EXPLORATION OF INDIGENOUS MEDICINAL KNOWLEDGE OF *PHONDA* IN THE VHEMBE DISTRICT

By

TSHIKUKUVHE LIVHUWANI DAPHNEY

Dissertation submitted in fulfilment of the requirements

For the degree of

MASTERS

in the Subject

African Studies

at the

UNIVERSITY OF VENDA

Supervisor	: Dr. P.E. Matshidze	(University of Venda)
Co-supervisor	: Prof. A. I. O. Jideani	(University of Venda)
Co-supervisor	: Prof. M.P. Tshisikhawe	(University of Venda)

FEBRUARY 2017

Declaration

I, **Tshikukuvhe Livhuwani Daphney,** hereby declare that this dissertation for Master of Arts Degree in African Studies at the University of Venda hereby submitted by me, has not been submitted previously for a degree at this or any other University and that it is my own work in design and execution, and that all reference material contained therein has been duly acknowledged.

Signed (Student): ..... Date: .....

Acknowledgements

My deepest and sincere thanks go to the Almighty God who made the completion of this study a reality. My sincere gratitude is also directed to the following people who in various ways, supported and encouraged me throughout this research project: My supervisor Dr. P.E, Matshidze, my co-supervisors Prof. A. I .O, Jideani and Prof. M.P. Tshisikhawe who provided academic support, perseverance and encouragement throughout all my research related activities as well as their contributions towards my intellectual growth. To Prof. V.O, Netshandama, I say thank you for your open heart, you were restless when thinking of students with no funding. Thank you also for the workshops that gave us skills to be good researchers. I am greatly indebted to Prof. E.K. Klu, Vice Dean of the School of Human and Social Sciences, for spending his time guiding us on how to construct our sentences correctly.

I would like to thank my children Vhulenda, Ngelekanyo, Mulinda Mathobo and Mukhethwa Tshikukuvhe for their words of encouragement and motivation. My research assistant Mbuelo Mmbi, thank you.

- My fellow Indigenous Knowledge System (IKS) team mates, the Postgraduates in Room 44, Centre for African Studies, Kugara Stewart Lee, BadugelaThivhavhudzi, Risimati Thlarihani, Mudhluli Tsetselelani, Madzivhandila Meisie, Murovhi Avhurengwi, Ramavhunga Ndidzulafhi, Sibadela Mukhethoni, Daswa Thizwilondi, Mabale Dolphin, Mathoho Ndivhuwo and Dr Omolola Adewale for the assistance rendered and always keeping me on my toes. Thanks guys for keeping me motivated and inspired. God bless you all. The gratitude also goes to the old man within the Department, Mr. I.P.E. Ndhambi for his inspiring words. Mr Ratshitanga N.T, from the Department of Information and Technology (IT), thank you.
- My Mom Marandela Maumela Mutavhatsindi for all your love and support and family for all the prayers, especially my brother Mr. Tshikukuvhe Lugisani Joseph for his deep desire to see me succeed in life: May God bless you abundantly. Mrs Mudau Masindi Fridah, organiser of focus group, I salute you, Thank you.
- I would also like to thank the Department of Indigenous Knowledge System (IKS) led by (H.O.D) Dr Matshidze P.E. and the Dean of the School of Human and Social Sciences Prof. M. A. Makgopa for all the necessary support rendered to me, as well as the Research Professor from the School of Human and Social Sciences, Prof. M.A. Masoga.

- I would also like to thank the funders of this project, namely: the National Research Foundation (NRF) at the University of Venda, Research and Innovation team and work study.
- I wish to express my special indebtedness and sincere appreciation to Mr. S. L. and Mrs. T.D. Kugara who made valuable contributions to the completion of this study. Thank you so much for challenging me to read more and to also question my own blind spots. You are indeed a wonderful and blessed couple. Thank you very much for your time and support. I am grateful to have people who pray for me daily. God bless you. (Words could not express my gratitude)
- Finally, I also wish to thank the entire participants who provided me with relevant information for my research.

Dedications

I dedicate this work to my Mom, Mutavhatsindi Maumela Marandela and also in memory of my sister in law Tshikukuvhe Ntsieni Josephinah.

This dissertation is also dedicated to the community of researchers, Directorate of Community Engagement under Prof Netshandama V.O., the Department of African Studies/ Indigenous Knowledge System (IKS) and the School of Human and Social Sciences in the University of Venda.

Abstract

This study explored indigenous medicinal knowledge of *Phonda* in the Vhembe District. It has been noticed that *phonda* is becoming a scarce crop. The objectives entail seeking to solicit information on the uses of *phonda*, to understand the attitudes of local households towards *phonda* and to establish what can be done to restore the cultivation of *phonda*. The study used qualitative method involving unstructured interviews to collect and thematically analyse data. Purposive sampling and snowballing methods were used to make up the study sample. From literature, it is known that traditional health practitioners used *phonda* for treatment of certain diseases and illnesses. *Phonda* is no longer common, but the study sought to encourage the cultivation of *phonda*. The study employed an Afrocentric paradigm of social change as the conceptual framework. The study found that many households no longer plough *phonda* as they used to in the past. The study recommends that people should be educated on the importance of *phonda* to encourage them to plough it. Additionally, the researcher recommends further studies into different purposes of p*honda* and areas to boost its farming.

Key words:

Indigenous knowledge system, food security, household medicinal, nutritional, traditional health practitioners, , *Phonda*.

List of Abbreviations and Acronyms

AIK	Agricultural Indigenous Knowledge
IKS	Indigenous Knowledge Systems
BNF	Biological Nitrogen Fixation
THPs	Traditional Health Practitioners
ANFs	Anti-Nutritional Factors
FAO	Food Agricultural Organisation
DWAF	Department of Water Affairs and Forestry
BGN	Bambara groundnut
WHO	World Health Organisation

Table of Contents

CHAPTER 1

INTRODUCTION TO THE STUDY

1.1 Introduction and background

In Africa, Indigenous Knowledge Systems (IKSs) have always been the backbone of every activity. An in-depth research about this alludes that IKSs has been apparent through diverse outlets; agriculture, medicine, and linguistics. In the agricultural sector, numerous aspects of IKSs are fading away as they are not put in black and white. Amongst the many Agricultural Indigenous Knowledge (AIK) that are disappearing, is the farming of *Phonda* and other legume plants. Groundnut, or peanut, is ordinarily called the poor man's nut. Nowadays, the farming of *Phonda* has resulted in an important production of oilseed and food crop. Moreso, it is a cheap source of dietary protein, oils, proteins and vitamins for humans and animals. Besides the consumption benefits that *Phonda* has, it has been argued to have the ability to improve soil fertility through biological nitrogen fixation (BNF) and is drought tolerant (Herridge, 2002; Azam-Ali *et al.,* 2001).

There are many different names of *Phonda* from different countries and the researcher will use the term *Phonda* in the study. The different names of *Phonda* are shown in Table 1 overleaf: (Murevanhema & Jideani, 2013:215).

Table 1: Names of country/Language and how Phonda is defined

Country/Language	**Name**
Madagascar	Baffin pea pistache
Zimbabwe	Nyimo
Ghana	Aboboi akyii
Nigeria	Epiroro, gujuya, Guijiya
Kenya	Njugumawe
Zambia	Jugobean
Malawi	Nzama
Central Africa	Njogobeans
Sudan	Fulabungawi
Sierra Leone	LeoneAgbororo
South Africa	Jugobeans
Tsonga	Ndluwa
Afrikaans	Jugoboon
Xhosa	Jugo
Zulu	Inndlubu
Siswati	Tindlubu
Ndebele	Indubu
France	Voandzou
Venda	*Phonda*/Nduhumvenda

The indigenous people around Vhembe district started farming *Phonda* and later valued it as one of the most important medicines; it was used for treatment of various ailments such as diarrhoea. *Phonda* became very distinctive amongst VhaVenda people as it was used to alleviate nausea associated with pregnancy, cure venereal diseases, prevent colon cancer, reduce heavy blood loss during menstruation and also used as an important ingredient in the performance of funeral rites. In addition, *Phonda* also played an important role in the diet of young children in that it prevented kwashiorkor. Consequently, as Akpalu (2013.68) puts it, the VhaVenda people started farming *Phonda* as subsistence farmers.

Picture 1: *Phonda* Kew.Org/ Science Conservation: accessed 05/05/2016)

Despite the importance of *Phonda* as a legume food and its medicinal purposes in traditional farming systems in Venda, limited breeding efforts have been made to improve this crop. Furthermore, little information is available about the extent of the genetic diversity among *Phonda* landraces, for long-term conservation and improvement. The decline of *Phonda* production is attributed to a lot of reasons; Foley (2005) indicates the issue of climate change. On the other hand, another polarized school of thought stipulates that modernity has led to the consumption of numerous chemicals that destroy the ozone layer. Therefore the study seeks to explore the indigenous medicinal knowledge of *phonda* in Vhembe district.

1.2 Problem Statement

Since time immemorial, indigenous people considered *Phonda* as valuable; for instance, it was cultivated for consumption in each household in Vhembe district some years back, before 1970. However, it has been noticed that *Phonda* is becoming a scarce crop (Foley, 2005). Recently, *Phonda* is sold in supermarkets and by most women traders from outside South Africa. Modern households no longer prefer to cultivate *Phonda* regardless of its nutritious and other value to human health. The scarcity of *Phonda* adds to the food security threats affecting mainly rural communities that depend largely on subsistence of crops. It also adds to the erosion of knowledge of indigenous food in the society (Foley, 2005: 25). Despite the importance of *Phonda* as a legume food and its medicinal purposes in subsistence farming in Venda, limited breeding efforts have been made to improve the cultivation of this crop. In addition, little information is available about the extent of genetic diversity among *Phonda* landraces, for long-term conservation and improvement.

1.3 Rationale of the Study

It is expected that the findings of the study will alert and encourage local households and farmers to farm *Phonda* on a larger scale. This will also contribute toward the body of knowledge since studies of this nature are rare in the Vhembe district. Therefore, the documentation of these findings are envisaged to enhance the body of knowledge in African studies regarding the modernity and suitability of indigenous food, and to document the medicinal and nutritional knowledge of *Phonda*, thus, addressing the negative perceptions of indigenous food. The University of Venda promotes community engagement in which IKS is one of its prime agendas. Therefore, the study about *Phonda* complements the University's initiatives towards the socio-economic development of the surrounding rural-based communities.

1.4 Purpose of the Study

The purpose of this study was to explore the medicinal indigenous knowledge associated with *Phonda*.

1.4.1 Objectives of the study

To achieve the main purpose above, the following research objectives were examined:

- To establish with the indigenous knowledge holders the nutritional value associated with *Phonda*
- To solicit information on the medicinal uses of *Phonda*

- To understand the attitudes of local households towards the cultivation and consumption of *Phonda*
- To determine adaptation practices to bring back the cultivation of *Phonda*

1.4.2 Research Questions

To achieve the objectives above, the following research questions were asked:

- What is the indigenous nutritional value of *Phonda*?
- What are the indigenous medicinal uses for *Phonda*?
- Which attitudes do local households have towards the cultivation and consumption of *Phonda*?
- Which adaption practices could bring back the cultivation of *Phonda*?

1.5. Theoretical framework

1.5.1 Afrocentric paradigm

Afrocentricity has been defined by Asante (2000) as a cultural ideology or world view that focuses on the history of Africans in response to global Eurocentric attitudes about African people and their historical contributions.

The theory introduces fundamental referential changes in the African community. It reflects high esteem perceptions on African identity and explanations for African conditions and its overall remedial proposals. This theory is against the spread of Eurocentric view where Western culture or innovations are viewed as superior. A principal advantage of the Afrocentric approach is that it compels the researcher to challenge the use of traditional Eurocentric criteria of objectivity, reliability and validity in the inquiry process. It holds that the main problem affecting African people is the unconscious adoption of the western worldview and perspectives and their attendant conceptual framework (Mazama, 2001: 387). The theory advocates that African people be relocated historically, economically, politically and philosophically. It holds that research should be conducted from an African perspective in order to create Africa's own intellectual perspective. The African paradigm serves as a liberating intellectual movement towards a pluriversal perspective in research. The fundamental aim of Afrocentricity is that all cultural centres must be respected.

Asante (1995:3) maintains that Afrocentricity is not colour conscious; it is not a matter of colour but of culture that matters in the orientation to centeredness. Asante (1980) further asserts that

the past five hundred years have seen Africans taken off their cultural, economic, religious, political, and social terms and have existed primarily on the periphery of Europe. As such, Africans now know little about their own classical heritage and contributions to world knowledge. Inherently, these ideas and theories have crept into the lives of Africans as ideal, unquestioned and universal. The inability to recognize that the generation of the ideas which include progress, development, democracy, and social organization rooted in the European cultural ethos has led to the relegation of African individuals from a historical perspective. The theory intends to re-locate the Africans as subjects, thus destroying the notion of being objects in the Western project of domination. Continuously, Afrocentricity seeks not to occupy all space and time or to become a reverse of Eurocentricity which aims to dominate other world groups. It suggests pluralism in philosophical views without hierarchy. As such, all cultural centres must be respected; this is the fundamental aim of Afrocentricity (Asante, 1980). Afrocentricity means literally placing African ideals at the centre of any analysis that involves African culture and behaviour (Asante, 1998: 2). Since Afrocentricity adopts Africa as a reference point of African civilization, it was useful in the exploration of indigenous medicinal knowledge on *Phonda.*

1.6 Definition of terms

Phonda

Phonda is a Venda term used to describe beans that are related to cowpeas and botanically known as *Vigna subterranean* (L) Verdc. There are two botanical varieties which are *V. subterranean* var. *spontaneas* which includes the wild varieties and *V. subterranean* var. *subterranean* which includes the cultivated varieties (Linneman, 1987:107).

Food security

When a society is described as food secure, it means that the society can produce, consume and store enough for its people. Food security, therefore, means the state of having enough to eat, and also being secure from hunger and starvation. In this study, food security refers to a situation in which people have enough to eat and whether that food is proper in terms of health implications. According to Boyle and Holben (2006: 415), food security is when people have access to enough food for an active and healthy life all the times. Food security has two aspects: ensuring that adequate food supplies are available and ensuring that households whose members suffer from under-nutrition have the ability to acquire food, either by producing it themselves or by being able to purchase it.

According to Marie *et al.* (2006: 415), food security is access s to enough food for active and healthy life by all people at all times..

Indigenous food crop

Indigenous food crop refers to food crop produced by indigenous people through cultivation and gathering, for example, *phonda* (Gibney, 2002:45).

Households

Household is defined as all the people living together in a house or flat (Hornby, 2010:730).

Human Nutrition

Human nutrition refers to the processes whereby cellular organelles, cell, tissues, organs, systems and the body as a whole obtains and uses necessary substances obtained from food (nutrients) to maintain the structural and functional integrity (Gibney, Vorster & Kok, 2002: 2).

Medicinal

Medicinal refers to the act of being helpful in the process of healing illness or infection (Hornby, 2010: 923).

Society

Society refers to people in general, living together in communities (Hornby, 2010: 1414).

Malnutrition

Malnutrition is a poor condition of health caused by a lack of food or lack of the right type of food, compared to nutrition (Hornby, 2010: 901).

Indigenous knowledge

According to the World Bank (1998), indigenous knowledge is a key element of the social capital of the poor, the main assets to invest in the struggle for survival to produce food, provide shelter or to achieve control over their own lives.

Village

A village is a very small place in another country that seems older-fashioned than a town (Hornby, 2010: 1658).

1.7 Division of the study

The study is divided into the following chapters:

***Chapter One*:** This chapter provides a clear introduction and background presentation of issues of focus in the study; it also presents the problem statement; aim and objectives of the study; major research questions and the rationale of the study.

***Chapter Two*:** The chapter comprises the relevant literature, works by different anthropologists and authors have been reviewed and recorded for reference. This was done to ensure correlation with major research questions of the study.

Chapter Three: The chapter presents the research methodology and research design. The chapter exposes the systematic discussions of the nature and type of research methods and choices. It further discusses research instruments, population and location and ethical issues and gives a clear explanation of how the study was conducted.

***Chapter Four*:** This chapter provides the discussion of findings and analysis of fieldwork data.

Chapter Five: The chapter includes the summary of the study findings, discussion, conclusions, and recommendations for further research.

Chapter 2

Literature Review

2.0 Introduction

The researcher reviewed literature on medicinal and nutritional knowledge associated with *Phonda* in Vhembe district. The researcher reviewed relevant historical, theoretical and research related to medicinal use of *Phonda* in Vhembe district. This will then be compared and contrasted with what the previous and current studies are saying and contributing to the topic. The review commences with the foundation of scientific thought, which subsequently facilitates the rise of contemporary industrial society. Questions were posed on existing literature to determine the gaps that exist in the study. This provides an insight into what is already known about the physiological differences between *Phonda* landraces and give examples of existing model frameworks. In this chapter, *Phonda* has been referred to by some scholars as Bambara groundnuts (BGNs). As such, these terms are used interchangeably.

2.1 The origins of *Phonda*

Phonda farming originated in West Africa, Bambara district, near Timbuktu (Hepper, 1963). It is opined that groundnuts were named *Bambara* after its place of origin and derived from the local tribe, Bambara (Jideani & Diedericks, 2014). *Phonda* is indigenous to sub-Saharan Africa where it is widely cultivated. The centre of origin is most likely North-Eastern Nigeria and Northern Cameroon, in West Africa. The species is also grown to a lesser extent in some Asian countries such as India, Malaysia, Philippines and Thailand. Sellschop (1962) submits that *Phonda* is ranked the third most important legume in Africa after groundnut. Oyiga (2009:1) also maintains that *Phonda* groundnut (*Vigna subterrenea* [L.] Verdc) is an indigenous African legume cultivated mainly by subsistence farmers under the traditional little effort agricultural system, the crop belongs to family *Papilionaceae* and is one of the underutilized crops in the sub Saharan Africa. The crop is a major source of dietary protein among rural and urban dwellers in Nigeria.

A further argument is that Bambara groundnut originated from the African continent, especially Central Africa long before the introduction of groundnuts (peanuts). It belongs to the family *Leguminosae*, subfamily *Papilionoideae* (Goli, 1997) and is related to cowpeas. The botanical name of the crop is *V. subterranea* (L) Verdc, which comprises of the wild species type (*V. subterranea* var. *spontanea*) and the cultivated type (V*. subterranea* var. *subterranea*).

Diversity of opinion exists among the different tribes as to who first brought *Phonda* to the Southern part of Africa. On the one hand, it is claimed that *Phonda* found its way into South Africa through migration of indigenous people from West Africa. In South Africa, *p*honda groundnuts were farmed first in Kwazulu Natal. From Kwazulu Natal, *phonda* grounds were carried to Bolobedu where it was also farmed until it found its place in Venda when some vhaVenda visited Bolobedu and took the seeds for farming. In Venda, they later called it *Phonda* (Jideani 2014:74).

On the other hand, the Balobedu of Letaba claim they came with it from the North. They arrived south of the Limpopo before the Venda people who in turn, assert that they brought *Phonda* from central Africa to the Transvaal. The latter contention in substantiated by two factors: the Venda name '*Phonda*' meaning ground in the contention, furthermore, the harvest ritual is customary for '*Phonda*' among the Venda.

2.2 Constraints of *Phonda*

Phonda groundnut is not attacked by diseases and pests in any of its production regions. However, in damp conditions, it may be susceptible to various fungal diseases (Baudoin & Mergeai, 2001:313). It has a very low insect pest and disease susceptibility (Tweneboah, 2000 in Nyau, Prakash, Rodrigues, Farrant 2015:7). According to Gowda (1995:34), in the rain season, *Phonda* groundnuts compete with several weeds species since the annual grasses and seasonal broad leaves weeds grow luxuriously and dominate during this season as compared to the post-rainy season. Weeds can make *Phonda* to become thin as they consume the food that is supposed to be taken by *Phonda*. According to Christina (2009), the decline in *Phonda* / BGN is due to lack of adequate processing techniques to promote utilization. According to DWAF (2002) water is an important limiting factor to crop production in South Africa and that the country receives an average rainfall of about 500 mm per year. The challenge is also that the rainfall is unevenly distributed both temporally and spatially (DWAF, 2002). The problem of water scarcity in South Africa has emphasized the need to develop and identify drought tolerant crops. The challenge for farmers and researchers is to find ways to increase the crop output per unit of water and overall crop production in order to meet the requirements of a growing population. It is within this context that previously neglected underutilised crops such as *phonda* fit. In South Africa, the species has never been allocated a large-scale research programme. In Vhembe district, the species is being cultivated in a small space for consumption and not for commercial purposes.

Masindeni (2006) asserts that the crop has a tendency to resist pests and diseases. This could be because they produce their food below the soil and are free from attack by flying insects or

maybe because they are mainly intercropped and isolated by crops such as maize. There are a number of pest problems and diseases found on BGN, but very little is known about the kind of pest and disease attacks and the extent of the damage to the plant, pods or seed. There are only a few authors who have reported on the pests and diseases of the crop. Swanevelder (1998) opines that *Meloidogyne incognita* and *M. javanica* are parasitic nematodes on BGN. Developing pods of BGN are damaged by *Piezotraachelus ugandum* (moth beetle), while larvae of the genus *Rivellia* cause damage to the root nodules. Various viruses have also been reported as being problems on Bambara groundnut production. There are no chemicals registered for the control of diseases and pests on Bambara groundnut in South Africa.

Masindeni (2006) listed some of the diseases such as leaf spot, powdery mildew, *Fusarium* wilt, leaf blotch and *Sclerotium roffsii* that have been recorded on BGN in Zimbabwe. *Fusarium wilt* disease has been reported in Kenya as one of the major diseases limiting yields of the crop, and in South Africa, most farmers' experience wilting problems in their fields.

Masindeni (2006) posits that *Cercospora* is one of the major diseases that attacks the crop and usually occurs under irrigation. Foliar diseases reduce the vegetative biomass and thus, the quality of the fodder. Bouriquet (1946) in Masindeni (2006) further maintains that powdery mildew is a widely spread disease in Madagascar and has been named *Sphaerotheca voandzeia*. The disease is caused by the Fungus *Erysiphepisi* and its presence is shown by white powder on the leaflets. *Fusarium* wilt has also been reported from Kenya (Cook, 1978) and Tanzania. Young seedlings are attacked by wilt in wet conditions, particularly under waterlogged conditions.

The crop is susceptible to viruses such as cowpea mottle virus (Shoyinka *et al*., 1978), cowpea mild mottle virus, *Voandzeia necrotic* mosaic virus (Fauquet *et al*., 1984), white clover mosaic virus (Quantz, 1968) and two potyviruses (Bird, 1989; Bird & Corbett, 1988; Bock *et al*., 1978). The potyvirus that was observed in Tanzania is related to peanut mottle virus and the potyvirus that is caused by seed borne diseases was observed in Togo.

2.3 Botany / Morphological Description of Bambara groundnut

BGN is an herbaceous, intermediate annual plant, with creeping stems at ground level. Differences in internodes length result in bunched, intermediate (semi-bunched), and spreading types. The general appearance of the plant is bunched leaves arising from branched stems which

form a crown on the soil surface. Stem branching begins very early, about one week after germination, and as many as 20 branches may be produced and each branch is made up of internodes. The plant has a well-developed tap root with profuse geotropic lateral roots. The roots form nodules for nitrogen fixation, in association with appropriate rhizobia. Leaf and flower buds arise alternately at each node. Leaves are pinnately trifoliate with erect petiole, thickened at the base. The flowers are borne on hairy peduncles which arise from nodes of the stem. The pods develop first, and reach its matured size about 30 days after fertilization. The seeds develop in the following 10 days (Doku & Karikari, 1971).

According to Goli and Ng (1988), the pods usually develop underground and may reach up to 3.7cm long, depending on the number of seeds they contain. Most varieties have single seeded pods, but pods with three seeds were frequently found in ecotypes collected in Congo. Matured pods are indehiscent, often wrinkled, ranging from a yellowish to a reddish dark brown purple, red or black. Various tests patterns are found, including mottled, blotched or striped, in addition to the predominantly uniformly coloured seeds.

2.4 Water management in Bambara groundnut

The amount of moisture available to a crop greatly influences its productivity. Excess or insufficient amount of water can be detrimental to crop growth and yield. However, since BGN is the most adaptable of all plants and has an extended flowering period, it tolerates relatively reasonable periods of moisture stress, particularly if the stress does not occur during germination and early pod filling. According to Ameyaw and Doku (1983), yield under available moisture of 40% was more than ten times that under 75% available moisture, indicating a low optimum water requirement. The crop requires average annual rainfall of 600-750 mm/year, but optimum yields are obtained at higher rainfall of 900-1200 mm/year. It is also grown in humid conditions e.g. in northern Sierra Leone where the annual rainfall exceeds 2000 mm (Brink & Belay, 2006). According to Karikari (1996), *Phonda* groundnut is reported to be tolerant to drought, poor soils and extreme heat, hence, making it a suitable crop to the low-input production systems. It is also reported that under severe drought conditions where groundnuts did not have any kernels, *Phonda* groundnut produces small filled pods (Mazhani & Appa-Rao, 1985).

2.5 Growing environment requirements

BGN (*Vigna subterranean*) which belongs to family *Fabaceae* is an annual herbaceous, intermediate plant with creeping stems at ground levels. It has a well-developed taproot with

profuse geotropic lateral roots. New roots often appear where nodes contact soil. The fibrous lateral roots form nodules for nitrogen fixation. The stems are branched and hairy, with short internodes. The leaves are trifoliate and are borne on long slender petioles. The flowers spread out close to ground level on hairy peduncles, each producing one to three flowers. Most flowers are light yellow in colour, although some are deep yellow (especially late in the day). After pollination, each small flower sends down a tendril, or peg, like a long root, which continues to burrow even after it has pierced the soil (Mazahib *et al*., 2013).

Crop growth and yield however require mineral nutrition which is supplied to the desired crop as manure. Manure is categorized as organic and inorganic fertilizer. There are various reports of inorganic fertilizer in the improvement of crop productivity and there are reports of the preference of inorganic fertilizer in the growth and productivity of crops. Therefore, there seems to be some level of specificity in crop adaptation to the type of fertilizer in order to increase its growth and yield potentials (Nweke & Emeh, 2013).

Most cultivars have single seeded pods, but pods with 3 seeds are frequently found in the ecotype from Congo (Amadou *et al*., 2001). The unripe pod is yellowish green while the mature pods are indehiscent, often wrinkled, ranging from yellowish to a reddish dark brown colour (Basu *et al*., 2007). The landrace consists of several genotypes which h different capacity to tolerate biotic and abiotic stress under a low input agricultural system (Zeven, 1998; Amadou *et al*., 2001; Basu *et al*., 2007). An average day temperature of 20–28 degrees Celsius is ideal for the crop; it has a growth period of 110–150 days for the crop to develop (Basu *et al.*, 2007). Bambara groundnuts will grow on any well drained soil, but light sandy, loams with a pH of 5.0–6.5 are most suitable (Basu *et al.,* 2007). Amadou *et al*. (2001) opine that Bambara groundnuts will often yield well in environments that may be too hostile for more favoured legumes, it is not prone to the risk of total crop failure, especially in low and uncertain rainfall (Brough *et al*., 1993; Baryeh, 2001), making it play an important socio-economic role in the semi-arid regions of Africa (Massawe *et al.,* 2002).

Phonda has become less important in many parts of Africa because of expansion of groundnut production. *Phonda* is a popular crop because of its resistance to drought and its ability to produce a reasonable crop when grown on poor soil.

The plant can be grown under dry climatic conditions where the rainfall during the rainy season would be adequate to enable them to accomplish their vegetative cycle (Borget, 1992) An evenly distributed rainfall in the range 600–1000 mm encourages optimum growth but satisfactory yields

can be obtained in areas with a pronounced dry season since the crop is relatively drought resistant (Messiaen, 1992). *Phonda* is resistant to high temperatures and can be grown on poor marginal soils not suitable for other leguminous crops (Yamaguchi, 1998).

Given reports that *Phonda* groundnut is drought tolerant (Linneman and Azam-Ali, 1993), has high nutritional value (Swanevelder, 1998), it has the potential to provide food security in the dry and marginal areas of Africa. The crop is rich in protein (16-25%), carbohydrates (42-60%), fat (5-6%) and other essential nutrients (Linnemann, 1988; Akani *et al*., 2000; Atiku *et al.,* 2004). Its neglect has been suggested to may have been due to its low lipid concentration (Massawe *et al.,* 2005). Additionally, *Phonda* groundnut can also contribute towards food security indirectly. *Phonda* groundnut is a legume which has a symbiotic relationship with bacteria (*rhizobia*) that form root nodules. *Rhizobia* can make use of free nitrogen from the air, incorporating it in the plant root tissue (Masindeni, 2006), hence increasing the amount of nitrogen in the soil which in turn, may be beneficial to subsequent crops. Consequently, farmers may end up applying less fertilisers, thus saving on much needed and scarce resources.

There are 327 known accessions of *Phonda* groundnut in South Africa with a wide range of differences in seed coat colour, seed size, and pigmentation around the eye, pod shape, growth habit, and yield, shelling percentage and time to maturity (Masindeni, 2006). It is important to know about genetic variation of *Phonda* groundnuts accessions for their efficient use in breeding programs and for studies on crop evolution. *Phonda* groundnut shows a considerable amount of variability for various morphological, physiological and agronomic traits (Ntundu *et al*., 2004).

Drought stress has a tremendous negative effect on agriculture (Sazares *et al*., 2011). Drought in plants occurs when there is insufficient soil moisture to meet the needs of a particular crop at a particular time. Neglected underutilised crops have been reported to have possibly evolved to become drought tolerant due to years of cultivation under often severe conditions. *Phonda* groundnut is one such crop that has been reported to be drought tolerant (Harris & Azam-Ali, 1993).

Seed planting is always the main method of developing the crop and is inter-planted with either cereals (pearl millet, root crops or other legumes) or in pure stands (Gibbon & Pain, 1985). Ocran *et al*. (1998) opines that the crop may be grown either as a single stand or intercropped with groundnut, millet or sorghum. In rotations, it may be planted as an opening crop, perhaps followed

by cassava, or in the second year it may be intercropped with cereals, vegetables, groundnuts or other pulses. The crop performs best on deeply ploughed field with a fine seedbed, eventually allowing the plant to bury its developing fruits. Ridging is advisable if the soil is shallow or prone to water logging (Brink *et al.,* 2006). Baudoin and Mergeai (2001) maintain that proper loosening of the soil helps pod penetration during fructification and improves the yield. Tweneboah (2000) also hold that a well prepared friable seed bed is required to enable the plants bury their pods after fertilization. Tindall (1997) asserts that seeds, normally shelled, are sown on beds or ridges in rows 40-50 cm apart, 20-30 cm between plants. According to Ocran *et al.* (1998), the recommended row spacing is usually 10-45 cm with an intra-row spacing of 15-17 cm. One seed is sown per hole 3-5 cm deep. Seed rate varies in several location, that is 35 kg/ha in Tanzania; 25-45 kg/ha in Kenya; higher rate of 60-75 kg/ha in South Africa when rat damage is expected (FAO, 1961). Gibbon and Pain (1985) maintain that the normal seed rate is 30-60 kg/ha of shelled nut giving 150,000 plants/ha.

Doku (1995) posits that the crop is relatively pest and disease–free apart from weevil attack during storage. Gibbon and Pain (1985) opine that no serious pest or diseases are reported for this crop, but damage is sometimes caused by leaf hoppers *(Hilda patruelis and Empoasca facialis)*. Tanimu and Aliyu (1995) have also made similar observations that *Phonda* groundnut is relatively free of the insect pests that plague other legumes such as cowpea and peanut. And on the whole, pesticides are hardly used by farmers when cultivating *Phonda* groundnut.

Harvesting usually starts about four months after sowing when the pods are mature and the plants' leaves are beginning to yellow. The plants are simply pulled out of the ground with the attached nuts manually (Gibbon and Pain, 1985). In a dry environment, harvesting takes place when the entire foliage dries up. In humid ecosystems, however, pod rotting or early seed germination (in the pod) may take place while the leaves are still partially green. Harvesting is then recommended before full foliage drying (Goli, 1995).

2.6 The importance of *Phonda*

According to Nnaman (2001:26), *Phonda* groundnut is an important legume produced extensively in north Nigeria. The legume is sweet and pleasant to eat either as dry or immature seeds. The protein content in the forage ranges from 20-25% dry matter basis (Arora, 1995). It has more methionine than is found in other grain legumes and would serve as a good supplement to sorghum protein. *Phonda* forms part of valuable food that can build our bodies. *Phonda* is used

as food and makes an important contribution to the diet of the people around Vhembe. *Phonda* is said to provide proteins, vitamins, carbohydrates and fats. Malnutrition can be decreased in areas where *Phonda* nuts are frequently eaten; and they promote health and reduce obesity in children (Nelushi, 2000:2). Primary prevention is aimed at preventing diseases by controlling risk factors that are related to injury and diseases. Low fat cooking classes, for example, help people change their eating and cooking patterns to reduce the risk of cardiovascular diseases. Secondary prevention focuses on detecting diseases early through screening and other forms of risk appraisal (Marie, 2006:9). It is confirmed by Massawe *et al.* (2005) that *Phonda* is an indigenous African legume which plays an important socio-economic role in semi-arid regions of Africa). It serves as a cheap source of protein to a large proportion of the population in poor countries of the tropics (Linnemann & Azam-Ali, 1993; Azam-Ali *et al.,* 2001).

2.7 Medicinal uses of *Phonda*

Some medicinal uses of *Phonda* were reported by Jideani & Diedericks (2014:199). They reported that *Phonda* groundnut has its role in treatment of some of the diseases which were contracted from communities in parts of Africa. For instance, a mixture of *Phonda* and water from boiled maize are consumed to alleviate diarrhoea. Furthermore, the authors claim that pregnant women can also chew and swallow the raw *Phonda* groundnut seeds in order to alleviate the nausea associated with pregnancy. It also plays a role in diets, especially of young rural children as it helps in overcoming the protein deficiency kwashiorkor. In some other countries like Nigeria, the Igbos use the seeds as treatment of different diseases such as sexual transmitted diseases and menstrual disorders by eating the roasted seeds.

The Igbo tribe in Nigeria uses the seeds for treatment of venereal diseases. To treat *polymenorrhea,* it is recommended that *Phonda* seeds be roasted before consumption. The water in which *Phonda* seeds are boiled is used as treatment for internal bruising, and a mixture of water and crushed seeds are prescribed for treatment of cataracts, *Phonda* seeds have the highest concentration of soluble fibre as compared to other beans; this could contribute to the reduction of heart disease incidence and prevention of colon cancer. Surveys amongst local communities in northern Côte d'Ivoire revealed that the *Phonda* seeds are mainly used for medical treatments as opposed to other parts of the plant. The seeds are used to treat anaemia, ulcers (black *Phonda* variety mixed with an unidentified plant) and menorrhagia during pregnancy (haemostatic drink prepared by a mixture of *Phonda* flour and *Pupalia lappacea* (L.) Amaranthaceous dissolved in water). The traditional uses of *Phonda* to treat several ailments are noteworthy, and present a

gap for detailed study on the pharmaceutical value of the crop. This would provide yet another means of highlighting the potential of *Phonda* as an underutilised legume and tap into ways of encouraging more sustained production and use of *Phonda.*

Perhaps the bioactive content of *Phonda* may explain some medicinal uses reported in some countries for *Phonda* ground nut. Leaf preparations are applied to abscesses and infected wounds; sap from *Phonda* leaves is applied to the eyes to treat epilepsy; roots are sometimes taken as an aphrodisiac; and pounded seeds are mixed with water and used to treat cataracts in Senegal. The Igbos in Nigeria use the plant to treat venereal diseases (Brink & Belay, 2006). The Lio tribe in Kenya use *Phonda* for treating diarrhoea by drinking water from boiled maize and *Phonda* (Goli, 1991). Extracts from *Phonda* leaves mixed with those of *Lanfana triflia L.* make a solution that can be used to wash livestock or as an insecticides (Mandawire, 2007). The black seeded landraces have a reputation of being a treatment for impotence in Botswana (NRC, 1996). Chewing and swallowing raw seeds is believed to check nausea and vomiting and is often used to treat morning sickness in pregnant women among South Africans (Swanevelder, 1998).

2. 8 Utilization and nutritional composition of *Phonda*

Legumes serve as a source of protein to a large proportion of the population in the poor countries of the world by being the least expensive and easily stored and transported non-processed protein source for rural and urban dwellers (Afakwabudu & Merson, 2007:271). The high carbohydrate (65%) and relatively high protein (18%) content of *Phonda* groundnut make it a complete food. *Phonda* groundnut is probably the most drought–resistant of the grain legumes and may be found growing successfully where annual rainfall is below 500 mm and optimum between 900–1000 mm per year.

According to Anakwenze *et al.* (2015:34), *Phonda* protein is one of the important resources of vegetable protein due to its high nutritional value. Therefore, developing countries have paid more attention to develop *Phonda* groundnut in order to overcome protein malnutrition. Proteins and carbohydrates are the main nutrient content of *Phonda* groundnut seeds, and the essential amino acid predominantly are lysine and Lucian. The literature study on food allergy indicates that there have been no reports of allergy on *Phonda* groundnut. However, the potency of allergen was estimated to come from protein and carbohydrate contents on *Phonda* groundnut. Accordingly, Boyle (2006:6) posits that many of the major chronic killer diseases, such as heart disease, some types of cancer, stroke, and diabetes are influenced by food that we eat.

Pakistan (2009:835) alleges that vitamins are organic nutrients found in natural food which is essential in minute quantities to the nutrition of animals. *Phonda* is an indigenous African grain legume (Poulter, 1981). The crop is reputable as a poor man's crop with high nutritional potentials (Poulter, 1981). *Phonda* is reported to be rich in protein and carbohydrates and little oil and it can be used in many different foods like baked products and milk produce which is compared to cow pea and soy bean milk.

Worsley (2008:241) asserts that children vary in many ways, some live in traditional families with both parents, some live with one parent. However, they share three characteristics: They are dependent on others for their care. As they age, their dependency usually decreases. Most often, but not exclusively, this care is provided by their parents or other caregivers. They grow physically, mentally and socially. They require nutritious food and stimulating, safe and highly social environments. Children are excellent learners. They actively explore their environments and learn rapidly. Most societies provide special opportunities for them to learn from previous generations about the world. Though they usually perceive the world quite differently from their parent's generation.

Various forms of food and nutritional education are prescribed for children in most societies because these are generally regarded as important life skills. Worsley (2008:242) posits that children nutrition promotion issues span several broad age groups or life stages: pregnancy and pre-natal and adolescents and young adults. In addition, Worsley (2008:97) opines that nutrition can be promoted by members of a community as they have their own set of beliefs and priorities about food and health which have to be taken into account in any nutrition promotion program. On the other hand, nutrition promoters have access to advanced nutrition and health knowledge which is derived from scientific research. The task facing promoters is to reconcile their expert knowledge with community interest and lifestyles so that programs are relevant while still being accurate. This is often difficult, since food and nutrition needs of particular social groups and communities vary widely. Many areas of science appear to change rapidly, yielding divergent findings and claims. This is compounded by the rapid publication of diverse scientific methods in the mass media. The result is that many of the communities are confused and demotivated by nutrition information. Nutrition promoters deal with a wide variety of problems and issues, ranging from food production to consumer food purchasing to deliver programs; nutrition promoters need to be confident that the scientific premises of their programs are valid and likely to remain so over fairly long periods.

Swanevelder (1995) reported the food uses of *Phonda* in South Africa. They include the following 'Sekome' (Sepedi), 'Tihove' (Shangaan) or 'Tshidzimba' (Venda) which is prepared by adding 'Njugo' beans and peanuts, or just one of the two, to maize or millet-meal and boiling the mixture until it forms a stiff dough. This is salted and pounded into a ball, and will often keep fresh for several days. *Phonda* groundnuts are boiled and then stirred to make a thin porridge, which is known as 'tshipupu' (Venda). Like maize, they may also be added to 'Lupida', a porridge made from peanuts. 'Njugo' beans are often eaten when still immature, simply boiled until soft, and shelled. When quite dry and hard, they are generally shelled, and then boiled to make a stiff porridge. *Phonda* groundnut can be cooked with maize and pounded into a thick, sticky dough known as 'Dithaku' (in Sepedi). According to Jideani & Dedericks (2014:200), *Phonda* can be used to produce a probiotic beverage as well as a rich source of soluble and insoluble fible that can be used to enhance the nutrition and textural properties of white bread. Jideani and Murevanhema (2011:957) reported that the colour of *Phonda* is associated with its protein content, the black variant has the highest protein content while the cream has the lowest. The high protein content of *Phonda* is an indication of its prospective usage as functional ingredients.

Phonda groundnut are consumed in many ways, eaten fresh, or grilled while immature (Goli., 1997; Swanevelder, 1998; Uvere *et al.*, 1999; Mpotokwane *et al.*, 2008). They harden at maturity, and therefore require soaking and or boiling before any specific preparation (Abu-Ghanna & McKenna, 1997). The fresh pods are boiled with salt and pepper, and eaten as a snack in many West African countries (Goli, 1997). In East Africa, *Phonda* groundnuts are roasted, then crushed, and used to make soup, with or without condiments (Goli, 1997; Uvere *et al.*, 1999). In Cote d'voire, the seeds are used to make flour, therefore, making it more digestible. In Zambia, bread is made from *Phonda* flour (Linneman, 1990); cakes in Botswana (Goli, 1997; Lawal *et al*., 2007); stiff porridge, which has a relatively long shelf-life (Goli, 1997). Paste from Phonda flour is used in the preparation of steamed product such as O*kpa* in Nigeria (Goli, 1997). O*kpa* is cooked dough-like gel made from *Phonda* paste that is wrapped in banana leaves and boiled. Roasted seeds can be boiled, crushed, and eaten as relish. In Botswana, consumers often prefer the immature seeds which are boiled in pod, salted, and consumed either on their own or with maize seeds. The seeds of mature black landrace are used for medicinal purposes (Heller *et al*., 1997).

Commercial canning of *Phonda* groundnuts has been practiced in Ghana, the nuts were canned in gravy by a government factory and over 40,000 cans were produced annually (Begemann, 1986). In Zimbabwe, canned *Phonda* groundnut were commercially produced for the market as

'Tulimara Nyimo Beans' and recommended for addition to soups, stews and salads. However, the successful commercialization of *Phonda* groundnut in Zimbabwe was hampered by problems such as transport difficulties as the roads were not suitable for truck deliveries, distances to the farms, the fuel crisis and food shortages which often resulted in the beans not always being available for sale by local farmers. Other rival factors included storage facilities (the beans needed to be fumigated and stored in cold rooms), marketing strategies (lack of awareness of *Phonda* groundnuts commercial products both locally and internationally as well as limited funds for marketing activities), distribution relatively expensive compared with other legumes (not widely distributed to local supermarkets with large populations and also not available in villages (de Kock, undated).

Despite Zimbabwe's production constraints, it has been successful in exporting more than 3000 tonnes of *Phonda* groundnut to South Africa and Swaziland (Hampson *et al.,* 2001).To date, there has been no commercialization of *Phonda* groundnut in South Africa. This means that South Africa is lagging behind. Lack of research efforts towards commercial utilization of *Phonda* groundnut in South Africa is delaying the legume's inception into a commercial scale. South Africa boasts better infrastructure and capacity than Zimbabwe, therefore it can be in a better position to successfully commercialize *Phonda* groundnut. The current study aims to contribute to the development of some scientific knowledge that may be needed in order to successfully commercialize *Phonda* groundnut in South Africa.

Antioxidants are principal ingredients that protects food quality by retarding oxidative breakdown of lipids (White & Xing, 2001), the human body cells and tissues from the damaging effects of toxic molecules called free radicals (Adelakun *et al.,* 2009). Most legumes contain some antioxidants. Typical compounds that possess antioxidants activity include phenols, phenolic acids and derivatives, flavonoids, tocols, phospholipids, amino acids and peptides, phytic acid, ascorbic acid, pigments, and sterols. Phenolic compounds are widely distributed in legumes. Chlorogenic, isochlorogenic, caffeic, ferulic, pcoumaric, syringic, vanillic, and p-hydroxybenzoic acids are commonly present in legumes (White & Xing, 2001).

Ihekoronye and Ngoddy (1985) reported that *Phonda* is richer than groundnuts in essential amino acids such as isoleucine, leucine, lysine, methionine, phenylalanine, threonine and valine. Phonda groundnut is a non-oily leguminous seed which contains only about 6% of ether extract, therefore it could not give a cash crop status, a great importance in food industry. In addition, the

fatty acid content is predominantly linoleic, palmitic and linolenic acids (Minka & Bruneteau 2000). The carbohydrate fraction of *Phonda* is predominantly composed of starch and non-starch polysaccharides with lesser amount of reducing and non – reducing sugar. Addo (1986) reported that *Phonda* groundnut contains high amount of lysine than other legumes, while the seed contains more methionine than any other grain legume.

The *Phonda* groundnut is a minor crop of potential importance in Africa. It has a high protein content (16-25 %) and is widely used on the continent to complement the staple foods which are basically carbohydrates. Creative schemes are needed to increase the quantity and quality of *Phonda* groundnut for production and processing into an inexpensive and nutritious source of protein. Processing usually improves the protein quality of foods, however, nutritional consequences on other food constituents should be minimal (Redempta, 1998:1). It is further stipulated that *Phonda* groundnut is an indigenous African yield that has been developed for hundreds of years in tropical areas south of the Sahara (Linneman & Azam-Ali, 1992). In spite of the fact that it is for the most part created in West Africa, it is broadly developed in eastern and southern Africa as well as in Madagascar (Williams, 1992). The yield is transcendently developed for human consumption, yet can likewise be utilized to encourage pigs and poultry (Oluyemi, et al., 1976).

Phonda groundnut can be consumed in several ways such as: boiled fresh immature seeds, boiled mature dry seeds, porridge and cookies (by combining its flour with cereal flours) as well as in the form of *Phonda* milk (Brough & Azam-Ali, 1992). It differs from Vhembe where *Phonda* is cooked fresh with pod and cooked mixed with peanuts and ground maize to be used as a relish like soup. Prevalence of malnutrition in Malawi among school aged children is 30% for stunting, 18% underweight and 3% wasting (NSO, 2006). Malnutrition is one of the contributing factors to reduced mental and physical development of children, hence delayed school enrolment, poor physical performance, increased school absenteeism, increased school dropouts, low academic and professional achievements (NSO, 2008).

BGN is adapted to a wide range of soils and its popularity with small farmers in Africa is attributed to the ability to produce yields on poor soils. Like other legumes, it can fix atmospheric nitrogen through symbiosis with rhizobia. As a leguminous crop, Bambara groundnut is useful in crop rotations because it may improve the nitrogen status of the soil. Mukurumbira (1985) in Ramolemana (1999) found that BGN has a higher residual nitrogen effect than groundnut, maize

or fallow. The crop has also been reported to be drought tolerant and able to produce some yield where other crops such as groundnut (*Arachis hypogaea*) fail (Linnemann & Azam-Ali, 1993).

BGN contributes to the livelihood of small farmers as a source of protein and income (Linnemann & Azam-Ali, 1993; Brink *et al*., 1996; Mulila-Mitti and Kanenga, 1997; Sesay *et al.*, 1997). The crop is mainly grown for the seeds, but the vegetative parts may be used as fodder. An important advantage of BGN is that not only mature, but also immature seeds can be consumed by humans.

BGN is one of the leguminous crops that have been described as a complete food with sufficient amounts of nutrients. The crop is a major source of proteins, minerals and vitamins. Poulter and Caygill (1980), Linnemann (1987) and Arora (1995) posit that the crop provides an important source of proteins (16-25%), carbohydrates (42-60%), and fat (5-6%). Plant proteins provide nearly 65% of the world supply of proteins for humans from 45-50% cereals and 10- 15% legumes Mahe *et al.* (1994), with legumes being a major source of proteins in tropical countries. BGN genotypes overall provide 20-25% of proteins.

According to Obizoba (1991), BGN mixtures (BG-Corn) showed a nutritional superiority to pigeon pea when cooked. The BGN and pigeon pea had a protein content of 14.85% and 18.39% respectively, when compared to the cowpea variety which had the highest protein content of 22.87% in their study of nutritive value of the crops. They further indicated that the cowpea and BGN mixture have acceptable characteristics as sole sources of nutrients for infants or supplements for adults. Blends of sorghum-BGN and sweet potatoes have a good protein quality (Nnam, 2001).

2.9 Anti-nutritional factors

Several studies on Phonda groundnut have identified anti-nutritional factors (ANF's) such as trypsin inhibitor (Tibe *et al*., 2007), phytate (Nwanna *et al.,* 2005), and tannins (Borget, 1992; Tibe *et al*., 2007). Borget (1992) identified low levels of trypsin inhibitor in *Phonda* groundnut seeds although these levels have been reported to be higher than those of pigeon pea (Fasoyiro *et al*., 2005) and chickpea (Apata & Ologhobo, 1997). In a comparative study between *Phonda* groundnut and soybean, *Phonda* groundnut seeds were reported to contain a higher anti–trypsin activity and the activity depended largely on the landrace (Tibe *et al*., 2007). High levels of phytate have been reported in *Phonda* groundnut and are associated with reducing Ca availability (Nwanna *et al*., 2005). Poulter (1981) found a correlation between seed colour and the level of tannins present in *Phonda* groundnut seeds. Cream coloured seeds had the lowest tannin level

while brown and red contained higher levels, respectively (Nwokolo, 1996; Amarteifio *et al*., 2006; Tibe *et al*., 2007). This pattern was also observed in sorghum varieties where brown varieties contained more condensed tannins than white varieties (Amarteifio *et al*., 2006). *Phonda* groundnut landraces have lower tannin concentrations compared with cowpea (Asante *et al*., 2004) and pigeon pea (Fasoyiro *et al*., 2005). However, in a separate study by Akindahunsi and Salawu (2005), it was concluded that low levels of tannins had beneficial effects on human and animal nutrition. This suggests that *Phonda* groundnut may be beneficial to both human and animal diets.

2.10 Processing methods of eliminating anti-nutritional factors (ANFs) detrimental effects

Heat treatment has been reported to overcome some or most of the ANFs activities in legumes (Apata & Ologhobo, 1997). Heat treatments such as boiling or roasting are usually effective in destroying trypsin inhibitors. Heat-treating BGN could improve the performance of BGN on growing broiler chicks. Trypsin inhibitor is also inactivated by autoclaving. Other effective forms of processing for reducing and/or eliminating ANF's include cooking, soaking, milling, hulling, germination and fermentation (Frunji *et al*., 2003). Traditional methods of cooking BGN normally involve soaking them overnight or for a few hours before boiling them. This suggests that indigenous knowledge may have evolved to develop ways of overcoming some of these ANF's. Onwuka (2006) observed 37% to 79% ANF's reduction after boiling both pigeon pea and cowpea for 80 minutes. However, some of these processes do not always increase the feeding value of the feed, making it a less attractive feed to the animal (Nwanna *et al*., 2005).

2.11 Potential of *Phonda* Groundnut as a Food Security Crop

Phonda groundnut is important for farmers because it is a legume capable of fixing atmospheric nitrogen, thus contributing to soil fertility. *Phonda* groundnut can produce reasonable yields with low input and is an ideal crop for resource-limited smallholder farmers. Nigeria and Zambia have been categorized as being the major *Phonda* groundnut producing countries (Purseglove, 1992; Enwere, 1998). However, even in these countries, the crop is mainly grown for subsistence with the surplus being sold on the local markets. Thus, the crop does not enter world trade (Enwere, 1998).

Plant protein has a worldwide food security role and provides about 65% of the world's supply of proteins for humans with up to 15% coming from legumes (Food and Agriculture Organization of

the United Nations, 2010). Protein-energy malnutrition is a major health problem in developing countries (Food and Agriculture Organization of the United Nations, 2010). Amongst the legumes, *Phonda* groundnut landraces can provide up to 25% of proteins. Inclusion of *Phonda* groundnuts in human rations could replace expensive animal protein sources, and therefore, prove economical to disadvantaged rural communities. The crop has a potential to boost food security in rural areas. Some African tribes have been reported to extract oil from *Phonda* groundnut seeds through roasting and pounding of the seeds.

Mohammed (2014: 1) stated that *Phonda* groundnut (*Vigna subterranea* [L.] Verdc.) is an under-utilized indigenous African legume crop which has substantial potential to contribute to food security in sub-Saharan Africa? The crop is well adapted to severe agro-ecologies and grows where other legumes may not survive. The seed is highly nutritious with an ideal balance of carbohydrate (55-72%), protein (18-20%) and fats (6-7% oil), which is particularly beneficial in balancing protein deficiencies in cereals. Also, the seed contains essential and non-essential amino acids of about 33% and 66% respectively. These attributes make *Phonda* groundnut an ideal crop to alleviate food insecurity, and to reduce protein malnutrition in rural communities of Africa. However, small-scale farmers grow low-yielding landraces in most production regions in sub-Saharan Africa. *Phonda* groundnut landraces exist as heterogeneous mixtures of seeds of a few to several seed morpho-types that embrace wide genetic potential for breeding.

The most important production constraint of *Phonda* groundnut production is the lack of improved varieties, suggesting that further breeding is needed to enhance productivity. *Phonda* groundnut landraces need to be sorted using discrete morphological features before breeding for genetic enhancement.

2.12 Dietary

According to Food and Agricultural Organisation /World Health Organisation (FAO/WHO) (2001), vitamin A is important for normal functioning of the visual system; growth and development; and maintenance of epithelial cellular integrity, immune function, and reproduction. Its deficiency in the body affects the growth and differentiation of epithelial cells throughout the body, hence diminishing mucous secretions which contain antimicrobial components. Finally, this leads to reduced resistance to invasion by potentially pathogenic micro-organisms (i.e. there is compromised immunity), increased morbidity and mortality, poor reproductive health, increased risk of anaemia, and contributions to slowed growth and development.

Lack of knowledge in nutritional importance of some legumes in developing countries is responsible for less utilisation (Olapade & Adetuyi, 2007). The consumption frequency was dependent on the availability of BGN stock such that the consumption would decrease with time. By the month of November, most households did not have BGN for consumption but for seed. There were about 8% of the households who reported that they also sold BGN locally. This may indicate lack of established markets for BGN which eventually may also affect production. In addition, use of unimproved varieties and small allocation of land for cultivation may also affect BGN production since it is grown in small patches throughout the country (Malawi Government, 2005). However, some households (13.6%) indicated that they bought BGN from their neighbourhood after their stock had depleted. Kerr, Snapp, Chirwa, Shumba and Msachi (2007) reported that 70% of households in northern Malawi grew legumes primarily for food with 16% of the households having income earnings from the sale of the legume.

BGN is believed to have originated from the African continent, especially Central Africa, long before the introduction of groundnuts (peanuts). It belongs to the family *Leguminosae,* subfamily Papilionoideae (Goli, 1997) and is related to cowpeas. The botanical name of the crop is *Vigna subterranea* (L) Verdc, which comprises of the wild species type (*V. subterranea* var. *spontanea*) and the cultivated type (*V. subterranea* var. *subterranea*).

CHAPTER THREE
METHODOLOGY AND RESEARCH DESIGN

3.1 Introduction

This chapter covers an overview of methodology used in the study. The discussion in the chapter covers the research design, population sampling, data collection and data analysis. Ethical considerations and measures to provide trustworthiness are also discussed.

Methodology refers to the process, principles, and procedures by which one approaches problems and seeks answers in the social sciences. Also, the term applies to how one conducts research; as in everything else we do, our assumptions, interests, and goals greatly influence methodological procedures (Allan & Akon 1987: 12). This section presents a description of the research design for this study. It provides a detailed explanation of the methods of data collection, sampling procedures, ethical measures and method of data analysis that have been taken.

3.2 Research design

The researcher used a qualitative research design in the study. According to Nicholas (1992), research design may be defined as the programme that guides the investigation in the process of connecting, analyzing and interpreting the findings. In that regard, the study is descriptive and explorative in its attempt to capture the multiple realities concerning the medicinal and nutritional knowledge associated with *Phonda*. Yin, (2003:21) states that a research design is a blueprint or a detailed plan of the method on which one intends conducting a research. According to Trochim (2006), a design is used to structure the research and to show how all of the major parts of the research project (the samples or groups, measures, treatments or programs, and methods of assignment) combine in an attempt to address the central research questions. Schumacher (2006:117) confirms that the goal of a sound research design is to provide findings that are deemed to be credible. The researcher concurs with these definitions and goals of research design as addressed in the literature above and for this reason, selected the qualitative research design. As the character of the research topic of this study is descriptive and explanatory, the researcher chose to use a qualitative research design. This research design reveals the purpose of the study which is characterised by exploration. Denzin and Lincoln (2005), as well as Creswell and Ebberson (2007:265), posit that in qualitative research, a researcher often approaches reality from a constructivist position, which allows for multiple meanings of individual experiences. Qualitative methodology was used because the study is inquiry-oriented thus, giving the process

of understanding where a researcher develops a complex holistic picture, analyses words, reports detailed views of participants and conducts the study in natural setting (Creswell, 2007:47). In qualitative research, a researcher often approaches reality from constructivist position, which allows for multiple meaning of individual experience (Denzin & Lincoln 2005).

Qualitative design is a more effective method of investigating emotional responses than quantitative research. In addition, qualitative research focuses on understanding the whole, which is consistent with the study (Brink and Wood 1998:246; Burns & Grove 2003:374-374).

3.3 STUDY AREA

The study was conducted around Vhembe district in two villages from each of the following municipalities: Thulamela, Mutale, Makhado and Musina. In Thulamela Municipality, the researcher visited the following villages: Khakhanwa and Itsani. In Mutale Municipality, the following two villages were visited: Hatshikundamalema and Shakadza. In Makhado Municipality, the following villages were visited: Tshimbupfe and Davhana. In Musina Municipality, the following villages were visited: Ha Mudimeli and Dolina. These research sites were chosen because the families in the areas have been generally known to farm *Phonda* in the province. Moreover, the places are close to the researcher thus, easily accessible. The researcher is also quite conversant with the language spoken in the areas, *Tshivenda*. Above all, the site visits made by the researcher have indigenous knowledge holders.

Figure 1 Vhembe District Municipality

Source: www.Mapparade.com/map of Vhembe district

3.4 population of the study

A population is any group that is the subject of research interest (Goddard 1996:34). The groups that the researcher targeted included local households, *vhomaine*, the elderly and farmers. All age groups were targeted.

3.5 sampling procedure

According to Bailey (1978:82), a sample is a subject or portion of the total population. Sampling is the process by which the sample (subject of population elements) is drawn from the known population. Non-probability sampling was used in the study.

The researcher used purposive sampling with the basis of the knowledge of the population and to make appropriate decisions on who to include in the study. The process took the form of snowball sampling as the respondents identified other participants who had similar or more knowledge to be studied until data saturation was satisfied. The advantage of using samples is that it saves time and money for the researcher since it reduces the number of individuals to be interviewed.

The researcher's complete sample comprised of twenty participants; one traditional health practitioner from each of the four (4) municipalities and two (2) households from two (2) villages in every municipality.

Fourteen (14) women were interviewed and six (6) men, of which women were more than men as shown in the literature that women are mostly engaged in the cultivation of *Phonda,* and therefore, more knowledgeable on information that is pertinent to the study.

Purposeful or intensity sampling (Miles and Huberman, 1994; Creswell, 2007) was used in this study to select information-rich cases. The choice was made because it was expected that the study would advance an understanding of and knowledge of *Phonda.* Access to households and the ability to engage with the culture as well as participants in the local language were primary in deciding where this study was conducted. The research therefore focused on one South African language group, Vhavenda.

Vhavenda were chosen because the researcher herself is of Venda origin. The nature of the study being explorative, and relating to issues reducing/stopping from the fact that indigenous cultures often do not have a voice in research and literature, it was felt that limitations arising from being

an "insider" would be outweighed by the advantages offered by what Ramugondo (2009) quoted in Adler & Adler (1998) calls "Verstehen" (understanding). Verstehen is strongly embodied within existential sociology, whose proponents argue that for one to understand reality as a researcher, one should be able to be deep in the reality, so as to feel, see and hear it (Adler & Adler, 1998). A shared Tshivenda language between the researcher and the participants and understanding with some of the contextual factors in the region were viewed as critical for gaining some understanding of the family's realities.

3.6 Data collection methods

Qualitative research is social research and an ethnographic one in itself. This means that is not only based mostly on interviewing and observing or eventually using focus groups, but also that it is designed to meet some certain form of problem-solving based not on scientific proofs, but rather, on possible or creative conclusions to questions that cannot be answered in the context of the 'logic' or accepted scientific paradigm, although not so strictly suggested (Zikic 2007:125). Data was collected using unstructured interviews and face-to-face interviews. In that way, an in-depth study could be achieved. These research methods of gathering data are discussed below.

3.6.1 Unstructured Interviews

Unstructured interviewing is considered the main method of data collection in ethnographic research as it provides a situation where the participants' descriptions can be explored, illumined and slightly probed (Kvale, 1996:89). The unstructured interview in ethnographic studies is intended to be in-depth (Burns & Grove 2003:284). (De Vos 2002:302) opines that the aim of the unstructured interview is to actively enter the world of people and to render those worlds understandable from the standpoint of a theory that is grounded in behaviours, languages, definitions, attitudes and feelings of those studied. No questions are deliberately formulated. The researcher used unstructured interviews in the home language of the participants. According to Hallet (1999:56), this approach reflects the open and accepting style of interviewing that seeks to produce the genuine views and feelings of participants. This may be difficult to achieve though, if the process has a fixed structure .The common ground in ethnographers' interviews is that by their nature, the interviews put the researcher in the role of the research instrument through which data are collected (De Vos 2002:301). In unstructured interviews, the researcher may use reasonable guidelines to prevent the participants from feeling that they are being "probed" on a topic (Burns & Grove 2003:285).

Williams (2010) defines unstructured interview as an interview in which there is no specific set of predetermined questions, although the interviewer usually has certain topics in mind that they wish to cover during the interview. In this regard, the objectives of the study became the topic that the researcher used. The researcher preferred using unstructured interviews because this method allows the interaction between the participants and the researcher. Moreover, it allows for richer and more valid data on the research topic under study because it allows the interviewer to ask follow-up questions. The researcher asked question and allowed the participants to give information they have, there were no formal questions, and the researcher was guided by the information given to ask questions.

3.6.2 Focus groups discussions

The researcher also found it necessary to use focus group discussions with households, and traditional health practitioners in the study. The researcher recruited a group of participants within the same village and one traditional health practitioner from the municipality in order to grasp the collective views of the participants regarding the medicinal use of *Phonda* since the households and traditional health practitioners have different knowledge and experiences on the use of *Phonda*. This means a gathering of different participants finally provided rich data which was relevant to the research objectives depending on the creativity of the researcher. Bernard (1995:224) asserts that in the hands of a skilled moderator, focus groups produce incredible results. The researcher decided to use four focus groups with the intention to discuss all the objectives of the study taking into consideration the motions of the households as a group during the discussion.

According to William (2011:100), a focus group can be seen as a type of group interview. However, one that tends to focus on in-depth interview on a particular theme or topic with an element of interaction. The group is often made up of people with relevant experience or knowledge about the subject/ research problem, or those that have a particular interest in it. In this study, the researcher interviewed one group of 10 households from four villages, eight households and four traditional health practitioners from Vhembe district. According to White, (2005:147), the number of participants depends on the objectives of the research which means that the size of focus groups might involve between five and twelve people. Smaller groups of between four to six people are better when the participants have the great deal of share about the topic or have intense or lengthy experiences with the topic under discussion. The role of the researcher was to take field notes for further analysis in the study.

White (2005:146) indicates that group members should introduce themselves and tell a little about themselves. In this study, the researcher planned to introduce herself to the group members. The introduction of the group discussion included welcome, overview of the research topic, and ground rules. The researcher encouraged the group members to speak one at a time in order to grasp their views clearly as the researcher was taking notes and exact phrases and statements made by participants which were very useful in the analysis of data (White 2005:146).

During the focus group discussion, the researcher decided to request the participants for permission to take photos and use a video camera for future reference. Participants accepted the request and eventually allowed the researcher to use her video and photo camera. They allowed the researcher to take photos and video-record them. Field notes were taken and were used when analyzing data made after each session. Two focus group discussions were carried out; Tshimbupfe and Khakhanwa. Each of them lasted 20-30 minutes. The participants were 9 and 11 respectively in the places.

3.7 Information gathering procedures

Management of the Vhembe district households is a bounded system, information was gathered from multiple sources, situating the study within its context. Initial information collected was that which helped describe *Phonda* and contextualised it within its setting. This included attending to temporal aspects as well as the family's physical, social, historical and economic settings. Temporal aspects refer to the ages of the participants as well as the periods of the interviews that this study refers to. All background information is described in the setting chapter of this report.

As informed by ethnography, the households were seen as a cultural system where the researcher studied different meanings of *Phonda* and the use of it. Interviewing was an important part of this study. Participants were interviewed in their local language, Tshivenda, which was also the language that they were most comfortable with.

The researcher took three months to collect data, she ended up visiting sixteen households. Most of the places are far from the University of Venda, for example 62 km / 45 km/160 km and36 km from the university. The researcher visited the villages before she started conducting the research where she went to the chiefs' kraals to introduce herself and explained everything about her research, she further explained the purpose of the research, that it is all about studying for her to fulfil her master's degree. She showed them the ethical clearance letter from the university which granted her permission to conduct the study.

After the researcher was granted permission to conduct the study in the villages, she asked the chief if there were any people in the village who cultivate *Phonda*. After getting the names and households of the people who cultivate *Phonda*. She visited the households and introduced herself and made appointments for the interviews.

The researcher visited the households on the agreed days. When the researcher arrived, she found that they also invited their neighbours to participate. The researcher started to conduct focus groups discussions. She introduced herself and informed them about her purpose. The participants' mood was good; people were very happy, even their faces were very bright and they were eager to answer all questions.

The researcher conducted the focus group discussions with ten participants where the first question were: What are personal uses *Phonda*? Are there any medicinal and nutritional benefits associated with *Phonda*? Among this the probing questions were asked. The participants provided answers in different ways which made the discussions very interesting. The discussions took the whole day including break because the researcher had prepared food for the occasion.

3.7.1. Tools used in the study

Pen and paper

The most common tools researchers use are pen and paper. With these tools, the fieldworker records notes from interviews during or after each session (Fetterman, 1995:73). Looking at the advantages of using these tools, the researcher recorded legible data in an organised manner bearing in mind that this data would at a later stage of data analysis, be used as verbatim quotations.

Photo camera

The role of a camera when conducting research is crucial. A camera was used to document plants, and other food that can be produced from *Phonda* including some interesting nutritional food such as *Tshidzimba*, roasted *Phonda* and places where *phonda* is planted, events, and settings over time. Camera enable the researcher to create a photographic record of specific behaviours (Fetterman 1995:82-83). The researcher used a camera to document specific behaviours and affirming material reality.

Video recorder

Using video recording devices can be useful, especially in micro-ethnographic studies. Researchers usually have a fraction of a second to reflect on a gesture or person's expressions and body language. This can also allow the researcher to stop the video and continue it and watch it over and over again, each time finding new layers of meaning or non-verbal signals from the informants (Fetterman 1995:85). The researcher with the permission of the participants, recorded the focus group discussion which managed to answer all the research questions.

3.8 Data analysis

Data was collected and analysed using coding. The researcher accurately organized the data. The researcher coded the data, sorted it in sequence and organised it in a manner which made it easier for her to interpret and understand. The raw gathered data from the field were summarised by checking key themes, phrases or passages. These selected themes, phrases and passages were used in a more detailed analysis.

3.9 Ethical considerations

According to De Vos (2002: 24), ethics is a set of moral principles widely accepted and which offer rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents and others. The research participants were accorded all the respect and the dignity. The researcher employed a variety of ethical standards during the research process of this study. Conducting of research requires not only expertise and diligence, but also honesty and integrity. This was done to recognize and protect the rights of participants. To render the study ethical, the rights to self-determination, anonymity, confidentiality and informed consent were observed.

3.9.1. Confidentiality

According to Yegidis (1996: 34), every individual has the right to privacy, and as such the researcher is obliged to keep the information acquired from the participants confidential. Privacy refers to keeping to oneself that which is normally not intended for others to observe or analyze. Participants were informed of all possible limits to this principle as well as the steps that were taken to ensure that no breach of this principle took place.

3.9.2 Anonymity

Reaves (1992:47) defines anonymity as something that exists when the person expects that no one, including the observer, will know who has done the behaviour. The researcher made sure that interviews were conducted in a place where participants were comfortable, if the participant did not agree to be interviewed in an open area, it was adhered to. The participants were assured that their names would not appear anywhere in the final report as pseudonyms instead of names were used.

3.9.3 Informed Consent

According to Nachmias (1996:83), informed consent is the procedure in which individuals choose whether to participate in an investigation after being informed of facts that would be likely to influence their decision. Reaves (1992:43) asssrts that when the participants are told at the beginning what all the risks are and give their consent to the procedure, which is informed consent. The researcher explained clearly to the participants what every participant had to know and agree to before participating in the research. There must be permission from the participant after thoroughly and truthfully informing participants about the purpose of the interview and the nature of the investigation. Anyone who participates in research should have the right to quit at any time for any reason, and it is the researcher's obligation to make sure that the participant knows this and understand it (Reaves 1992:43).

3.9.4 Honesty

The researcher did not promise the participants anything or reward after getting information from them, the researcher explained to them that the information is needed in order to use for the study purposes only. The respondents were not given something after interviews; honesty is required from the interviewer to establish a position of trust with the prospective participants. The prospective participants were not made to feel that they are among several who are going to be subjected to questioning, but rather that the interviewer was interested in them as individuals and that he/she respects their uniqueness. Not only were the participants assured of complete anonymity, but they were also made to feel completely free to express their true feelings and options without fear or disapproval from their interviewer. The researcher was completely honest with the participants by telling them that the research is done for the purposes of studying in order to get the degree.

Only when there is a relationship of mutual confidence and respect between the two parties, are the chances that the participant will feel free to reveal his or her inner most feelings and the beliefs to the interviewer. This is especially true when these feelings and beliefs are in conflict with the generally accepted norms of a community.

3.9.5 Permission for data collection

The researcher used the letter from the university when asking for permission to collect data in the communities. All the participants that were involved in the study were informed of the pros and cons that all participants may encounter, the processes that needed to be followed, and the limits to which the information gathered could be used. Participants were fully aware of the purpose and aim of the study before interviews were conducted. As such, participants were at liberty to make informed decisions about getting involved. This was done to ensure that no form of deception or harm was done to any participants involved.

3.9.6 Voluntary participation

Participation was voluntary as no one was forced to participate in this study. Furthermore, the researcher informed the participants that they were participating in the study voluntarily.

3.10 Quality criteria

Measures to ensure trustworthiness

Lincoln and Guba (1995: 216) posit that trustworthiness of a research study is important in evaluating its worth. Trust worthiness refers to the degree of confidence qualitative researchers have in their data assessed using the criteria of credibility, transferability, dependability, confirmability and authenticity (Polit & beck, 2010:570). Trustworthiness involves establishing:

3.10.1 Credibility (Truth value)

Credibility is defined as truth-value which will be obtained from the discovery of human experiences as they are lived and perceived by the research participants (Lincoln & Guba, 1995: 216). Credibility refers to the confidence in the truth of data and interpretation of them.

Credibility depends less on sample size than on the richness of the information gathered and on the analytical abilities of the researcher. Credibility is usually ensured through prolonged engagement, persistent observation and member checking. Prolonged engagement refers to the investment of sufficient time during data collection to have an in-depth understanding of the phenomenon under study, thereby enhancing credibility (Polit & Beck, 2010: 542).

3.10.2 Participant observation

Participant observation refers to the researcher's focus on the aspects of a situation that is relevant to the phenomenon being studied (Polit & Beck, 2010:542). The researcher observed the participants as they were being interviewed, probed for clarity on issues raised by participants and focused on elements that were most relevant to the problem.

3.10.3 Member checking

Member checking means that the researcher provides feedback to study participants about emerging interpretations and obtains their realities (Polit & Beck, 2010: 545).

3.10.4 Making segments of raw data

Other techniques for addressing credibility include making segments of the raw data available for others to analyse, and the use of "member checks," in which respondents are asked to corroborate findings (Lincoln & Guba, 1985, 313-316).

3.11 Measures To Ensure Trustworthiness

3.11.1 Transferability (applicability)

In the naturalistic paradigm, the transferability of a working hypothesis to other situations depends on the degree of similarity between the original situation and the situation to which it is transferred. Transferability refers to the degree to which the findings can be applied to another context or with other groups (Lincoln & Guba, 1995: 215). According to Polit and Beck (2010) transferability refers essentially to the generalizability of the data, that is, the extent to which the findings can be transferred to or have applicability in other settings or groups (Polit & Beck, 2008: 539). De Vos (2005: 346) refers to transferability as the extent of demonstrating the applicability of one set of findings to other context.

The researcher cannot specify the transferability of findings; he or she can only provide sufficient information that can then be used by the reader to determine whether the findings are applicable to the new situation. Other writers use similar language to describe transferability, if not the word itself. For example, Stake (1978:6) refers to what he calls "naturalistic generalization". Patton suggests that "extrapolation" is an appropriate term for this process (Patton, 1990: 489). Eisner states that it is a form of "retrospective generalization" that can allow us to understand our past (and future) experiences in a new way (Eisner, 1991: 205). In this study, transferability will be ensured by densely describing the background information of participants. The research context and setting were described so as to allow others to assess how transferable the findings will be.

The purposive sampling technique was used to select participants who fit the criteria described (Lincoln and Guba, 1995: 215).

3.11.2 Dependability (Consistency)

The concept dependability implies trackable variability, which is variability that can be ascribed to identify sources (Lincoln & Guba, 1995: 216). In this study the researcher coded the data and waited for a certain period and return to recode the same data to ensure accuracy. Kirk and Miller (1986: 41-42) identify three types of reliability referred to in conventional research, which relate to: the degree to which a measurement given repeatedly, remains the same; the stability of a measurement over time; and the similarity of measurements within a given time period (Kirk & Miller 1986: 41-42).

Although they give several examples of how reliability might be viewed in qualitative work, the essence of these examples can be summed up in the following statement by Lincoln and Guba (1985: 316) "Since there can be no validity without reliability (and thus no credibility without dependability), a demonstration of the former is sufficient to establish the latter".

Nevertheless, Lincoln and Guba (1995) do propose one measure which might enhance the dependability of qualitative research; that is the use of an "inquiry audit," in which reviewers examine both the process and the product of the research for consistency (Lincoln & Guba, 1985: 317).

3.11.3 Conformability (Neutrality)

Conformability refers to the criteria for evaluating the quality of data by referring to objectivity or neutrality. Neutrality refers to the degree to which the findings are a function solely of the participants and conditions of research and not biases, motivations and perspectives (Lincoln & Guba, 1995: 216). Conventional wisdom states that research which relies on quantitative measures to define a situation is relatively value-free and therefore objective. Qualitative research which relies on interpretations and is admittedly value-bound and (it) is considered to be subjective. In the world of conventional research, subjectivity leads to results that are both unreliable and invalid. There are many researchers, however, who call into question the true objectivity of statistical measures and, indeed, the possibility of ever attaining pure objectivity at all (Lincoln & Guba, 1985: 290; Eisner, 1991:36).

Patton (1990:498) maintains that the terms objectivity and subjectivity have become ideological ammunition in the paradigms debate. He prefers to avoid using either word and to stay out of futile debates about subjectivity *versus* objectivity. Instead, he strives for empathic neutrality. While admitting that these two words appear to be contradictory, Patton (1990) points out that empathy is a stance towards the people one encounters, while neutrality is a stance toward the findings. A researcher who is neutral tries to be non-judgmental, and strives to report what is found in a balanced way.

Lincoln and Guba (1985: 216) choose to speak of the "confirmability" of the research. In a sense, they refer to the degree to which the researcher can demonstrate the neutrality of the research interpretations, through a "confirmability audit." This means providing an audit trail consisting of 1) raw data; 2) analysis notes; 3) reconstruction and synthesis products; 4) process notes; 5) personal notes; and 6) preliminary developmental information (Lincoln and Guba,1985, 320-321).

3.12 Limitations of the study

The researcher faced challenges when she made appointments for interviews. Sometimes participants would agree to participate and also agreed on time. When the researcher arrived the participants would apologise for having less time because he or she would be having limited time. Some participants would demand the drinks for refreshments from the researcher. Elderly people had less knowledge on the nutritional values of *Phonda* and also the quantity suitable for consumption.

3.13 Conclusion

In this chapter, the research design and rationale for using qualitative methodology was discussed. Ethical issues were dealt with. Methods for data collection and analysis were discussed. The next chapter will present the analysis and interpretation of the fieldwork data.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

Chapter four focuses on the collected data of the study; an exploration of indigenous medicinal knowledge of *Phonda* in Vhembe district, Limpopo province. The researcher used a qualitative research design thus, qualitative data analysis was adopted. The nature of data gathered in the study is mainly qualitative as it emanated from focus group discussions and open ended questions. In that regard, the data were analysed thematically.

The purpose of this study was to explore the medicinal indigenous knowledge associated with *Phonda.* To achieve the aim of the study, the following research questions were asked to the participants of the study: What is the indigenous nutritional value of *Phonda*? What are the indigenous medicinal uses for *Phonda*? Which attitudes do local households have towards *Phonda*? And, how can we restore the cultivation of *Phonda*? These questions were derived from the objectives of the study hence, the answers thereof shall form the themes and sub-themes of the study. The answers to the above questions are comprehensively discussed below.

4.2 The indigenous nutritional value of *phonda*

The researcher wanted to know the indigenous nutritional value of *Phonda* within the *VhaVenda* households. This was important because most of the indigenous knowledge holders are dying and going to the grave without passing this important knowledge to the next generation. The loss of this knowledge is detrimental as some valuable information which can help edify people's health is also lost. Thus, carrying out such a research would be of paramount importance in documenting and preserving such information.

In that regard, to clearly capture all the information about *Phonda*, the following sub-themes were developed as the researcher wanted to know the indigenous nutritional value of *Phonda* and its cultivation:

4.2.1 What is *Phonda* and how is it cultivated?

The discussion below focuses on defining *Phonda* and its cultivation:

4.2.1.1 Description of *Phonda*

Participants were asked to describe what *Phonda* is. In addition, the researcher also inquired from the participants, information about cultivating, harvesting, processing and preservation of *Phonda* within their communities. Firstly, this was done by researcher so as to establish and ascertain if the researcher and participants were talking of the same plant (*Phonda*). Secondly, the researcher wanted to know if there are any cultural underpinnings in the whole process of its cultivation. Thirdly, this was to document the indigenous cultural way of cultivating *Phonda*.

Phonda was generally described as a legume with strong well-developed tap roots and a short lateral stem on which the leaves are borne. To add, *Phonda* can be divided into distinct vegetative and reproductive phases. The vegetative stage involves emergence and continuous production of leaves and elongation of roots and is grown in the semi-arid tropics where water is usually in short supply. Below is a picture of *Phonda*.

Picture 2: Picture of *Phonda*

https://www.google.co.za/imgres?imgurl=http://africanorphancrops.org/wp-content/uploads/2016/07/Vigna-subterranea-265x300.jpg&imgrefurl=http://africanorphancrops.org.

Some of the interviewed participants said the following:

> **Participant 1:** "It is the underground nut that has healing powers and usually planted in January."
>
> **Participant 2:** "It is the underground nut that has healing powers."

4.2.1.2 Cultivation and storage of Phonda

With regards to the cultivation of *Phonda*, traditionally, it was cultivated in extreme, tropical environments by small-scale farmers without access to irrigation and/or fertilizers and with little guidance on improved practices. Furthermore, it was mainly grown by women for the sustenance of their families. The participants generally agreed that *Phonda* is resilient to adverse environmental conditions as it tolerates low fertility soils and low rainfall. However, some participanrts indicated that there were a lot of taboos that were surrounding the farming of *Phonda* within the *VhaVenda* communities.

Phonda is stored in different ways depending on the use that the owner wants to use it for later. Participants to the study indicated that *Phonda* is stored unprocessed or processed depending on the owner's preference. Some participants indicated that it is processed either by grinding or by removing the pods and drying or drying it with its pods. Processed plant material is then left in the sun to dry, before being stored in a granary.

Some of the respondents said the following:

> **Participant 1:** "*Phonda* is not allowed to be cultivated before January and at the same time with maize. One should plant *Phonda* in January because if one plants them earlier it will not rain. If it may happen you plant them earlier you must uproot the other ones from corners and put them upside-down at the corners."
>
> **Participant 2:** "In our *VhaVenda* culture, *Phonda* is not allowed to be cultivated before January. The name *Phonda* is derived from *Phando* which is January in *Tshivenda*. It is believed that *Phonda* can stop rain, there are a lot of taboos

concerning *Phonda.* If you eat *Phonda* and throw *Phonda* pods everywhere and someone steps on the pods during rain or in winter, that person will develop *munyavhili* (sores or rush that occurs if it is raining) and also *vhunyilili* (sores that develop under the feet where someone will feel like needles in the feet).

Participant 3: "There are many taboos of *Phonda.* The one I know is *Phonda* is not allowed to be planted before maize. It is also planted around January. If you plant *Phonda* before January the rain will stop and they also cause lightning. Also, if the chief knows that there is someone who has planted *Phonda* before January, he will send people to uproot the whole field. If you plant them at the end of December you need to uproot one in every corner and you put them upside-down. Or you soak them prior to planting them, by doing this, there will be rainfall. When you eat *Phonda* there are some rules; one is not allowed to litter its pods. If you litter everywhere and someone steps on them they cause feet diseases *vhunyilili*, you develop rush in the whole body during rain *munyavhili* or if it is cold."

4.2.2 Uses of Phonda

Participants were asked of different indigenous foods that they make out of *Phonda*. *Phonda* is primarily used for human consumption. The seeds are consumed at different developmental stages, either immature or fully ripe. The immature seeds can be consumed fresh, boiled, grilled, as a meal or mixed with immature groundnuts or green maize (Bamshaiye *et al.,* 2011).

The participants gave different views of the uses of *Phonda* within their different households. *Phonda* is primarily used for human consumption. The seeds are consumed at different developmental stages, either immature or fully ripe. The immature seeds can be consumed fresh, boiled, grilled, as a meal or mixed with immature groundnuts or green maize. In the research areas under study, participants indicated that they use *Phonda* to make *tshidzimba,* snacks, performing rituals, relish, medicinal, oil, soft porridge and cultural weather predictions.

4.2.2.2 Making of *tshidzimba*

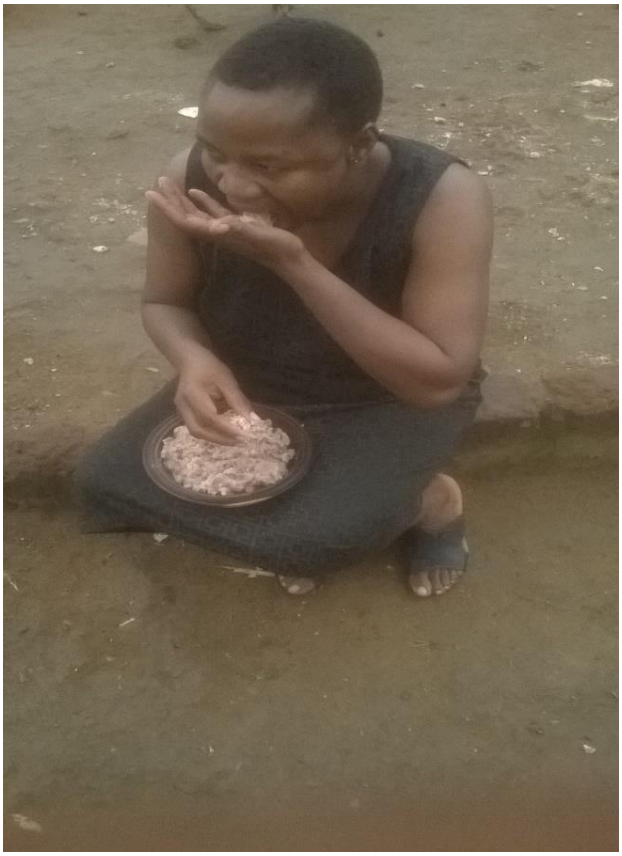
Traditionally, *Phonda* has always been receiving much attention for utilization in a variety of food systems due to their wide distribution throughout the world and potentially high protein content. The majority of the participants indicated that they use *Phonda* to prepare *tshidzimba* (maize

cooked with *phonda* and ground peanuts*)*. The pictures below show *tshidzimba* (maize cooked with *phonda* and ground peanuts*)*.

Picture 3: Picture of *tshidzimba* taken at Khakhanwa 01 December 2016

Picture 4: Researcher preparing *Phonda* to make *tshidzimba* (picture taken at Khakhanwa 01 December 2016)

Picture 5: Researcher cooking *tshidzimba* (picture taken at Khakhanwa 01 December 2016)



Picture 6: Researcher eating *tshidzimba* (picture taken at Khakhanwa 01 December 2016)

The researcher did not only ask the participants about the issue of *Phonda*. To allow acceptance and to open doors of disclosure, the researcher bought *Phonda* from the participants, cooked it with them to see the procedure and ate the food with them. This is one of the methods that IK holders accept as a way to show that you are not there just to document things from them but to show that you are part of them.

One participant said the following:

> **Participant 1:** "I used *Phonda* in cooking *tshidzimba*." *Tshidzimba* is more like Vhavenda staple food. It is made up of peanuts (*nduhu*) groundnuts (*Phonda*) and samp (*thuvhule*). These are the ingredients to prepare it: 1 cup peanuts smoothly crushed, 1 cup whole peanuts cooked, 1cup ground nuts cooked, 3 cups samp cooked, 4 tablespoon salt, some water to simmer salt to taste and

then combine all the cooked ingredients together with the ground powder peanuts, water. Season well. Bring to a low heat simmer for two hours or so. Preparation may take roughly about 15 minutes and cooking 2 hours, water to be used in this measurement is 15 litres of water. Sometimes it takes time due to the mode of cooking used. Cooking *tshidzimba* needs more fire and water."

Making of snacks

Phonda is used to make snacks. Participants to the study indicated that ripe dry seeds are also roasted and eaten. *Phonda,* just like snack, is also produced through roasting and can also be dried and stored for later use. In restaurants in Angola and Mozambique, boiled salted seeds are often served as appetizers. Some of the participants said the following:

> **Participant 1:** "I used *Phonda* in making snacks. Fresh *Phonda* seeds boast appetite. A corrugated iron plate is placed on fire and the fresh seeds are heated."

4.2.2.3 Performing rituals

Some participants were of the view that *Phonda* is used in performance of rituals. Some of the participants said the following:

> **Participant 1:** "*Phonda* is regarded as a sacred crop as it is used in rituals with other crops such as finger millet during libation and dedications to the gods. There are six colours varieties of *Phonda*; white, black, brown, cream white, light brown and yellow. In most rituals, black variety of *Phonda* is used and they represent *vhakegulu tshipofu (elderly).*"

> **Participant 2:** "I also cook *tshidzimba* and use them during rituals as the gods (*vhadzimu*) eat *Phonda* during ritual dances."

> **Participant 3:** "*Phonda* is used during rituals such as *miphaso* and *thevhula* (libation). As a traditional doctor, I cook and eat *Phonda* alone and also with *tshidzimba*."

4.2.2.4 Used as a relish (*Iupida*) and oil

Picture 7: *Phonda* used as relish **(picture taken at Khakhanwa 01 December 2016)**

The participants also noted that *Phonda* can be used as relish. In that regard they explained that ripe dry seeds are also roasted, broken into pieces, boiled, crushed and eaten as relish. Some of the participants said the following:

> **Participant 1:** "I also use *Phonda* as relish. It is delicious."
>
> **Participant 2:** "I also use *Phonda* as relish. It can also be processed into flour for use in soups, and flat cakes. *Phonda* can be grilled and make sauce or soup. The seeds are also used to make oil used when cooling meat or vegetables. When dried, the seeds are very hard and can only be eaten when ground into powder or flour."
>
> **Participant 3:** Unripe seeds can be eaten fresh but mature seeds have to be soaked and boiled before eating. The nuts are boiled with pepper and salt in the preparation. The seeds of *Phonda* are often mixed with other foods, such as meat stew, rice, spinach, other vegetables, maize and sorghum. Cakes or balls may be made from the flour mixed with maize**.**

4.2.2.5 Used For medicinal purposes

Participants noted that *Phonda* can be used for medicinal purposes. Some of the participants said the following:

> **Respondent 1:** it is a taboo for a male to eat *phonda* that was not grown according to the cultural & traditional rites by adding soil to *phonda* that is having flowers (*ushela*) the stem down to root of *phonda* must covered with soil after one to two months, for example; if a male eats *phonda* that was not grown according to *ushela* rites, he may become impotent. He will therefore, be required to visit a traditional health practitioners for treatment.

> **Respondent 2:** "*Phonda* was also cooked and mixed with *muswiswa* which *is a traditional medicinal plant* and given to a child who is breast feeding. In that regard, the child will forget about breast feeding. Also, if someone loses a relative, if they are given *Phonda* they will be able to forget about the death and the pain will be eased."

4.2.2.6 Soft porridge

The participants in the research area submitted that *Phonda* can also be used to make soft porridge. Mature *Phonda* seeds are very hard, hence boiling becomes a prerequisite before any further preparation. Participants noted that ripe seeds are milled to produce flour which can be used to make soft porridge. Some of the participants said the following:

> **Respondent 1:** "It is ground to become powder and used to make soft porridge for children. The soft porridge will be used to feed babies to serve as milk substitute for the baby."

> **Respondent 2:** "It is ground to become like 'mealie meal' and used to make soft porridge for children. To make a soft porridge with the *Phonda*, the *Phonda* seeds should be dry. It must be ground until it becomes flour or maize meal. To cook it, it needs water and salt. First, a person must boil the water and then add salt and stir together with water until it is smooth and changes colour to brown."

4.2.2.7 Weather predictions

Picture 8: Different colours of *Phonda* *(Phonda* Kew.Org/ Science Conservation: accessed 05/05/2016)

Some elderly participants indicated that *Phonda* can be used as a prediction indicator. Some indicated that it can show weather conditions. This is within the VhaVenda cultural astronomy. It was noted that *Phonda* comes in many different colours as can be shown by the picture above. Some of the participants indicated that these colours had great significance with regards to predictions of weather or meant a lot about the soil type in which they grew from. The participants indicated that the colour of the seed can be a predictor of how the weather would be like. The following quotation encapsulates the views of one of the respondents:

> **Respondent 1:** "*Phonda* can be brown or light brown in colour. Brown and light brown represent *mavu ononaho* (fertile soil). While white *Phonda* represents clouds that can bring rain. Yellow *Phonda* shows or represent winter."

Analysis of indigenous nutritional value of *phonda*

In a bid to know the indigenous nutritional value of *Phonda* within the *VhaVenda* households, the above were discussed. It was clear that *Phonda* can be prepared in different ways and as such produces different nutrient values. And in that regard, *Phonda* possesses sufficient quantities of nutrients such as proteins, vitamins and minerals. *Phonda* seeds provide an important source of

crude protein (up to 24%), carbohydrates (up to 63%) and fats (up to 6.5%) (Belewu *et al*., 2008). Also, the crop has a good balance of essential amino acids. This, therefore, suggests that *Phonda* within the *VhaVenda* indigenous communities may be beneficial to both human and animal diets.

4.3 The indigenous medicinal uses for *Phonda*

It was noted above that *Phonda* is also used for medicinal purposes when the researcher wanted to know more about its nutritional uses within the *VhaVenda* indigenous communities. It was reported that *Phonda* can be used for medicinal purposes, this prompted the researcher's curiosity to know more about how *Phonda* was used for medicinal purposes and which diseases it cured. The researcher had to interview the *VhaVenda* traditional health practitioners in order to unveil these questions of the study. Most of the traditional health practitioners in the study area were largely senior citizens, with the majority having more than 30 years of experience in traditional healing. Most of them had no formal education, and only the minority have secondary school education.

It was also during this study that the researcher was informed that the constant eating of *Phonda* had many health advantages. Consumption of *Phonda* was noted to be one of the ways that one can prevent other diseases. The researcher compiled a list of how *Phonda* can be used as a medicinal crop. These are discussed below.

4.3.1 Stop breast-feeding

Traditionally with the *VhaVenda* communities, *Phonda* was used to wean children from breast-feeding. Some of the responses are given below:

> **Respondent 1:** "When I grew up I was taught that *Phonda* is a medicine that can assist if a child is grown up and the parents want the child to stop breastfeeding. They cook *Phonda* with the medicine from the traditional health practitioners. They cook *Phonda* and give her with her/his *tshixele* (neighbouring children friends) for them to eat together. By so doing they want a child to forget about the mother and make the child to remember only the playmates."

> **Respondent 2:** "*Phonda* is a medicine used when a women falls pregnant again while the child is still young, it is used by the traditional health practitioners who cook *Phonda* with *vhulivhadza* (medicine prepared from roots of *Lannea*

stuhlmannii) and feed them to a child for her to eat with granny and the other playmates to make her/him to forget about following the mother."

Respondent 3: We also choose black *Phonda* and cook it with a mixture of *mutshutshungwa (Lannea edulis) or muswiswa and vhulivhadza (Lannea stuhlmannii)* medicine for us to give to the child if a mother is pregnant. This is done to prevent the child from malnutrition.

4.3.2 Animal feeds

Phonda can be used as animal feeds. The remnants of the plant after removing *Phonda* seeds are used to feed cattle. If people wants to change the colour of their herds of goats or cows, they use *Phonda* to choose the colour since *Phonda* occurs in different colours which could be brown, black, cream, white and the other ones with dotted colours. They feed the goats or the cows with *Phonda* of a desired colour during pregnancy. This will make them to deliver to kids or calves of the desired colour. *Phonda* is also used to increase the number of livestock. In that way, they choose the twin *Phonda* and feed them to goats or cows during their pregnancy. This will make the goats or cows to give birth to twins or triplets.

4.3.3 Sexual booster and curing morning sickness

Participants indicated that *Phonda* also works as an aphrodisiac for males. If a man sleeps with a woman who has just given birth, they cook *Phonda* and give him to eat. They also noted that if they fail to give him this medicine, the private parts will shrink. One participant noted the following:

Respondent 1: "*Phonda* is a plant that is respected, that's why there is a lot of taboos and something needs to be done to keep its healing powers for men."

Participants also noted that *Phonda* can cure many diseases such as morning sickness.

4.3.4 A Cure for Malnutrition and child diseases

Phonda is a medicine used for many things. If a child is suffering from kwashiorkor, the VhaVenda people use *Phonda* because they are rich in nutrients and treat malnutrition. Participants' views are as follows:

Respondent 1: *"Phonda* is a medicine, if a child is suffering from a disease called *lukalu.* We boil *Phonda* and we give that child the concoction to drink. It also assists if a child is suffering from constipation, we boil it and we give the child a concoction to drink. Another thing we do is to braai *Phonda* and grind it

like flour and we put a little bit of the powder in the anus of a child. This will allow the child to relieve himself or herself smoothly in the toilet. We also use *Phonda* if the body temperature of a baby is high, we take that powder to smear all over the body and the temperature will decrease. ”

Respondent 2: “*Phonda* is a good medicine for infant boys who are born with big genitals. In that instance, they take a small seed of *Phonda* and roll it on the private parts. In that way, the size will reduce and if the size is too small they choose big *Phonda* seeds and roll as if smearing Vaseline or soap. The size will increase.”

4.3.5 Treatment of epilepsy and constipation

Phonda is not only used as a food source, but it has medicinal benefits, it is used to cure diseases such as epilepsy. It can also be eaten by vegetarians as a source of protein in place of meat. Participants said that it is used as a medicine to cure gout, a disease caused by the consumption of red meat. It is also good in digestion as it encourages drinking plenty of water after eating to prevent constipation. For elderly people, eating *Phonda* alleviates painful waist and spinal cord.

Phonda is a medicine that heals and prevent piles. Participants pointed out that *Phonda* is an immune booster and helps prevent colon cancer. *Phonda* has many benefits when used for different purposes including medicinal uses. Participants also indicated that *Phonda* can also be be used to cure varicose veins in hands and head. In that regard, the participants pointed out that *Phonda* is rolled and rubbed over in the affected area to accelerate healing.

4.3.6 Healing testimony 1

During focus group discussions, one participant gave evidence that she had been sick for many years. She consulted many different doctors and different prophets because she was suffering from painful stomach pains and constipation, but did not get healed. In 2005, some old lady called her to come and assist her in her business. In that business venture, she was also selling cooked *tshidzimba* which was cooked from *Phonda* among other ingredients. This is what she said:

“It was my first time to eat t*shidzimba* because I didn’t have interest in it. That week I was surprised to hear my body change. From that day, the pain I used to feel stopped till today. I am completely healed by *Phonda/ tshidzimba tsha Phonda*. I was not aware that *Phonda* healed me but someone came as an

angel who opened my eyes and told me that that *Phonda* is a medicine that can cure colon cancer and piles."

4.3.7 Healing testimony 2

One of the participants in another household gave evidence of being cured of veins that were developed on her forehead;

> "I was told by my younger sister to use dry *Phonda* to rub the veins every day in the morning. I started to rub it and I am completely healed now. (*Phonda ndi muloi*) *Phonda* is like a witch. I suffered for so many years."

4.4 Attitudes towards *Phonda*

The researcher wanted to know the attitudes of the participants towards *Phonda*. There are diverse opinions that participants had towards this type of legume vegetable. In some instances, some of the participants that were interviewed really turned to despise it stating that it is not a good delicacy since it takes most of people's time in preparing, harvesting, processing and storing. Some actually loved *Phonda* since they use it in various ways; some use it to prepare *tshidzimba*, snacks and for medicinal purposes. Also, some participants had nothing to say about the legume vegetable, they were neutral.

The views of the participants were categorised with regards to how they viewed them; those who were against *Phonda*, those who highly esteemed *Phonda* and those who had nothing to say regarding *Phonda*. Below are the categorised groups and their respective views:

4.4.1 Despised Phonda

Those who despised Phonda had a range of reasons. Some of the respondents were saying that cultivating *Phonda* requires close attention. It is because of this that they find cultivating *Phonda* very laborious.

> **Participant 1:** "The last time I went to the fields during the planting of Phonda I sweated a lot and imagined it was very hot, you can't plant that vegetable during summer. No, no! It took most of my time and that's why I hate planting it again and I don't think I can plant it this year."

> **Participant 2:** "You know what? The last time I was planting *Phonda,* it was raining and the time and attention it needs it's a lot, in such a way that one has to go to the field every day because if you don't go, grass will cover the *Phonda.* So I really despise *Phonda* not because it's bad, but the attention it requires is a lot."

> **Participant 3:** "*Phonda* isn't bad, but the problem comes when one has to harvest it. I recall last year when I planted it, it was so painful to harvest it. I do not have many children so the workforce is small and imagine it when the rain wasn't stopping. It continued raining none stop to an extent that it got rotten since I could not remove it all from the ground. For that reason, I will not prefer planting it again."

Some of the respondents indicated to the researcher that after eating *Phonda* some people do have a running stomach and fart a lot, thereby pollution the air. It is because of the running stomach and the issue of farting that they despise *Phonda*. To add, some of the respondents regard *Phonda* as bad in that after eating it, they go to the toilet many times and they would be dehydrated after constant visits to the toilet.

> **Participant 4:** Whenever I eat *Phonda*, I do not move out from the toilet. I remember eating *phonda*; it is very nice but it usually results in constipation. So that is why I really despise it a lot because of the pain it does cause after eating and time spent in the toilet."

Some of the participants that were interviewed indicated that the economic returns of *Phonda* are high, but they take time to clear the stocks as few people buy them. As a result, some despise farming Phonda because of that.

> **Participant 5**: "What I can say is that *Phonda* is not all that good. I recall when I was planting, it gave me more hardship in terms of time needed and costs. Because I had to force my family to help and thought I would buy them something from the sale. No one is coming to buy it and this coming year I can't cultivate this *Phonda* again because it did not give me profit. We worked a lot and the profit margin was low. Some of the harvest is still in my house and it's not good eating it every day."

4.4.2 Highly esteemed *Phonda*

Those who highly esteemed *Phonda* gave the following reasons: Some of the respondents indicated that *Phonda* is a nice crop as it helps in making "*tshidzimba*'. This is food that most *VhaVenda* like. And this food is highly recommended for health reasons. Some of these participants said *Phonda* is highly medicinal and most traditional health practitioners and Western doctors advise their patients to eat plenty of *Phonda*. The participants further stated that their bodies can be strong if they constantly eat *Phonda*.

> **Participant 1**: "To be honest, *Phonda* is very good. If I recall the last time I went to the hospital, the doctors and nurses actually recommended me to eat these types of African foods like round-nuts, groundnuts, etc. They told me that it helps in making my body strong, heals arthritis and reduces high blood pressure. So for that reason I liked it and *Phonda* is very good."

> **Participant 2:** "*Phonda* is very rich in nutrients and doctors prefer people to eat these African foodstuff more than these processed food. Since when I became very sick, I went to the clinic and I was diagnosed with this another disease. To my surprise, the doctor actually recommended me to eat *Phonda*."

Some of the participants pointed out that *Phonda* is very good when it comes to conserving nature. These participants indicated that *Phonda* has long and strong roots that bind the soil together and avoid soil erosion. Also, they were of the view that planting Phonda is a good way of manuring (or fertilising) the soil for other plants.

> **Participant 3:** "*Phonda*, to tell you the truth, are very good part of vegetation. I tell you, I recall when I planted them last year in my field. In that year, there were lots of rain. But to my surprise, I went back and I saw a lot of soil being accumulated around these *Phonda*. I strongly think *Phonda* helps in reducing soil erosion and keeping the soil intact. So I encourage people to actually consider planting *Phonda* mostly as it actually helps even though it requires much of someone time, but it's a good plant.

> **Participant 4:** "*Phonda* are very rich in nutrients I tell you, the last time I planted them they were a lot from a small piece of land. One good part is that they are used for oil too. Meaning that they can be squeezed early until they remain with

oil for cooking. So it's quite a good crop since it can also bring money in your pocket if one is able to plant it well enough.

Participant 5: "*Phonda* is quite a good crop I tell you, if it is planted and harvested well. I recall I went to this other museum and what I saw is that they were placed in containers as part of tourist attraction to whites and foreigners and this can bring foreign currency and can boost the economy. So I think there is nothing bad about *Phonda* crop since most of it helps in bringing in the foreign currency to our country.

It can be noted that majority of the participants' attitudes towards *Phonda* were very positive. In other words, those who despised *Phonda* were few as compared to those who highly esteemed it. The researcher also observed that those who despised *Phonda* were not well versed with the many uses of *Phonda*. Moreover, those who were despising it were also noted to be leading modernised lifestyles as compared to the many who esteemed it and still follow the indigenous way of life. From the above responses and analysis, the researcher noted that very few people are now cultivating *Phonda* within the *VhaVenda* communities. For that reason, the researcher probed for its restoration.

4.5 Restoring the cultivation of *Phonda*

In response to why people no longer cultivate Phonda, the participants indicated the numerous variety of foodstuff, new generation not into farming, change into other religious views and failure to see the benefits of it. These views are discussed below;

4.5.1 Variety of food stuff – preferences

Participants were asked why *Phonda* is no longer planted in different households. Some participants indicated that these days, there is a large variety of food and people have a variety of choices unlike in the past. Some of the participants said the following:

Participant 1: "Some households still plant *Phonda,* but some households are not planting *Phonda*. It is because we have different foods at the markets these days. In the past we used to plant *Phonda* because we were only relying on the food that we were planting in our own farms."

Participant 1: "I can say nowadays we have restaurants at different places where we buy different food that are more delicious than *Phonda*."

Participant 3: "Our kids do not like *Phonda.* They regard it as an indigenous food and they criticize it. They say it is food for people who are staying in poverty. We are not planting *Phonda* because some people don't take it seriously, some people who are staying in the urban areas don't like it and they have access to different food."

The participants indicated that food is no longer a problem and planting *Phonda* is taking them back to the olden days where people were supposed to work harder in order to get food. Some households in the villages still plant it, but they are few villages that are really planting it. Some participants indicated that if they plant *Phonda* they will be looked at as if they are poor. On the other hand, some participants said they want to plant *Phonda* but there is shortage of the seed.

4.5.2 New generation not into farming

Some participants indicated that the new generation is not interested in cultivating *Phonda*. Some participants indicated that these days, people or the new generation have different roles than the olden days wherein people relied on farming. Some of the responses given below are as follows:

Participant 1: "It seems like the new generation are not into farming because these days there are many schools where children and adults are going to. For this reason, time for farming is limited for them."

Participant 2: "I have noticed that some of the people are working in different places, especially the young generation always seem preoccupied and never think about food security as long they can buy food from Shoprite. As such, it is not possible for the new generation to do farming due to work load. Some of the new generation youths are not passionate about farming, but are passionate about degrees due to modernization and technological aspects. These days, technology is very high than before. Nowadays these new generation youth are relying more on instant food and others consider farming as a lower standard thing."

Participant 3: "Nowadays we have many things to keep us busy than during the olden days. In the olden days, people were doing farming because it was a must for them to do so. We are now relying on the food from the market than planting for ourselves. Another thing that is making us not to be interested into farming is because of the monetary issue. Money is not a problem to us so

whenever we want something we just buy it or hire people to do it on our behalf, therefore the spirit of farming is dying slowly but surely."

Some of the participants were free to express themselves about the new generation and farming, they indicated that the new generation and farming are two different things. They indicated that the new generation did not have time for farming and took farming *Phonda* as something that was meant and done by olden indigenous people.

4.5.3 Conversion into other religions and not into rituals wherein Phonda was mainly used

Participants were asked why they are not taking *Phonda* seriously or even planting it. Some participants indicated conversion into other religions as one of the factors why *Phonda* is no longer farmed. Some participants said they now subscribe to different religions whereby *Phonda* seed is not a need. Below are some of the responses given:

> **Participant 1:** "In other religions, *Phonda* is only eaten and not used necessarily for rituals. I am a Christian and we don't use *Phonda* for any rituals but we just eat it."

> **Participant 2**: "I don't see any importance of keeping *Phonda* because I'm not doing any rituals with it and in our religion we don't use it for any rituals and mmmmmmmmh……. I normally don't understand anything about the taboos behind *Phonda*. Because of that, I don't associate myself with it."

4.5.4 Lack of knowledge of its benefits

Other participants indicated that people are not cultivating *Phonda* because they lack the knowledge of the importance that *Phonda* has. In agreement with that assertion, some participants indicated that they do not have any knowledge of other uses of *Phonda* besides for eating. With regard to the benefit they indicated that the never heard or see any benefit of *Phonda*. Some of the views are encapsulated below:

> **Participant 1: "**Personally I don't have any knowledge of *Phonda*, at my house they don't farm it, and sometimes we just buy if from the street but just for eating only."

The above concludes the responses that the researcher got from the participants in the study area with regards to why people no longer cultivate *Phonda*.

4.6 Ways to restore its farming

With the findings that were indicated above, the researcher wanted to hear from the participants if there were mechanisms that the VhaVenda people can put into place in order to restore the farming of *Phonda* within the *VhaVenda* communities. The participants gave different views in their responses ranging from teaching about the importance of *Phonda*, reviving the taboos that are becoming extinct and making seeds available. These shall be discussed separately under different themes.

4.6.1 Teaching of its importance to the new generation

Participants maintained that the restoration of farming *Phonda* should be done through teaching the incoming generation. Some participants indicated that teachers and parents should also teach children the importance of valuing indigenous foods, especially *Phonda*. Some participants indicated that parents should keep on cooking *Phonda* for the children so that they will grow up knowing the benefits and importance of consumption of *Phonda*. The responses that are below were suggested by participants.

> **Participant 1**: "My parents are teaching me that when I eat *Phonda* I will be a strong man and it will make me to grow the clan as it has reproductive powers. My uncles also said *Phonda* makes a man to be strong in bed."

> **Participants 2:** "Our kids should be taught of indigenous values and norms at school. The government should ensure that our kids have a syllabus that teach this. By so doing we will promote and restore our *Phonda* than Western aspects that have side effects."

4.6.2 Following taboos

Through the issue of enculturation, the participants also indicated that if people can be conscientized of the taboos it will restore a bumper harvest in the cultivation of *Phonda.*

> **Respondent 1:** "Following taboos of the *VhaVenda* when it comes to planting Phonda is a very important thing. This will make it multiply and no curses will come up. It is because failure to follow taboos will bring consequences."

> **Respondents 3:** "I strongly believe that if taboos are followed with the farming of *Phonda,* then *Phonda* farming can be restored. What is causing it to disappear is the failure to observe our sacred ancestral rules."

4.6.3 Production and distribution of seeds to farmers

Other participants were of the view that *Phonda* farming is mainly limited due to the scarcity of farming seeds. Numerous farmers were of the view that the production and distribution of seeds to farmers is a problem nowadays. They were submitting this by saying that people are eating all the harvests and that included the seeds for the next coming season. Some were of the view that *Phonda* seeds are expensive and scarce on the market. Below are some of the views that they maintained:

> **Respondents1:** "When we plant *Phonda* it is hard for us to keep the seeds. Sometimes we keep the seeds but it is less."
>
> **Respondent 2:** "It is hard for us to keep the seeds due to the rain because some years back we were facing some challenges of rain. The soil was dry and we could not plant in the dry soil and ended up eating the seeds."

4.7 Conclusion

Chapter four focused on the presentation of collected data of the study. The gathered data were presented thematically using the objectives of the study: What is the indigenous nutritional value of *Phonda*? What are the indigenous medicinal uses of *Phonda*? Which attitudes do local households have towards *Phonda*? And, how can we restore the cultivation of *Phonda*? These questions were answered in this chapter. The following chapter will address the conclusions and recommendations made.

CHAPTER FIVE

SUMMARY OF THE FINDINGS AND RECOMMENDATIONS

5.0 Introduction

This chapter gives the summary of the findings of the study and the recommendations made. The aim of this study was to explore the medicinal indigenous knowledge associated with *Phonda.* To achieve this aim of the study, the following research questions were asked to participants of the study: What is the indigenous nutritional value of *Phonda*? What are the indigenous medicinal uses of *Phonda*? What attitudes do local households have towards *Phonda*? And, how can we restore the cultivation of *Phonda*? Below are the findings of this study.

5.1 Discussion of findings of the study:

Below are the findings of the study that was done:

5.1.1 The indigenous nutritional value of *Phonda*

In a bid to know the indigenous nutritional value of *Phonda* within the *VhaVenda* households, the study looked at the different foods that can be produced from *Phonda*. The study showed that *Phonda* can be used to make *tshidzimba*, snacks, soft porridge, relish and oil. It can also be used when performing rituals, for medicinal concoctions and for cultural weather predictions. It was also noted that *Phonda* can boost men's sexual prowess to enable them to perform better sexually as well as to give nutritional value to children suffering from malnutrition. It also was noted that *Phonda* can be prepared in different ways and as such produces different nutritional benefits. *Phonda* possesses sufficient quantities of nutrients such as proteins, vitamins and minerals. *Phonda* seeds provide an important source of crude protein (up to 24%), carbohydrates (up to 63%) and fats (up to 6.5%) (Belewu *et al*., 2008). The crop also has a good balance of essential amino acids. This, therefore, suggests that *Phonda* within the *VhaVenda* indigenous communities may be beneficial to both human and animal diets.

5.1.2 The indigenous medicinal uses for *Phonda*

It was noted in the study that *Phonda* was also used for medicinal purposes. The following medicinal purposes were noted: traditionally, within the *VhaVenda* communities, *Phonda* was used to wean children from breast-feeding, to change the colour of a goats and cattle upon birth, as a sexual booster and to cure morning sickness, malnutrition, child diseases, epilepsy and to prevent constipation.

5.1.3 Attitudes towards *Phonda*

The study unveiled numerous attitudes that people have towards *Phonda*. People's attitudes were categorised with regards to how they viewed them; those who are against *Phonda* crop, those who highly esteem *Phonda* crop and those who had nothing to say regarding the *Phonda* crop. Those who despised the cultivation of *Phonda stated that they* did so because the cultivation of *Phonda* is very laborious, it causes stomach aches and makes one fart and pollute the air. The other group that highly esteemed it did so because they know its good medicinal value and other benefits derived from it.

5.1.4 Restoring the cultivation of *Phonda*

The study noted that people no longer cultivate *Phonda* because the new generation is not into farming, some changed religious views and other people fail and/or do not see the benefits of it. The study also noted that the new generation has no time for farming and took farming *Phonda* as something that was meant to be done by olden indigenous people.

5.2 Conclusion

The study explored the medicinal indigenous knowledge associated with *Phonda.* The study managed to give a detailed data of the medicinal knowledge that is associated with *Phonda*. However, the researcher noted that despite the medicinal indigenous knowledge that Phonda has, numerous households no longer cultivate this crop. It is because of this knowledge that some health challenges crop up unabated. Therefore, because of this, the following recommendations are given:

5.3 Recommendations of the Study

The following recommendations are made based on data collected from the study:

5.3.1 Cultivation of *Phonda*

- Strategies to improve cultivation and utilisation of *Phonda* should be improved. In this regard, the government should finance people and households who are interested in cultivating *Phonda* and also encourage the traditional leadership in rural areas to give land to those who have passion for cultivating *Phonda*.

- Those interested in farming *Phonda* must undergo training on how best they can cultivate *Phonda.* Furthermore, farmers must be motivated to cultivate *Phonda* through incentives like creating awards for best Phonda farmers

5.3.2 Education

The issue of indigenous knowledge should be incorporated into the schools' curriculum so that students should know about such plants as *Phonda*. This is one important subject that has been neglected by the government. Also, the parents and family members should share the information with the next generation and avoid going to the grave with vital information that can save the continent. Indigenous knowledge is not documented and it is fast becoming extinct, thus, the process of education on IKS (including *Phonda*) should be spread all over through diverse vehicles. Government should put adverts and hold campaigns to raise awareness about the importance of *Phonda*.

5.3.3 Recommendations for further study

This study sheds light on areas of expansion and further research with an exploratory foundation of the medicinal value of *Phonda*. There is a need for other researchers from different disciplines to probe into the different aspects that the study has found. There is also an opportunity to explore other aspects like the taboos, the medicinal value and ritual use of *Phonda*. Additional knowledge about row-crop ecosystems will reveal additional opportunities for providing services and delivering them more efficiently. The researcher thus recommends further studies into these areas.

APPENDIX A

QUESTIONS ASKED INCLUDE

1) What is the indigenous nutritional value of *Phonda*?

2) What are the indigenous medicinal uses for *Phonda*?

3) Which attitudes do local households have towards *Phonda*?

4) How can we restore the cultivation of *Phonda*?

APPENDIX B

INFORMED CONSENT FORM

Dear participant

My name is **Tshikukuvhe Livhuwani Daphney** a student from the University of Venda, School of Human and Social Sciences, Department of African studies. I am conducting a study on Exploration of Indigenous Medicinal Knowledge of *Phonda* in the Vhembe district of Limpopo province. The study is all for academics purpose and all the data that will be collected will be used for the purpose of this study and will not affect you or the relationship with your patients. The interview will last for about 2 hours in focus group and 45 minutes in individual.

Please sign the consent form as an indication that you're agreeing to take part in the study.

Signature ----------

This study is conducted under the supervision of: Dr P. E. Matshidze who is the Head of the Department of African Studies in the School of Human and Social Sciences, Prof A.I.O Jideani Head of Department: Department of Food Science and Technology in the School of Agriculture, Prof M. P Tshisikhawe from the Department of Botany in the School of Mathematical and Natural sciences.

This study has been approved by the University Higher Degree's Committee (UHDC) on the 1st of February 2017. The research project number is: SHSS/16/AS/07/0102.

The purpose of this study is to explore the medicinal indigenous knowledge associated with *Phonda.*

I am requesting your participation in interviews concerning this study. Please note the following before signing the consent form as a research participant:

- This interview will last between 45 minutes and two hours.
- Sometimes interviews will be audio-taped or video-recorded for verification of the findings by the supervisors.
- Information shared with the researcher will be treated as confidential.
- No financial compensation will be offered for participating in the study.

- The information provided by informant will not be used for commercial benefit by the researcher since it is aimed for academic purpose.
- Should you feel the need to terminate your participation in the research, you have a right to do so without supplying reasons to the researcher.

APPENDIX C

Consent Form

PARTICIPANT

I, ----------, hereby consent to participate in the research study. I understand that my participation is voluntary and that I am free to withdraw from the study should I want to do so at any time of the study. The conditions of this study have been fully explained to me and I understand the circumstances of my participation.

- Signature of the participant: ----------Date----------
- Witness----------Date----------
- Researcher's signature: .....Date……

1.6 References

Abu-Ghannam, N. and McKenna, B. (1997). The application of Peleg's equation to model water absorption during the soaking of red kidney beans *(Phaseolus vulgaris L*.) *Journal of Food Engineering* **32**, 391–401.

Addo, A.A. and Oyeleke, O.A. (1986). Nutritional evaluation and organoleptic properties of biscuits supplemented with Bambara groundnut flour. A Seminar Paper, 1 – 10.

Adelakun, O. E.,Oyelade, O. J.,Ade-Omowaye, B. I. O., Adeyemi, I. A. and Van De Venter, M. (2009). Chemical composition and antioxidative properties of Nigeria Okra Seed *(*Abelmoschus esculentus Moench) Flour. Food and Chemical toxicology.

Akindahunsi, A.A. and S,S.O. (2005). Phytochemical screening and nutrient anti-nutrient composition of selected tropical green leafy vegetables. *African Journal of Biotechnology* 4(6), 497-501.

Akpalu, D.A. (2013) Agricultural Extension Service delivery in a semi-Arid Rural Area in South Africa; The case study of Thorndale in the Limpopo Province. African Journal of *Food, Agriculture, Nutrition and Development*, Vol 13, 4.

Anakwenze **(**2015) *World Journal of Pharmacy and Pharmaceutical Sciences* Tropical Crops Communication 5, (4), 2056-2067.

Amadou, H. I., Bebeli, P. J. and Kaltsikes, P. J. (2001). Genetic diversity in Bambara groundnut (*Vigna subterranea* L.) germplasm revealed by RAPD makers. *Genome.* **44**:995–999.

Amarteifio, J.O., Tibe, O. and Njungo, R.M. (2006). The composition of *Bambara* groundnut (*Vigna subterranea L.Verdc*.) grown in Southern Africa. *Africa Journal of Biotechnology.* 5, 2408 – 2411.

Ameyaw, M.V and Doku. E.V. 1983. Effect of soil moisture stress on the reproductive efficiency and yield of Bambara groundnut (*Vondzia subterranean), Tropical Grain Legumes Bulletin*. 28:23-29.

Apata, D.F. and Ologhobo, D. (1997). Trypsin inhibitor and other anti-nutritional factors in tropical legume seeds. *Tropical Science*. 37, 52-59.

Asante, I.K., Adu-dapaah, H. and Addison, P. (2004). Seed weight and protein and tannin contents of 32 cowpea accessions in Ghana. *Tropical Science.* 44, 77-79.

Asante, M.K. (1998). *The Afrocentric idea: Revised and expanded edition.* Philadelphia: Temple University press.

Asante M.K. (1980). *Afrocentricity: The theory of social change*. New York: Amulefi publishing company.

Bailey, K.D. (1987) *Methods of Social Research* (4th ed). New York: Macmillan.

Baryeh, E. A. (2001). Physical properties of Bambara groundnuts. Journal of *Food Engineering Vol.* 47, 321–326.

Basu, S. N., Roberts, J. A., Azam-Ali, and Mayes, S. (2007). Bambara groundnut. *Genomic Mapping and Molecular Breeding in Plants Vol* **3**. Pulses, Sugar and tuber Crops Edited by C. Kole. Springer, New York. Pp 159–173.

Baudoin, J. P. and Mergeai, G (2001) Grain Legumes in Crop production in Tropical Africa. P. 313– 317.

Begemann, F. (1988). Eco geographical Differentiation of Bambara Groundnut (*Vigna subterranean* (L.)) in the collection of the International Institute of Tropical Agriculture (IITA).

Belewu, A.R., Linnemann, A.R. and Craufurd, E. (2008) Effects of temperature and photoperiod on phonological development in three genotypes of Bambara groundnut. *Anatomy of Botany* 74:675-681.

Bernard H. 1995. Research Methods in Anthropology: Qualitative and Quantitative Approaches. Second edition. Thousand Oaks, CA: Sage Publication.

Borget, M. (1992). Food Legumes. In: The Tropical Agriculturalist, CTA Macmillan.

Brink, M. and Belay, G. (2006). (*Vigna subterranean*). In Brink, M. & Belay, G. (Editors). Plant Resources of Tropical Africa1. Cereals and pulses. PROTA Foundation, Wageningen, Netherlands/ Backhuys Publishers, Leiden, Netherlands/CTA, Wageningen, Netherlands. Pp213-218.

Brink, M. and Belay, G. (Eds.). (2006). Cereals and Pulses. *Prota Foundation*, pp. 214. Backhuys Publishers. CTA, Netherlands.

Brink, M., Ramolemana, G.M and Sibuga,K.P. (2006). *Vigna Subterranea* (L.) Verdc. In Brink, M. and Belay, G. (Editors). Plant Resources of tropical African 1. Cereals and pulses. PROTA Foundation, Wageningen, Netherlands. Pp. 213-218.

Brough, S. H., Azam-Al, S. N., and Taylor, A. J. (1993). The potential of Bambara groundnut (*Vigna subterranean*) in vegetable milk production and basic protein functionality systems. *Food Chemistry.* 47:277–283.

Borget, M. (1992). *Food Legumes in the Tropical Agriculturalist*, CTA: Macmillan.

Burns, E.V. and Grove, S.K. (2003). Operational selection in wild Bambara groundnuts. *Ghana Journal of Science*. 11:47-56.

Creswell, Ebberson (2007) *First step in Research*. Pretoria: Van Schaik.

De Vos, AS (Ed). 1998. *Research at Grassroots: A primer for the caring Professions*. Pretoria: J.L.Van Schaik Academic.

Denzin, E.V. and Lincoln, S.K. (2005) Bambara groundnut. Economic Botany. 25:225-262.

Doku, E.V. (1996). Problems and Prospects for the Improvement of Bambara groundnut. In: Proceedings of the International Bambara groundnut symposium. University of Nottingham, UK.

Doku, E.V. (1995). Bambara Groundnut (*Vigna subterranea* (L.) Verdc.). University of Ghana. Proceedings of the international Bambara Groundnut Symposium, July 23-25,University of Nottingham, Uk, pp. 19-27.

Doku, E.V. and S.K. Karikari, S.K. (1971). Operational selection in wild Bambara groundnut. *Ghana Journal of Science*. 11: 45-56.

Doves, E.V. (2002). The role of ants in pollination and pod production of Bambara groundnut. *Economic Botany.* 25: 357-362.

DWAF, 2002. Annual Report: Available http://unpan1.un.org/intradoc/groups/public/documents/cpsi/unpan035539.pdf **[2016 November, 25].**

Eisner, A.R. (1991) Bambara groundnut (*Vigna subterranea* (*L.) Verdc*.): A review. Abstract on Tropical Agriculture 12:7.

Enwere N.J. (1998). Foods of plants origin: Processing and utilization with recipes and Technology profiles. Afro-orbis Publishers, Nsukka, Nigeria. p59-61.

Fasoyiro, SB., Ajibade, sr., Saka, Jo. ashaye, oa, Obatolu, va., Farinde, eo. and Afolabi, O.O (2005). Physical Characteristics and effects of processing methods on pigeon pea. *Journal of Food, Agriculture and Environment*. 3, 59-61.

FAO (1961). Agricultural and Horticultural Seeds. FAO Agricultural Studies No. 55, Food and Agricultural Organization, Rome, Italy.

Fetterman, D. M. 1989. *Ethnography*: Step by Step. London: Sage Publisher.

Finster, k., Liesack, w, and Tindall, B.J. 1997 Sulfurospirillum arcachonense SP.Nov. A new Micro aerophilic sulfureducing bacterium. International Journal System. Bacterial. 47: 1212-1217.

Frunji, F. Niess, N. AND Pfeffer, E. (2003).Effects of raw and heat-treated Bambara groundnut (*Vigna subterranea*) on the performance and body composition of growing broiler chicks. Archives of Animal Nutrition. 6: 443 – 453.

Gibbon, D. and Pain, A. (1985). Crops of the Drier Regions of the Tropics,Longman Scientific and Technical Longman Group UK Ltd.

Gibney, M.J, Voster. H.H, Kok. F.J, (2002). *Introduction to Human Nutrition*. London: Blackwell Publishing.

Goddard, Melville (1996). Research Methodology an introduction. Juta. Landsdowne.Iita (1979). Selected Methods for Soil and Plant Analysis. Manual Series. 1:3 – 70.

Goli, A.E. and Ng, N.Q. (1988). Bambara groundnut multi – locational yield trial. pp. 11–12 in *Annual Report, Genetic Resources unit*, IITA. 1987.

Goli, A. E. Begemann, F. and Ng, N. Q. (1997). Characterisation and evaluation of IITA's bambara groundnut (*Vigna subterranean* (L.) *Verdc*. Proceedings of the workshop on conservation and improvement of Bambara groubdnut (*Vigna subterranean* (L.) Verdc).pp. 1-12. November 14–16 1995, Harare, Zimbabwe. *International Plant Genetic Resources institute. pp.* 101–118.

Goli, A.E (1995). Bibliographical Review in Proceedings of the Workshop on Conservation and Improvement of Bambara Groundnut *(Vigna subterranean* (L.)verdc) Harare, Zimbabwe.

Hallet, D.R (1999). Genotype-environment interaction of no-till winter wheat in Western Canada. Canadian Journal of Plant Science. 81:7-16.

Hampson K.J. Azam-ali, S.H., Sesay, A., Mukwaya, S and Azam-ali, SN. (2001). Assessing opportunities for increased utilization of Bambara groundnut in Southern Africa. Journal of Science, Food and Agriculture. 34: 245-248.

Heller, J., Begemann, F. and Mushonga, J. (Eds). 1997. Bambara groundnut. (*Vigna subterranea* (L.) Verdc. Promoting the conservation and use of underutilisedand neglected crops. 9. Proceedings of theWorkshop on Conservation and Improvement of Bambara Groundnut (*Vigna subterranea* (L.) Verdc.), 14–16 November 1995, Harare, Zimbabwe. Institute of Plant Genetics and Crop Plant Research, Gatersleben/Department of Research & Specialist Services, Harare/International Plant Genetic Resources Institute, Rome, Italy.

Hepper, F.N., 1963. Plants of the 1957-58 West Africa Expedition II: The Bambara groundnut (*Voandzeia subterranea)* and Kersting's groundnut (Kerstingiella geocarpa) wild in West Africa. *Kew Bulletin*. 16: 395-407.

Herridge, D. (ed.) 2002. Inoculants and Nitrogen Fixation of Legumes in Vietnam. ACIAR Proceeding 109e www.aciar.gov.au/publications

Hornby, A.S. (2010). Oxford Advanced Learners Dictionary. (8th revised edition). USA: Oxford University Press.

Ihekoronye, A.I. and Ngoddy, P.O. (1985). *Integrated Food Science and Technology for the tropics*. Macmillan Published London and Basingstoke.

Jideani V.A, Diedericks C.F (2014). Nutritional, Therapeutic, Prophylactic Properties of *Vigna subterranea*, *Moringa olefera*. (http:// Creativecommons.org/licenses/by/3.0): INTECH.

Jonathan A. Foley, Ruth Defries, Gregory P, Asner, Carol Barford , Gordon Bonan, Stephen R, Carpenter, F. Stuart Champion, Michael T. Coe, Cretchen C. Daily Holly K. Gibbs, joseph H. Helkowsk, Tracey Holloway, Erica A. Howard , Christopher J. Kucharik, Chad Monfreda ,Jonathan A. Patz, L. Collin prentice ,Navin Ramankutty, Peter K. Snyder .(2005) American Association For the Advancement of Science New York.

Lawal, S. O., Adebowale, K. O. and Adebowale, Y. A. (2007). Functional properties of native and chemically modified proteins concentrates from Bambara groundnut. *Journal of Food Research International.* 40 (8):1003–1011

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic Inquiry*. Newbury Park, Ca: Sage Publications.

Lincoln, Y.S. (1995). Emerging criteria for quality in qualitative and interpretive research. Paper presented at the Annual Meeting, American Educational Research Association, San Francisco, and April 18-22, 1995.

Linnemann A.R, Azam-Ali, S. (1993). Bambara groundnut (*Vigna subterranea*) literature review : A revised and updated bibliography. *Tropical Crops Communication* No. 7.Department of Tropical Crop Science Wageningen Agricultural University, Netherlands pp.124.

Linnemann, A. R. 1990. Cultivation of bambara groundnut (*Vigna Subterranean* (L) *Verdc.*) in western province, Zambia. *Report of a field study Tropical Crops Communication*., pp. 15-19.

Linnemann, A.R. (1988). Cultivation of Bambara groundnut in northern Nigeria. *Tropical Crops Communication*. 15: 1-14.

Machi, T. and Shumba, J. (1990). *Statistical analysis of multi-locational trials*. Advance in Agronomy. 44:55-85.

Mahe, T., Cook, A.A., and Coudert, M.J., (1994). Bambara groundnut (Voandzeia subterrannea). In: Diseases of tropical and subtropical vegetables and other plants. Hafner Press, New York, USA, pp. 15.

Mandawire, C. H. (2007). Rediscover some of the underutilised and neglected cropsof the worldwith a view to broaden our food recourse base: Bambara groundnut. Available from www.articlebase.com/college-anduniversity- articles. Accessed January 18 , 2011.

Marie, A.Boyle, and David, H. Holben. 2006. *Community Nutrition in action, an entrepreneurial approach*. United States of America: Peter Marshall.

Masindeni, D.R. (2006). Evaluation of Bambara groundnut (Vigna subterranea [L.] Verdc.) for yield stability and yield related characteristics. M.Sc. Thesis, University of the Free State

Massawe, F. J., Dickinson, M., Roberts, J. A. and Azam-Ali, S. N. (2002). Genetic diversity in Bambara groundnut *(Vigna subterranean* (L.) Verdc). *Genome.* 45:1175–1180.

Mazahib, A. M., Nuha, M. O., Salawa I. S. and Babiker, E. E. Some nutritional attributes of Bambara groundnut as influenced by domestic processing. *International Food Research Journa*l 20(3): 1165-1171 (2013)

Messiaen, C.M (1992). The Vegetable Garden, Macmillan Press Limited. P. 318.Minka SR, Bruneteau M. Partial chemical composition of Bambara pea (*Vigna subterranean (L.Verde*). *Food Chemistry* 2000; 68:273-6.

Minka SR, Bruneteau M. Partial chemical composition of Bambara pea (*Vigna subterranean (L.Verde*). *Food Chem* 2000; 68:273-6.

Mohammed, M.J. (2014). Cowpea and Bambara groundnut; prospects for regional trade development in West Africa. FAO microfiche XF 83322635. International Trade Centre UNCTAD/GATT, Geneva, Switzerland.

Mpotokwane, S. M., Gaditlhatlhelwe, E., Sebaka, A. and Jideani, V. A. (2008). Physical properties of Bambara groundnuts from Botswana. *Journal of Food Engineer.* **89**:93–98.

Murevanhema Y.Y, Jideani V.A (2013) Potential of Bambara Groundnut *(Vigna Subterranea* (L.) Verdc) milk as a Probiotic Beverage –A Review. Cape Peninsula University of Technology, Bellville, South Africa: published online: 14 June.

Mukurumbira, L.M. (1985). Effects of the rate of fertilizer nitrogen and previous grain legume Crop on Maize Yields*. Zimbabwe Agricultural Journal* .82 (6): 177-179.

Nachmias, L.T. (1996) Crop evolution, adaptability and yield. Cambridge University Press, London.

Nelushi, A.J. (2000) The cultural Significance, ethno-ecological knowledge and ethno-conservation of grasshoppers among the Vhavenda of northern province, South Africa, UNIVEN.

Nicholas, A.G.O. (1992). Genotypic stability and adaptability: analytic methods and implications for cassava breeding for low input agriculture. In: Tropical root crops in a developing economy. F. Ofori and S.K. Hahn (Eds.), pp.130-137. Proceedings of the 9th Symposium of the International Society for Tropical Root Crops, 20-26 October 1991, Accra, Ghana.

Nnam N.M, 2000, Evaluation of the effect of sprouting on the viscosity, proximate composition and mineral content of hungry rice (Digitaria exilis) Flour. *Nigeria food*. 18:57-62.

NRC, National Research Council. (1996). Lost Crops of Africa. Vol. I: Grains. Board of Science and Technology for International Development, pp. 59–76.*National Academy Press*, Washington, DC.

Ntundu, W.H, Shillah, S.A., Marandu, W.Y.F. and Christiansen, J.L. (2006). Morphological diversity of Bambara groundnut (Vigna subterranea [L.] Verdc.) Landraces in Tanzania. *Genetic Resources and Crop Evolution*, 53 (2): 367-378

Nwanna, L.C, Enujiugha, V.N, Oseni, A.O. and Nwanna, E.E. (2005). Possible effects of fungal fermentation on Bambara groundnuts (*Vigna subterranean* (L.) Verdc) as a feedstuff resource. *Journal of Food Technology*. 3 (4): 572-575.

Nweke, E. (2013) Effect of manure and mineral Fertilizer on the growth performance and Quality of Cucumber fruits. *Journal of experimental biology and agricultural sciences*, vol 3(4)

Nwokolo, E. 1996. Bambara groundnut (Vigna subterranean (L.) Verdc.). pp. 216 – 221 in Legumes and oil seeds in nutrition. (E. Nwokolo and J. Smart, Eds.). Chapman and Hall.

Obizoba, I.C., (1991.) Effect of sprouting on the nitrogenous constituents and mineral composition of pigeon pea (Cajanus cajan) seeds. *Plant Foods Human Nutrition.* 41(1):21-26.

Ocran, V. K, Delimini, L. L., Asuboah, R. A and Asiedu, E. A (1998). Seed Management Manual for Ghana, MOFA, Accra Ghana.

OECD and Food and Agriculture Organization of the United Nations. (2010).Meat. OECD-FAO Agricultural Outlook 2010. OECD Publishing. 147–158.

Oluyemi, J.A., Fetuga, B.L.; Enderley. N.L., (1976) The metabolizable energy value of some feed ingredients for young chicks, poult.ry Science. 55.11-618.

Onwuka, G.I. (2006). Soaking, boiling and antinutritional factors in pigeon peas (*Cajanus cajan*) and cowpeas (*Vigna unguiculata)*.Journal of food processing and preservation. 30, 616-630.

Oyiga, B. C. and Uguru, M. I. (2011). Interrelationships among pod and seed yield traits in Bambara groundnut (Vigna subterranea [L.] Verdc.) In the derived Savanna agro-ecology of South-eastern Nigeria under two planting dates. International Journal of Plant Breeding, 5 (2): 106-111.

Pakitsan, A.J. (2009). Catalogue of Bambara germplasm. Agricultural Research Council – Grain Crops Institute, Potchefstroom.

Patton, M. Q. (1990). Qualitative evaluation and research methods (2nd Ed.). Newbury Park, Ca: Sage

Poulter, N.H. (1981). Properties of some protein fractions from Bambara groundnut", Journal of the Science of Food and Agriculture. 3, 41-50.

Poulter, N.H. and J.C. caygill. 1980 vegetable milk processing and rehydration characteristics of Bambara groundnut (Vaondzeia Subterranea) (L) Thou) J. Sci. Food Agric.31 (11):1158-1163.

Purseglove, J. W. (1992).Tropical Crops (Dicotyledons). Longman House Burnt Mill, Harlow, Essex CM20 2JE England.

Rachie, K.O, Silvester, P. (1977). Grain Legumes. In: Food crop of the lowland Tropics, Leakey, C.L A, and T.B. Wiliany (Eds), Oxford University Press, U.K. pp. 41-74.

Ramolemana, G. M. Tropical Resource Management Papers, ISSN 0926-9495, No. 26 (1999) ISBN 90-6754-562-7 Wageningen Agricultural University

Ramugondo, E.L (2009). Intergenerational shifts and continuities in children's play within a rural Venda family in the early 20th and 21st centuries: University of Cape Town.

Reaves, S.A. (1992). Stability parameters for comparing varieties. Crop Science 6:36-40.

Schumacher, E.V. (2006). Flowering and pod production of bambara groundnut. Ghana Journal of Agricultural Science 3:17-26.

Swanevelder, J. C. (1998). Bambara food for Africa (Vigna subterranean–bambara groundnut). National department of Agriculture. ARC–Grain Crops Institute, South Africa.

Schneider, F. Carlos E. García , D. M. Prett, M. (1989) *Survey Methods and practice, human science research council*: Blackwell publishing, inc.

Sellschop, J.P.F., 1962. Cowpeas (Vigna unguiculata (L) Walp). Field Crop Abstracts 15(4):259-266.

Tanimu, B and L. Aliyu. Bambara Groundnut (*Vigna subterranea* (L.) Verdc.). Proceedings of theworkshop on Conservation and Improvement of Bambara Groundnut (*Vigna subterranea* (L.) Verdc.) 14–16 November 1995 Harare, Zimbabwe.

Tibe, O., Amarteifio J.O. and Njogu R.M. (2007). Trypsin inhibitor activity and condensed tannin content in bambara groundnut (*Vigna subterranea* (L.) Verdc) grown in Southern Africa, Journal of Applied Science and Environmental Management. 11, 159 – 164.

Tindal, H. D (1997). Vegetables in the Tropics, Macmillan Education Ltd. *Toxicol.* **47**:1123–1126.in Vitro Plantlet Registration from the bulbs of Shallot (Allium *Cepa Var. Group Aggregatum)*

Tweneboah, C. K (2000). Modern Agriculture in the Tropics, Food crops. Co-wood Publishers

Uvere, P. O., Uwaegbute, A. C. and Adedeji, E. M. (1999). Effect of malting on the milling performance and acceptability of bambara groundnut (*Voandzeizasubterranean* Thouars) seeds and products. *Plant Foods Human Nutrition.* **54**:49–57.1999.

White, P. J. and Xing, Y. (2001). Antioxidants in Food: Source of Natural Antioxidants. Woodhead Publishing Limited, Boca Raton. p166

William, S.T. (1992). Growth, development, and yield of bambara groundnut (Vigna subterranea L. Verdc) in response to soil moisture. Journal of Agricultural Science (Cambridge) 126:307318.

William, L.D. (2010). The effect of soil moisture on light interception and the conversion coefficient for three landraces of bambara groundnut (Vigna subterranea). Journal of Agricultural Science 133:151-157.

World Bank (1998). Indigenous knowledge for development. Knowledge and learning center, Africa Region, Washington DC.

Worsely, T. (2008) *Nutrition promotion, theories and methods, systems and settings*; Australia and New Zealand: Allen and Unwin.

Yamaguchi, M. (1983). World Vegetables. Van Nostrand Reinhold, 115 Fifth Avenue, New York 10003.

Yegidis, B.L, Weinbach, R.W. (1996). *Research Methods for Social Workers*. London: Allyn and Bacon.

Yin, W. (2003). Yield analysis of winter oilseed rape (Brassica napus L.): A review. Field Crops Research 67:35-49.

Zeven, A. C. (1998). Landraces: A review of definitions and clarifications. *Euphytica.* **104**:127–139.

Zikic, B. 2007. *Qualitative Research in Anthropology*: An Overview of Basic Research Methodology.

www.Maqpparade.com/ Map of Vhembe district Municipality.in za.tlkf.

http://study.com/academy/lesson/unstructured-interview-definition-advantages-disadvantages-example.html (accessed 29/04/2016)