Purslane	Portulaeaceae	Native to Southern Africa grassland, woodland, forest margins, riverbank, vegetation and disturbed areas.	Cooked and eaten like spinach, sometimes with groundnuts or simply cooked with porridge.	Thakur et al., 2009.

Source: Own compilation

In the section that follows, the description of geographical distribution, climatic and soil requirement, method of cultivation, nutritional composition, method of preservation and consumption, as well as the commercialisation potential of some examples of indigenous vegetables will be reviewed.

2.2 COMMON INDIGENOUS LEAFY VEGETABLES IN SOUTH AFRICA

2.2.1 Jew's mallow (Corchorus olitorius L)

Description: Jew's mallow is an erect, annual herb that varies from 20cm to approximately 1,5m in height depending on the cultivars; leaves are alternate, simple, lanceolate, 5 to 15cm long with an acuminate tip and a finely serrated or lobed margin. Flowers are small bright yellow pompoms, 2 to 3 cm in diameter with five petals. The plant flowers from August to October and the seeds ripen in October (Van Rensburg, 2007). Jew's mallow is a deciduous shrub that grows to about 1.5m and spreads up to 3m. It reproduces by suckering and is frost hardy. Seeds can also be produced by beating the dry stem and branches with sticks (Bamigboye, 2011).

Geographical distribution: Jew's mallow was first cultivated in Egypt (Nierenburg, 2011). It has reportedly been cultivated for centuries in Asia and Africa and grows in the wild on both continents. It is native to tropical and subtropical regions throughout the world and is largely produced as a very important vegetable in arid regions of the Middle East and Africa (DAFF, 2012).

Climatic and soil requirement: According to Van Rensburg et al. (2007), Jew's mallow prefers warm, humid conditions and performs well in areas with high rainfall (600 to 2 000 mm) and high temperature. Jew's mallow requires an annual temperature ranging from 16 to 25 degrees Celsius. Temperatures below 15 degrees are detrimental to the crop and it is also sensitive to drought. Jew's mallow grows in a wide variety of soils, but prefers rich, well-drained and loam soil. It tolerates a pH

ranging from 4,5 to 5,2. It cannot grow in the shade and requires moist soil but cannot tolerate being water-logged (Shackleton, Pasquini & Drescher, 2009).

Method of cultivation: Jew's mallow is not cultivated, but it is harvested from the wild or in farmers' fields. It is propagated by seed and can be planted either by direct seeding, which is used when seeds are plentiful or transplanting. Labour is limited to the dry season when flooding is not a problem (DAFF, 2012). Planting is done at the beginning of the rainy season when there is uniform distribution of rainfall. Seeds are drilled 10 to 12 cm apart into furrows and slightly covered with fine soil. Fertilisers (both organic and inorganic) improve yields and maintain soil fertility (Nierenburg, 2011). Drip irrigation or micro-sprinkler irrigation is recommended, especially in areas with a limited water supply. Harvesting is done 20-40 days after planting (Van Rensburg, 2007).

Nutritional composition: The Jews Mallow leaves are very rich in the following nutrients: iron, protein, calcium, thiamine, riboflavin, niacin, folate and dietary fibre (USDA, 2011). The nutritional value of Jew's mallow is presented in table 2.2.

Table 2.2: Nutritional value per 100g of Jew's mallow

Energy	37 kj
Carbohydrates	7.29 g
Fats	0.20 g
Protein	3.68 g
Vitamins	
Vit A equiv	278 mg
Thiamine (B1)	0.133 mg
Riboflavin (B2)	0.546 mg
Niacin (B3)	1.26 mg
Pantothenic acid (B5)	0.072 mg

Vitamin B6	0.6 mg
Folate	123 mg
Vitamin C	37 mg
Trace metals	
Calcium	208 mg
Iron	4.76 mg
Magnesium	64 mg
Manganese	0.123 mg
Phosphorus	83 mg
Potassium	559 mg
Zinc	0.79 mg

Source: (USDA, 2011)

Method of preservation and consumption: Jew's mallow can be preserved by freezing (Nierenburg, 2011). There are a number of drying techniques that are traditionally used to prolong the shelf life of this vegetable, the most frequent method is sun-drying. The fresh or cooked leaves are formed into balls and dried on flat zinc, metal or flat rock surfaces that are exposed to the sun. The dried leaves are stored either in a huge clay pot or in a sack. They are kept in the pot with lid on, sealed with fresh cow dung. The pot is exposed to the sun to allow the dung to dry and then kept next to the fireplace. If kept in a sack, the sack is either hung by a string or kept on top of any object to prevent contact with the ground. The leaves can also be dried and pounded into a powder to be used in the dry season as a thickener in soup or as a tea (DAFF 2012). The Jew's mallow can be eaten raw or cooked. It is boiled and the resulting liquid is a thick, highly mucilaginous broth. It is often described as "slimy", like cooked okra, and is frequently turned into a kind of soup or stew together with lamb (Melamed, 2010).

Commercial potential: Jew's mallow is rich in essential nutrients, which makes it an important source of income. Besides its nutritional value, it can also be used as a source of fibre; its fibre is

strong and waterproof, making it perfect for the production of burlap sacks, furnishings and even clothing. At Middle Letaba Irrigation Scheme in South Africa, the crop is supplied to local markets and distant urban markets (Van Rensburg et al., 2007). Dried vegetables are also common in the market throughout Southern Africa (Shackleton, 2009).

2.2.2 Nightshade (Solanum retroflexum)

Description: Nightshade is a spreading, rounded, annual herb, bright green, pubescent with simple hairs, prickles absent. Leaves ovale to ovale-lanceolate, the lamina 4-8cm long, 2,5 cm wide, slightly discoloured, lobed, petiole to 4 cm long (Jain, Sharma, Gupta, Sarethy & Gabrani, 2011). This plant is considered a weed and is found in many wooded areas (Abukutsa, Agong, Mwai, Womdim & Ojiewo, 2013).

Geographical distribution: Nightshade is originally from South Africa. Sparingly naturalised on Eyre Peninsula North of York Peninsula, South Africa and Madagascar (Omami, Opala, Opile & Tuwei, 2013).

Climatic and soil requirement: Nightshade performs well in varying degrees of climatic conditions, but grows best within cool high moisture environments in both medium and high altitudes and tolerates shade (Nierenburg, 2011). Nightshade grows in different kinds of soil, including light (sand), medium (loamy), heavy (clay), dry, strong, shallow or deep soils, but nitrogen and phosphorus, which is rich in organic matter increases the leaf yield if watered at least once a week. It can be cultivated in tropical and subtropical agro-climatic regions by sowing the seeds during April and May (Jain et al., 2011).

Method of cultivation: According to Abukutsa et al., (2013), nightshade is an easily grown plant, although, it is not drought tolerant. Cultivation procedures like mulching with tall grass is done to help retain moisture and should be watered at least once a week.

Nutritional composition: Nightshade is an excellent source of protein, iron, vitamin A, iodine and zinc. The high nutritional value makes it especially important for poor people as a vital source of nutrients for people suffering from HIV/AIDS (Nierenburg, 2011). It is also used to treat various ailments such as pain, inflammation and fever. Oriental systems of medicine use the nightshade as an anti-tumorigenic, antioxidant, anti-inflammatory, hepato-protective, diuretic and antipyretic agent (Jain et al., 2011). According to Abukutsa et al. (2013), a diet incorporating African Nightshade is

recommended for pregnant and nursing mothers, as it is good for people with iron deficiencies and malaria patients. The nutritional value is shown in table 2.3 below.

Table 2.3: Nutritional value per 100g of fresh Nightshade

Water	87.2 g
Iron	10 mg
Protein	4.3 g
Carbohydrates	5.7 g
Fibre	1.4 g
Calcium	442 mg
Vitamin C	20 mg
b-carotene	366 mg
Phosphorus	75 mg
Riboflavin	0.59 mg

Source: (Abukutsa et al., 2013)

Method of preservation and consumption: After harvesting nightshade, the leaves can be sun-dried on banana leaves as a means of preservation (Nierenberg, 2011). The leaves are thoroughly boiled in salty water and used like spinach or any other vegetables. In South Africa, these leaves are combined with the fruit and eaten raw as a salad (Jain et al., 2011). Nightshade is also sometimes cooked mixed with other vegetables, after boiling, the water is thrown away to remove the strong bitter taste (Abukutsa et al., 2013).

Commercial potential: Nightshade has been domesticated from commercial and subsistence farming and its production commercialised, it is now being semi-cultivated and distributed through supermarkets. Nightshade produces low leaf yields compared to other high-value and high-yielding ILVs and is therefore considered uneconomical. However, it is in high demand in some areas because

of its healthy, nutritional and medicinal benefits, hence, it can still improve the income of households (Jain et al., 2011). Cameroon produces enough nightshade for export to neighbouring countries. Demand for the crop has recently risen significantly since East African supermarkets started supplying it (Maundu et al., 2013). In Tanzania, the crop is widely sold in the vegetable markets and, as a result, farmers in peri-urban areas have also increased production to keep up with local demand (Nierenburg, 2011). In South Africa, nightshade is being commercially produced in the Vhembe district, probably because it has better potential for development as a crop (Van Rensburg et al., 2007).

2.2.3 Spider plant *(Cleome Gynandra)*

Description: The Spider plant is an annual,
herbaceous wild flower native to Africa. It is an erect, mainly branched plant which generally varies between 0.5 and 1.5 m tall depending on the environment. Its sparse leaves are each made up of three to five oval-shaped leaflets. The flowers are white to rose pink. The seeds are brown, 1.5 mm diameter spheres (Van Rensburg et al., 2007).

Geographical distribution: The Spider plant is native to Africa and is widely distributed in tropical and subtropical regions throughout the world (Mishra, Moharana & Dash, 2011). In South Africa, cleome gynandra is found in agricultural land and near human settlements. It is less common in areas with highly humid climates and it is drought tolerant. It extends from Limpopo, North West, Gauteng, Mpumalanga, KwaZulu-Natal, Free State and Northern Cape to Namibia. Being semi-cultivated as, for instance, in the Kentani District of Eastern Cape, has probably extended its distribution (Mutshinyalo, 2011).

Climatic and soil requirement: The Spider plant grows well in full sun or semi-shade in disturbed areas and around pan edges. It grows best in summer and is sensitive to cold. It is produced well in areas with short periods of rainfall and tolerates drought, although it cannot withstand flooding (DAFF, 2010). It does not grow well in temperatures below 15 degrees Celsius, it adapts to many soil types and has a ph range of 5,5 to 7,0. Soil types range from sandy loam to clay soil. It does not tolerate heavy clay soils (Van Rensburg et al., 2007).

Method of cultivation: The seeds for cleome gynandra are wind dispersed. It grows from seeds which are dispersed and geminate during the rainy season and is mostly considered an agricultural weed. The seeds can be collected and distributed before or after tilling the soil and the plant does not

require any maintenance. Since it is not cultivated, it is tolerated or nurtured in crop fields and around homesteads (Kolberg, 2001). If not controlled it can take over and therefore people often remove excess plants and retain only what is sufficient (Mutshinyalo, 2011). If planted, cleome gynandra emerges after four to eight days. Thinning can be done at a very early stage because the young seedlings have a taproot with few lateral roots (Shackleton, 2009).

Nutritional composition: These leaves have a high nutritional value and possess anti-oxidative and anti-inflammatory properties. They are believed to lower blood pressure due to active phytochemicals and are used as anti-cancer medicine and anti-diabetic drugs (Mishra et al., 2011). The leaves are also given to mothers before and after delivery and in other situations where blood has been lost (Mutshinyalo, 2011). The nutrients found in the Spider plant are shown in table 2.4 below.

Table 2.4: Nutritional value per 100g edible portion of Spider plant

Water	86.6 g
Energy	142 kj
Protein	4.8 g
Fat	0.4 g
Carbohydrates	5.2 g
Fibre	1.2 g
Vitamin C	13 mg
Potassium	410 mg
Magnesium	86 mg
Sodium	33.6 mg
Phosphorus	13 mg
Iron	11 g
Zinc	0.76 mg

Calcium	213 mg
B-carotene	18.9 mg

Source: (FAO, 2009)

Method of preservation and consumption: Only the young leaves of the plant are harvested, dried in the shade and stored for use during winter months. Another way of preserving them is blanching the leaves, making them into balls and either sun-dried or air-dried. These balls can be stored up to a year and then soaked in water before being used for cooking (Mutshinyalo, 2011). The leaves are boiled in salty water and the water is then discarded. The leaves are eaten as a side dish or as spinach with porridge. They can be mixed with other vegetables in stews to reduce the bitter taste. Peanut butter can also be added to improve the taste (Kolberg, 2001).

Commercial potential: Spider plant is sold at Thohoyandou and Sibasa towns by street vendors. It is mainly sold during the rainy season. Some cross-border trade of dried produce takes place, for example from Zimbabwe to Botswana, making it important to the economy (Mishra, 2011). Cleome gynandra is also among the group of African leafy vegetables that have good potential for development as a crop (Van Rensburg et al., 2007).

2.2.4 Black jack *(Bidens Pilosa)*

Description: Black jack is usually identified by its three or five leaflets that are green, a green stem which sometimes has brown stripes, flowers with white petals, and fruits and seeds that are blackish and have what some people call “little teeth” as they stick to clothes and fur (Taleni and Goduka, 2013). It is an erect, slender, branching, annual herb growing up to 100 cm in height. Stems are erect, ramified, square, hairless, and up to 120 cm tall with spreading branches. The leaves are opposite and are divided into three to five leaves with toothed margins. The terminal and lateral leaflets are ovate to lanceolate shaped. The stalk of the leaf is slightly winged. Flowers are small, white and yellow in colour and are five to 15 mm in diameter. The fresh leaves and young shoots are the essential parts (Silva, 2011).

Geographical distribution: Black jack originated from South America and is common in all tropical and subtropical areas of the world. It is recorded as a weed in cultivated land and used as a vegetable or pot herb in many African countries such as Kenya, the Congo, Botswana, Zambia, Zimbabwe,

South Africa and Mozambique. The plant is distributed throughout tropical Africa. It is commonly widespread and an extremely troublesome weed found in most disturbed areas (DAFF, 2011).

Climatic and soil requirement: Black jack prefers hot weather conditions. It grows well in temperatures ranging from 25 to 38 degrees Celsius. Temperatures above 45 degrees are not favourable and they do not tolerate frost. It grows well in sunny or slightly shaded areas. It thrives with abundant rainfall but can withstand droughts (Taleni and Gouduka, 2013). Black jack grows in fertile soil in the wild, planting fields and gardens. It prefers light, medium and heavy soils, but thrives in loose soil high in organic matter. It thrives in deep well-drained soil (Silva, 2011).

Method of cultivation: Black jack is propagated by seed. Seeds are sown in early spring, in a greenhouse and must be covered. They must be picked out into individual pots. They grow fast and flowering starts six weeks after emergence and continues until two to three months. Each plant bears at least eighty flowers. The first harvest is four to six weeks after sowing when the plants are 15 to 30cm high, and a second harvest can be done after two weeks. Harvesting is done by hand picking, cutting or uprooting (DAFF, 2011).

Medicinal use: Black jack contains many essential nutrients and, because of this, it is a medicinal plant. It has traditionally been used for dietary anaemia, helping blood flow, prevention of malaria, alleviating toothache, improving eye health and in treatment of wounds, including those experienced by people suffering from HIV/AIDS (Silva, 2011). The leaves of this plant have been reported to possess antiseptic and anti-inflammatory properties and help in treating ailments such as arthritis, abdominal trouble, headache and diarrhoea (Taleni and Gouduka, 2013).

Nutritional composition: Black jack contains many essential nutrients including high levels of vitamin A, vitamin C, iron and protein (Silva, 2011). The nutrients in black jack are illustrated in table 2.5 below.

Table 2.5: Nutritional value per 100g of black jack

Water	85 g
Energy	180 kJ
Protein	3.8 g

Fat	0.5 g
Carbohydrates	8.4 g
Fibre	3.9 g
B carotene	1800 mg
Vitamin C	63 mg
Iron	15 mg
Zinc	19 mg

Source: (DAFF: 2011)

Method of preservation and consumption: Black jack leaves cannot be stored for more than one day because they spoil easily. However, they can be stored in a fridge or parboiled and then dried in the sun for later use. Sun-dried, powdered leaves are preserved to be used during dry seasons or winter. The young shoots and tender leaves have a high food value. Although the leaf has an astringent taste, they are used as a leaf vegetable, boiled or stir fried like spinach (DAFF, 2011).

Commercial potential: According to Taleni and Goduka (2013), the leaves are collected and sold at local markets during the rainy season when other fresh vegetables are scarce. Black jack leaves are important during times of food shortages. Volumes are traded even internationally and this makes black jack important vegetables for generating foreign currency.

2.2.5. Chinese cabbage (Brassica rapa spp, chinensis)

Description: Chinese cabbage is a non-heading type of cabbage. It is an annual, erect, leafy vegetable that can grow up to 15 to 30 cm tall (Van Rensburg et al., 2012). The leaves of this vegetable are arranged spirally in a rosette during vegetative stage. It has broad, thick tender leaves with heavy midribs. It can either be loosely or tightly headed (Rudrappa, 2014).

Geographical distribution: Chinese cabbage originates from China but has been distributed to other countries. The crop probably found its way from Asia into Africa as a result of trade between the two continents (DAFF, 2013). Chinese cabbage is mainly produced in the semi-arid, dry summer

subtropical, and summer rainfall climatic zones of the country. In South Africa, it is mainly produced in the Limpopo, North West, Mpumalanga, Gauteng, Eastern Cape and KwaZulu Natal provinces (Shackleton, 2009).

Climatic and soil requirement: Chinese cabbage prefers warm climates, but grows under many different environmental conditions. It thrives best during the cooler periods of the growing season. It prefers an average temperature of 18 to 22 degrees Celsius during early growth. It is a cool, seasonal crop and needs water throughout its growth period (Rudrappa, 2014). It grows successfully on a range of soil types ranging from sandy soils to the much heavier textured loams. The soils that are well drained, possess good structure, fertility and water holding capacity usually produce a satisfactory crop of Chinese cabbage (DAFF, 2013). It grows well where there is a good supply of organic matter and in soils which have pH values of between 5,5 and 7,6ç although the ideal pH value for growth is neutral (Van Rensburg et al., 2012).

Method of cultivation: Chinese cabbage is propagated from seed. The seeds are sowed in tilted soil 1 to 2 cm apart in a row or sprinkled into the furrow. When the seedlings are 15 cm tall they can be transplanted. Fertiliser can be used based on soil analysis. Poultry, pig or kraal manure can also be used. Irrigation depends on the type of soil. Harvesting is done by hand when the plant reaches the 8-leaf stage after 60 to 95 days, usually in mid-July and continues through November (Van Rensburg, 2007).

Nutritional composition: The sweet and crunchy leaves of Chinese cabbage hold many vital vitamins, minerals, anti-oxidants and plant compounds such as carotenes, thiocyanates, lutein, zea-xanthin and sulforaphane. In addition, it is an abundant source of soluble and insoluble dietary fibre. The nutrients found in Chinese cabbage are illustrated in table: 2.6.

Table 2.6: Nutritional value per 100g Chinese cabbage

Principle	**Nutrient value**	**Percentage of RDA**
Energy	16 kcal	1%
Carbohydrates	3.23 g	2.5%
Protein	1.2 g	2%

Total fat	0.2 g	1%
Dietary fibre	1.2 mg	3%
Vitamins		
Folate	79 mg	20%
Niacin	0.400 mg	2.5%
Vitamin A	318 mg	11%
Vitamin C	27 mg	45%
Vitamin K	42.9 mg	38%
Electrolytes		
Sodium	8 mg	0.5%
Potassium	238 mg	5%
Minerals		
Calcium	77 mg	8%
Iron	0.31mg	4%
Magnesium	13 mg	3%
Phosphorus	29 mg	4%

Source: (Rudrappa, 2014)

Preservation and consumption: The shelf life of fresh Chinese cabbage is short and it can be stored for up to a week in the fridge, if it is kept in a plastic bag and the temperature is less than 50 degrees Celsius (Van Rensburg et al., 2012). The leaves can be cooked, dried and kept in a plastic container. Chinese cabbage is stir-fried or added to soup, curry or casserole. It can also be sliced in half and steamed while smaller plants can be cooked whole and served as a side dish (Rudrappa, 2014).

Commercial potential: Chinese cabbage is easy to grow and requires minimum input, thus making it a source of income generation. It is normally sold at local markets, particularly by street vendors and retail shops (Van Rensburg et al., 2012).

2.2.6 Common Purslane *(Portulaca oleracea)*

Description: Common Purslane is a fleshy, succulent herb, mainly seen creeping on the ground at roadsides and also in cultivated land (Shackleton, 2009). It has smooth, reddish, mostly prostrate stems and alternate leaves clustered at stem joints and ends. The yellow flowers have five regular parts and are up to 6mm wide. The leaves are egg shaped to oblong, hairless, succulent, stalkless and are opposite to one another along the stem (Mahr, 2011).

Geographical distribution: Common purslane is native to North America, Southern Africa, the Middle East and the Indian sub-continent. It has an extensive old world distribution, extending from North America through the Middle East and the Indian Subcontinent to Malaysia and Australia. It is eaten throughout much of Europe, the Middle East, Asia and Mexico (Yan, Sun, Zhou, Chen, Zhang, Dai & Tan, 2012).

Climatic and soil requirement: Common purslane grows rapidly in spring and summer. It thrives under dry conditions (Mahr, 2011). It prefers loose, nutrient rich, sandy soil and grows just about anywhere from fertile garden soil to the poorest arid soils. It germinates in high soil temperatures and its succulent characteristics make it very drought tolerant (Shackleton, 2009).

Method of cultivation: Common purslane reproduces by seed and sometimes by stem fragment. It is easily grown from seed and ready for harvest in six to eight weeks if sown in fertile, well-drained soil and thinned 4 to 6 cm apart (Yan et al., 2012). The entire plant can be harvested, or the stems can be cut back to within 2 inches of the crown and the plant will regrow, providing edible leaves for most of the summer. If common purslane is grown as a food crop, it must be watered regularly, as moisture-stressed leaves are not as palatable as those from well-watered plants (Mahr, 2011).

Nutritional composition: This wonderful, green, leafy vegetable is very low in calories and fats; nonetheless, it is rich in dietary fiber, vitamins and minerals. It is an excellent source of vitamin A, one of the highest among green leafy vegetables, and vitamin A is a known, powerful, natural

antioxidant and an essential vitamin for vision (Rudrappa, 2014). The nutrients found in common purslane are shown in table 2.7.

Table 2.7: Nutritional value per 100g of common purslane

Energy	16 kj
Carbohydrates	3.4 g
Fat	0.1 g
Protein	1.30 g
Vitamins	
Vitamin A	1320 iu
Thiamine (B1)	0.047 mg
Riboflavin (B2)	0.112 mg
Niacin (B3)	0.48 mg
Vitamin B6	0.073 mg
Folate (B9)	12 mg
Vitamin C	21 mg
Vitamin E	12.2 mg
Trace metals	
Calcium	65 mg
Iron	1.99 mg
Magnesium	68 mg
Manganese	0.303 mg
Phosphorus	44 mg

Potassium	494 mg
Zinc	0.17 mg
Water	92.86 g

Source: (USDA, 2011)

Method of preservation and consumption: Common purslane can be preserved for later use by pickling them for long-term storage. Method: rinse the purslane in cold water to remove dirt, cut the leaves with a sharp knife and fill a canning jar, add three sliced garlic cloves and 10 whole peppercorns then fill the jar with apple cider vinegar. Screw the lid tightly and place in the refrigerator and allow pickling (Mahr, 2011). The leaves can also be sun dried (Guarrera and Savo, 2013). These vegetables are normally eaten fresh, as a salad or on sandwiches, stir-fried, cooked as spinach or pureed. Because of its mucilaginous quality, common purslane is also suitable for soups and stews (Van Rensburg et al., 2007).

Commercial potential: Common purslane is also sold in stores or at farmers' markets (Mahr, 2011). Because of its long production season, it has great potential for income generation.

2.2.7 Amaranth *(Amaranthus)*

Description: Amaranth is a small to medium-sized bushy plant with a distinct taproot, diamond-shaped leaves and feather-like seed heads (Goebel et al., 2010). It is annual, growing to 3 to 6 feet; is frost tender, coarse, hairy, has stout stems, and its leaves are usually dull green with long stalks, prominent veins, oval to lance shaped. It is often notched when young (Rhoades, 2014). It is a composition genus of annual or short-lived perennial plants and like cymes of densely packed flowers, grows in summer or autumn (USDA, 2011).

Geographical distribution: Amaranth originated in Spain/Mexico. It is mainly cultivated and consumed in Asia and warm, temperate regions. Amaranth is also found in South Africa around gardens, stop signs, vacant lots and will not grow in the shade (Gregory, 2013).

Climatic and soil requirement: This plant uses the carbon fixation pathway which makes them adapted to high light intensities, temperatures and drier conditions (Kolberg, 2011). It grows well in

warm climates in spring and summer. It is more tolerant of drought than most other leafy vegetables (USDA, 2011). It tolerates a wider range of soil and grows well in average to rich, well-drained soil with equal amounts of nitrogen and phosphorus (Rhoades, 2014).

Method of cultivation: Amaranth is usually grown as an annual for grain. The seeds readily disperse in gardens or can be sprinkled on the ground and raked. Unlike other leafy vegetables, the plant is drought resistant, which is the reason why farmers to grow it (Gregory, 2013). Cuttings can also be used to produce new plants and can be grown in large pots or garden beds with a well-drained loam and compost mix (Goebel et al., 2010).

Nutritional composition: The cooked leaves are a good source of vitamin A, vitamin C and folate. They are also a complement source of other vitamins such as thiamine, niacin, riboflavin plus some dietary minerals including calcium, iron, potassium, zinc, copper and manganese (Rhoades, 2014). The nutrients are illustrated in Table 2.8 below.

Table 2.8: Nutritional value per 100g amaranth

Energy	1.554 kj
Carbohydrates	65.25 g
Starch	57.27 g
Sugars	1.69 g
Dietary fiber	6.7 g
Fat	7.02 g
Protein	13.56 g
Vitamins	
Thiamine B1	0.116 mg
Riboflavin B2	0.2 mg
Niacin B3	0.923 mg

Pantothenic acid B5	1.457 mg
Vitamin B6	0.591mg
Folate	82 mg
Vitamin C	4.2 mg
Vitamin E	1.19 mg
Trace metals	
Calcium	1.59 mg
Iron	7.61 mg
Magnesium	2.48 mg
Manganese	3.333 mg
Phosphorus	557 mg
Potassium	508 mg
Zinc	2.87 mg

Source: (USDA, 2011)

Medicinal use: The leaves are also effective in stopping diarrhoea and excessive menstruation. They are natural astringent and make a great wash for skin problems like eczema, and are a wonderful acne remedy (Chandra, 2013).

Method of preservation and consumption: Just like any other leafy vegetable, amaranth leaves are highly perishable and must be wrapped in a damp paper towel and refrigerated or dried in the sun. The leaves are firm and can also be stored frozen. The tender young leaves are eaten raw in salads or mixed with rice. The leaves are best prepared lightly steamed, older leaves require longer steaming or they can be added to moist dishes like curries or stews (Gregory, 2013; Goebel et al., 2010). The leaves are also used as a stir-fry vegetable, in soups or cooked like spinach (Rhoades, 2014).

Commercial potential: Amaranth is commercially cultivated and sold as a grain of leaves for income generation. It is found fresh and cheap at South African markets (Rhoades, 2014).

2.2.8 Cowpea Leaves *(Vigna unguiculata)*

Description: Cowpea is an annual herb with varying growth forms. It may be erect, trailing, climbing or bushy. It has a strong taproot and many spreading, lateral roots. The first pair of leaves is basic and opposite while the rest are arranged in an alternate pattern and are trifoliate. Leaves are dark green in colour and exhibit considerable variation in size and shape (Kimiywe et al., 2007).

Geographical distribution: Cowpea is native to Africa. It is indicated that cowpea was introduced from Southern Africa to the Indian subcontinents. It has reached Europe and possibly North Africa from Asia. Speculations are that the Northern part of the Republic of South Africa (former Transvaal region) was the centre of speciation of Vigna unguiculata (Nabulo, Young & Black, 2010). The species moved northwards from the Transvaal to Mozambique and Tanzania. It is now grown throughout the tropics and sub tropics and has become a part of the diet of about 110 million people (Darkwa & Darkwa, 2013).

Climatic and soil requirement: Cowpea is susceptible to cold and frost, but is tolerant of heat and dry weather conditions. The optimum temperature for growth and development is around 30 degrees Celsius and it can grow under minimum rainfall, unlike many other crops (DAFF, 2011). Cowpea grows on a variety of soils from sands to heavy, –well-drained soils and heavy-textured, strongly alkaline soils. It prefers sandy soils that tend to be less restrictive on root growth. The plant utilises soil moisture efficiently (Nabulo et al., 2010).

Method of cultivation: Cowpea is grown directly from seed. The land is prepared and both inter-row and intra-row spacing is done depending on the type of variety and growing pattern. For optimum yield, cowpeas should be planted late November to early December in lower rainfall areas of South Africa. The reason includes escape from periods of high pest load, or to plant cowpea at such a time that harvesting of the crop would coincide with the period of dry weather. The leaves are picked four weeks after planting and this continues until the plant start to flower (DAFF, 2011).

Nutritional composition: Cowpea leaves have the highest percentage calories from protein among vegetarian foods (USDA, 2011). The nutrients in cowpea leaves are illustrated in the table 2.9.

Table 2.9: Nutritional value of cowpea leaves

Total Fat	0.9g
Saturated fat	0.024g
Polyunsaturated fat	0.038g
Monounsaturated fat	0.008g
Sodium	3mg
Potassium	164mg
Carbohydrates	1.74g
Protein	1.48g
Vitamin A	5%
Vitamin C	22%
Calcium	2%
Iron	4%

Source: (Kimiywe et al., 2007)

Method of preservation and consumption: The leaves are sun-dried to store for the dry season. Usually, they are steamed or boiled first before drying. Sun-drying requires 1-3 days. The dried, cooked cowpea leaves can be stored for up to a year because they are not damaged by insects as is the case with the seeds. Excessive losses of Beta-carotene, vitamin C and amino acid often occur in sun-dried leaves; however this can be reduced by drying in the shade and minimal cooking (Nabulo et al., 2010).

Commercial potential: Cowpea is sold at a high price. It is a source of income for people who make and sell snack foods from the seeds (legume), which are also very good sources of protein. Cowpea is consumed by millions of people in Africa and this makes it the most economically important,

indigenous leafy vegetable. Large rural families depend on its production for income and animal feed because it is highly appreciated (Aju and Popoola, 2013).

2.2.9 Sweet potato leaves *(Ipomea batatas)*

Description: Sweet potato is a dicotyledonous plant that belongs to the family convolvulaceae. It is a herbaceous perennial vine, bearing alternate heart-shaped or palmate lobed leaves and medium-sized sympetalous flowers. The edible root is long and tapered with a smooth skin whose colour ranges between yellow, orange, red, brown, purple and beige with flesh ranging from beige through white and pale yellow (Haider, 2012).

Geographical distribution: Sweet potato originated from Central America. It is most popular among both Caribbean and Asian shoppers especially in the US. Currently, sweet potato is cultivated in more than 100 countries, mostly throughout tropical and sub-tropical Asia. In South Africa, the major production areas are Limpopo (Hoedspruit, Marble Hall, Burgersfort, Levubu), Mpumalanga (Nelspruit), KwaZulu Natal ad Western Cape Provinces (DAFF, 2012).

Climatic and soil requirement: The plant does not tolerate frost and grows best in summer. It grows best at an average temperature of 24 degrees Celsius, abundant sunshine and warm nights. Annual rainfalls of 750-1000mm are considered most suitable, with a minimum of 500mm in the growing season. It is sensitive to drought at the tuber initiation stage 50-60 days after planting and it is not tolerant to water logging (Haider, 2012).

Method of cultivation: This plant is relatively easy to plant because it is sown by vine cuttings rather than seeds. These plants are also propagated from sprouts. Because the rapidly growing vines shade out weeds, little weeding is needed. In the tropics, the crop can be maintained in the ground and harvested as needed for market or home consumption. The cuttings of about 30 - 40 cm long are left under a moist cloth in the shade for a couple of days to promote nodal rooting before planting in the field. The recommended plant spacing is 350 cuttings in a 100m row (DAFF, 2012).

Nutritional composition: Sweet potato leaves are low in saturated fats. It is a good source of protein, calcium and iron and a very good source of dietary fibre, vitamin A, vitamin C, thiamin,

riboflavin, magnesium and potassium (USDA, 2011). Table 2.10 illustrates the nutrients found in sweet potato leaves.

Table 2.10: Nutritional value of sweet potato leaves

Energy	175 kj
Carbohydrates	8.82 g
Dietary fibre	5.3 g
Fat	0.5 g
Protein	2.49 g
Vitamins	
Vitamin A	189 mg (24%)
Beta-carotene	2217 mg (21%)
Lutein	14720 mg (21%)
Thiamine (B1)	0.156 (14%)
Riboflavin (B2)	0.345 mg (29%)
Niacin (B3)	1.13 mg (8%)
Panthothenic acid (B5)	0.225 mg (5%)
Vitamin B6	0.19 mg (15%)
Vitamin C	11 mg (13%)
Vitamin K	302.2 mg (288%)
Trace metals	
Calcium	78 mg (8%)
Iron	0.97 mg (7%)

Magnesium	70 mg (20%)
Phosphorus	81 mg (12%)
Potassium	508 mg (11%)

Source: (FAO, 2010)

Method of preservation and consumption: Sweet potato leaves are blanched and sun-dried to preserve them for use in times when vegetables are scarce. They can also be covered in a plastic bag and frozen fresh. These leaves can be eaten as a salad or green vegetable, like spinach, by steaming, boiling or stir-frying them. Sweet potato leaves are boiled for a short time in a small amount of water or can be fried in a covered pot and added to soups making an excellent food for babies, pregnant women and breast feeding mothers (Cook, 2011).

Commercial potential: Sweet potatoes are a staple food for human consumption and the yield is very high, thus making them a very good source of income generation (Haider, 2012).

2.2.10 Common lambsquarter *(Chenopodium album)*

Description: It is a fast growing, weedy, annual plant in the genus chenopodium. It grows upright at first, reaching heights of 10 to 150 cm, but typically becomes recumbent after flowering. The leaves are alternate and can be varied in appearance. The first leaves, near the base of the plant are toothed and roughly diamond shaped 3 to 7 cm long and 3 to 6 cm broad. The leaves on the upper part of the flowering stems are entire and lanceolate-rhomboid, 1 to 5 cm long and 0.4 to 2cm broad, they are waxy coated, unwettable and mealy in appearance with a whitish coat on the underside. The small flowers are radially symmetrical and grow in small cymes on a dense, branched inflorescence 10 to 40cm long (FAO 2010).

Geographical distribution: Common lambsquarters originated from Southern Africa, North America. It is extensively cultivated and consumed in Northern India. It is widely introduced elsewhere in Africa, Australia and Oceanica and now occurs almost everywhere in soils rich in nitrogen, especially in wasteland (Nierenburg and Ahearn., 2013).

Climatic and soil requirement: It rapidly grows in summer. It adapts to almost any environmental condition and thrives in all types of soil at many pH levels. Lambsquarter attains its greatest size on

fertile, heavy soils but can also survive on coal-pit heaps. It is one of the last weeds to be killed by frost. If ploughed under when plants are young, lambsquarter makes a good fertiliser. It grows in all inhabited areas of the world except in extreme desert climates (Neirenburg, 2013).

Method of cultivation: Lambsquarter is reproduced by seed and a single plant produces asmay as 100 000 seeds. Because it has no special seed dispersal mechanisms, most seeds are deposited near the mother plant and, consequently, the plant grows in patches (Guarrera and Savo, 2013).

Nutritional composition: Common lambsquarters are very rich in vitamin A. They contain excellent levels vitamin C, which is very useful in treating scurvy (USDA, 2011). The nutrients in common lambsquarter are illustrated in table 2.11.

Table 2.11: Nutritional value of common lambsquarter

Energy	180 kj
Carbohydrates	7.3 g
Dietary fibre	4 g
Fat	0.8 g
Protein	4.2 g
Vitamins	
Vitamin A equiv	580 mg (73%)
Thiamine (B1)	0.16 mg (14%)
Riboflavin (B2)	0.44 mg (37%)
Niacin (B3)	1.2 mg (8%)
Pantothenic acid (B5)	0.092 mg (2%)
Vitamin B6	0.274 (21%)
Vitamin C	80 mg (96%)
Trace metals	

Calcium	309 mg (31%)
Iron	1.2 mg (9%)
Magnesium	34 mg (10%)
Manganese	0.782 mg (37%)
Phosphorus	72 mg (10%)
Potassium	452 mg (10%)
Sodium	43 mg (3%)
Zinc	0.44 mg (5%)

Source: (USDA, 2011)

Method of preservation and consumption: The leaves and young shoots may be eaten fresh, steamed, boiled or fried as a leafy vegetable. Sun drying is one way of preserving this vegetable for the winter seasons. It can also be blanched and frozen (Lanini & Wertz, 2014).

2.3 THE ROLE OF INDIGENOUS LEAFY VEGETABLES IN INCOME GENERATION

The most striking and obvious contribution of ILVs to the rural communities is the nutrition and the income generated, particularly to women who engage either in their collection or sales. For some of these women, income from the sale of ILVs accounts for a significant proportion of their cash income, while for others it represents their only income source. Thus, ILVs may play a very important nutritional and economic role in the south-eastern parts of the country (Aju et al., 2013).

According to a study conducted in the Kiambu district (Kenya), ILVs are important contributors to household income. They have increasingly become commercially important over the past 15 years, whereby they have progressively featured in both formal and informal markets in Nairobi and neighbouring areas (Mwaura et al., 2013). The sale of ILVs provides an important source of employment for those outside the formal sector in peri-urban areas, because of their generally short, labour intensive production systems, low levels of investment and high yield (Kwenin, Wolli & Dzomeku, 2011). The marketing of ILVs, although associated with low capital outlays, has high potential for profit. This affirms the assertion by Schippers (2000) that ILVs offer a significant

opportunity for the poorest people to earn a living as producers and or traders without requiring large capital investments (Aju et al., 2013 ; Oulai, Lessoy, Megnanou, Doue & Niamke, 2014).

2.4 REASONS FOR UNDERUTILISATION AND PERCEPTION OF ILVS

Consumption of ILVs is associated with a certain level of income and safety concerns (Van Rensburg, 2007). Although consumers of these vegetables are at different income levels, the majority are at low income levels. High-income earners associate the consumption of ILVs with poverty. The middle and average income earners, especially in urban centres, consume little of these vegetables for fear of risking their health (Muhanji et al., 2011). It is believed that most of indigenous vegetables grow with untreated sewerage along open sewer lines or near sewerage treatment plants (Muhanji et al., 2011).

Unfamiliarity with ILVs and the declining availability of ILVs are more reasons for the underutilisation of these edible plants (PSPPD, 2011). Most people in urban areas have little to no knowledge of ILVs, while some know of them, but have a negative attitude towards their consumption because they consider them as not trendy and unfashionable compared to fast foods like French fries. Most people do not consume ILVs due to lack of reliable information regarding their nutritive value and limited availability (Muhanji et al., 2011). Loss of indigenous knowledge results in reduced consumption of ILVs, which contributes to the lack of diet diversity. Factors contributing to the loss of indigenous knowledge include: the introduction of new vegetables, politics, change in lifestyle, the stigma associated with the use of ILVs and habitat loss (Dweba and Mearns, 2011).

The decline in consumption of ILVs is due to modernisation as the youth prefer the fatty tastes associated with many snacks and fast foods. They claim that these vegetables taste bad since they are not familiar with the taste. These vegetables are associated with poverty, the past and low self-esteem, particularly in the eyes of the youth and urbanised communities. Labelling ILVs as weeds, the preserve of older people, or old-fashioned contributes to underutilisation of ILVs (Taleni et al., 2012).

ILVs are called poor people's food or money savers because people who eat them are poor and have no food (Faber et al., 2010). The decline in utilisation may also be associated with the lack of knowledge of how to access quantities and employ practices that can satisfy daily nutrient requirements (Taleni et al., 2012).

2.5 PERCEPTIONS AND UTILISATION OF INDIGENOUS VEGETABLES

ILVs, both domesticated and wild, are among the most widely consumed traditional food in Southern Africa. They are seasonally consumed during the first and last quarter of the year (Faber et al., 2010). These vegetables are used in soups, stews, porridges and relishes which accompany carbohydrate staples. According to a study by Aju et al, (2013) done in the Imo state of Nigeria, 22 species of ILVs are consumed in the rural communities of the state, with each household consuming on the average five different species of vegetables twice weekly. It is obvious that ILVs are highly utilised in other countries and contribute immensely in meeting dietary needs of people.

In the North West province of South Africa, ILVs are utilised mainly because: they are perceived to be having a good taste, are easily available, are cheap, are sold in nearby informal markets and vendors, and possess health and nutrition benefits (PSPPD, 2011). Farmers perceive ILVs to be nutritious, easily available at little cost, taking less time to cook, bridging food gaps during dry periods and offering income to women without men's interference (Muhanji et al., 2011).

It is documented that ILVs are not only used as a source of food, but also as a medicinal source (Ezebilo, 2010). They constitute a pool of health-promoting and medicinal compounds and, because of this, they are often consumed raw (Guarrera and Savo, 2013). They are believed to have antibacterial properties and contain antioxidants that help to promote good health by assisting in the prevention of cancer and hypertension. Their role is not only dietary, but also therapeutic as they may help to stimulate the immune system and generate tissue (Dweba and Mearns, 2011).

It is reported that the roots, leaves and twigs, as well as the bark of a large number of ILVs, are used in traditional medicine. Several of these ILVs continue to be used for prophylactic and therapeutic purposes by rural communities (Kwenin et al., 2011). People suffering from diseases like high blood pressure, HIV/AIDS, cancer and hypertension have been advised to consume ILVs for their medicinal value (Muhanji et al., 2011). For instance, the Spider plant has been, and still is, reported to relieve constipation and help during childbirth while Nightshade is said to cure stomach-ache (Wambua, 2012).

Women are custodians of indigenous knowledge on the use, management, processing, preparation and sale of ILVs and usually gather them from the wild (Adebooye and Adedayo, 2008). There are many techniques used to harvest ILVs. The harvesting of leaves is done sequentially at different times during the growing period to enable the plant to grow. In some cases, the vegetables are

harvested by uprooting the whole plant or by cutting off the top part (Seeiso and Materecha, 2014). Proper handling, preparation and storage are done in order to take full advantage of their nutrients (Ramos et al., 2013).

Preservation methods like sun-drying of fresh or cooked leaves, freeze-drying and steam-blanching, followed by dehydration, have been reported as the most used and most effective preservation methods in retaining nutrients (Uusiku et al., 2010). Sun-drying is the cheapest and most accessible means of food preservation, especially in rural places where electricity is either not available or expensive (Djuiko et al., 2011). This helps to ensure food availability during the dry season (Dweba and Mearns, 2011).

ILVs can be consumed raw or cooked. In Tropical Africa, ILVs are traditionally cooked and eaten as a relish together with a starchy staple food (Oulai et al., 2014). The most common method used to prepare these vegetables is boiling the leaves in large quantities of water. Once cooked, excess water is drained and discarded (Dweba and Mearns, 2011). Indigenous vegetables can be prepared as a single plant species or a combination of different species in order to add flavour, taste, colour and aesthetic appeal to meals (Oulai et al., 2014). Salt is added to enhance the taste, and oil, groundnuts, coconut, milk, bicarbonate of soda, tomato and onion are also added, depending on availability and preference (Uusiku et al., 2010).

According to Faber et al. (2010) the leaves of ILVs are never fried, but are boiled, then tomatoes, salt and sometimes onion are added and boiling water is retained. Certain types of these vegetables, e.g. Spider plant, have a bitter taste and as a result, they are boiled with plenty of water. Water is discarded two to three times to get rid of the bitterness (Dweba and Mearns, 2011). Some people rinse and drain to improve the taste, but others think this causes nutrient loss, e.g. water-soluble vitamins such as vitamin B complex and vitamin C (Van Der Hoeven et al., 2013).

A study by Taleni et al, (2012) in Bushbuckridge, north of South Africa, found that the bitter taste of nightshade and cleome are highly appreciated, particularly by males, whereas, in the southern parts of the country, the sweet taste of Amaranth leaves is preferred. Similarly, many people in the north enjoy the mucilaginous texture of corchorus and okra, whereas, people in the South dislike sliminess.

However, in South Africa the utilisation pattern is highly variable and depends on factors such as poverty, status, degree of urbanisation, distance to fresh produce markets and season of the year (Uusiku et al., 2010).

2.6 PREVIOUS STUDIES ON ATTITUDE OF CONSUMERS TOWARDS ILVS

Previous studies on the attitude of consumers towards the utilisation of ILVs reveal that the younger generation considers these crops to be of low status and dislikes the way they are cooked. According to Lyatuu et al. (2009), to the youth ILVs are just bitter vegetables that are not even that hygienic because of little stones detected when eating. A study by Mahlangu (2014), in the Capricorn district in the Limpopo province of South Africa, found that consumers of ILVs were very shy about these crops even though their value for these vegetables was noticeable. Furthermore, the most common barriers to eating ILVs, as cited by many, is the cost, time to prepare them and knowledge of quick and easy preparation methods of these vegetables (Leone, Beth, Scott, Macguire, Nelson, Robert, Tate & Ammerman, 2012). According to Mavengahama et al. (2013:5), people are not willing to formally adopt these vegetables as cultivated crops may be influenced by perceptions, cultural beliefs, values and social stigmas attached to them.

However, a study by Thandeka, Sithole, Thamaga-Chitja and Makanda (2011) in KwaZulu-Natal shows that even though ILVs were reported to be declining due to changes in customs and land use, there was a general positive attitude towards ILVs. The frequency of ILVs consumption was positively and significantly correlated with the age and education level of the household, which could be attributed to high knowledge accumulated with age and access to information by the educated.

2.7 PROMOTING THE USE OF ILVS

According to Darkwa and Darkwa (2013), the consumption of ILVs is key to improving the health of many. Since many of these vegetables are rich in sources of carotenoids, they should be promoted by nutritionists and public health workers worldwide in order to overcome vitamin A deficiencies and age related macular degeneration (Djuikwo et al., 2011).

To help promote the use of many ILVs, which are under-exploited and underutilised, it is important to develop new, tasty recipes using ILVs that would be accepted by consumers as this could help promote their consumption (Darkwa and Darkwa, 2013). It would be important to make sure that the vegetables used in the preparation of these recipes are hygienic and safe to eat. The addition of ILVs to other products like pastries, drinks, sauces and salads could increase their usage and enhance

consumer acceptability (Taleni and Goduka, 2013). Having a wide variety of products to choose from could attract people to eat more of these vegetables and obtain all the health benefits associated with consuming them (Darkwa and Darkwa, 2013).

Farmers can form groups that focus on the production of these valuable vegetables. Together, they can bear the production and transportation costs, market together, as well as sell directly to retailers at higher prices (Wambua, 2012). There is also a need to discuss the future of the uncultivated, but edible plant species that have served as basis of livelihood for the poor people over several years. It is important to discuss how ILVs will not become extinct, as they are valuable sources of food and possible sources of germplasm for crop improvement. Farmers need to be educated on the importance of these crops and the danger of sending them into extinction in the wake of climate change (Adebooye and Adedayo, 2008).

Another way of promoting fresh produce of ILVs is through conducting sensory evaluation studies (Babalola and Akinwande, 2014). Research on the acceptability of food is needed to determine the impact of taste and preference on dietary intake patterns of consumers, which can be used to improve general acceptance of ILVs (Van der Hoeven, 2013).

Since most ILVs are abundant during the first and last quarter of the year, it is important to promote them together with consumption of locally produced or commercially available spinach (a cool weather crop) to ensure a year round consumption of dark-green, leafy vegetables to ensure sustainable delivery of nutrients, and the aspect of affordability should therefore be avoided and used carefully during promotion to avoid the perception that ILVs are food for the poor. The emphasis should be on the potential nutritional and health benefits the consumption of these vegetables could offer (Faber et al., 2010).

2.8 IMPROVING URBAN ACCESS TO ILVS

There is a need to promote production and consumption of ILVs for food dietary diversity, and to minimise the stigma by including them in the food-based dietary guidelines (FBDG) and in the Life Sciences Curriculum in schools. Vegetable gardening, especially in urban areas with sustainable water supply, can improve accessibility of ILVs. This will bring more attention to the various advantages of consuming these vegetables (PSPPD, 2011).

It is important to strengthen people's abilities to cultivate food for themselves, especially ILVs, as opposed to merely depending on government support systems such as social grants. In this way, people in urban areas will maintain healthy balanced diets. In addition, the water budgets of ILVs remain positive with lower than average water use since they have the advantage of being primarily rain fed (Khuzwayo, 2014).

Heavy rainfall occurs during the rainy summer season, since most houses have zinc roofs, gutters can be fixed to house roofs, channelling water to plastic tank reservoirs for watering vegetables when water is scarce. This can be included in the RDP responsible for, among others, housing and clean water to promote home vegetable gardening (PSPPD, 2011). The transfer of indigenous knowledge associated with ILVs to the younger generation also holds the key to improving the potential future use of indigenous vegetables, because it will ensure that the availability and utilisation of indigenous vegetables will be maintained as an important food source both in rural and urban areas (Dweba and Mearns, 2011).

2.9 ECONOMIC ANALYSIS OF THE PRODUCTION OF ILVS

Several researchers have reported that, while ILV production has been shown to be important in so many ways, like income generation, there seem to be constraints in their production. Farmers lack financial resources, technical knowledge and adequate technical support to invest in their farming activities and this hinders growth (Mahlangu, 2014; Nya et al., 2010). A study by Mpala, Dlamini and Sibanda (2013) in the rural Hwange district, found that there is no support from government and other organisations in the training of farmers who grow indigenous vegetables.

However, the marketing of ILVs is very limited, most farmers produce for their own consumption with little produce reaching the informal market (Lyatuu et al., 2009). The quantity of ILVs available for marketing is higher during the rainy season than in the dry season. This makes the selling prices higher in the dry season than in the rainy season. This limited supply during the dry season because most of the ILV farmers only rely on rains for production (Ayanwale et al., 2014).

Marketers also reported spoilage and transportation as major problems because markets are located in non-motor able and far off communities (Ayanwale et al., 2014). According to Mpala et al. (2013), improving the condition of roads could potentially reduce transportation costs for ILV farmers who stand to gain better income from selling these vegetables**.**

CHAPTER THREE

AIMS AND OBJECTIVES

3.1 AIM

The aim of this research is to examine the contribution of ILVs to food consumption and the income of rural households in Greater Tubatse Local Municipality Limpopo, South Africa.

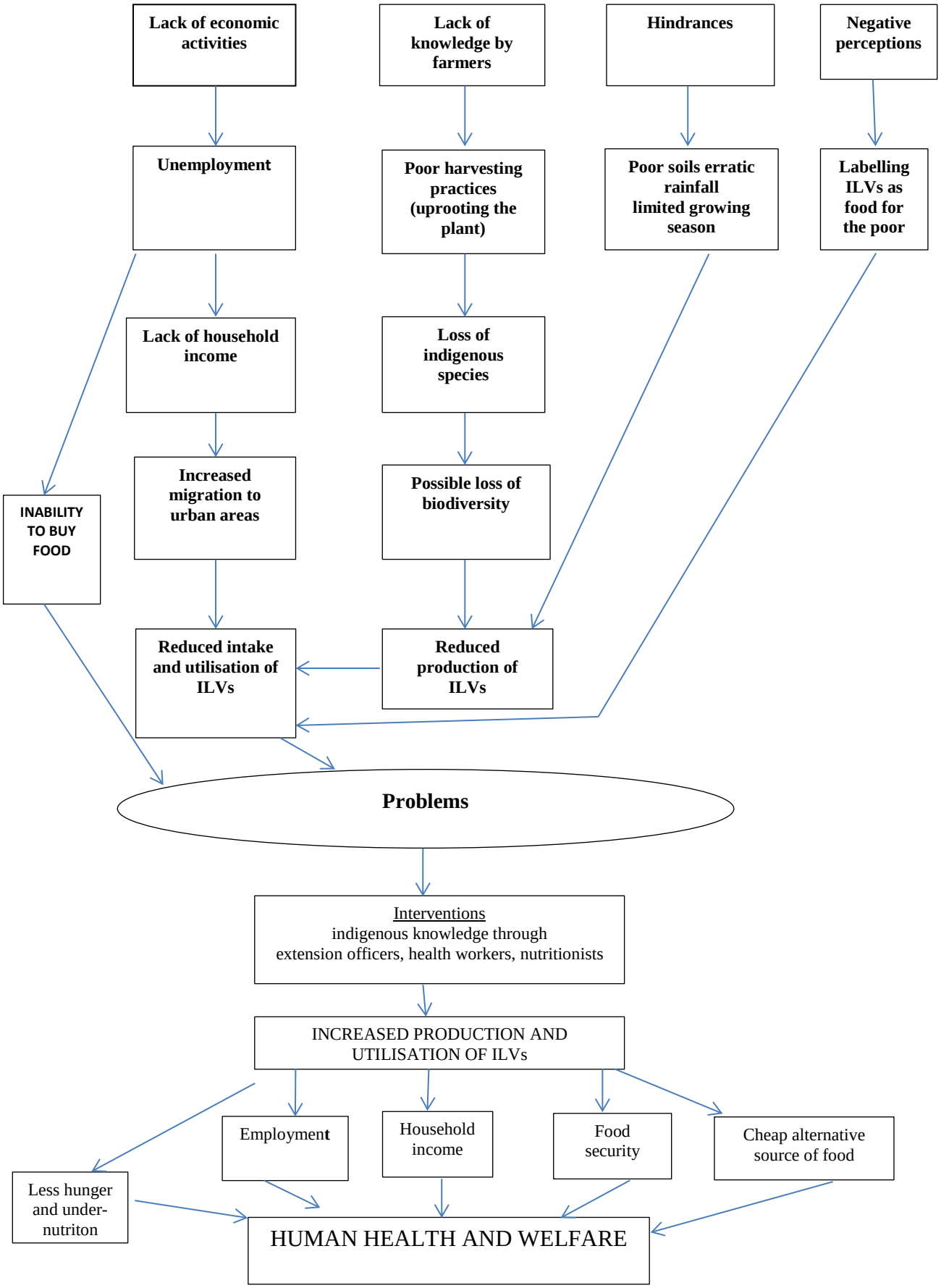
3.2 OBJECTIVES

- To investigate attitude towards the utilisation of ILVs by households in rural communities in the Greater Tubatse Local Municipality, Limpopo, South Africa.
- To determine the contribution of ILVs to the income of rural households in Greater Tubatse Local municipality, Limpopo, South Africa

3.3. CONCEPTUAL FRAME WORK

The conceptual framework presents the major relationships and interests in this study by showing the interactions between human health and welfare and the economic and nutritional benefits, resulting from increased production and utilisation of ILVs. It links the major reasons for poor intake and utilisation of indigenous vegetables, for instance lack of knowledge, and the problems resulting from this, such as poverty, food insecurity and malnutrition. The benefits resulting from increased production and utilisation of ILVs are illustrated in figure 3.1 below.

Figure 3.1: Framework showing benefits resulting from increased production and utilization of ILVs



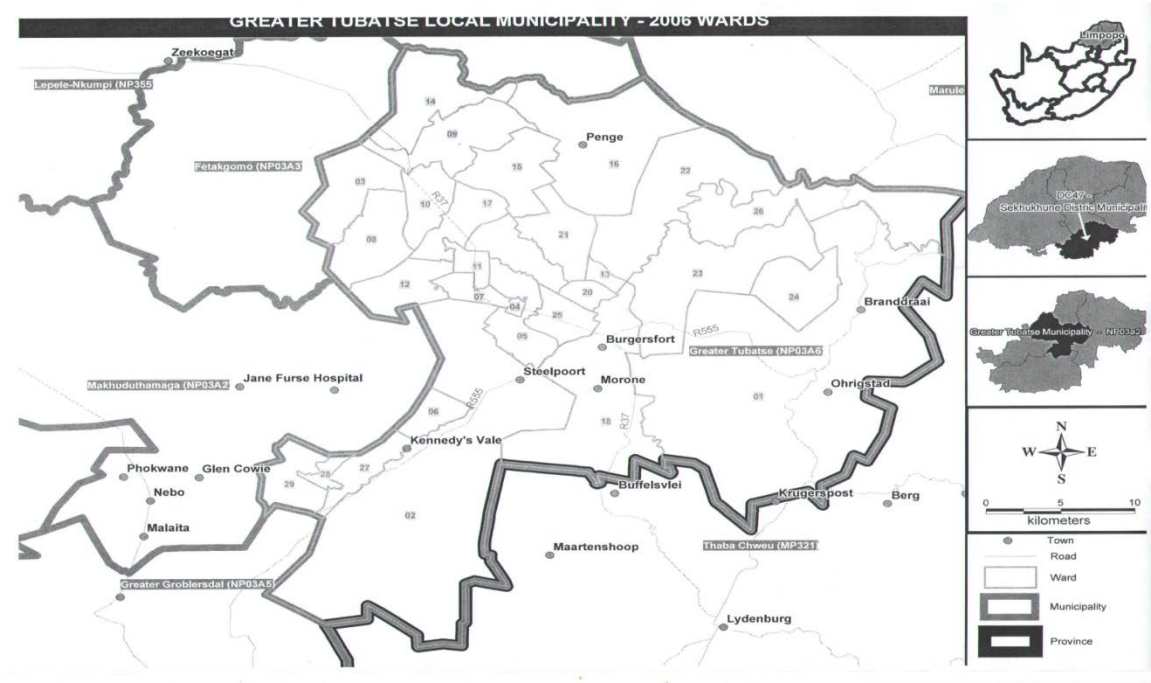
CHAPTER FOUR

RESEARCH METHODOLOGY OVERVIEW

4.1 STUDY AREA

The Greater Tubatse Municipality lies in the Sekhukhune district in the Limpopo Province, the northern most part of South Africa. It covers an area of approximately 4 550 square kilometres, most of which is rural. The Greater Tubatse Municipality consists of 166 settlements, most of which are villages and the economy is driven largely by agriculture, mining and tourism activities (GTM, 2014). The population size of Greater Tubatse municipality is at **335 676 (**STATSSA, 2014). The Greater Tubatse map is shown in figure 4.1.

Figure 4.1: Greater Tubatse Map



4.2 RESEARCH DESIGN

This research was in the form of a cross-sectional survey design in which questionnaires were used to collect data from respondents. A cross-sectional survey collects data to make inferences about a population of interest (universe) at one point in time. Cross-sectional surveys have been described as snapshots of the populations about which they gather data.

4.3 RESEARCH INSTRUMENTS

The questionnaire instrument consisted of six sections: Section 1: data collection on the socio-biographics of respondents; section 2: data collection on the attitudes towards the utilisation and consumption of ILVs; section 3: data collection on the contribution of ILVs to the total vegetable intake; section 4: data collection on the contribution of indigenous vegetables to economic activities; section 5: key informant data collection, and section 6: focus group data collection.

4.4 SAMPLING AND DATA COLLECTION

The sampling method was a mixture of cluster and purposeful sampling. The population of Greater Tubatse Municipality (66 611 households) was divided into five clusters (North, East, West, South and Centre), based on geographical distribution. A total of 1 000 respondents above 18 years (both male and female), who consume or commercialise indigenous vegetables were selected to be interviewed on a voluntary basis. Two hundred respondents from each cluster were selected randomly from a list of households in that cluster.

Data collection was done through interviews, which were conducted by the primary researcher in the Sepedi (Northern Sotho) language from October to March. Respondents could read and speak English were assisted by the primary researcher to complete the questionnaire.

4.5 DATA ANALYSIS

The responses of respondents were captured using numbers attributed to the different response scales. Statistical analysis such as mean, standard deviation, correlation, regression and significance testing, charts were carried out using the SPSS software.

4.6 ESTABLISHMENT OF VALIDITY AND RELIABILITY OF THE INSTRUMENT

The reliability of the questionnaire and observation instruments was tested in a pilot study with 40 randomly selected respondents (eight from each cluster). Interviews with the same instrument were conducted for each respondent. The necessary adjustments were made to ensure reliability of the instrument. The instruments were evaluated under face and content validity by a panel of experts with experience in food security.

4.7 ETHICAL CONSIDERATIONS

Ethical clearance for this research was approved by the College of Agriculture and Environmental Sciences (CAES) Ethical Committee, UNISA. Approval was also sought from the management of the

Greater Tubatse Local Municipality to conduct research in the area. The respondents were advised on the nature of the study being conducted and given a choice of either participation or non-participation. The participants signed a consent form describing the nature of the research. In addition, participants were given the right to withdraw from the study at any time, should the wish to. The participants' privacy was protected during the study and confidentiality was ensured. The findings of this research were reported in a complete and honest manner, without misrepresentation or compromising the outcome of the study.

4.8 LIMITATION OF THE RESEARCH

Accessibility to some areas for the research proved to be very difficult due to poor roads. Obtaining permission from households to interview them was also a challenge, with some refusing to reveal information. The questionnaires were prepared in English and most of the respondents were illiterate. In most cases, it was necessary to translate the questions into the Sepedi language in order to complete the questionnaires. This detracted from the participants' interest. As such, the viewpoints of all those households who could not be interviewed are lacking.

CHAPTER FIVE

RESEARCH RESULTS

5.1 SOCIO-BIOGRAPHIC DETAILS OF RESPONDENTS

The socio-demographic data indicated that the number of female respondents (57%) who participated in the study was slightly above the number of male respondents (42.7%). The ages of most of the respondents (48.4%) ranged from 25 to 45 years. Regarding race, 97% of all respondents were black while the coloured, white and Indian/Asian races constituted only 3%. Only almost 33.9% of respondents were officially married (civil or customary marriage), while up to 46.4% were single, divorced or separated. Only about 10.4% of respondents were cohabiting with a partner and only almost 9.3% were widowed (table 1).

Table 5.1: Biographical information of respondents (n=854)

Variables		Frequency (%)
Gender	Female	487 (57.0)
	Male	365 (42.7)
	Missing system	2 (0.3)
Age	Under 25	198 (23.1)
	25-35	208 (24.4)
	36-45	205 (24)
	46-55	128 (15)
	56-65+	83 (9.7)
	66-75	32(3.7)
Race	Black	824 (96.6)
	Coloured	11 (1.3)

	White	10 (1.2)
	Indian/Asian	8 (0.9)
Marital status	Married – civil	169 (19.8)
	Married – customary	121 (14.1)
	Unmarried – cohabiting with a partner	89 (10.4)
	Divorced/Single	338 (39.6)
	Widowed	79 (9.3)
	Separated	58 (6.8)
Level of education	No formal education (Illiterate)	131 (15.3)
	Primary education (Grade 9)	113 (13.2)
	Secondary education (Grade 12)	399 (46.7)
	Tertiary education	211 (24.7)
Average monthly income	No salary	99 (11.6)
	Below R1 000	168 (19.7)
	R1 000 – R2 999	275 (32.2)
	R3 000 – R4 999	93 (10.9)
	R5 000 – R6 999	65 (7.6)
	R7 000 – R8 999	43(5)
	R9 000 – R15 000	59(6.9)
	Above R15 000	52(6.1)
Employment status	Pensioner	92 (10.8)

	Formal employment	233 (27.3)
	Self-employment	112 (13.1)
	Casual labour	123 (14.4)
	Farming	34 (4%)
	Unemployed/other social grants	260 (30.4)

Up to 96.5% of respondents had attended at least primary education, compared to only 15.3% of respondents that had no formal education and could not read or write. Up to 63% of respondents received an average monthly salary of less than R5 000.00. Up to 30% of respondents were unemployed and depended on social grants for income, while only 27% of the respondents were formally employed. The rest of the respondents were pensioners (10.8%), self-employed (13.1%), involved in casual labour (14.3%) or farming (4%) as shown in table 5.1.

5.2 RESIDENTIAL AND HOUSEHOLD INFORMATION OF RESPONDENTS

Regarding the residential and household details of respondents, up to 72.8% of the households of respondents were located in rural settlements, compared to about 24.5% that were located in urban areas and only about 2.7% in informal settlements. Up to 58% of respondents' households had more than three members per household, while 24% of households had two members per household. Furthermore, up to 79% of respondents' households had either one or two adults, 50% of which had two members per household. Of these households, 67.8% were headed by adult males, compared to 32.2% headed by adult females (table 5.2).

Table 5.2: Residential and household details of respondents (n=854)

Variables		**Frequency (%)**
Residential category	Urban (City/Township)	209 (24.5)
	Rural settlement	622 (72.8)
	Informal settlement	23 (2.7)
Number of persons in	1 (Live alone)	155 (18.1)

households	2	205 (24)
	3	100 (11.7)
	4	122 (14.3)
	5	94 (11)
	6	69(8.1)
	Above 6	109(12.8)
Number of adults in households	1 (Live alone)	244(28.6)
	2	430(50.4)
	3	82(9.6)
	4	42(4.9)
	5	17(2)
	6	29(3.4)
	Above 6	10(1.2)
The head of households	Father	471(55.2)
	Mother	220(25.8)
	Grand father	33(3.9)
	Grand mother	37(4.3)
	Uncle	17(2.0)
	Aunt	18(2.1)
	Others	57(6.7)

5.3 CONSUMPTION OF ILVS

Up to 92% of respondents indicated that they consumed ILVs and the reasons given were that they were cheap (35%), healthy and nutritious (29%), easily available (22%) and tasteful (8%). For the minority or respondents who did not consume ILVs, the reason given by most of them was that they disliked ILVs (table 5.3).

As for the frequency of consumption in the past year, only 20.8% indicated that they had never consumed ILVs, compared to 24% who also never consumed contemporary vegetables. The number of respondents who consumed ILVs once or twice per week (37%) was equal to those who consumed contemporary leafy vegetables once or twice per week, which was also 37%. A total of 24% of respondents consumed indigenous vegetables three to four times per week, which is more or less the same as the 23.6% of those who consumed contemporary leafy vegetables. Only 9% consumed indigenous vegetables five to six times per week, compared to 6.5% who consumed contemporary leafy vegetables five to six times per week (table 5.3). The ANOVA of the consumption of ILV across different demographic factors indicated that only race and residential area affected the consumption of ILVs (table 5.4).

Table 5.3: Consumption of ILVs and reasons for or for not consuming ILVs (n=854)

A: RESEARCH QUESTION: Do you eat indigenous leafy vegetables (ILV) (morogo)?	
Response	Frequency (%)
Yes	789 (92.4)
No	64 (7.5)
Missing system	1 (0.1)
B: RESEARCH QUESTION: If no, why?	
Reasons	Frequency (%)
I dislike ILVs	35(4.1)
Not accessible	9 (1.1)

I don't know how to cook	9 (1.1)
Total	64 (7.5)
C: RESEARCH QUESTION: If yes, why?	
Reasons	Frequency (%)
I like the taste	32 (8)
They are cheap	140 (34.8)
They are nutritious and healthy	115 (28.6)
Easily available	90 (22.4)
Total	789(92.4)
D: RESEARCH QUESTION: How often did you consume ILV in the past year?	
Response	Frequency (%)
Never	179 (20.8)
1-2 times per week	321 (37.3)
3-4 times per week	210 (24.4)
5-6 times per week	77 (9)
Missing system	73 (8.4)
E: RESEARCH QUESTION: How often did you consume contemporary leafy vegetable in the past year?	
Response	Frequency (%)
Never	206 (24)
1-2 times per week	319 (37.1)
3-4 times per week	203 (23.6)

5-6 times per week	56 (6.5)
Missing system	76 (8.9)

Table 5.4: ANOVA of the consumption of the ILVs (ILVs) (n=402)

Descriptions	**ANOVA between groups (p-value)**							
Research questions	Gender	Age	Race	Employ-ment	Monthly income	Residential area	Household head	Household size
Do you eat (ILVs) (morogo)?	0.086	0.139	0.012¥	0.094	0.004¥	0.001¥	0.051	0. 001¥
If no, why?	0.871	0.497	0.421	0.478	0.176	0.469	0.035	0.789

¥ = Significance at $p \leq 0.05$

Of the 10 most consumed ILVs, those consumed by more than 50% of the respondents were as follows: jute (*Corchorus spp*) was consumed almost 73% of the respondents, followed by leroto (*Cleome gynandra*) with 69%, mphodi (*Cucurbita maxima*) (64%) and thepe (*Amaranthus thunbergii*) (63%). In contrast, the least consumed ILV was motangtang (*Momordica balsamina*) consumed by only 15% of the respondent. This was followed by mothagaraga (*Bidens Pilosa*) (18%), lehlanya (*Common lamb'squarters*) (24%) and motshatsha (*Citrillus lanatus*) (28%) (figure5.1). The staple foods with which ILVs are eaten the most was pap as indicated by up to 88% of the respondents. This was followed by potatoes and rice, with only 2.3% and 1.3% of the respondents, respectively (figure 5.2).

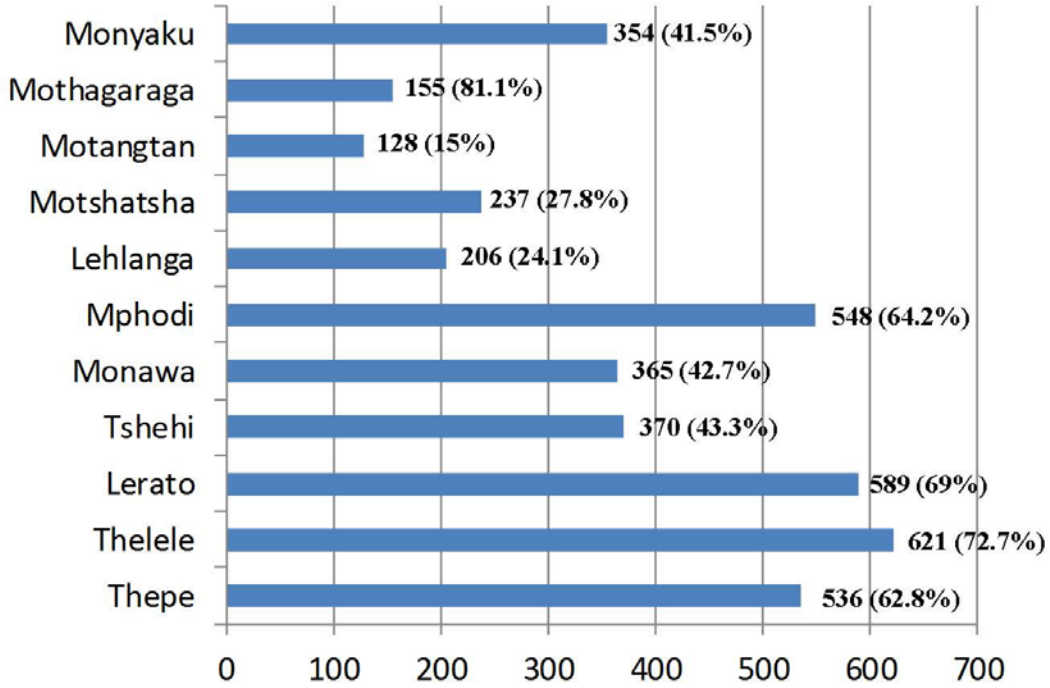


Figure 5.1: The top 10 most preferred and consumed ILVs

Monyaku (*Cucumis africanus*), Mothagaraga (*Bidens Pilosa*), Motangtang (*Momordica balsamina*), Motshatsha (*Citrillus lanatus*), Lehlanya (*Common lamb'squarters*), Mpodi (*Cucurbita maxima*), Monawa (*Vigna unguilata*),Tshehlo (*Tribulus cistoides*), Leroto (*Cleome gynandra*), Thelele (*Corchorus spp*), Thepe (*Amaranthus thunbergii*).

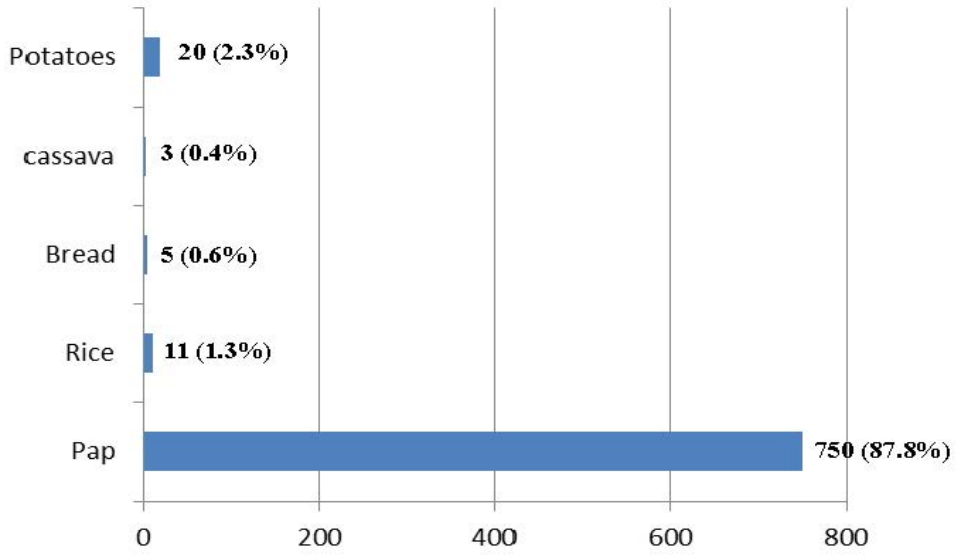


Figure 5.2: The food with which ILVs are eaten with most

5.4 CULTIVATION AND TRADING OF ILVS

Almost 71% of respondents indicated that they had known ILVs from childhood, while 20% indicated they had known them for more than five years. Up to 66% of respondents did not cultivate ILV and the reason given was that there was no need to cultivate ILVs because they grew in the wild. Out of those who cultivated them, 81% indicated that they sold them to passers-by at roadsides, 42% at local markets, 3% in townships and very few, 0.5% sell them to shops (table 5.5).

The ANOVA of the consumption of ILVs across different demographic factors showed that only employment and the sex of household head significantly affect the consumption of ILVs. The partial

cross-tabulation analysis within a group indicated that the unemployed consumed ILVs the most (58.4%), followed by those practising subsistence farming (52.9%), pensioner (36.4) and lastly self-employed (35.3%) (table 5.6).

Table 5.5: Knowledge on the existence and cultivation of the most preferred and consumed ILVs

A: RESEARCH QUESTION: How long have you known your most preferred and consumed indigenous leafy vegetables (ILVs)?	
Response	Frequency (%)
Less than a year	5 (0.6)
From 1 to 5 years	8 (0.9)
Above 5 years	173 (20.3)
From childhood	604(70.7)
I can't remember	64(7.5)
B: RESEARCH QUESTION: Do you cultivate ILVs?	
Response	Frequency (%)
Yes	291(34.1)
No	563 (65.9)
C:RESEARCH QUESTION: If no, reason for not cultivating ILVs	
Reasons	Frequency (%)
No need, it grows in the wild	404 (47.3)
Lack of seeds	40 (4.7)

I never thought of cultivating ILV	12 (1.9)
ILV are difficult to cultivate	6 (0.7)
I cannot say exactly why?	64(7.5)
Total	563(65.9)
B: RESEARCH QUESTION: If yes, do you sell part of your ILV harvest?	
Response	Frequency (%)
Yes	236(80.5)
No	57(19.5)
Total	293(100)
C: RESEARCH QUESTION: If yes, where do you often sell your ILV harvest?	
Response	Frequency (%)
Road side passer-by	162(18.8)
Local market	36(4.2)
Shop keepers	4(0.5)
In the township	23(2.7)

Table 5.6: ANOVA of the cultivation of indigenous leafy vegetable (ILV) (n=402)

Descriptions	**ANOVA between groups (p-value)**							
Research question	Gender	Age	Marital status	Employ-ment	Monthly income	Residential area	Household head	Household size
Do you eat (ILV) (morogo)?	0.095	0.001¥	0.160	0.000¥	0.001¥	0.175	0.023¥	0.000¥

If no, why?	0.764	0.811	0.414	0.002¥	0.002¥	0.005	0.569	0.106

¥ = Significance at p≤0.05

5.5 ACCESS TO ILVS BY HOUSEHOLD

A total of 42% of respondents indicated they get ILVs by harvesting, while another 41 buy and harvest ILV, while 10% only got ILV by buying. With regard to who buys ILV, they often buy it from roadside vendors (39%), Neighbouring households (9%), informal market and, lastly, supermarket (3%). On the other hand, for those who collect ILVs, the place where they often collect is own garden (28%), followed by open uncultivated land in the wild (26%), fields in the wild (13%), roadside in the wild (9%) and, lastly, wetlands in the wild (8%) (table 5.7).

Table 5.7: Means of acquiring ILVs for household consumption (n=854)

A: RESEARCH QUESTION: How do you often obtain ILV for household consumption?	
Response	Frequency (%)
Buy	87 (10.2)
I harvest them	353 (41.3)
I buy and harvest	350 (41)
Other means	64(7.5)
B: RESEARCH QUESTION: If you buy, where do you often buy ILVs?	
Response	Frequency (%)
Supermarket	23(2.7)
Informal market	33 (3.9)
Roadside vendors	330(38.6)
Neighbouring households	73(8.5)
C: RESEARCH QUESTION: If you collect, where do you often collect ILVs?	

Reasons	Frequency (%)
Own garden	242 (28.3)
Open uncultivated land in the wild	217 (25.4)
Wetlands in the wild	66 (7.7)
Fields in the wild	107 (12.5)
Roadside in the wild	74(8.7)

5.6 METHODS OF PROCESSING AND PRESERVING ILVs

The majority of the respondents (up to 87%) reported that they process and preserve ILVs for future use. Drying is the most common method used for preservation. Out of this percentage, 46.6% used the uncooked sundry method while 40% used the cooked sundry method. Only up to 37% of respondents used the fridge for preserving ILVs (table 5.8).

Table 5.8: Means of processing and preserving ILVs for future use by households (n=854)

A: RESEARCH QUESTION: Do you often process and preserve ILVs for future use?	
Response	Frequency (%)
Yes	789 (86.5)
No	115 (13.5)
B: RESEARCH QUESTION: If yes, which methods do you often used to process and preserve ILVs?	
Response	Frequency (%)
Cooked-sun dry	342(40)
Uncooked sun dry	398 (46.6)
Use the fridge	330(38.6)

C: RESEARCH QUESTION: If you collect, where do you often collect ILVs?	
Reasons	Frequency (%)
Own garden	242 (28.3)
Open uncultivated land in the wild	217 (25.4)
Wetlands in the wild	66 (7.7)
Fields in the wild	107 (12.5)
Roadside in the wild	74(8.7)

CHAPTER SIX

DISCUSSION

6.1 SOCIO-BIOGRAPHY DETAILS

The reason why the number of female respondents was slightly higher than that of male respondents could be that the natural population dynamics in the GTM whereby there are more women than men (STATSA (2015:1). Furthermore, women in rural communities are often responsible for ensuring that households had access to food, hence, were more likely to be the household respondent (Van der Hoeven et al., 2013:6). The fact that most of the respondents were between 25 and 45 years old means that the majority of the respondents were in their active working age and are able to work in the fields. The working age population in South Africa is 31.8 million people, which is made up of citizens between the ages of 15 and 64 years who are able and willing to work (Mayer, 2011:10; Daniels, Partridge, Kekana & Musundwana, 2013:10-11). The fact that most of the respondents were black is not surprising considering that blacks constitute 97.8% of the GTM population, compared to 1.6% of white people and 0.7% of other races (STASSA, 2015:1).

Most of the respondents were not married; that is, they were single or divorced. One reason why most respondents were not officially married could be that, traditionally, people have to pay lobola (bride price) to the family of the woman before they become officially married. Underprivileged men may not have the required amount of money to pay lobola and other expenses associated with traditional marriage (Heeren, Kemmott, Tyler, Tshabe & Ngwane, 2011:74). Households with single parents are more likely to have a relatively lower income, compared to those in which parents are married or living with their partners (Sawhill, 2014:1). This further suggests that many households can potentially benefit considerably from the utilisation and cultivation of ILVs (Taleni, 2013:129).

The majority of respondents had an average monthly income of lower than R5 000.00. Black African households were found to have an average annual income of R60 613 (Daniels et al., 2013:17). The lack of higher education qualification and skill of individuals in rural communities resulted in unemployment and low income (Baiyegunhi and Oppong, 2015:6). Unfortunately, poor households with low income are likely to find it difficult to purchase exotic vegetables. Given the extremely low levels of household income in rural areas, most households do not have sufficient income to purchase food, let alone expensive agricultural inputs (Aliber and Hart, 2009:448). ILVs that are cheaper

remain the only alternative for those families that cannot afford expensive, exotic vegetables (Oladele, 2011:2).

This makes the households in GTM vulnerable to food insecurity. ILVs could provide a cheap alternative source of food and alleviate food insecurity (Dweba, 2011:567; Mavengahama, 2013:2; Bvenura and Afolayan, 2015:5).

6.2 RESIDENTIAL AND HOUSEHOLD INFORMATION

The vast majority of respondents lived in rural settlements and people living in rural communities are more likely to utilise ILVs, considering they can access these vegetables for free in the wild (Taleni et al., 2013:128; Mavengahama, 2013).

Up to half of the households had at least three members and at least two adults per household. A family's ability to feed itself depends on factors such as family size, availability of land and accessible water. The larger the family size the lesser the food availability to each person within the household and poor nutritional status (Olayemi, 2012: 137).

The fact that the majority of households were headed by the father of the house is a positive indication considering that male-headed households are unlikely to be resource constrained such as lacking access to productive assets (land, labour, capital), hence, the potential to cultivate ILVs (Baiyegunhi and Oppong, 2015:1393). There is a popular belief that males are more dominant in agricultural activities, compared to females who are considered to be weak (Oladele, 2011:2). Results from previous studies done in the Limpopo Province indicate that more men and fewer women accessed larger fields (Aliber and Hart, 2009:447).

6.3 CONSUMPTION OF ILVS

The fact that the vast majority of respondents often consume ILVs is an indication of the important role ILVs have played and continue to play in the food chain of many rural communities in South Africa (Van Rensburg, 2007:324). These ILVs that are freely available to households in rural communities are often perceived by the well-off as food for the poor (Kruger et al. 2015:1118; Faber, 2010:37-38). Even though exotic vegetables varieties have contributed to the decline in the consumption of ILVs, ILVs remains the vegetable of choice during periods of hunger and shortage of disposable income (Smith & Eyzaguire 2007:5). ILVs ensure food security and dietary diversity in

many rural households in GTM, considering that they are a good source of macro and micronutrients (Oulai, 2014:218).

The ANOVA indicated that race, monthly income, residential area and household size affected the consumption of ILVs. This is not surprising, considering that most of the residents in rural communities and townships are black, with usually large household sizes and ILVs are indigenous to many rural communities in Africa. Under apartheid, black people were forced to live in townships that were built as far away as possible from economic city centres (Alam, 2014:1). The reality is that unemployment among blacks is high, compared to unemployment among whites (Writer, 2015:1; Stats SA: 2012). Literature is full of evidence that large households are associated with poverty. The absence of well-developed social security systems and low savings, especially in African countries, tends to increase fertility rates, particularly among the poor, in order for parents to have some economic support from children when parents reach old age (Anyanwu, 2013:10)

Rural households are affected by numerous factors, many of them unique to the country and stemming from the legacy of the country's apartheid history, which featured policies that excluded the black majority of South Africans from the nation's productive assets (Daniels et al., 2013:4). ILVs grow under harsh climatic and resource-poor conditions encountered in many rural areas where these problems occur, hence, their consumption by many rural villagers is widespread (Beletse, 2014:1).

Thelele (*Corchorus spp*), leroto (*Cleome gynandra*), mpodi(*Cucurbita maxima*), and thepe (*Amaranthus thunberg*) were the most consumed ILVs. These ILVs are among the seven most consumed and renowned ILVs in South Africa (Taleni, 2012:5). They are important sources of macro- and micronutrients that are important for the maintenance of good health and prevention of diseases (Maroyi,2013:6). Jute was mostly consumed because people in the GTM highly enjoy the mucilaginous texture and taste of this vegetable. It takes a short time to cook and it is easy to cook, Jute also provides a glutinous constituency with stew and soup and facilitating swallowing of food such as pap (Taleni, 2012:5).

In addition to its taste, Leroto was mostly consumed because it is perceived to be medicinal. It helps to control blood pressure, toothaches, common colds and stomach aches and fever (Kruger et al., 2011). Mpodi was also mostly consumed because it is commonly grown in home gardens. The seeds are easily available from the fruit of the plant. People like the soft, fast-cooking leaves of this

vegetable. On the other hand, Thepe was mostly consumed because it is readily available, tastes good and sometimes used on special occasions (Taleni, 2012:5). These crops are suitable for cultivation in rural communities because of their ability to adapt to adverse environments such as drought, low manure and pest resistant (Nagarani et al., 2014:5469; Chivenge, Mabhaudhi, Modi & Mafongoya, 2015:5698; Onyango et al., 2013:2183).

6.4 CULTIVATION OF ILVS

The fact that the vast majority of respondents have known ILVs from childhood supports the view that indigenous knowledge of these vegetables has been passed on from generation to generation (Van der Hoeven, 2013:9) through observations and narrations, survival tools that were important in the conservation and management of the natural agricultural ecosystems (Chevenge, 2015:5690). The transfer of indigenous knowledge to younger generations holds the key to the potential future use of ILVs in many rural communities (Dweba & Mearns, 2011:565). The recording of indigenous knowledge transferred across generations in the past has been problematic due to little or no documentation. In cases where some documentation exists, there is sometimes a lack of consistency due to the use of many different dialects in different communities that offer descriptions of similar products in different names (Aura, 2013:249).

The majority of respondents did not cultivate ILV crops and the most cited reason for this is that there is no need to cultivate them since they grow naturally in uncultivated land, roadside and in the wild. This confirms assertions by various authors that, traditionally, ILVs grow in the wild and communities often retreat in the bush and emerge with a bunch (Aworh, 2015:1; Van Jaarsveld, 2014:77-78; Darkwa, 2013:1; Mavengahama, 2013:58). The fact that most ILVs grow readily in the wild on an annual basis without being cultivated makes it difficult for people in rural areas to take interest in cultivating these vegetables (Bvenura & Afolayan, 2015:14). Individuals who did not cultivate or purchase ILVs can only access them by harvesting in the field and nearby commercial farms (Karmakar and Rahman, 2013:199).

Another challenge that can hamper the cultivation of these crops is the lack of access to irrigation water, limited infrastructure and technical knowledge for irrigation development (Chivenge et al., 2015:5688). Furthermore the cultivation of ILVs can also be hampered by the lack of commercial indigenous vegetable seed producers (Berinyuy & Fontem, 2011:4647) and climate changes that have caused loss of the productivity of some cultivated land (Kahane, Hodgkin, Jaenicke, Hoogendoorn, Hermann, Keating, Hughes, Padulosi & Looney, 2013:671). Less cultivation of ILVs can have a

negative impact on the future availability of and accessibility to these vegetables, thereby aggravating food insecurity in GTM. Furthermore, the uprooting and cutting of the entire ILV plants during harvesting in the wild by some individuals in some rural communities can cause an erosion of some of these crops (Seeiso & Materecha, 2014).

The fact some respondents get ILVs only by buying it from local suppliers implies there are some forms of a supply chain of these vegetables in both formal and informal retail outlets (Mwaura et al., 2013:2). ILVs with available seeds such as the drought resistant Vigna Unguigulata (monawa) can be cultivated successfully on a large scale (Chivenge, 2015:5697) and integrated into the food chain systems (Kahane et al., 2013:671). Jute, leroto, mpodi and thepe have been found to be among the most common ILVs that are often available in both formal and informal retail outlets in South Africa (Taleni, 2012:5) and roadside vendors have been found to be the main supplier of indigenous vegetables (Kruger et al., 2015:1118).

The vast majority of those who cultivated indigenous leafy vegetables were able to sell them to clients at roadsides, local markets and even to shop owners. Hence, the commercialisation of ILVs can provide employment and income-generation opportunities in rural communities (Kwenin et al., 2011:1300). In general, fewer financial inputs are required for the cultivation of ILVs and the risk of financial losses are little with exotic vegetables; hence, more profitability (Muhanji et al., 2011:199). Furthermore, ILVs can be sold in urban areas at prices much higher than their introduced counterparts, particularly during the dry season (Adebooye and Opabode, 2004:701).

Income generation from the cultivation and commercialisation of ILVs has been realised in many areas in Soshanguve and Durban, South Africa (Faber et al., 2010:37) and in Nairobi, Kenya (Maundu, 2013:4). ILVs offer a significant opportunity for the poorest people living in rural communities to cultivate and trade without requiring large capital investments (Aju et al., 2013:667; Oulai et al., 2014:213; Adebooye and Opabode, 2004:701).

6.5 METHODS OF PROCESSING AND PRESERVING ILVS

The facts that the vast majority of respondents processed and preserved ILVs is due to the fact that these vegetables are available seasonally and are prone to deterioration after harvesting due to their high moisture content (Oulai et al., 2014:217). People in rural communities need to ensure that there is availability of food in their households throughout the year by using drying which is a traditional

method of food preservation (Dweba and Mearns 2011:569). Furthermore, preservation ensures that there is less wastage of food during the harvest season (Atogo, 2013:1).

Preservation of ILVs does not only reduce post-harvest losses, but also ensures constant supply of food, thereby preventing hunger and diseases (Elimu, 2013:2).

Most of the respondents dry uncooked or cooked ILVs as this is a cheap and convenient way of preserving ILVs in bulk soon after the harvest (Dweba & Mearns, 2011:3569; Uusiku, 2010:500). Some researchers suggest that all vegetables should be blanched in steam before drying, to deactivate the action of enzymes and also to prevent the loss of some nutrients (Van der Hoeven et al., 2013:9) Steam-blanching, followed by dehydration as indicated by some respondents in GTM, has been reported as the most effective preservation methods in retaining ascorbic acid. Freeze-drying also retains most ascorbic acid in comparison with shade, sun and vacuum drying of ILVs (Uusiku et al., 2010:503).

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

The study examines attitudes towards the cultivation and utilisation of ILVs in the Greater Tubatse Local Municipality. Findings from the study show that the majority of people who consume indigenous vegetables or generate an income from the sales of indigenous vegetables is black, most of whom are not formally employed and earn an average monthly income less than R5 000.00. The vast majority of households are located in rural settlements with the majority of them having more than three members per household. Most of the people in the Greater Tubatse Local Municipality consume ILVs mainly because they are cheap, healthy and nutritious, and easily available. Jute (*Corchorus spp*), leroto (Cleome gynandra), mpodi (Cucurbita maxima) and thepe (Amaranthus thunbergii) are the most consumed ILVs in the Greater Tubatse Local Municipality. They are consumed as relish to accompany the main carbohydrate staple foods, like maize porridge. Most of the people do not cultivate ILVs because they are harvested in the wild and are available for free. However, the few who cultivate ILVs sell them and generate income from them. Furthermore, ILVs used during periods of hunger and low harvest are mostly preserved by drying. However, based on the findings of this study, the cultivation of ILVs has a great potential to ensure the availability of the vegetables, improve food security, boost income generation at a low or no expense and alleviate poverty in rural communities. Furthermore, production of ILVs can effectively contribute to employment opportunities of disadvantaged people who cannot get formal employment in the Greater Tubatse Local Municipality.

7.2 RECOMMENDATIONS

Further research on a variety of areas is needed, economic potential of ILVs, production of ILV seeds and their nutritional value. The study noted that most people who consume ILVs are not formally employed, earn lower income, live in rural areas and most of them consume ILVs not out of choice, but because they do not have alternatives. It is necessary to prioritise education and proper communication strategies targeted to the general public by food policy makers in order to increase awareness on the importance of ILVs to nutrition and health, production and income opportunity. To boost the utilisation of the most consumed ILVs in GTM, recipes can also be developed and marketed in popular eating places and introduced in school feeding programmes and government

institutions like hospitals and prisons.

The research revealed that very few people cultivate the ILVs and the vegetables are harvested continuously without harvesting has affected diversity of these important vegetables. There is need for more government and non-government (NGOs) involvement in developing seeds. Cultivation of these vegetables should be encouraged with access to seeds and training on cultivation and harvesting of ILVs to ensure future availability and accessibility of these vegetables.

The study noted that very few people sell ILVs to generate income. There should be some kind of motivation (offering financial support by the government) for people in rural areas to cultivate these vegetables and sell them. For example, there can be a special community day where farmers are given the opportunity to display a variety of ILV cultivation and culinary expertise. Considering that ILVs can be sold at high prices during dry seasons, especially with the view that little monetary input is required for their production, there is need for farmers to be educated on the proper ways of preserving these vegetables so they can be available year round. Furthermore, improving the conditions of roads in rural areas could potentially encourage farmers to sell their vegetables in urban markets and enable them to generate better income and alleviate poverty in their communities.

REFERENCES

Abukutsa, O.M.O., Agong, S.G., Mwai, G.N., Womdim, R.N. & Ojiewo, C.O., 2013. Exploiting genetic diversity of vegetable African Nightshades. Global Science Books. *International crops research institute for semi-arid tropics* 7 (1):6-13. Available at: http://oar.icrisat.org/id/eprint/6365 [Accessed on 14 September 2013].

Adebooye, O.C. & Adedayo, A. 2008. Future of the Nigerian under exploited indigenous fruits and vegetables in the era of climate change: The need for farmer's education. Conference on International Research on Food Security, Natural Resource Management and Rural Development. University of Hohenheim, October 2008. Available at 7-9,: www.tropentang.de/2008/abstracts/full/392.pdf [Accessed on 17 October 2014].

Adebooye, O.C. & Opabode, J.T. 2004. Status of conservation of the indigenous leaf vegetables and fruits of Africa. *African Journal of Biotechnology* 3 (12):700-705. Available at: http://www.academicjournals.org/AJB.

Aju, P.C. & Popoola, L. 2013. The dietary role of traditional leafy vegetables in the rural communities of Imo State, Nigeria. *Journal of sustainable Development in Africa* 13 (3):104-113.

Aju, P.C., Labode, P., Uwalaka., R.E., & Iwuanyanwu, U.P. 2013. The Marketing Potentials of Indigenous Leafy Vegetables in South-eastern Nigeria. *International Journal of AgriScience* 3 (9):667-677.

Alam, A. 2014. The Economics of South African Townships. Addressing the spatial inequalities in the country, reflected in the townships, is essential to improving the lives of people. The World Bank.

Aliber, M. & Hart, T.G.B. 2009. Should subsistence agriculture be supported as a strategy to address rural food insecurity? *Agricon* 48 (4):434-458.

Anyanwu, J. C. 2013. Marital status, household size and poverty in Nigeria: Evidence from the 2009/2010 Survey Data. Working Paper Series. *African Development Bank Group* 180:1-28. Available at: http://www.afdb.org/.

Atogo, A. 2013. *Traditional methods of Indigenous vegetable preservation*. Kenya.

Aura, S. 2013. The diversity of indigenous African Leafy Vegetable that is produced consumed and sold in various households in Vihinga District Western Kenya-International symposium on underutilised plant species: crops for the future-beyond food security 979: 249-254.

Aworh, O.C. 2015. Promoting food security and enhancing Nigeria's small farmers' income through value added processing of lesser-known and under-utilised indigenous fruits and vegetables. Food Research International. Available at: http://www.elsevier.com/locate/foodres. [Accessed on **5 June 2015**].

Ayanwale, A. B., Oyedele, D. J., Adebooye, O. C.& Adeyemo, V. A. 2014. A Socio-economic analysis of the marketing chain for under-utilised indigenous vegetables in South Western Nigeria. African Crop Science Conference Proceedings. 10:515-519. Available at: http://www.researchgate.net/publication/261363968.

Babalola, S.O. & Akinwande, B.A. 2014. Determination of minerals by ICP-AES in indigenous vegetables from South West Nigeria. *Journal of Nutrition of Food Science* 44(3):249-257.

Baiyegunhi, L.J.S. & Oppong. B.B. 2015. Commercialisation of mopane worm (imbrasia belina) in rural households in Limpopo Province, South Africa. *Food policy and Economics* 1389-9341.

Bamigboye, O.L. 2011. Effect of intercropping and plant population density of jute mallow (corchorus olitorius) on the growth and yield of hot pepper. A project report. University of Agriculture, Abeokuta. Available at: http://www.unaab.edu.ng/ugprojects/2011bagricbamigboyeol.pdf [Accessed on 18 October 2014].

Beletse, Y.G. 2014. Indigenous / Traditional African Leafy Vegetables. Agricultural Research Council. Available at: www.arc.agric.za/arc-vopi/pages/cropscience/indigenous-crops.aspx.

Berinyuy, J.E. & Fontem, D.A. 2011. Evaluating post-harvest opportunities and constraints to the utilisation and marketing of African leafy vegetables in Cameroon. *African Journal of Food, Agriculture, Nutrition and Development* 11(2):4647-4663.

Bvenura, C. & Afolayan, A.J. 2015. The role of wild vegetables in household food security in South Africa: A review: *Food Research International*. Available at: http://10.1016/j.foodres.2015.06.013 [Accessed on 12 June 2015].

Chandra, K. 2013. Eat shoots and leaves: six native amaranth leaves for good health. *Lifestyle Magazine*. Available at: http://www.thealternative.in/lifestyle/6-native-indian-amaranth-leaves-for-good-health [Accessed on 25 November 2013].

Chivenge, P., Mabhaudhi, T., Modi, A.T. & Mafongoya, P. 2015. The potential role of neglected and underutilised crop species as future crops under water scarce conditions in Sub-Saharan Africa. *International Journal of environment Res*. Public health 12(6):5685-5711.

Chopra, M, Mccoy, D., Sanders, D., Jackson, D., Karaolis, N., Sogaula, N., & Schofield, C. 2014. Who guidelines for management of severe malnutrition in Rural South African hospitals. Health systems trust 363 (9415):1110-1115. Available at: http://www.hst.org.za/publications/who-guidelines-management-severe-malnutrition-rural-south-african-hospitals-effect-case

Daniels, R.C., Partridge, A., Kekana, D. & Musundwa, S. 2014. Rural Livelihoods in South Africa. Southern Africa Labour and Development Research Unit. Working paper series number 122.

Darkwa, S. & Darkwa AA. 2013. The use of indigenous green leafy vegetables in the preparation of Ghanaian Dishes. *Journal of Food Processing and Technology* 4 (12):286.

Department of Agriculture, Forestry and Fisheries (DAFF). 2011. Indigenous food crops. Available at: http://www.nda.agric.za/docs/brochures/indigenous.june.pdf.

Department of Agriculture, Forestry and Fisheries (DAFF). 2012. Most common indigenous food crops of South Africa. Directory of Plant Production, Division of Indigenous Food Crops. Available at: http://www.nda.agric.za/docs/Brochures/Indigfoodcrps.pdf.

Department of Agriculture, Forestry and Fisheries (DAFF). 2013. Most common indigenous food crops of South Africa. Directory of Plant Production, Division of Indigenous Food Crops. Available at: http://www.nda.agric.za/docs/Brochures/Indigfoodcrps.pdf[Accessed on 17 October 2014].

Djuikwo, V.N., Ejoh, R.A., Gouado, I., Mbofung, C.M. & Tanumihardjo, S.A. 2011. Determination of major carotenoids in processed tropical leafy vegetables indigenous to Africa. *Food and Nutrition Sciences* 2: 793-802.

Dweba, T.P. & Mearns, M.A. 2011. Conserving indigenous knowledge as the key to the current and future use of traditional vegetables. *International journal of information* 31 (6):564-571.

Elimu, A. 2013. Traditional Methods of Indigenous Vegetable Preservation. A project of the National Museums of Kenya. Available at: http://www.elimuasilia.org.

Ezebilo, E.E. 2010. Conservation of a leafy vegetable important for communities in the Nigerian rain forest. *Forest Ecology and Management* 259 (8):1660-1665.

Faber, M., Olefofse, A. & Wenhold, P. 2010. African leafy vegetables consumed by households in the Limpopo Province and Kwazulu-Natal provinces in South Africa. *South African Journal of Clinical Nutrition* 23 (1):30-38.

FAO, 2012. The State of Food Insecurity in the world. Food and Agriculture Organisation of the United Nations, Rome. Available at: http://www.fao.org/docrep/016/i3027e/3027e.pdf.

Food and Agriculture Organisation. 2012. Decent rural employment for food security: A case for action. Available at: http://www.fao.org/docrep/015/i2750e/i2750e00.pdf [Accessed on 7 October 2013].

Goebel, R., Taylor, M. & Lyons, G. 2010. Leafy green vegetables in the tropics. Feasibility study on increasing the consumption of nutritionally-rich leafy vegetables by indigenous communities in Samoa, Solomon Islands and Northern Australia. Australian Centre for International Agricultural Research.

Greater Tubatse Local Municipality (GTM). 2014. GTM report for 2013-2014. Demographics. Available at: http://www.tubatse.gov.za [Accessed on 10 October 2014].

Greater Tubatse Local Municipality (GTM). 2015. The Local Government Handbook. A complete guide to municipalities in South Africa. Available at: http://www.localgovernment.co.za/locals/view/125/Greater-Tubatse-Local-Municipality [Accessed on 10 December 2014].

Gregory, N. 2013. *The ancient Greek Hero in 24 hours*. Cambridge. Harvard university press. USA. Pp 1432.

Guarrera, P.M. & Savo, V. 2013. Perceived health properties of wild and cultivated food plants in local and popular traditions of Italy. A review. *Journal of Ethno pharmacology* 146: 659-680.

Habwe, F.O & Walingo, K.M. 2008. Food Processing and Preparation Technologies for Sustainable Utilisation of African Indigenous Vegetables for Nutrition Security and Wealth Creation in Kenya. International Union of Food Science and Technology.

Haider, P. 2012. Health benefits of sweet potato leaves. Relax into success. Available at: http://paulhaider.wordpress.com/health-benefits-of-sweet-potato-leaves/amp/ [accessed on 9 May 2012].

Hart, T. & Vorster, I. 2006. *Indigenous knowledge on the South African Landscape: Potentials for Agricultural Development*. Human Sciences Research Council. Cape Town.

Heeren, G.A., Jemmott, J.B., Tyler, J.C., Tshabe, S. & Ngwane, Z. 2011. Cattle for wives and extramarital trysts for husbands? Lobola, men, and HIV/STD risk behaviour in Southern Africa. *Journal of Human Behaviour in the Social Environment* 21(1):73-81.

Hyde, M.A., Wursten, B.T., Ballings, P. & Coates, P.M. 2014. Flora for Zimbabwe*: species information*: corchorus tridens.Available at: http://www.zimbabweflora.co.zw/speciesdata/speciesid=138340[Accessed on 10 July 2014].

Jain, R., Sharma, A., Gupta, S., Sarethy, I.P. & Gabrani, R. 2011. *Solanum nigrum: current perspectives on therapeutic properties*. Attern Med Rev 16 (1):78-85. Available at: http://www.altmedrev.com/publications/16/1/78.pdf. [Accessed on: 16 March 2011].

Kahane, R., Hodgkin, T., Jaenicke, H., Hoogendoorn, C., Hermann, M., Keating, J.D.H., Hughes, J.D., Padulosi, S., & Looney, N. 2013. Agrobiodivesity for food security, health and income. Agronomy for sustainable development 33(4):671-693.

Karmakar, K., Muslim, T. & Rahman, M.D.A. 2013. Chemical Composition of some leafy vegetables of Bangladesh. Dhaka Uni. *Journal of Science*. 61 (2):199-201.

Khuzwayo, W. 2014. Millions lack despite local veggies. Business report. Independent newspapers. Available at: http://www.iol.co.za/business/news/millions-lack-despite-local-veggies-1.66 [Accessed on 16 March 2014].

Kimiywe, J., Waudo, J., Mbithe, D. & Maundu, P. 2007. Utilization and Medicinal Value of Indigenous Leafy Vegetables Consumed in Urban and Peri- Urban Nairobi. *African Journal of Food Agriculture Nutrition and Development*. 7 (4):1-15.

Kolberg, H. 2001. Indigenous Namibian leafy vegetables: A literature survey and project proposal. Available at: http://www.nbri.org.na/index.php?id/common-lampsquarters [Accessed on 16 July 2014].

Kruger, A., Van Der Hoeven, M. & Matenge, S. 2011. Agricultural Biodiversity and Health Policy Development in South Africa. Available at: http://www.psppd.org.za/MediaLib/Downloads/Home/Research [Accessed in December 2011].

Kruger, J., Mongwaketse. T., Faber, M., Van der Hoeven, M. & Smuts, C.M. 2015. Potential contribution of African green leafy vegetables and maize porridge composite meals to iron and zinc nutrition. *Journal of Nutrition*. 31:1117-1123. Available at: http://www.nutritionjrnl.com [Accessed on 11 May 2015].

Kwenin W.K.J., Wolli, M. & Dzomeku, B.M. 2011. Assessing the nutritional value of some African Indigenous green leafy vegetables in Ghana. *Journal of Animal and Plant Sciences* 10(2):1300-1305.

Lanini, W.T. & Wertz, B.A. 2014. Common lambsquarters. Weed management. *College of Agricultural science*. Available at: http://extension.psu.edu/pests/weeds/weed-id/common-lampsquarters .

Leone, L.A., Beth, D., Scott, B.I., Macguire, K., Nelson, E., Robert, A.S., Tate, D.F. & Ammerman, A.S. 2012. Attitudes Toward Fruit and Vegetables Consumption and Farmers Market Usage Among Low Income North Carolinians. *Journal of Hunger Environ Nutriti*. 7(1):64-76. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3789536. [Accessed on: **7** March 2012].

Lyatuu, E., Lebotse, L., Msuta, G. & Marope , M. 2009. Marketing of Indigenous Leafy Vegetables (ILVs), and how Small-Scale Farmer Income can be improved in SADC region. (Tanzania, Zambia, and Botswana). Implementation and Coordination of Agricultural Research and Training in the SADC Region, regional workshop report.

Mahlangu, S. A. 2014. Production and Commercialisation Potential of Indigenous Leafy Vegetables: Case Study of Capricon District in the Limpopo Province, South Africa. University of Limpopo.

Mahr, S. 2011. *Common purslane, Portulaca oleracea. The Wisconsin master gardener program, volunteers in horticulture*. University of Wisconsin Madison. Available at; http://wimastergardener.org/?q=Portulaca oleracea [Accessed on 17 October 2014].

Masarirambi, M.T., Mavuso, V., Songwe, V.D, Ngambule, T. & Mhazo, N. 2010. Indigenous post-harvest handling and processing of traditional vegetables in Swaziland. A review. *African Journal of Agricultural Research* 5 (24):333-341.

Maroyi, A. 2013. Use of weeds as traditional vegetables in Shurugwi District, Zimbabwe. *Journal of Ethno biology and Ethno medicine* 9:60. Available at: http://www.ethnobiomed.com/content/9/1/60 [Accessed on 20 August 2013].

Maundu, P., Kimiywe, J., Mbumi, M., Smith, I.F., Johns, T. & Eyzaguirre, P.,B. 2013. Nutrition and Indigenous Vegetables in Urban and Peri-Urban Agriculture in Kenya. Biodiversity International.

Mavengahama, S. 2013. *The contribution of vegetables to food security and nutrition within selected sites in South Africa*. Dissertation. Stellenbosch University. Available at: http://cirettransdisciplinarity.org/biblio/biblio_pdf/Sydney_Mavengahama.pdf [Accessed on 11 October 2014].

Mayer, M.J. 2011. Towards a youth employment strategy for South Africa. Development planning division working paper series 28:1-56.

Melamed, S. 2010. The incredible journey of Corchorus Olitorius. Food Bridge. Available at: http://www.sarahmelamed.com/2010/07/the-incredible-journey-of-corchorus-olitorius/ [Accessed on 18 October 2014].

Mishra, S.S., Moharana, S.K. & Dash, M.R. 2011. Review on Cleome Gynandra. *International Journal of Research in Pharmacy and Chemistry* 1(3):2231-2781.

Motsa, M.M., Slabbert, M.M., Van Averbeke, W. & Morey, L. 2015. Effect of light and temperature on seed germination of selected African leafy vegetables. *South African Journal of Botany*. 99:29-35.

Mpala, C., Dlamini, M. & Sibanda, P. 2013. The accessibility, utilisation and role of indigenous traditional vegetables in household food security in rural Hwange District. *International Open and Distance Learning Journal*, 3(June 2013).

Muhanji, G., Roothaert, R.L., Webo, C. & Mwangi, S. 2011. African Indigenous vegetables enterprises and market access for small-scale farmers in East Africa. *International journal of Agricultural Sustainability* 9 (1):194-202.

Mutshinyalo, T. 2011. Cleome gynandra L. Plant Z Africa. Available at: www.plantzafrica.com/plantcd/cleomegynandra2.htm [Accessed on 8 June 2011].

Mwaura, S.N., Muluvi, A.S. & Mathenge, M.K. 2013. African leafy vegetables and household wellbeing in Kenya: A disaggregation by gender. 4th International Conference of the African Association of Agricultural Economics. Available at: http://ageconsearch.umn.edu/.../S.N.%20Mwaura,%20A.S.%20Muluvi%20and%20Mathenge [Accessed on 10 July 2013].

Nabulo, G., Young, S.D. & Black, C.R. 2010. Assessing risk to human health from tropical leafy vegetables grown on contaminated urban soils. *The Science of the total environment.* 408 (22): 5338-5351.

Nagarani, G., Abirami, A., Nikitha, P. & Siddhuraju., P. 2014 Effect of hydrothermal processing on total polyphenolics and antioxidant potential of underutilised leafy vegetables, Boerhaavia diffusa and Portulaca Oleracea. *Journal of biomedicine* 4(1): 5467-5470

Nierenberg, D. 2013. 15 Indigenous Crops feeding the world. Food tank. Available at: https://foodtank.com/news/2013/11/going-forward-by-going-back-indigenous-crops-importance-feeding-the-world/. [Accessed on 14 November 2013].

Nierenberg, G. 2011. *Jute Mallow: A Plant with many names and many uses*.

Njume C., Goduka., N.I. & George, G. 2014. Indigenous leafy vegetables (imifino, morogo, muhoro) in South Africa: A rich and unexplored source of nutrients and antioxidants. *African Journal of Biotechnology* 19:1933-1942. Available at: http://www.academicjournals.org/AJB [Accessed on 7 May 2014].

Nya, E. J., Okorie, N. U. & Eka, M. J. 2010. An Economic Analysis of Talinum Triangular (Jacq) Production / Farming in Southern Nigeria. Trends in Agricultural Economics 3:79-93. Available at: http://scialert,net/abstract/?doi=tae.2010.

Odua I. 2012. Numerous uses of bitter leaf. *A handbook of African medicinal plants*. Available at: http://potentnaturalmedicinaltips.blogspot.com/2012/08/numerous-uses-of-bitter-leaf.html[Accessed on 1 August 2011].

Oladele, O.I. 2011. Contribution of Indigenous Vegetables and Fruits to Poverty Alleviation on Oyo state, Nigeria. *Journal of Human Ecology* 349(1):1-6.

Olayemi, A.O. 2012. Effects of Family Size on Household Food Security in Osun State, Nigeria. *Asian Journal of Agriculture and Rural Development* 2(2):136-141.

Omami, E.N., Opala, P.A., Opile, W.R. & Tuwei, C. 2013. Response of the African Nightshade to phosphate fertilizer application in Western Kenya. *Archives of Applied Science Research* 5(1):195-201.

Oulai, P., Lessoy, Z., Megnanou, R.M., Doue, R. & Niamke, S. 2014. Proximate composition and Nutritive value of leafy vegetables consumed in Northern Cote D'ivoire. *European scientific journal* 10 (6):1857-7881.

Phillips L. 2013. African leafy vegetables: drought-tolerant, easy to grow and nutritious. *Farmers' weekly*. Available at: http://www.farmersweekly.co.za. [Accessed on 26 March 2013].

Plants for A Future (PFAF). 2012. Earth. Plants. People. Available at: http://www.pfaf.org/user/default.aspx [Accessed on 11 October 2013].

Poulsen, M.N., McNab, P.R., Clayton, M.L. & Neff, R.A. 2015. A systematic review of urban agriculture and food security impacts in low-income countries. Food policy 55: 131-146. Available at: www.elsever.com/locate/foodpol. [Accessed on 20 July 2015].

Programme to Support Pro-poor Policy Development in South Africa (PSPPD). 2011. Policy brief 5: Agricultural Biodiversity and Health Policy Development in South Africa. Available at: http://www.psppd.org.za/MedialLib/Downloads/Home/ResearchEvidence/Policy%20Brief%205 v3.pdf [Accessed on 17 October 2014].

Puoane, T., Alexander, L. & Hutton, B. 2013. The Revolving Door: Child malnutrition in Mount Frere, Eastern Cape Province. South Africa. University of Western Cape. Available at: http://open.umich.edu/sites/default/files/2012-malnutrition-case-study-tpuoane-lalexander-bhutton-case-studies.pdf [Accessed on 19 October 2013].

Ramos, B., Miller, F.A., Brandao, T.R.S., Teixeria, P. & Silva, C.L.M. 2013. Fresh fruit and vegetables – An overview on applied methodologies to improve its quality and safety. *Innovative Food Science and Emerging Technologies* 20: 1-15.

Rhoades, H. 2014. Tips for growing Amaranth for food. *Gardening know how*. Available at: http://www.gardeningknowhow.com/edible/vegetables/amaranth/growing-amaranth-food.htm [Accessed on 30 January 2014].

Rudrappa, U. 2014. *Pumpkin preparation, selection, storage, health benefits. Nutritional facts.* Available at: www.nutrition-and-you.com/pumpkin.html [Accessed on 10 July 2014].

Sawhill, I.V. 2014. How Marriage and Divorce Impact Economic Opportunity. Available at http://www.brookings.edu/research/opinions/2014/05/06-family-structure-poverty-sawhill [Accessed on 6 May 2014]

Schippers, R.R. 2000. African Indigenous vegetables: An overview of the cultivated species: Natural Resources Institute Technical Centre for Agricultural and Rural Co-operation. University of Greenwich. Chatham.UK.

Schonfeldt, H.C. & Pretorius., B. 2011. The nutrient content of five traditional South African dark green leafy vegetables – A preliminary study. *Journal of Food Consumption and Analysis* 24(8):1141-1146.

Seeiso, M.T. & Materecha, S.A. 2014. Biomass yields and crude protein content of two African ILVs in response to kraal manure application and leaf cutting management. *African Journal of Agricultural Research* 9 (3):397-406.

Seidu, J.M., Bobobee, E.Y.H., Kwenin, W.K.J., Frimpong, R., Kubge, S.D., Trevor, W.J. & Mahama, A.A. 2012. Preservation of ILVs. *Journal of Agricultural and Biological Science* 7(6):407.

Shackleton, C.M., Pasquini, M.W. & Drescher, A.W. 2009. *African indigenous vegetables in urban agriculture*. London: Earthscan.

Shumsky, M.T., G.M. Hickey., T. Johns., B. Pelletier & J. Galaty.2014. Institutional factors affecting wild edible plants (wep) harvest and consumption in semi-arid Kenya. *Land use Policy* 38:48-69.

Silva, F.L. 2011. Complication of secondary metabolites from Bidens Pilosa. *Molecules.* 16 *(2):1070-1102.*

Smith, I.F. & Eyzaguirre, P. (2007). African Leafy Vegetables: Their role in the world health organisation's global fruit and vegetables initiative. African Journal of Food Agriculture Nutrition and Development. 7(3):1-17..

Stadlmayr, B., Charrondiere, U.R., Addy, P., Samb, B., Enujiugha, V.N., Bayili, R.G., Fagbohoun, E.G., Smith, I.F., Thiam, I. & Burlingame, B. 2010. Food and Agriculture Organisation of the

United Nations. 2010. Available at: http://www.fao.org/3/a-i1755e.pdf [Accessed on 17 October 2014].

STATISTICS SOUTH AFRICA. 2014. Limpopo province profile, Pretoria. Available at: http://statssa.gov.za [Accessed on 10 July 2014].

STATISTICS SOUTH AFRICA. Gender Statistics in South Africa. 2013. Available at http://www.statssa.gov.za/qLFS/indes.asp.

STATISTICS SOUTH AFRICA. General household survey. 2013. Available at http://www.statssa.gov.za/publications/P0318/P03182013.pdf.

STATISTICS SOUTH AFRICA. Greater Tubatse Municipality. 2015. Available at www.statssa.gov.za/page-id=9938-id=greater-tubatse-municipality.

Taleni, V. & Goduka, N. 2013. Perceptions and use of indigenous leafy vegetables (ILVs) for nutritional value: A case study in Mantusini Community, Eastern Cape Provinces, South Africa. 2013 International Conference on Food and Agricultural Sciences, Singapore. Available at: http://www.ipcbee.com/vol55/024-ICFAS2013-G3022 [Accessed on 10 July 2014].

Thakur, G.S., Bag, M., Sanodiya, B.S., Bhadouriya. , Debnath, P.M., Prasad, G.B. & Bisen, P.S. 2009. Momordila balsamina: a medicinal and neutraceutical plant for health care management. *Current Pharmaceutical Biotechnology* 10 (7):667-82.

Thandeka, N., Sithole, N., Thamaga-Chitja, J. M. & Makanda, I. 2011. The role of traditional leafy vegetables in household food security in rural Kwazulu Natal. *Indilinga African Journal of Indigenous Knowledge Systems* 10(2):195-209. Available at: http://www.reference.sabinet.co.za/document/EJC61397.

United Nations Children's Fund (UNICEF). 2013. The state of the world's children report. Available at: http://www.unicef.org/sowc/ [Accessed on 10 July 2014].

United State Department of Agriculture (USDA). 2011. National Nutrient Database for standard reference. Plants Profile. Senna occidentalis (L). The plant database. Available at: http://plants.usda.gov/java/profile?symbol=SEOC2 [Accessed 17 October 2013].

Uusiku, N.P., Oelofse, A. & Duodu, K.G. 2010. Nutritional value of leaf vegetables for Sub-Saharan Africa and their potential contribution to human health. A review. *Journal of Food Composition and Analysis* 23:499-509.

Van Der Hoeven, M., Osei, J., Greeff, M., Kruger, A., Faber, M. & Smuts, C.M. 2013. The indigenous and traditional plants: South African parents' knowledge perceptions and uses and their children's sensory acceptance. *Journal of Ethno-biology and Ethno-medicine* 9: 78. Available at: http://www.ethnobiomed.com/content/9/1/78 [Accessed on 10 July 2014].

Van Jaarsveld, P., Faber, M., Van Heerden, I., Wenhold, F., W.J., Van Rensburg, W.S.J. & Van Averbeke, W. 2014. Nutrient content of eight African leafy vegetables and their potential contribution to dietary reference intakes. *Journal of Food Composition and Analysis* 33:77-84.

Van Rensburg, W.S.J., Cloete, M., Gerrano, A.S. & Adebola, P.O. 2014. Have you considered eating your weed? *American Journal of Plant Sciences* 5: 1110-1116. Available at: http://www.scirp.org/journal/ajps. [Accessed on 14 March 2014].

Van Rensburg, W.S.J., Van Averbeke, W., Beletse, Y.G., Slabbert, R., Faber, M., Van Jaarsveld, P., Van Heerden, I., Wenhold, F. & Oelofse, A. 2007. African leafy vegetables in South Africa, pp 317-326. Available at: http://www.wrc.org.za.

Van Rensburg, W.S.J., Van Averbeke, W., Beletse, Y.G. & Slabbert, M.M. 2012. Bittermelon (Citrillus lanatas subsp, lanatus). Production guidelines for African leafy vegetables, South African water research commission. Water Research Commission, 31-32.

Vorster, I.H.J., Van Willem, R.J. & Sonja, L. 2007. The Importance of Traditional Leafy Vegetables in South Africa. *African Journal of Food, Agriculture, Nutrition and Development* 7(4):1-13.

Wambua, J. 2012. Weed plants back on dinner plates. Create solutions that empower farmers to work and communicate in new and innovative ways. Available at: http://mfarm.co.ke/blog/post/weed-plants-back-on-dinner-plates [Accesssed on 10 July 2014].

Welman M. 2004. Momordica balsamina L. National Herbarium, Pretoria. Available at: http://www.plantzafrica.com/plantklm/momordbalsam.htm [Accessed 10 July 2014].

Writer S. 2015. Whites' vs black unemployment in South Africa. Business Tech. Available at: http://businesstech.co.za/news/general/96887/white-vs-black-unemployment-in-south-africa [Accessed 27 August 2015].

Yan, J., Sun, L.R., Zhou, Z.Y., Chen, Y.C., Zhang, W.M., Dai, H.F. & Tan, J.W.2012. Homoiso-flavooids from the medicinal plant portulaca oleracea, I 80: 37-41.

Young, A. 2013. Inequality, the Urban- Rural Gap and Migration. *The Quarterly Journal ofeconomics.*Availableat:http://qje.oxfordjournals.org/content/early/2013/08/21/qje.qjto25 [Accessed 21 August 2013].

APPENDIX A: CONSENT FORM

Department of Life and Consumer Sciences

Private Bag X6

Florida

1710

Tel:0114712080

Fax: 0114712796

Email: 44581998@mylife.unisa.ac.za

ATTITUDE TOWARDS THE CULTIVATION AND UTILISATION OF INDIGENOUS LEAFY VEGETABLES (ILVs) IN RURAL COMMUNITIES

Dear Mr/Mrs/Miss/ Date……/……/20……

Nature and Purpose of the study

The study seeks to investigate the production and consumption of indigenous vegetables in the Greater Sekhukhune District of Limpopo Province, South Africa.

Research process

The researcher will interview both men and women between the ages of 18 and 65+ years in rural and urban areas. Questionnaires will be given to participants and they will be asked a series of questions relating to the utilisation and attitudes towards consumption of ILVs, their contribution to dietary intake and economic activities. Your Demographic information such as age, racial group, monthly salary and level of education will be recorded.

Notification that tape recordings will be required

Tape recording may be used where deemed necessary by the researcher.

Confidentiality

Your ratings and assessments of any of the research instruments as well as your opinions are viewed as strictly confidential, and only members of the research team will have access to the information. No data published in dissertations and journals will contain any information by means of which you may be identified. Your anonymity is therefore ensured.

Withdrawal clause

I understand that I may withdraw from the study at any time. I therefore participate voluntarily until such time as I request otherwise.

Potential benefits of the study

The findings of the research will make positive contributions to the knowledge of utilisation and consumption of indigenous leafy vegetables and household food insecurity. It will benefit communities with knowledge on the unexploited roles of indigenous leafy vegetables in food security, alleviating malnutrition and income generation.

Further Information

If there is any question concerning this study contact Dr Frederick Tabit, 0114712080, Department of Life and Consumer Sciences, UNISA.

Consent

I, the undersigned, (full name) have read the information relating to the project and have also heard the verbal version, and declare that I understand it. I have been afforded the opportunity to discuss

relevant aspects of the project leader, and hereby declare that I agree voluntarily to participate in the project.

I indemnify the university and any employee or student of the university against any liability that may incur during the course of the project.

I further undertake to make no claim against the university in respect of damages to my person of reputation that may be incurred as a result of the project/trial or through the fault of other participants, unless resulting from negligence on the part of the university, its employees or students.

I have received and signed copy of this consent form.

SIGNATORIES

The main Participant:

Full names……

Signature …….

Date…… …….

Witnesses:

First witness

Signature……

Date……

Place……..

Second witness

Signature……

Date……

Place……

APPENDIX B: QUESTIONNAIRE

NYARAI MUNGOFA

P O Box 228, Burgersfort

1150

Cell No: 0027729930657

30 August 2014

Dear Sir / Madam

I, Nyarai Mungofa am undertaking a research project to determine the attitude towards the cultivation and utilisation of ILVs in rural households of Greater Tubatse Municipality, Limpopo, South Africa. To this end I kindly request that you complete the following short questionnaire. It should take no longer than 15 minutes of your time. Although your response is of the utmost importance to me, your participation in this survey is entirely voluntary.

Please do not enter your name or contact details on the questionnaire. It remains anonymous. Information provided by you remains confidential and will be reported in summary format only.

Kindly return the completed questionnaire to me in the envelope provided. Summary results of this research will be published in the Steelburger in December 2015. Should you have any queries or comments regarding this survey, you are welcome to contact me on 0027729930657 or nyariebm@yahoo.com or 44581998@mylife.unisa.ac.za.

Yours Sincerely

Please answer the following Questions by ticking (√) the relevant block or writing down your answer in the space provided.

Example of how to complete this questionnaire:

Your gender? (Tick one)

If you are male:

1	Male	√

2	Female	

QUESTIONNAIRE NUMBER …… **(Official use)**

SECTION A – Biographic Information

This section of the questionnaire refers to background or biographical information. Although I am aware of the sensitivity of the questions in this section, the information will allow me to compare groups of respondents. Once again, I assure you that your response will remain anonymous. Your co-operation is greatly appreciated.

1. Gender

1	Male	
2	Female	

2. What is your age?

1	Under 25	
2	25-35 years	
3	36-45 years	
4	46-55 years	
5	56-65 years	
6	Over 65 years of age	

3. Ethnicity

1	Black	
2	White	

3	Coloured	
4	Indian or Asian	

4. Marital Status

1	Married by law	
2	Traditional marriage	
3	Living together	
4	Separated	
5	Widowed	
6	Single	

5. What do you do for a living?

1	Pensioner	
2	Formal employment	
3	Self- employment	
4	Farming	
5	Casual labour	
6	Unemployed	
7	Specify other	

6. How would you describe your monthly average income?

1	Below 1000	

2	R1000-R2999	
3	R3000-R4999	
4	R5000-R6999	
5	R7000-R8999	
6	R9000-R15000	
7	Above R15000	

7. Your highest educational qualification?

1	No formal education	
2	Can read and write	
3	Junior-primary education	
4	Senior primary	
5	Secondary education	
6	Tertiary education	

8. How would you describe the area in which you are residing

1	Urban (town or city)	
2	Rural (country life)	
3	Informal settlement (temporary shelter)	

9. Size of your household, i.e. the number of people including yourself, who live in your house/ dwelling for at least three months of the year?

1	Live alone	
2	2	
3	3	
4	4	
5	5	
6	6	
7	More than 6	

10. What is the number of adults or children in your household?

	Members	**Numbers**	
1	Adults		
2	Female adults		
3	Male adults		
4	Number of children		

11. Who is the head of the household?

1	Father	
2	Mother	
3	Grandfather	
4	Grandmother	

5	Uncle	
6	Aunt	
7	Specify other	

SECTION B

This section of the questionnaire explores the utilisation and attitudes towards the consumption of indigenous leafy vegetables (morogo).

12. Do you eat indigenous leafy vegetables (morogo)?

1	Yes	
2	No	

If you answered no to question 12, please answer question 13 only. If you answered yes to question 12, please skip question 13 and continue from question 14.

13. If no why?

1	Dislike them	
2	Can’t get them (not available)	
3	Can’t cook them	
4	Don’t know them	
5	Other	

Other: Specify_____

_____

Thank you for your co-operation in completing this questionnaire. Kindly return the questionnaire as specified in the cover letter.

The following questions pertain to people who eat indigenous leafy vegetables.

14. If yes, why?

1	I like the taste	
2	They are cheap	
3	They are highly nutritious	
4	They have many health benefits	
5	They are easily available	
6	Other	

Other: Specify_____

_____

15. Provide the names of indigenous vegetables that are commonly consumed in your community.

1	
2	
3	
4	
5	
6	
7	
8	

9	
10	

16. Name at least 10 of the indigenous leafy vegetables you consume the most in the last 12 months.

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

17. Which of the following food (s) do you eat with indigenous leafy vegetables? (tick the relevant ones).

1	2	3	4	5	6
Pap	Rice	Bread	Cassava	Potatoes	other

18. How do you obtain indigenous leafy vegetables? [NB: The ones you listed in question 16] (tick one)

1	Buy	
2	Collect	

3	Buy and collect	

19. If collected where from? (tick one)

1	Own garden	
2	Veldt (open, uncultivated land)	
3	Wetlands	
4	Field	
5	Roadside	
6	Other	

Other: Specify_____

_____

a. Which month (s) of the year do you collect indigenous leafy vegetables? Tick the relevant month (s)

1	2	3	4	5	6	7	8	9	10	11	12
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

b. How often per week do you collect the indigenous leafy vegetables you named in Question 16 during the last harvest season?

Vegetable		Tick the correct time per week			
		Once	Twice	Thrice	Above thrice
1					
2					

3					
4					
5					
6					
7					
8					
9					
10					

Other: Specify_____

_____

20. How much do you prefer each of the indigenous leafy vegetables you listed in question 16? Rank your preference of each (1= most preferred 5= least preferred)

Name of indigenous leafy vegetable		Ranking (tick a rank)				
		1	2	3	4	5
1						
2						
3						
4						
5						
6						
7						

8						
9						
10						

21. How long have you known the indigenous leafy vegetables you listed in question 16? (tick one)

1	Less than a year	
2	1-5 years	
3	More than five years	
4	From childhood	

22. Do you cultivate the indigenous leafy vegetables listed in question 16? (tick one)

1	Yes	
2	No	

a. How much do you prefer to cultivate for each of the indigenous vegetables you listed in question 16? Rank them in order of preference of each (1= most preferred 5= least preferred)

Name of indigenous leafy vegetable		Ranking (tick a rank)				
		1	2	3	4	5
1						
2						

3						
4						
5						
6						
7						
8						
9						
10						

Other: Specify_____

_____

b. If you do not cultivate indigenous leafy vegetables, what could be the reason? (tick one)

1	2	3	4	5	6	7
There is no need since they occur naturally	Do not know how	Lack of seeds	Never thought of it	They are not easy to	Do not eat them	Other

Other: Specify_____

_____

23. If you purchase indigenous leafy vegetables, where do you often buy them from? (tick one)

1	Supermarket	
2	Local market	
3	Roadside vendors	
4	Neighbours	

24. In what form do you consume the vegetables?

1	Raw	
2	Boiled	
3	Fried	
4	In soups	
5	In stews	
6	Other	

Other: Specify_____

_____

25. Do you process, preserve and store indigenous leafy vegetables for future use? (tick one)

1	Yes	

2	No	

26. If yes, how do you process, preserve and store them? (tick one)

1	Dry (cooked)	
2	Dry (uncooked)	
3	Place in fridge	
4	Other	

Other: Specify_____

_____

SECTION C

This section looks at the contribution of indigenous leafy vegetables to the total vegetable intake of your household.

27. How often do you consume the indigenous leafy vegetables you listed in question 16 in your household for each? (tick one)

How often do you eat a serving of indigenous vegetables?				
Code	**1**	**2**	**3**	**4**
Frequency	**Never or less than once per week**	**1-2 per week**	**3-4 per week**	**5-6 per week**
How often do you eat a serving of indigenous				

vegetables?				
With breakfast				
With lunch				
With dinner				
When feeling sick				
Anytime when feeling hungry				
Cooked in fat (oil margarine, butter, animal fat, ghee)				
Boiled				
Raw				
Dried				
In stews				
In soups				

Other specify				

28. How often do you consume contemporary leafy vegetables (e.g. spinach)? (tick one)

How often do you eat a serving of contemporary vegetables				
Code	**1**	**2**	**3**	**4**
	Never or less than once per week	**1-2 per week**	**3-4 per week**	**5-6 per week**
How often do you eat a serving of spinach (introduced leafy vegetables)?				
With breakfast				
With lunch				
With dinner				
When feeling sick				
Anytime when feeling				

hungry				
Cooked in fat ((oil margarine, butter, animal fat, ghee)				
Boiled				
Raw				
Dried				
In soups				
In stews				
Other specify				

The following section is only for those who cultivate or sell indigenous leafy vegetables

SECTION D

This section examines the contribution of indigenous leafy vegetables to the income of rural households in Greater Tubatse Local Municipality, Limpopo.

29. Do you cultivate any indigenous leafy vegetables? (tick one)

1	Yes	
2	No	

30. Do you sell part of your indigenous vegetable harvest? (tick one)

1	Yes	
2	No	

31. If yes who sells? (tick one)

1	Mother	
2	Child	
3	Other (specify)	

32. Who do you sell your indigenous leafy vegetables to? (tick one)

1	Passers-by at roadside	
2	At local market	
3	Supply shops	
4	Townships	
5	Schools	

6	Other	

Other: Specify_____

33. How much money do you generate from the sale of indigenous vegetables per annum? (tick one)

1	Less than R1000	
2	R1001- R4 000	
3	R4001 - R8 000	
4	R8001 - R12 000	
5	R12001 - R16 000	
6	R16001 – R 20 000	
7	Above R20 000	

34. How far do you have to travel to the market to sell your harvested indigenous leafy vegetables?

1	Less than 1km	
2	1.1km – 2km	
3	2.1km – 3km	
4	3.1km – 4km	
5	4.1km – 5km	
6	More than 5km	

35. How do you often transport your indigenous leafy vegetables to the market? (tick one)

1	Walk	
2	Private transport	
3	Bicycle	
4	Donkey cart	
5	Taxi	
6	Other (specify)	

36. Who keeps the money from the sales of indigenous leafy vegetables? (tick one)

1	Father	
2	Mother	
3	Other (specify)	

37. Who decides how to spend the money earned from the sale of indigenous leafy vegetables? (tick one)

1	Father	
2	Mother	
3	Other (specify)	

38. Do you often have problems with selling your indigenous leafy vegetables? (tick one)

1	Yes	
2	No	

39. If yes, list five of these problems starting with the most important ones.

1_____

2_____

3_____

4_____

5_____

40. How do you often spend money earned from indigenous vegetable sales?

1	School fees for children	
2	Buying food in the house	
3	Medical expenses	
4	Clothes	
5	Rent	

Other: Specify_____

THANK YOU

Key informant and focus group instrument

NB: Key informant and focus groups members should complete section A

1. Identification of indigenous leafy vegetables in this area

Name of indigenous leafy vegetables that grow in this area	Harvest season	Harvested in the wild	Cultivated in vegetable gardens	Sold for cash

2. Describe the level of consumption and cultivation of indigenous leafy vegetables in this area compared to introduced vegetables like spinach with regards to the following:

Successes

_____

_____

_____

Challenges

_____

_____

_____

Area for improvement

_____

_____

_____

3. Describe the level of commercialisation of indigenous leafy vegetables in this area compared to introduced vegetables like spinach.

Successes

_____

_____

_____

Challenges

_____

_____

_____

Area of improvement

_____

_____

APPENDIX C: PERMISSION LETTER

Department of Life and Consumer Sciences
University of South Africa
Private Bag X6 Florida, 1710

Mr MM Moja
Acting Municipal Manager
Greater Tubatse Municipality

PERMISSION TO CONDUCT A RESEACH IN THE GREATER TUBATSE LOCAL MUNICIPALITY

I hereby ask for permission to conduct a research in your local municipality. The title of the research is "attitude towards the cultivation and utilisation of indigenous leafy vegetables (ILVs) in rural communities in Greater Tubatse local municipality, Limpopo Province".
I am a Masters student in the Department of Life and Consumer Sciences at the University of South Africa. The research study is expected to take approximately three months of data collection. Data collection procedures will only include questionnaires which will be administered by the researcher and research assistants. The participants will be members of households who are 18 years and above.

The research results will indicate the consumption level of indigenous vegetables in the selected communities and the potential for commercialisation. The results will be communicated to the local municipality concerned.

For more details on this project you can contact my supervisors Dr FT Tabit via Tel: 01147128 and email: tabitft@unisa.ac.za.

A copy of the research proposal will accompany this letter for your reference.

Your consideration in this regard will be greatly appreciated.

Yours faithfully

…….

Nyarai Mungofa (Researcher)

…….....

Dr FT Tabit (Supervisor)

The GTM
GREATER TUBATSE
MUNICIPALITY
South Africa's first democratic platinum city

23 October 2014

Nyarai Mungofa
Student Nr 44581998
Department of Life and Consumer Sciences
University of South Africa
Private Bag X6
FLORIDA
1710

Fax: 012 429 4150

Dear N Mungofa

RE: PERMISSION TO CONDUCT A RESEARCH STUDY IN GREATER TUBATSE LOCAL MUNICIPALITY

The above matter refers.

Kindly note that Greater Tubatse Municipality has granted yourself the permission to conduct the consumption and commercialization of indigenous leafy vegetables of households in Greater Tubatse Municipal households.

On the basis of above; the Municipality wishes you a good luck on your research and hopes that it can be a success on gathering the required information.

Hoping you will find this in order.

Yours faithfully

Moja M.M
Acting Municipal Manager

Date: 28/10/2014

Address:
1 Kastania Street
P O Box 206, Burgersfort, 1150
Tel: (013) 231 1000
Fax: (013) 231 7467
Website: www.tubatse.co.za