

**MULCHING, PLANT POPULATION DENSITY AND INDIGENOUS  
KNOWLEDGE OF WILD GINGER (*SIPHONCHILUS AETHIOPICUS*)**

**BY**

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### DECLARATION

I declare that this thesis, for the degree of M INST AGRAR (Agronomy): Plant Production, has never been submitted for any degree at any university. The research work reported is the result of my own original investigation, except where acknowledged.



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24-05-04

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# MULCHING, PLANT POPULATION DENSITY AND INDIGENOUS KNOWLEDGE OF WILD GINGER (*SIPHONCHILUS AETHIOPICUS*)

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## **Abstract**

The benefits of mulching for moisture retention and weed control as well as the effect of spacing on yield and quality of wild ginger was investigated. A survey on indigenous knowledge of wild ginger was also conducted. The field experiment was conducted at Hatfield Experimental Farm, University of Pretoria and the questionnaire survey was done in Venda.

Treatments used in the field experiment were mulching or non-mulching in combination with three levels of spacing. Wheat straw mulch was applied at a thickness of about 6cm and rhizomes were spaced at 15, 30 and 45cm apart.

Mulching was effective in reducing the soil temperature, keeping the soil moisture content for a longer period, and suppressing weed growth. The main effects of mulching and spacing did not affect wild ginger growth, but interactions between mulching and spacing were significant. Plant spacing of 30cm with non-mulching was better than both 15cm and 45cm spacings. On the other hand, 15cm spacing with mulching was better than both 30cm and 45cm spacings. This experiment demonstrated that 30cm spacing is ideal if no mulch is used. However, when mulch is used, a spacing of 15cm is recommended.

Respondents interviewed were traditional healers (30%), sellers (29%) and indigenous knowledge bearers (41%). Also, most of the respondents indicated that they had gone

through formal education, so they were able to read and write. All of the respondents knew wild ginger as *tshirungulu*.

Results from the survey indicated that wild ginger is used mainly for stomach pains. It was encouraging to learn that people who use this plant feel that even home-grown wild ginger is as effective as the wild one for medicine. The plant is currently so scarce that some of the respondents were travelling as far as Zimbabwe to find it.

If continued use of this important medicinal plant is to be realized, users will need to be taught on how best to grow the plant and how to harvest the plant without destroying the mother tuber or rhizome. This will ensure sustainable use of wild ginger.

Keywords: Wild ginger, mulching, spacing, indigenous knowledge, questionnaire survey

## GENERAL INTRODUCTION

*Siphonochilus aethiopicus*, commonly known as wild ginger, is a member of the family Zingiberaceae and has a restricted distribution to South Africa, Zimbabwe, Malawi and Zambia. Wild ginger originated in north-eastern India. The plant (Fig. 1) is easily cultivated in the warm parts of South Africa and attempts have been made for the large scale production of rhizomes (Fig. 2) through tissue culture, in order to reduce the pressure on wild populations (Van Wyk, van Oudtshoorn & Gericke, 2000).



Fig. 1. Mature plant of wild ginger (Van Wyk, van Oudtshoorn & Gericke, 1997)



Fig. 2. Mature rhizomes of wild ginger (Van Wyk *et al.*, 1997)

Wild ginger is a perennial herb with tubers (Langenheim & Thimann, 1982). It is a deciduous plant with large, hairless leaves (Fig. 1) developing annually from small, distinctive, cone-shaped tubers (Van Wyk *et al.*, 2000). Langenheim & Thimann (1982) stated that the inflorescence can be a compact spike or an open raceme or the plant can bear solitary flowers, each flower or cluster of flowers joined by a conspicuous bract. The spectacular flower (Fig. 1) appear at ground level in early summer, from end of October to early December. They are broadly funnel-shaped, pink and white in colour with a small yellow blotch in the middle (Van Wyk *et al.*, 2000).

Van Wyk *et al.* (2000) reported that most plants are bisexual and they have much larger flowers than female plants. The small, berry-like fruits are borne below or above the ground. The leaves and rhizomes have a smell similar to that of real ginger, *Zingiber officinale*. Van Wyk *et al.* (2000) also reported that the rhizome (Fig. 2), which is cone-shaped and narrows to a tapering point, is dug up and sold. Rhizomes harvested during the growing season will have roots on them and are used as such.

Those taken during the dormant period, when the plants are leafless, have no roots on them.

Watt & Breyer-Brandwijk (1962) found that tubers of wild ginger yield 2 % of oil made up of 93% orange flower scented oil and 7% heavier oil with the odour of crushed ivy leaf, as cited by Hutchings, Scott, Lewis & Cunningham (1996). Van Wyk *et al.* (2000), on the other hand, reported that wild ginger contains volatile oil with  $\alpha$ -terpineol (a natural antiseptic) and various other monoterpenoids, but the main compound is a highly characteristic sesquiterpenoid. The similarity between wild ginger and true ginger appears to be superficial only, as none of the terpenoids of ginger oil are present in the essential oil of *Siphonochilus*.

According to Van Wyk *et al.* (1997), monoterpenoids and sesquiterpenoids in the oil are most likely responsible for the reported benefits against colds and influenza. Volatile oils are generally used for their decongestant, antiseptic and diuretic effects. Watt & Breyer-Brandwijk (1962) reported that overdose of medicine from wild ginger is said to stupify horses, as cited by Hutchings *et al.* (1996).

According to Van Wyk *et al.* (2000) and Hutchings *et al.* (1996), rhizomes of wild ginger have been used to relieve colds (to clear the nasal passages), coughs, influenza and hysteria. It can also be taken for pain relief. Several other traditional and cultural uses have been recorded, including the treatment of asthma and dysmenorrhoea (Van Wyk *et al.*, 2000).

Watt & Breyer-Brandwijk (1962) reported that wild ginger is used by the Swazi for malaria and chewed by women during menstruation, probably to relieve pain, as cited by Hutchings *et al.* (1996). They also reported that the cold rhizome infusions of wild ginger species are administered to horses as prophylactics against horse sickness. According to Van Wyk *et al.* (2000), rhizomes and fleshy roots are very popular in traditional medicine in southern Africa to the extent that concern has been expressed about regional extinction.

Because wild ginger is becoming extinct, determining the agronomic potential of the plant as well as finding indigenous knowledge of the plant is of utmost importance. The objective of this study was to investigate the benefits of mulching (such as moisture retention and weed control) and the effect of spacing on yield and quality of wild ginger and to gather indigenous knowledge about the plant through a questionnaire survey.

### Definition and structure

Rhizome is a woody or fleshy elongated stem that usually grows horizontally below the ground, forming leaves above the ground and roots into the ground.

There are several examples of rhizomatous plants that are used primarily for medicinal purposes including ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and ginger root (*Alpinia officinarum*).

### Types of rhizomes

- i) The pachynormous rhizome
- ii) The leucormous rhizome

ii) The leucormous rhizome is a type of rhizome that is characterized by its white color and its ability to store food reserves. The rhizome is a horizontal stem that grows below the ground and is used for vegetative propagation.

## CHAPTER 1

### LITERATURE REVIEW

#### 1.1 RHIZOMES

##### 1.1.1 Definition and structure

A rhizome is a woody or fleshy elongated stem that usually grows horizontally below the ground, forming leaves above the ground and roots into the ground (Van Wyk *et al.* 1997). There are several examples of medicinal plants that are used primarily for their rhizomes, including ubani (*Agapanthus spp.*), bulrush (*Typha capensis*), piles root (*Sansevieria hyacinthoides*) and ikhathazo (*Alepidea amatymbica*). Mathew & Swandels (1994) and Hartmann, Kester, Davies & Geneve (1997) defined rhizome as a specialized stem structure in which the main axis of the plant grows horizontally at or just below the ground surface.

Edmond, Senn, Andrews & Halfacre (1975) and Hartmann *et al.* (1997) described two general types of rhizomes:

i) The pachymorph e.g. Iris and Ginger

The rhizome is thick, fleshy and shortened in relation to length. It appears as a many-branched clump made up of short, individual sections. It is determinate, which means that each clump terminates into a flowering stalk, growth will only continue from lateral branches. The rhizome tends to be oriented horizontally with roots arising from the lower side.

ii) The leptomorph e.g. Lily-of-the valley

The rhizome is slender with long internodes. It is indeterminate, which means that it grows continuously in length from the terminal apex and lateral branch rhizomes. The stem is

symmetrical and has lateral buds at most nodes, nearly all remaining dormant. This type does not produce a clump but spreads extensively over an area.

Intermediate forms between these two types is called **mesomorphs**.

### 1.2.2 Growth pattern

Hartmann *et al.* (1997) reported that rhizomes grow by elongation of the growing points produced at the terminal end and on lateral branches. Length also increases by growth in the intercalary meristems in the lower part of the internodes. As the plant continues to grow and the older part dies, the several branches rising from one plant may eventually become separated to form individual plants of a single clone (Hartmann *et al.*, 1997).

Hartmann, Kester & Davies (1990) reported that rhizomes exhibit consecutive vegetative and reproductive stages, but the growth cycle differs in the two types of rhizomes. For example, in the pachymorph rhizome of *Iris*, a growth cycle begins with the initiation and growth of a lateral branch on a flowering section. The flowering stalk dies, but these new lateral branches produce leaves and grow vegetatively during the remainder of that season. Growth of the underground stem, storage of food and the production of a flower bud at the end of the vegetative period is dependant upon photosynthesis. In general, plants with this structure flower in the spring and grow vegetatively during the summer and fall (Hartmann *et al.* 1990).

Hartmann *et al.* (1997) reported that plants with a leptomorph habit as a general rule, grow vegetatively during the beginning of the growth period and flower later in the same period. The length of time during which an individual rhizome section remains vegetative varies with different kinds of plants. For example, bamboo is divided into clump growers (pachymorphs), which have constricted rhizomes and running bamboos (leptomorphs), which spread rapidly by vigorous rhizomes that grow several feet or more (Hartmann *et al.* 1997). According to Hartmann *et al.* (1990), pachymorphs are more desired ornamentally. Some bamboo species remain vegetative for many years, but they change abruptly and the entire plant produces flowers.

## 1.2 MULCHING

Thorpe (1989) and Andrews (2002) defined mulching as a covering material that act as a blanket and also helps to prevent moisture in the soil evaporating during hot weather. Waggoner, Helgerson & Deroo (1960), McDonald & Helgerson (1990), and Adams (1997) reported that for centuries, mulching has been recognised as a beneficial practice in agronomic systems, where it often enhances growth and yield of annual and perennial crops, as cited by Green, Kruger & Stanosz (2001). According to Ingels (1985), mulching refers to the application of loose aggregate materials to the surface of a planting bed and the materials may be organic or inorganic (Table 1.1).

Table 1.1 Soil temperature and tomato yield with straw or black plastic mulch

	Not irrigated		Irrigated daily	
	Straw mulch	Plastic mulch	Straw mulch	Plastic mulch
Average soil temp (°C)	24	37	24	35
Tomato yield (Mg/ha)	68	30	70	24

Soil temperature measured at 5cm below the soil surface, average of weeks 2 - 10 of the growing season (Tindall *et al.*, 1991)

### 1.2.1 Advantages of mulch

Mulching with straw (Table 1.1), sawdust, woodchips or other material helps conserve soil moisture and controls weeds and erosion (Reiley & Shry, 1979). These materials should be added deeply enough to shade the ground and to prevent the surfacing of weeds. A fine material such as sawdust should be applied only to 5 or 8 cm, but coarse, open material such as straw should be up to 10 or 13 cm thick. Mulching is necessary for moisture retention, weed control, organic matter supply and moderating the temperature for the roots. Mulching also improves the appearance of the area. Trees in the landscape may be mulched with attractive materials such as hardwood bark, pine bark, cocoa hulls and tanbark (Reiley & Shry, 1979).

Mulching with a light covering of weed-free straw or hay helps to hold moisture and prevent the seed from washing away during watering or rainfall. Straw also helps to hide the seed from birds. Mulches applied evenly and lightly may be left in place and the grass allowed to grow through. Peat moss or other fine material do not make satisfactory mulch. These materials become packed too tightly, resulting in the seed being planted too deeply. On terraced areas or sloping banks, cheesecloth, burlap or commercial mulching cloth helps to hold in moisture and keep the seeds in place. Grass is able to grow through these mulching materials, which may be left to rot (Reiley & Shry, 1979).

Halfacre & Barden (1979) reported that in certain plants, excessive soil temperatures could be detrimental. By providing a layer of 10 to 15cm of mulch on the soil surface, soil temperatures are suppressed considerably in the summer. Most mulches are organic in nature and type used depends largely on cost and availability.

### 1.2.2 Disadvantages of mulch

Janick (1972) and Andrews (2002) found that some of the problems associated with mulching materials arise from their tendency to act as sources and harbours of plant pests-weeds, disease-producing micro-organisms and rodents. Because of the disease problem, the refuse of the plant being protected should not be used as mulch. Straw that has been improperly handled may contain weed or grain seed, which may contribute to the weed population the following spring.

According to Janick (1972), fresh straw should be spread and moistened during warm weather to induce germination before being used. Many mulching materials are highly inflammable and present a fire hazard. Straw mulch in particular should not be placed too close to buildings. The partially decomposed fresh leaves make unsatisfactory mulch because they tend to pack closely and may smother plants. When the organic mulches decompose, it eventually contributes to the plants nutrients and the high carbon content of many of these materials may contribute to nitrogen deficiency (Janick, 1972).

### 1.2.3 Temperature effect

#### 1.2.3.1 Soil temperature

Temperature of a soil greatly affects the physical, biological and chemical processes occurring in that soil (Brady, 1990). In cold soils, chemical and biological rates are slow. Biological decomposition can come to a near standstill, thereby limiting the rate at which nutrients such as nitrogen, phosphorus, sulfur and calcium are made available. Also, absorption and transport of water and nutrient ions by higher plants are adversely affected by low temperature (Brady, 1990).

#### 1.2.3.2 Absorption and loss of solar energy

Solar radiation is the primary source of energy to heat soils (Brady, 1990). Dark soils usually are high in organic matter and hold large amounts of water, which requires comparatively more energy to be warmed than light soil and also cools the soil when it is evaporated. Whether the soil is bare or is covered with vegetation or mulch is another factor that markedly influences the amount of solar radiation reaching the soil (Fig. 1.2). Bare soils warm up more quickly and cool off more rapidly than those covered with vegetation or with plastic mulches (Brady, 1990).

#### 1.2.3.3 Movement of heat in soils

Brady (1990) stated that the significance of conduction with respect to field temperatures is not difficult to comprehend. It provides a means of temperature adjustments, but, because it is slow, changes in subsoil temperatures lag behind those of the surface layers. Moreover, temperature changes are always less in the subsoil. In temperate regions, surface soils (Fig. 1.1) in general are expected to be warmer in summer and cooler in winter than the subsoil, especially the lower horizons of the subsoil.

i) Mulch

Brady (1990) stated that soil temperatures are influenced by soil cover and especially by organic residues or other types of mulch placed on the soil surface. In hot weather, they keep the surface soil cooler than where no cover is used (Fig. 1.2) while during cold spells in the winter, they moderate rapid temperature declines. Mulches tend to buffer extremes in soil temperatures.

According to Brady & Weil (1999), disturbance of the leaf mulch, changes in water content due to reduced evapotranspiration and compaction by machinery are all factors that influence soil temperatures through thermal conductivity.

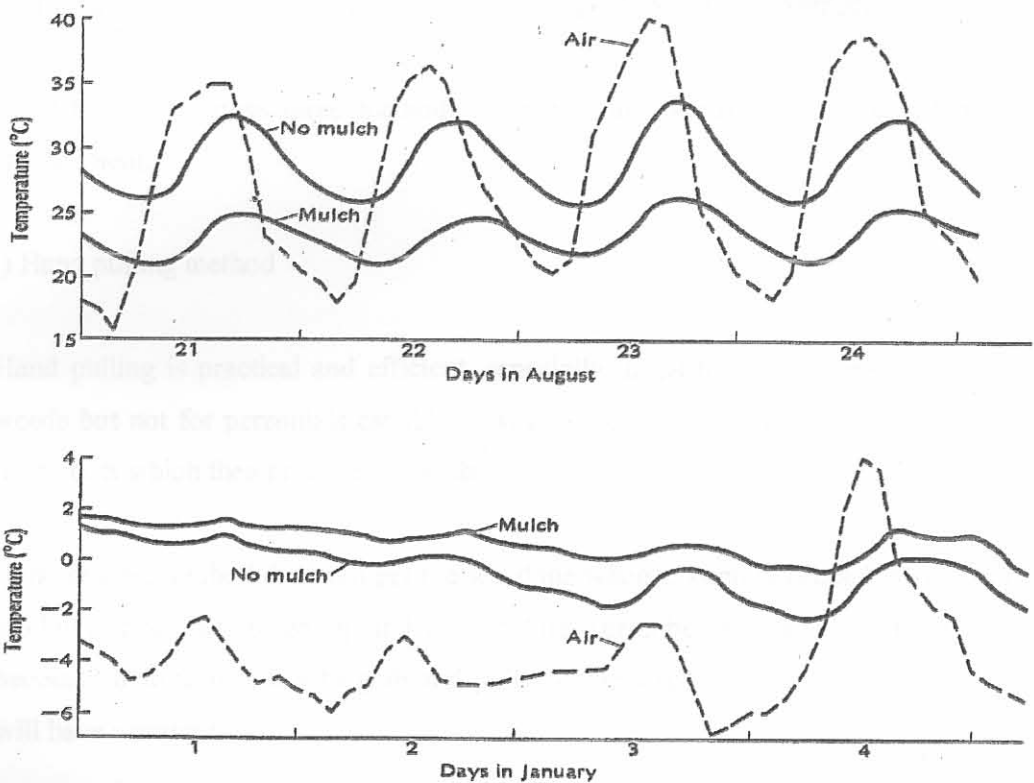


Fig. 1.2 a) Influence of straw mulch on air temperature at a depth of a 10 cm during an August hot spell in Bushland, TX. Soil temperatures in the mulched area are consistently lower than where no mulch was applied  
 b) During a cold period in January the soil temperature was higher in the mulched than in the unmulched area (Unger, 1978)

### 1.2.3.4 Soil temperature data

Brady (1990) reported that temperature of the soil at any time depends on the ratio of the energy absorbed to that being lost. The constant change in this relationship is reflected in the seasonal, monthly and daily temperatures. Brady (1990) found that considerable seasonal and monthly variations of the soil temperature occur, even at the lower depths (Fig. 1.1). The surface layer temperatures vary more or less according to the temperature of the air, although these layers are generally warmer than the air throughout the year. In the subsoil, the seasonal temperature increases and decreases lag behind changes registered in the surface soil and in the air (Fig. 1.1).

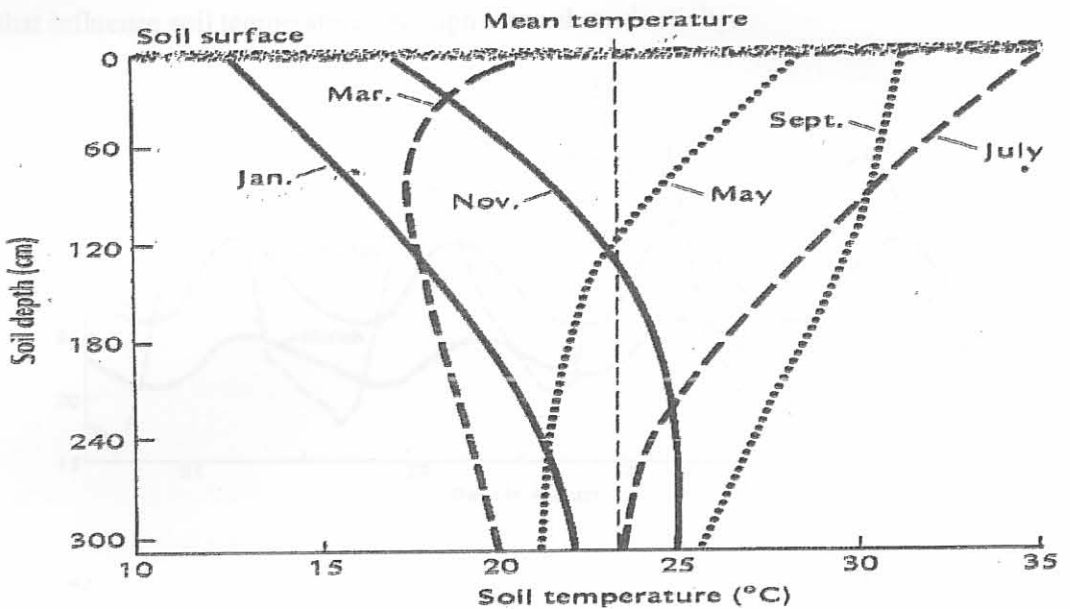


Fig. 1.1 Average monthly soil temperatures for six months of the year at different soil depths at College Station (1951-1955) (Fluker, 1958)

### 1.2.3.4 Soil temperature control

Brady (1990) described two kinds of management practices, which have significant effects on soil temperature, namely, those that keep some type of cover or mulch on the soil and those that reduce excess soil moisture:

## ii) Moisture control

The other method of controlling soil temperature is through management practices that influence soil moisture (Brady, 1990). Poorly drained soils in temperate regions that are wet in the spring have temperatures 3 to 6<sup>0</sup>C lower than comparable well-drained soils. Only by removing this water can temperature depression be alleviated. Water removal can be attempted by the installation of appropriate drainage systems, using ditches and underground tiles.

### 1.2.4 Weed control

A weed is a plant growing where it is not desired (Zimdahl, 1993). The Oxford English Dictionary defines a weed as a wild herb growing where it is not wanted.

Zimdahl (1993) gives three methods of controlling weeds, which are not harmful to environment:

#### i) Hand pulling method

Hand pulling is practical and efficient, especially in gardens. It is very good for annual weeds but not for perennials capable of vegetative reproduction because shoots separate from roots which then produce a new shoot.

Hand pulling method does not get the job done when it is most needed. Most people are too busy or too lazy to go out and weed before weeds become obvious. By the time they become obvious and easy to grab and pull, the yield reduction due to weed competition will have occurred.

#### ii) Hand hoeing

Hand hoeing has been used for mechanical weed control for many years. It is still done regularly in beets, lettuce and onions and it is probably the most common method in

gardens. Hand hoeing will control the most persistent perennials if it is done often enough. Hand hoeing can be efficient and is widely used, although it takes a lot of time.

If human labour is abundant and cost is not important, hand weeding is an acceptable method of weed control. If human labour is not abundant or if it is expensive, hand weeding is expensive and not efficient.

### iii) Mulching

Mulch excludes light and prevents shoot growth. Thick wide mulches are required to control perennials that creep to the edge and emerge. Mulches increase soil temperature and may promote better plant growth. Several different materials have been used for mulch, including straw, hay, manure, paper and black plastic. Mulches are used mostly in high-value crops and in crops where laying the mulch can be mechanized. As the amount of wheat straw mulch increased in a wheat-corn-fallow dryland production system, weed growth decreased.

## 1.3 SPACING

Spacing is the distance between-row and within-row of planted crops (Widders & Price, 1989). In different spacings of sweet potato, for example, 15cm, 30cm and 45cm with 96cm between rows, the total number of leaves per plant was greatest in plants growing at 45cm spacing between 4 and 18 weeks after planting (Somda & Kays, 1990). According to Stoffella & Bryan (1988), plant populations and plant arrangement can have a pronounced influence on plant development, growth and marketable yields of many vegetables crops.

Sundstrom, Thomas, Edwards & Baskins (1984) reported that marketable bell pepper yields from two-row beds spaced 1.2m apart were higher than yields from beds 1.8m apart, but yields were not significantly different between 23 and 30cm within-row spacing. Stoffella & Bryan (1988) reported that higher plant populations generally decreased root and shoot weights at anthesis and final harvest growth stages with bell pepper. Plant

height increased with higher plant populations, while stem diameter, root and shoot weights generally decreased as plant populations increased.

The recommended distances between beds for bell pepper are 1.5 to 1.8m for two-row beds and 0.8 to 1.2m for one-row beds. Spacing within-row is recommended at 23 to 30cm with one or two plants per hill, depending on planting location and number of rows per bed (Stoffella & Bryan, 1988). Stoffella & Fleming (1990) reported that plant spacings for a double-row, raised bed planting system recommended in Florida were 38 to 61cm between rows, 25 to 30cm between plants in a row and 1 to 1.5m between bed centers. Generally, use of low plant populations has increased cabbage head size but reduced marketable yields per hectare. Higher planting density has a negative effect on yield of a crop, since crops will produce poor quality products. Low planting density gives quality yield of produce. High plant population per area influence fast growth of crops but with poor yield. The plants always compete for sunlight, water and nutrients, so it is of importance to have good or sufficient spacing for both between-row and within-row of crops.

If crops are spaced too closely, they will have to compete with neighbouring plants for water and nutrients. If spaced plants too far apart, you waste valuable garden space and leave room open for weeds (Ellis, 1990). Climate is a factor to be considered. Wider spacing is recommended for planting in unusual dry climates, because plant roots need to search further for water. If your soil is not very fertile, heavy feeders will also benefit from wider spacing. Overcrowded conditions result in competition for moisture and nutrients, which leads to weak, unhealthy plants (Ellis, 1990).

Default & Waters (1985) reported that increasing plant population densities in broccoli and cauliflower also increase the yield and the profit potential. Default & Waters (1995) also stated that when increasing plant populations it also increase the competition among plants and subsequently reduced marketable yield. Potatoes may be planted entirely by hand or using a potato planter, generally on ridges 0.9m apart. Spacing of the potato seeds within rows varies from 20 - 30cm (Kochlar, 1986).

## 1.4 INDIGENOUS KNOWLEDGE

### 1.4.1 Indigenous knowledge as a phenomenon complex

Seeland (1997) reported that knowledge may be called indigenous if it originates from, and is bound to local experiences and takes its local world perhaps not as the only one in existence, but as the most relevant. The opinion that there is a locally meaningful world characterizes an indigenous world-view. 'Indigenous' or 'local knowledge of forests' is a holistic view of what is revealed to human perception through, and as, forest life. The term indigenous means something that originates locally, and is performed by a community or society in this specific place.

Cohen, Normann, & Snyman (1993) and Warren, Slikkerveer & Brokensha (1994) defined indigenous knowledge (IK) as the community knowledge systems, communication methods and associations that serve as bases for agriculture, irrigation, animal husbandry, aquaculture, food preparation and storage, engineering, ecology, environmental management, education, health care, social support and welfare networks, finance, marketing, labour mobilization and a wide range of other livelihood sustaining activities, as cited by Mazur (1996).

Indigenous knowledge (IK) is human life-experience in a distinct natural and cultural amalgamation, within a unique local and contemporary setting (Seeland, 1997). In a traditional society, the local context is taken as the universal frame in which knowledge matters. This context is formed from physical facts, social interactions among people in the surroundings they perceive as their world, and of the spirituality connected with its space (Seeland, 1997).

### 1.4.2 Indigenous knowledge movement

Indigenous knowledge (IK) is dynamic. Rau (1991) refers IK as generated by people to serve their own needs both in response to their changing physical, social and economic environment, as cited by Mazur (1996). There is increasing recognition of the importance of IK among indigenous peoples surviving in Northern countries.

IK respects the richness, variety and value of indigenous knowledge, which underlies successful development - whether or not its role is understood by outsiders. Warren (1993) stated that indigenous knowledge is the only viable manner for realising the widely concepts of participatory decision making, empowerment of local communities, capacity building of individuals and institutions involved in development at the local level and sustainable development, as cited by Mazur (1996).

It is also important to recognize that while IK has strengths, it also has weakness that need to be complemented by conventional western-oriented scientific methods and ideas. Indigenous knowledge is increasingly being recognized as a national resource, just as important as biodiversity.

#### 1.4.3 Comparing traditional medicine with modern medicine

Ferreira, Charlton & Impey (1996) give three reasons why the practices (of selling indigenous plants for medicinal purposes) must persist:

Firstly: Modern medicine does not have all the answers; it is especially poorly equipped to provide answers to everyday maladies with a strong psychosomatic undertone and chronic degenerative diseases associated with old age.

Secondly: The choice of traditional medicine rather than conventional medical treatment may be influenced by economic factors. For example, Maria, the market seller, reported that an elderly client was recently prescribed pills for arthritis by his doctor, which cost fifty rands a pill. The man was unable to afford the drugs and consulted Maria, who advised him to use a home remedy of feverfew and berg celery to treat his condition, which he apparently did with success.

Thirdly: The availability and accessibility of modern medical care and the relationships between the providers and the consumers of the care are also factors that either facilitate or impede health-care utilization. It may be surmised that traditional medical practices are common among populations that may be less receptive to institutions and services offered by modern medicine.

Self-treatments, using home remedies, enable practitioners to prepare their own medicine, which add to the credibility of their healing powers vis-à-vis those of modern medicine. Mayeng (1996) reported that another factor that has tended to mask the relationship between traditional and western medicine is the competition between the two.

In the battles of the 17<sup>th</sup> and 18<sup>th</sup> centuries between physicians, apothecaries and herbalists, the loser has always been traditional medicine. This happened and is still happening, because governments and pharmaceutical companies banded together to fight the traditional medicine groupings (Mayeng, 1996). They passed laws and acts banning the use of traditional medicine based on statistics claiming toxicity, deaths caused by such medicine and the allegation that traditional medicine was not standardized and pure. The unfair protection of western medicine has led to traditional medicine still being viewed unfavourably (Mayeng, 1996).

#### 1.4.4 South African traditional healers

It seems to be widely accepted that indigenous medicine knowledge is under threat and that it is essential to find mechanisms to record it for posterity (Mayeng, 1996). The urgency of documenting the knowledge differs, however, depending on the culture, history, presence of traditions of apprenticeship and perceived loss of biodiversity. Mayeng (1996) reported that the medicinal knowledge of the Griquas, Outeniquas and Namas was already very much remnant and urgent, focused programmes were needed to rescue this knowledge. The medicinal plant knowledge of Zulu, Sotho, Tswana and Xhosa peoples is less urgently threatened, because strong traditions of apprenticeship still exist.

Mayeng (1996) found that some leaders of traditional healers' associations were anxious to participate with academic institutions and non-governmental organizations in the process of documenting indigenous knowledge, while others felt that they should be given the resources to enable them to document the information by themselves, for themselves.

#### 1.4.5 Plants and plant use

Moerat (1994) stated that there was no data from which to draw firm conclusions but a novel approach that gives an indication of use has recently been adopted, as cited by Mckenzie, Moerat & Naidoo (1996). Mckenzie *et al.* (1996) reported that the procedure adopted was to interview herb sellers and Rastafarians in the Paarl and Cape Peninsula areas and record the plants collected (or bought), the plant parts used, the ailments treated and the location and season in which collected.

## CHAPTER 2

### MULCHING AND SPACING AFFECTS GROWTH OF WILD GINGER

#### 2.1 INTRODUCTION

Thorpe (1989) and Andrews (2002) defined mulching as a covering material that acts as a blanket and also helps to prevent excessive moisture in the soil evaporating during hot weather conditions. Besides being good for moisture retention, according to Reiley & Shry (1979), mulching is necessary for weed control, organic matter supply and moderating the temperature for the roots, and it also improves the appearance of the area. Mulching has been a beneficial practice in agronomic systems, where it often enhances growth and yield of annual and perennial crops. Plastic mulches increase soil temperature and may promote better plant growth. They are used mostly in high-value crops and in crops where laying the plastic mulch can be mechanized (Zimdahl, 1993).

Spacing is the distance between-row and within-row of planted crops (Widders & Price, 1989). Stoffela & Bryan (1988) reported that within-row spacing affected total plant growth to a greater extent than between-row spacing in cucumbers. Plant height increased with higher plant populations, while stem diameter, root and shoot mass generally decreased as plant populations increased. Ellis (1990) showed that wider spacing is recommended for planting in unusually dry climates, because plant roots need to search further for water. If soil is not very fertile, heavy feeders will also benefit from wider spacing. Overcrowded conditions result in competition for moisture and nutrients, which leads to weak, unhealthy plants (Ellis, 1990).

The objective of this study was to investigate the benefits of mulching on wild ginger, and to investigate the effect of spacing on yield and quality of the plant.

## 2.2 MATERIALS AND METHODS

### 2.2.1 Location and environmental characteristics

The experiment was conducted at Hatfield Experimental Farm - University of Pretoria, South Africa. The region is a summer rainfall area with an average rainfall of about 600 - 700mm per annum (October - March). The altitude of the experimental farm is 1370m. Frequent occurrence of frost is experienced during winter months.

### 2.2.2 Planting material

Rhizomes of wild ginger that were used as planting material were obtained by digging out cultivated plants that were established in a field by the CSIR from tissue-cultured material. The rhizomes were immediately treated with copper oxychloride to prevent fungal growth during storage. After the fungal treatment, all materials were wrapped with newspapers and placed in cut-boxes. After that, they were stored in an uncontrolled storage room until planting.

### 2.2.3 Experimental design and layout

The layout of the experiment was a randomized complete block design (RCBD) with 6 treatments consisting of a factorial combination of 3 levels of spacing and 2 levels of mulching, with each treatment replicated four times. Plants were spaced in rows 50cm apart. The three levels of in-row spacing were 15cm, 30cm and 45cm in combination with mulching or non-mulching.

### 2.2.4 Treatments and measurements

Rhizomes were categorized into 4 different sizes that passed through 5cm, 4cm, 3cm or 2cm diameter holes. The circumferences of rhizomes were measured with a Measy vernier callipers (Swiss). Rhizomes were separated in relation to their size and each rhizome was kept

in a separate netting bag (Netlon produce, Huhtamaki Packaging Worldwide, RSA), with a tag showing its number. Rhizomes used in the experiment were from the 3cm (834 rhizomes) and 4cm categories (326 rhizomes), giving a total of 1160 rhizomes for the experiment. These two sizes were combined randomly and used for planting.

Rhizomes were treated again with copper oxychloride at the time of planting (11 to 12 December, 2001), to prevent them from fungal infection. Rhizomes were planted  $\pm 7$ cm deep. The soil was a sandy loam. The three different plots per block were mulched on 16<sup>th</sup> December 2001, and the mulch was  $\pm 4$ cm deep. The mulch used was wheat straw and it was placed before the rhizomes started to emerge. The second mulch was added on 12<sup>th</sup> January 2002, because the first was washed away by rains, wind and irrigation water. The mulch, which was added or supplemented, was  $\pm 6$ cm deep and was secured to the ground by thin steel rods.

#### 2.2.5 Data collection

The data collected was:

- Soil moisture content

The soil moisture was taken using an auger on 29/04/02, 02/05/02, 08/05/02, 21/05/02, 22/05/02 and 23/05/02. Soil samples were taken from mulch and non-mulched plots at soil depths of 10 and 15cm. The soil moisture was expressed as gravimetric water content. The soil samples taken were weighed, then placed in an oven for 24 hours at 100°C. Plants were irrigated twice per week during cool days and three times per week.

Soil samples were taken each time before irrigation and after irrigation to determine the soil water content.

- Soil temperature

Soil temperature was measured continuously from 11/04/02 (when the plants were 3 months old) until 19/06/02. Soil temperature was measured using thermocouples connected to a data logger (USA – Campbell Scientific Inc.). Thermocouples were buried at soil depths of 5cm and 10cm. Data was recorded hourly for 72 days and the values used in plotting graphs were the minimum and maximum daily soil temperatures.

- Rhizome/root yield

Wild ginger rhizomes and roots were harvested on 19/06/02 until 21/06/02.

- Weed biomass

Weeds were harvested by hand on 31/01/02 and on 03/04/02. Fresh weed mass was measured using a Mettler scale (Model PM 6000-F).

- Emergence rate

Emergence rates were recorded from the first day after germination and it was done mostly on Tuesdays.

## 2.3 RESULTS AND DISCUSSION

### 2.3.1 Soil temperature

Between 11 April and 13 May, the maximum soil temperature in non-mulched plots was higher than in mulched plots at 5cm soil depth (Fig. 2.1a). The average maximum soil temperature difference between mulched and non-mulched plots was about 5<sup>0</sup>C. The highest soil temperature difference between mulched and non-mulched plots was about 7<sup>0</sup>C, while the lowest soil temperature difference was about 3<sup>0</sup>C. Therefore, mulching played an important role in reducing maximum temperature at this soil depth. In contrast, the minimum soil temperature in mulched plots was higher than in non-mulched plots.

Therefore, mulching acted as a blanket during the night and prevented some of the heat from escaping into the atmosphere. The average minimum soil temperature difference between mulched and non-mulched plots was about 2°C. The highest soil temperature difference between mulched and non-mulched plots was 4°C, while the lowest soil temperature difference was 1°C.

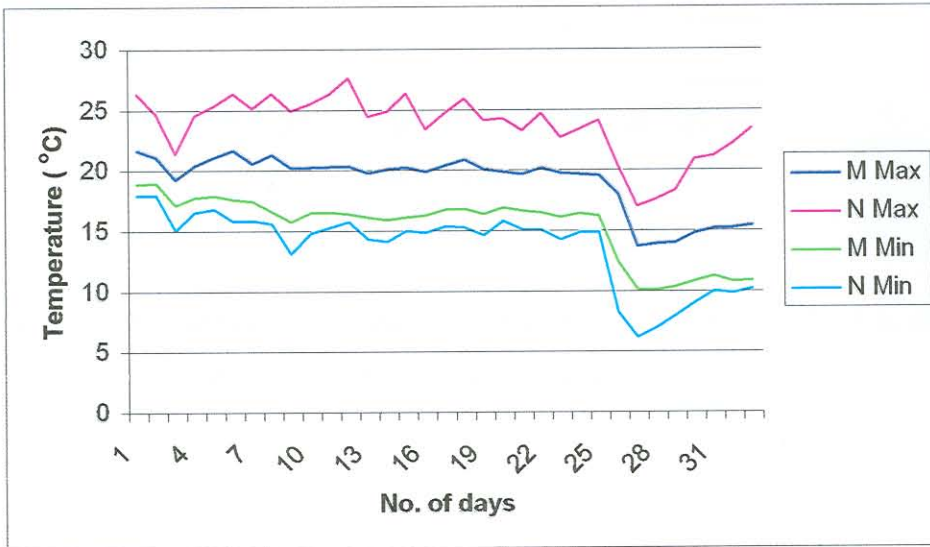


Fig. 2.1a Soil temperature data taken at 5cm soil depth from day 1 to day 33 (11 April to 13 May 2002). M represents mulch and N no mulch

Soil temperature measurements taken at a depth of 10cm followed the same trend as measurements taken at a depth of 5cm (Fig. 2.1b).

Between 14 May and 21 June, the maximum soil temperature in non-mulched plots was higher than in mulched plots at 5cm soil depth (Fig. 2.1c). The average maximum soil temperature difference between mulched and non-mulched plots was about 5°C. Compared to earlier in the season (Fig. 2.1a), there was a lot of temperature fluctuations in the non-mulched plots compared to the mulched ones (Fig. 2.1c). Therefore, mulching not only reduced day temperatures, but it also had a stabilising effect on the daily maximum temperatures.



Fig. 2.1b Soil temperature data taken at 10cm soil depth from day 1 to day 33 (11 April to 13 May 2002). M represents mulch and N no mulch

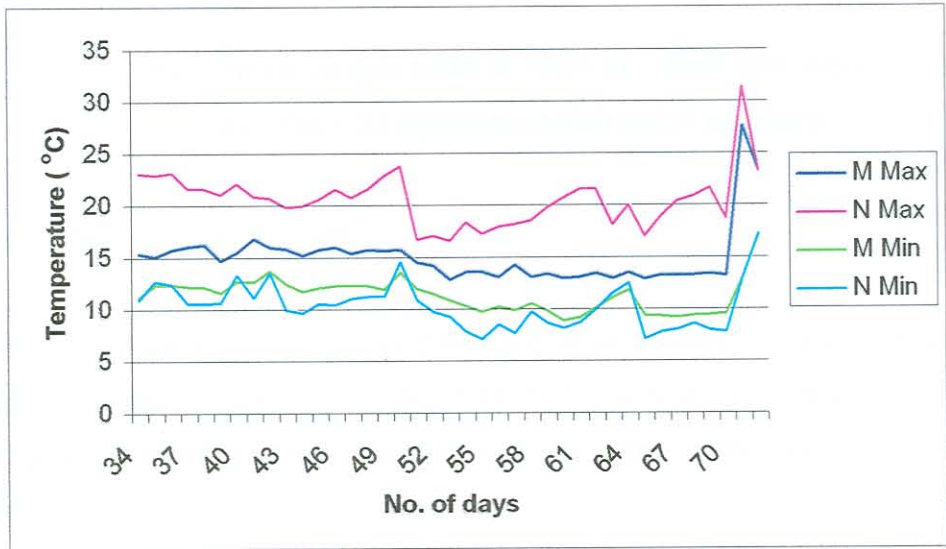


Fig. 2.1c Soil temperature data taken at 5cm soil depth from day 34 to day 71 (14 May to 21 June 2002). M represents mulch and N no mulch

Soil temperature measurements taken at a depth of 10cm followed the same trend as those taken at a depth of 5cm (Fig. 2.1d). Again, mulching kept minimum temperatures at night slightly higher than non-mulching.

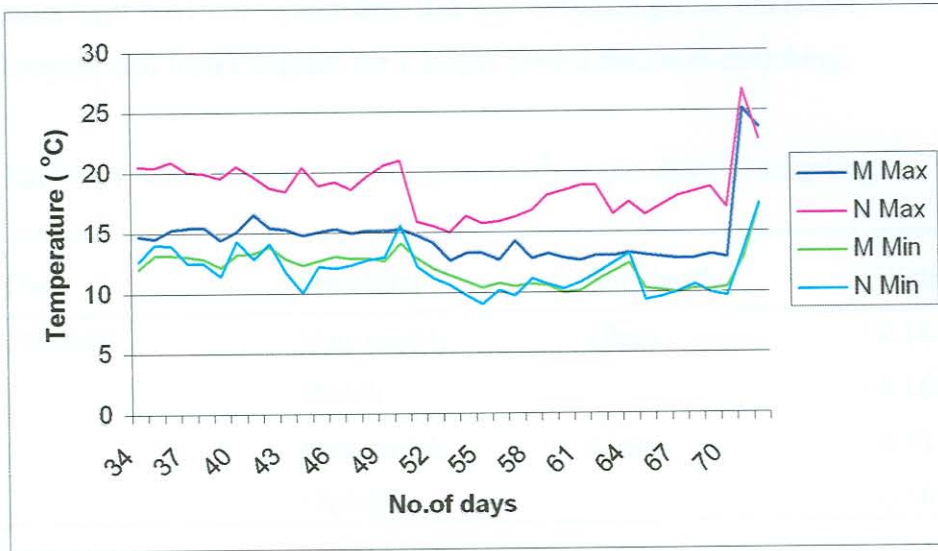


Fig. 2.1d Soil temperature data taken at 10cm soil depth from day 34 to day 71 (14 May to 21 June 2002). M represents mulch and N no mulch

### 2.3.2 Soil moisture content

At 10cm depth, there was no difference in soil water content between mulched and non-mulched plots on 29/04/02 (Table 2.1). At 15cm depth, mulching retained more soil moisture than non-mulching. There was about  $0.03\text{cm}^3$  extra moisture content retained by mulching.

At 10cm depth, mulching retained  $0.01\text{cm}^3$  more water than non-mulching on 02/05/02 (Table 2.1). At 15cm depth, mulching had a stronger effect on soil moisture content because it retained  $0.03\text{cm}^3$  more water than non-mulching. The difference in moisture content was higher with 15cm depth and lower with 10cm depth.

There was a big difference in soil water content within mulched and within non-mulched plots on 21/05/02 (Table 2.2). Mulching retained 0.05 cm<sup>3</sup> more water than non-mulched plots. There was a stronger difference between mulched and non-mulched plots on 22/05/02. Mulched plot retained 0.04 cm<sup>3</sup> more water than non-mulched plot. There was no difference in soil water content within mulched and within non-mulched plots on 23/05/02. Mulched plots kept 0.01 cm<sup>3</sup> water than did non-mulched plots. Therefore, mulching was effective in keeping soil water content for a longer period than non-mulching.

Table 2.1 Gravimetric water content (cm<sup>3</sup>) at two days of sampling

Date	Mulching	Soil depth	Water content
29/04/02	Non-mulch	10cm	0.16
	Mulch		0.16
	Non-mulch	15cm	0.13
	Mulch		0.16
02/05/02	Non-mulch	10cm	0.11
	Mulch		0.12
	Non-mulch	15cm	0.12
	Mulch		0.15

### 2.3.3 Weeding

During the first weeding (31/01/2002), straw mulching significantly reduced the number of weeds compared to bare soil (Table 2.3a). A similar response was found by Ehrhardt (2003) where straw mulch was good in reducing the number of weeds, but weed seeds may come with it. Mulch always increased net return compared to hand-weeding, as the value of the increased yield with mulch more than made up for the increase in production costs (Hemphill & Crabtree, 1988).

Table 2.2 Gravimetric water content ( $\text{cm}^3$ ) taken at soil depth of 15cm at three days in succession

Date	Mulching	Water content
21/05/02	Non-mulch	0.10
	Mulch	0.15
22/05/02	Non-mulch	0.10
	Mulch	0.14
23/05/02	Non-mulch	0.11
	Mulch	0.12

Non-mulching did not significantly suppress the emergence of weeds on 03/04/2002 (Table 2.3b). This can be due to lighter mulch on the plots, as it was long not added again. Therefore, the thinner the mulch, the lesser the effect on weeds.

There was a highly significant difference in weed mass between mulched and non-mulched plots with the combined or overall data (Table 2.3c). Mulching was highly effective in reducing the number of weeds in the plots.

Table 2.3a Weeds harvested on 31/01/2002

Treatment	Fresh weed mass (g)
Non-mulch	1136.7
Mulch	265.4
	**

Table 2.3b Weeds harvested on 03/04/2002

Treatment	Fresh weed mass (g)
Non-mulch	572.6
Mulch	382.3
	NS

Table 2.3c Combined data for the two sampling dates in Tables 2.3a and 2.3b

Treatment	Fresh weed mass (g)
Non-mulch	854.6
Mulch	323.8
	**

#### 2.3.4 Initial fresh rhizome mass and circumference

Fresh rhizome mass and rhizome circumference were measured in all the rhizomes before planting to determine if they would influence measured parameters at harvest. At harvest, initial fresh rhizome mass and initial rhizome circumference measured before planting were found to be correlated with fresh rhizome mass, enlarged fresh root mass and rhizome circumference but not with root length. Therefore, where there were correlations, initial rhizome mass and rhizome circumference were linked with these parameters during statistical analyses. However, for simplicity, only data linked with initial fresh rhizome mass is reported.

#### 2.3.5 Fresh rhizome mass

Spacing and mulching alone did not influence fresh rhizome mass (Tables 2.4a and 2.4b). However, the interaction between spacing and mulching was showing significance for fresh rhizome mass (Fig. 2.2). At 15 and 45cm spacing, fresh rhizome mass was greater with

mulching than with non-mulching. However, at 30cm spacing, the opposite was true. Plants from non-mulched plots gave greater fresh rhizome mass than plants from mulched plots. Fresh rhizome mass at the spacing of 30cm in non-mulched plots was also significantly greater than at either 15 or 45cm spacings. In mulched plots, however, 15cm spacing gave greater fresh rhizome mass than either the 30 or the 45cm spacing. Therefore, optimum plant spacing was a function of mulching.

Table 2.4a Fresh rhizome mass as influenced by spacing

Spacing (cm)	Means (g)	Spacing (cm)	Means (g)	P value
15	10.50	30	11.13	0.5412 <sup>NS</sup>
15	10.50	45	8.94	0.2279 <sup>NS</sup>
30	11.13	45	8.94	0.1293 <sup>NS</sup>

Table 2.4b Fresh rhizome mass (g) as influenced by mulching

Mulching	Means	Mulching	Means	P value
Non-mulch	9.72	Mulch	10.63	0.3934 <sup>NS</sup>

### 2.3.6 Rhizome circumference

There were no interactions between spacing and mulching for rhizome circumference. Neither did spacing (Table 2.5a) nor mulching (Table 2.5b) affect rhizome circumference.

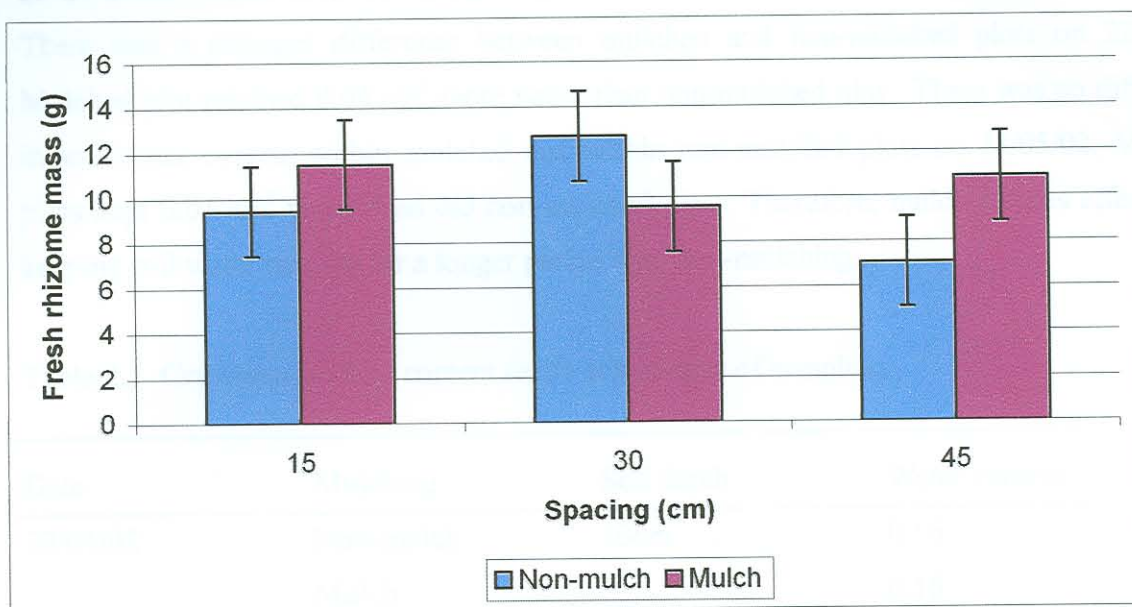


Fig. 2.2 Fresh rhizome mass as affected by mulching and non-mulching at three levels of spacing

Table 2.5a Rhizome circumference as influenced by spacing

Spacing (cm)	Means (cm)	Spacing (cm)	Means (cm)	P value
15	2.47	30	2.38	0.5388 <sup>NS</sup>
15	2.47	45	2.55	0.5767 <sup>NS</sup>
30	2.38	45	2.55	0.3389 <sup>NS</sup>

Table 2.5b Rhizome circumference (cm) as influenced by mulching

Mulching	Means	Mulching	Means	P value
Non-mulch	2.49	Mulch	2.44	0.6917 <sup>NS</sup>

### 2.3.7 Fresh enlarged root mass

There were no interactions between spacing and mulching for fresh enlarged root mass. Neither did spacing (Table 2.6a) nor mulching (Table 2.6b) affect fresh enlarged root mass.

Table 2.6a Fresh enlarged root mass as influenced by spacing

Spacing (cm)	Means (g)	Spacing (cm)	Means (g)	P value
15	14.55	30	14.90	0.7893 <sup>NS</sup>
15	14.55	45	13.18	0.3615 <sup>NS</sup>
30	14.90	45	13.18	0.3160 <sup>NS</sup>

Table 2.6b Fresh enlarged root mass (g) as influenced by mulching

Mulching	Means	Mulching	Means	P value
Non-mulch	13.58	Mulch	14.84	0.3185 <sup>NS</sup>

### 2.3.8 Enlarged root length

There were no interactions between spacing and mulching for enlarged root length. Neither did spacing (Table 2.7a) nor mulching (Table 2.7b) affect enlarged root length.

Table 2.7a Enlarged root length as influenced by spacing

Spacing (cm)	Means (cm)	Spacing (cm)	Means (cm)	P value
15	4.31	30	4.18	0.3659 <sup>NS</sup>
15	4.31	45	4.24	0.6621 <sup>NS</sup>
30	4.18	45	4.24	0.7558 <sup>NS</sup>

Table 2.7b Enlarged root length (cm) as influenced by mulching

Mulching	Means	Mulching	Means	P value
Non-mulch	4.34	Mulch	4.14	0.1262 <sup>NS</sup>

## 2.4 SUMMARY

An experiment was conducted to determine whether mulching and spacing were important in the production of wild ginger. Treatments used were mulching or non-mulching in combination with three levels of spacing. Wheat straw mulch was applied at a thickness of about 6cm and rhizomes were spaced at 15, 30 and 45cm.

Mulching was effective in reducing the soil temperature, keeping the soil moisture content for a longer period and suppressing weed growth. The main effects of mulching and spacing did not affect wild ginger growth, but interactions between mulching and spacing were significant. Plant spacing of 30cm with non-mulching was better than both 15cm and 45cm spacings. On the other hand, 15cm spacing with mulching was better than both 30cm and 45cm. There were no interactions between spacing and mulching for rhizome circumference, fresh enlarged root mass and enlarged root length.

This experiment demonstrated that 30cm spacing was ideal if no mulch is used. However, when mulch is used, a spacing of 15cm is recommended.

## CHAPTER 3

### INDIGENOUS KNOWLEDGE ON WILD GINGER

#### 3.1 INTRODUCTION

Cohen *et al.* (1993) and Warren *et al.* (1994) defined indigenous knowledge (IK) as the community knowledge systems, communication methods and associations that serve as bases for agriculture (broadly defined to include knowledge of plants, trees, soils, insects, pests, diseases, etc), irrigation, animal husbandry, aquaculture, food preparation and storage, engineering, ecology, environmental management (involving both conservation and improvement), education, health care, social support and welfare networks, finance, marketing, labour mobilization and a wide range of other livelihood sustaining activities, as cited by Mazur (1996).

IK is human life-experience in a distinct natural and cultural amalgamation, within a unique local and contemporary setting (Seeland, 1997). In a traditional society, the local context is taken as the universal frame in which knowledge matters. This context is formed from physical facts, social interactions among people in the surroundings they perceive as their world, and of the spirituality connected with its space (Seeland, 1997).

Warren (1993) stated that IK is the only viable manner for realising the widely concepts of participatory decision making, empowerment of local communities, capacity building of individuals and institutions involved in development at the local level and sustainable development, as cited by Mazur (1996). It is also important to recognize that while IK has strengths, it also has weaknesses, which needs to be complemented by conventional western-oriented scientific methods and ideas. IK is increasingly being recognized as a national resource, just as important as biodiversity.

The objective for conducting the survey was to find out what the communities in Venda knew about wild ginger.

## 3.2 MATERIALS AND METHODS

The questionnaire survey was conducted in nine different villages around Venda in Limpopo Province. These villages were selected randomly and the survey was conducted for five days. Data was collected using personal interviews. The interviews were conducted on 76 respondents from these different villages. There were three groups which were interviewed: traditional healers, sellers and indigenous knowledge bearers.

## 3.3 RESULTS AND DISCUSSION

### 3.3.1 Respondents' profile

Of the total respondents interviewed, 30% were traditional healers, 29% were sellers and 41% were bearers of IK. From the interviews, it was found that traditional healers performed a lot of duties in their industry such as selling, healing, predictions, circumcisions and protecting families from witches. Gericke (2002), for example, reported that a highly respected Venda healer, Mr Joseph Tshikovha, has been successfully treating malaria in adults and children for many years with a decoction of two plants: marula (*Sclerocarya birrea*) and wild ginger (*Siphonochilus aethiopicus*).

### 3.3.2 Demographics and preparation

The majority of respondents (34%) were 61 to 70 years old. The respondents were mainly female (59%). A slight majority of respondents (53%) went through formal education, while the rest had informal education. This shows that a lot of respondents were able to read and write. Most respondents (36%) were from Vuwani area. Other villages had fewer respondents with 13% for both Tshitomboni & Khubvi. The rest of the respondents were from Lufule 1 & 2, Thohoyandou complex, Sibasa, Maniini and Mulenzhe.

### 3.3.2 Concerning the plant

All the respondents knew the plant as *tshirungulu* (*Siphonochilus aethiopicus*), and the plant was known better by older people rather than younger generations. Through personal interview, they indicated that *tshirungulu* was regarded as an important medicine in the family (each and every household was supposed to have the plant in their yards).

All the respondents either got the plant materials from wild/bush, cultivated, sangoma/traditional healers or from the street. The majority of respondents (84%) used the medicine for stomach pains. A traditional healer from Mulenzhe, Mrs Mavis Ramashia, indicated that the plant played a significant role in their daily work, as they could incorporate it with any medicinal plant to give power to the other plant. And she continued saying that there was “taboo” that certain medicines cannot be touched by everyone, but if they mixed the medicine with wild ginger, they could be touched by anybody and they worked according to the expectations of the user.

The majority of respondents (64%) disagreed with the statement that plants which grew naturally were regarded to have more medicinal value compared with those that were cultivated. The reason given was that they were used to growing different medicinal plants in their yards but that these plants performed the same way as wild plants. About 22% of the respondents were dubious about the statement.

Amazingly, 54% of the respondents indicated that they had a plant at home. The community themselves know that there is a shortage of medicinal plants because they collect the plant materials far from where they stay.

### 3.3.3 Domestication and propagation

The majority of the respondents (68%) knew how to grow wild ginger, while about 32% had no idea about propagating the plant. It is quite interesting because one of the outcomes of the survey was to find out if the community was willing to be taught on how best to grow wild ginger. For those who did not have an idea about growing the plant, 83% were interested in growing it, while about 17% were not interested in propagating the plant. Of those who were interested, about 93% had land available to grow the plant.

Surprisingly, 66% of the respondents were willing to see traditional medicines replacing western medicines in clinics and hospitals, while 34% did not. The respondents (93%) maintained to say that traditional medicines should be encouraged in public clinics and hospitals because western people were using these plants for making their medicines. Seven percent of the respondents did not comment on the statement.

### 3.3.4 Harvesting and post-harvest handling

The most amazing part is that the plant is so scarce but most of the respondents did not have any difficulties (89%) in obtaining the materials, while 11% encountered some problems. All the respondents indicated that the procedure for harvesting wild ginger was the same for all people, where they are supposed to dig on the sides to avoid damage to the mother tuber. Interestingly, all the respondents indicated that they did not encounter any problems when harvesting wild ginger.

The majority of respondents (58%) harvested wild ginger from home. The respondents received planting material elsewhere in order to establish their own plants at home.

A slight majority of respondents (57%) indicated that the plant parts mostly harvested were rhizomes and tubers, while about 23% of the respondents harvested rhizomes, tubers and leaves and about 21% harvested only rhizomes.

The majority of respondents (45%) indicated that they could use the plant in both wet and dry states. Twenty-eight percent of the remaining respondents indicated that they kept the plant materials for 7 days if the weather was hot enough, while 13% used it when still wet and the rest (8%) kept the plant materials for 5 days if the weather was hot enough to dry the materials.

Most of the respondents (60%) did process the plant materials before selling them, while the rest indicated that they were selling the plant materials without processing them. All the respondents indicated that the medicine was prepared by grinding the rhizomes and tubers and sometimes mixed with other medicines to give power to the other medicines.

When asked whether they added anything else when processing the medicine, most respondents (56%) indicated that they added something, while the rest indicated that they did not add anything. Eighteen percent add *mphurampuli*, *water* and *mulanga* as their main ingredient in the medicine, while about 9% of the respondents added *mutavhatsindi* (*Brackenridgea zanguebarica*), *mususu* (*Terminalia sericea*), *tsemo*, *tshigombo* and

*mutshutshungwane*. Most of the respondents (98%) indicated that local wild ginger could become extinct in South Africa, while 2% disagreed with the statement.

### 3.3.5 Marketing

Nineteen percent of the respondents travel less than 10km from their homes, whereas 10% of them travel about 20km to collect the plant materials. The majority of respondents (33%) travel from 70km to 75km in order to collect the materials, while 5% of them travel about 55km. Twenty-nine percent of the respondents travel about 100km from where they reside in order to collect the medicines, while 5% of respondents travel as far as 180km to collect the plant materials.

Seventeen percent of the respondents pay less than R10 for their travelling costs. The other 17% of the respondents pay R25 to R30 for travelling. The majority of the respondents (39%) were paying R50 up to R65 for their travelling costs when collecting the plant materials. Twenty-two percent of respondents pay from R80 up to R85, while 6% of respondents pay as much as R370 for travelling costs to collect material from Zimbabwe during out of season periods.

Fifteen percent of the respondents sell single rhizomes/tubers at a price of R5 to R15, whereas 24% of the respondents charge R16 to R20 per single rhizome/tuber. Fifteen percent were charging at least R21 to R35 per single rhizome/tuber. The majority of the respondents (47%) were charging from R36 to R50 per single rhizome/tuber.

More surprisingly, 92% of the respondents indicated that they sold wild ginger to adults most of the time, while 8% of the respondents were selling to all age groups. This shows that traditional medicines are not normally used by young people, but mainly by elder people. Most respondents (92%) who bought wild ginger were women; this is true because people who know the health situation in a family are women.

A number of respondents indicated that they also sell five other important medicinal plants rather than wild ginger, namely, *mpeta* (*Osyris lanceolata*), *mpesu* (*Securidaca longepedunculata*), *muobadani*, *musalamarubini* and *mutavhatsindi* (*Brackenridgea*

*zanguebarica*). The other respondents were selling other medicinal plants but, in small quantities such as *mukundulela*, *mungulawa*, *mulanga*, *tshigombo*, *mphurampuli*, *mutshutshungwane*, *murenzhe*, *vhulivhadza* (*Lannea schweinfurthii*), *mulomo-munandi*, *mugwiti*, *munie*, *mufula* (*Sclerocarya birrea*), *pfure*, *murumelelwa*, *mususu*, *muthathavhanna*, *mupharatsheni*, *mutshilikhomu*, *thidigwane*, *munungu*, *tshikhopha*, *phila*, *phathatshimima*, *nndilele* and *gumululo*. Most of the respondents (97%) indicated that wild ginger was an excellent medicine when compared to other medicinal plants.

### 3.4 SUMMARY

A survey was conducted in nine different villages around Venda in Limpopo Province. There were 76 respondents that were interviewed. The objective of this survey was to find out indigenous knowledge about wild ginger. People interviewed were traditional healers (30%), sellers (29%) and indigenous knowledge bearers (41%). Most of the respondents were female (59%). Also, most of the respondents indicated that they had gone through formal education, so they were able to read and write. All of the respondents knew wild ginger as *tshirungulu*.

Results from the survey indicated that wild ginger is used mainly for stomach pains. It was encouraging to learn that people who use this plant feel that even home-grown wild ginger is as effective as the wild one for medicine. The plant is currently so scarce that some of the respondents were travelling as far as Zimbabwe to obtain it.

If continual use of this important medicinal plant is to be realized, users will need to be taught on how best to grow the plant and how to harvest the plant without destroying the mother tuber or rhizome. This will ensure sustainable use of wild ginger.

## GENERAL DISCUSSION AND CONCLUSIONS

An experiment was conducted to determine whether mulching and spacing were important in the production of wild ginger in an open field. Wild ginger was planted in the field using rhizomes. The planted rhizomes were those that passed through 3cm or 4cm diameter holes to maximize uniformity of planting material. Each rhizome was given a code in order to be able to monitor its growth and development from emergence until harvest. A questionnaire survey was also conducted in search of indigenous knowledge about the plant.

To determine the importance of mulching and spacing in wild ginger growth, wheat straw mulch with a thickness of about 6cm was used in combination with 15, 30, and 45cm spacings. Unfortunately, there was general poor emergence of plants.

There was no response of wild ginger to both the main effects of spacing and mulching. However, there was interaction between spacing and mulching which resulted in an increase in fresh rhizome mass. There was no interaction between spacing and mulching in rhizome circumference, fresh enlarged root mass and enlarged root length. Mulching was also effective in reducing the soil temperature as compared to non-mulching. From mid-May to mid-June, mulching reduced the soil temperature by 8<sup>0</sup>C, which was the highest temperature difference between mulching and non-mulching. This indicates that mulching had played an important role in reducing soil temperatures. During May to June months, the average soil temperature difference between mulching and non-mulching was 4<sup>0</sup>C and the lowest was 2<sup>0</sup>C.

Mulching also affected the moisture content in the soil but this was dependent on the depth of the soil. With 10cm depth, both mulching and non-mulching did not affect the moisture content of the soil. However, with 15cm depth, mulching kept the moisture content for longer period as compared to non-mulching.

Mulching was also effective in suppressing the weed growth as compared to non-mulching. Therefore wheat straw applied to a thickness of about 6cm was effective in

controlling weed growth. However, as the growth season progressed, the mulch became thinner, resulting in poor suppression of weed growth.

The experiment was conducted in a field plot and spacing were important.

The questionnaire survey was conducted on three groups of respondents: traditional healers, sellers and indigenous knowledge bearers. Of the total respondents interviewed, 30% were traditional healers, 29% were sellers and 41% were IK bearers. The majority of respondents interviewed were elderly people and also female (59%). The majority of respondents (53%) were able to read and write. The village which had many respondents was Vuwani area with 36% respondents.

The treatments used in this experiment were mulching or non-mulching.

All the respondents knew the plant and they knew it as *tshirungulu*. The most important uses of wild ginger was for stomach pains, coughs and flu. Most respondents indicated that children were always given this medicine to prevent a number of diseases. The plant is grown by most people interviewed. Those who were not growing it, were willing to learn how to grow wild ginger and to eventually cultivate it in their lands.

It was encouraging to learn that people who use this plant feel that even home-grown wild

ginger is as effective as the wild one for medicine. It is therefore important to educate traditional healers, sellers and IK bearers on how best to grow wild ginger. Innovative ways of harvesting, such as leaving the mother tuber in the ground, should be encouraged for sustainable usage of wild ginger.

The survey, there were 76 respondents that were interviewed.

Of the total respondents interviewed, 30% were traditional healers, 29% were sellers and 41% were IK bearers.

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It is therefore important to educate traditional healers, sellers and IK bearers on how best to grow wild ginger.

## GENERAL SUMMARY

An experiment was conducted to determine whether mulching and spacing were important in the production of wild ginger. The experiment was done at Hatfield Experimental Farm, University of Pretoria. The survey was conducted to find out indigenous knowledge about wild ginger. A survey was done in nine different villages around Venda in Limpopo Province. The villages were Vuwani, Tshitomboni, Khubvi, Lufule 1 and 2, Thohoyandou complex, Sibasa, Maniini and Mulenzhe.

Treatments used in this experiment were mulching or non-mulching in combination with three levels of spacing. The experiment conducted was a randomised complete block design (RCBD). Wheat straw mulch was applied at a thickness of about 6cm and rhizomes were spaced at either 15, 30 or 45cm.

Mulching was effective in reducing the soil temperature, keeping the soil moisture content for a longer period and suppressing weed growth. The main effects of mulching and spacing did not affect fresh rhizome mass, but interactions between mulching and spacing were significant. Plant spacing of 30cm with non-mulching was better than both 15 and 45cm spacings. On the other hand, 15cm spacing with mulching was better than both 30cm and 45cm for fresh rhizome mass. There were no interaction between spacing and mulching for rhizome circumference, fresh enlarged root mass and enlarged root length.

In the survey, there were 76 respondents that were interviewed. People interviewed were traditional healers (30%), sellers (29%) and indigenous knowledge bearers (41%). Most of the respondents were female (59%). Also, most of the respondents indicated that they had gone through formal education, so they were able to read and write. All of the respondents knew wild ginger as *tshirungulu*.

Results from the survey indicated that wild ginger is used mainly for stomach pains. It was encouraging to learn that people who use this plant feel that even home-grown wild ginger is as effective as the wild one for medicine. The plant is currently so scarce that some of the respondents were travelling as far as Zimbabwe to get it.

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Source of Variance	DF	Mean Squares <sup>2</sup>	
		Wet weight (g)	Fresh weight (cm)
Spacing (S)	2	167.2 <sup>**</sup>	0.347 <sup>**</sup>
Mulching (M)	1	62.0 <sup>**</sup>	0.049 <sup>**</sup>
S X M	2	396.2*	7.342 <sup>**</sup>
Replication	3	18.3 <sup>**</sup>	0.283 <sup>**</sup>
Error	15	8.9	0.229

\* P - value significant (\*) or highly significant (\*\*), p < 0.05

APPENDIX TABLES

ANOVA TABLE

Table A1 Analysis of variance for fresh rhizome mass, rhizome circumference, fresh enlarged root mass and enlarged root length as affected by mulching and spacing

Sources of variation	DF	Mean Squares <sup>Z</sup>			
		Fresh rhizome mass (g)	Rhizome circumference (cm)	Fresh enlarged root mass (g)	Enlarged root length (cm)
Spacing (S)	2	167.2 <sup>NS</sup>	0.347 <sup>NS</sup>	90.0 <sup>NS</sup>	0.409 <sup>NS</sup>
Mulching (M)	1	62.0 <sup>NS</sup>	0.049 <sup>NS</sup>	21.0 <sup>NS</sup>	2.942 <sup>NS</sup>
S X M	2	390.2*	1.342 <sup>NS</sup>	25.0 <sup>NS</sup>	0.681 <sup>NS</sup>
Replication	3	18.3 <sup>NS</sup>	0.283 <sup>NS</sup>	48.0*	0.212 <sup>NS</sup>
Error	15	8.9	0.229	8.3	0.157

<sup>Z</sup>F – value significant (\*) or highly significant (\*\*) at 5% level of probability

**QUESTIONNAIRE – SURVEY ON WILD GINGER**

A Respondent

V1    1-3

*Answer each question by circling the appropriate number in a shaded box, or write your answer in the shaded space provided.*

**A. Respondent's profile**

1. What is the title of your job position?

Traditional healer	1
Seller	2
IKS	3

V2  4

2. What age category do you fall into?

Less or equal to 20 years	1
21 years to 30 years	2
31 years to 40 years	3
41 years to 50 years	4
51 years to 60 years	5
61 years to 70 years	6
71 years and older	7

V3  5

3. What is your gender?

Male	1
Female	2

V4  6

4. What is your educational background?

V5   7-8

5. In which village do you live?

V6   9-10

**B. Concerning the plant**

1. What is the traditional name for wild ginger  
(*Siphonochilus aethiopicus*)?

V7  11

2. Where do you get the plant materials from?

Wild/bush	1
Cultivate	2
Sangoma/traditional healer	3
Street	4
Other (specify):	

V8  12  
V9  13  
V10  14  
V11  15  
V12  16

3. What are the uses of wild ginger?


V13   17-18  
V14   19-20  
V15   21-22  
V16   23-24  
V17   25-26

4. "Plants that grow naturally are regarded to have more medicinal value compared with those that are cultivated". Do you agree with this statement?

Yes	1
No	2
Unsure	3

V18  27

5. Where do you obtain wild ginger from during the out of season period?


V19   28-29  
V20   30-31  
V21   32-33

**C. Domestication and propagation**

1. Do you know how to grow wild ginger?

Yes	1
No	2

V22  34

2. If "No" to Q C.1, would you be interested in learning how to cultivate wild ginger?

Yes	1
No	2

V23  35

3. Do you have land available to grow the plant?

Yes	1
No	2

V24  36

4. Would you like to see traditional medicines replacing European medicines in clinics and hospitals?

Yes	1
No	2

V25  37

5. Would you like to see traditional medicines also in clinics and hospitals?

Yes	1
No	2

V26  38

**D. Harvesting and post-harvest handling**

1. Do you have any difficulties in obtaining wild ginger for harvesting purposes?

Yes	1
No	2

V27  39

2. How do you harvest wild ginger?

V28   40-41

V29   42-43

V30   44-45

V31   46-47

V32   48-49

3. Do you encounter any problems when harvesting wild ginger?

Yes	1
No	2

V33  50

4. If "Yes" to Q D.3, what main problem do you encounter when harvesting wild ginger?

V34   51-52

5. From which area do you harvest wild ginger?

V35   53-54

6. Which plant part do you mostly harvest?

V36   55-56

7. For how long do you store the plant materials for medicinal purposes? (Answer in days)

V37   57-58

8. Do you prepare your plant materials before selling them?

Yes	1
No	2

V38  59

9. If "Yes" to Q D.8, how do you prepare them?


V39   60-61

V40   62-63

V41   64-65

V42   66-67

V43   68-69

10. When preparing the medicine, do you add anything else?

Yes	1
No	2

V44  70

11. If "Yes" to Q D.10, what main ingredient do you add?

--

V45   71-72

12. Do you think that local wild ginger can become extinct in the wild?

Yes	1
No	2

V46  73

**E. Marketing**

1. What is the distance from where you get the wild ginger? (Answer in km)

--

V47    74-76

2. What are your traveling costs to where you get the materials? (Answer in Rand)

--

V48    77-79