# Traditional Vegetables of Meatu, Shinyanga, Tanzania:

## Importance for Household Food Security and Vegetable Identification

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# 2. Introduction

Traditional African domesticated and wild vegetables are valuable for their contribution to food security, nutritional values and as a source of household income in many regions of Tanzania. These vegetables may not necessarily be indigenous to the area, but their long-standing use and selection by communities have incorporated them into local tradition and culture (Gudrun Keding, 2007). Traditional vegetables are associated with traditional production systems and tacit knowledge systems among cultivators. This paper takes the local understanding of traditional vegetables as vegetables which are both indigenous and introduced, that have become naturalized to the community (Smith & Eyzaguirre, 2007).

Traditional vegetables are important as multi-purpose crops which foremost provide alternative income-generating opportunities, and food items (European Commission-FAO Partnership Programme, 1999). While the uses of traditional vegetables are many, and suitability for local growing conditions is well adapted, preference for their consumption has been in decline by residents, in favour of more valuable exotic species.

While not an ideal region for vegetable growing, Meatu, Shinyanga provides a study for how communities in semi-arid areas have been able to meet their dietary needs during the different seasons of the year. Cultivated traditional vegetables are typically intercropped among cash crops allowing for an efficient use of soil nutrients, sunlight and physical space, while allowing for nitrogen-fixation by leguminous crops. Despite the harsh environment, over time, farmers have experimented with various growing methods and are able to

produce successful harvests sufficient for household consumption and sales for income generation.

Understanding this has tremendous implications for developing a home-grown strategy for combating malnutrition common to regions of Eastern Africa in meeting macro and micro-nutrient deficiencies (Uusikua, Oelofsea, Duodub, Bester, & Faber, 2010; Schonfeldt & Pretorius, 2011). The neglect of policy makers and academics towards traditional vegetables overlooks the importance of traditional vegetables in sustaining food security and diversifying incomes especially amongst poorer households and the inherent importance of conserving genetic diversity (Flyman & Afolayan, 2006; Weinberger & Swai, 2006; Schippers, 2002). It is problematic that information about Sub-Saharan Africa's per capita consumption, production or sales patterns of traditional vegetables are not known while figures for cash crops with mercantile interest are widely known (onion, carrots, tomatoes, cabbages, groundnut, cotton) (Smith & Eyzaguirre, 2007; National Research Council, 2006).

Promoting the inclusion of traditional African vegetables in food policy is valuable not only for their nutrient-density properties, but has implications that could well lead to contributions to the household incomes and increase efficiency in sustainable small-holder farming systems. Overall promotion of traditional African vegetables in regular diets can be advantageous over the use of modern vegetables because most residents would have access to these nutrient-dense vegetables which are intrinsically suited to the environment and have low capital outlay requirements. Research attention towards traditional

vegetables is much warranted for promoting their consumption benefits as well developing best practices to increase harvest yields much the way that soybean, and tomato enjoys (National Research Council, 2006).

# Research Goal and Objectives

The overall goal of this research project was to gain an understanding of how the cultivation and the gathering of traditional vegetables affect rural households and livelihoods. In fulfilling these objectives, qualitative information about the study area and general village-wide uses of vegetables will be collected. Furthermore, this study will yield a baseline of traditional vegetable agriculture habits. This information will be suitable for drawing a comparison of benefits and costs between traditional vegetables and modern exotic vegetables measured in hours of labour and financial outlay. This baseline research will add to the growing body of traditional knowledge about local species in less-studied semi-arid, rural areas of Tanzania. This proposed work will aid the development of activities to promote traditional vegetable usage and how to better partner with rural communities who most depend on traditional vegetables for livelihoods and household incomes.

**Objective #1: To identify vegetable groups and their common uses in Meatu villages**

**Objective #2: To analyse the consumption practices of cultivated and gathered traditional vegetables in households**

**Objective #3: To identify and document the production methods involved in the cultivation and gathering of traditional vegetables by households**

**Objective #4: To determine the marketing practices of cultivated and gathered traditional vegetables for their economic impact on households**

# 3. Background on the Traditional Vegetables of Meatu, Shinyanga

Estimates of traditional and indigenous, cultivated and wild African plants used today as vegetables have been estimated as low as 1,000 to as high as 6,376 species of plants, timber, fruit, vegetables, fibers and condiments (Pasquini & Drescher, 2009; Grubben & Denton, 2004). These vegetables have been cultivated and collected over generations and remain an important source of nutrients and vitamins for the rural population in Tanzania and are increasingly grown by urban populations due to low production costs (Dongus, 2001). However, there is consensus that while there has been recent formal research and government interest in traditional African vegetables, there still is little complete information easily accessible regarding their availability, distribution and even naming (Mnzava, Dearing, Guarino, & Chweya, 1999; Grubben & Denton, 2004; Schippers, 2002). Even within communities, as modern vegetables replace traditional vegetables and Western medicine replaces plants used for medicinal purposes, genetic erosion and loss of indigenous knowledge is taking place (Dweba & Mearns, 2011; Adebooye & Opabode, 2004).

Recognizing their genetic and nutritional value, there has been an increase in efforts among the research community to conserve the vegetables and increase their usage including organizations such as AVRDC, PROTA, and IPGRI/ Bioversity International (Mnzava, Dearing, Guarino, & Chweya, 1999; International Plant Genetic Resources Institute, 1997; National Research Council, 2006; Gudrun Keding, 2007; Grubben & Denton, Plant

Resources of Tropical Africa 2. Vegetables, 2004). Such research in Tanzania has mostly focused on major species and improving production, market-linkages and documentation in urban and peri-urban areas with humid climates (Smith, Nasr, & Ratta, 2001; Jacobi, Amend, & Kiango, 2001; Putter, van Koesveld, & de Visser, 2007). Rural, semi-arid regions have not received the same degree of attention, though these regions are significant as they tend to be more isolated, more reliant on traditional vegetables and have lower household incomes than urban counterparts. There exists the need for research on traditional vegetables for nutritional values, suitability to harsh environments, high-yielding varieties, and market promotion for increased adoption. Such research would bear implications for improving the livelihoods of most of the Tanzanian population, living in rural, semi-arid areas, who are prone to exploit traditional cultivated and traditional wild vegetables to meet daily livelihood needs.

## What Constitutes a *Vegetable*?

The definition of vegetables would appear to be simple: "succulent plant parts consumed as side dish with a starchy component," (Grubben & Denton, 2004). However, the understanding of vegetables according to a botanical definition contrasted with common culinary usage is subject to interpretation and based on local practices. Vegetables need not necessarily just refer to leafy greens but also includes roots, tubers, bulbs, seeds, and botanically categorized fruit and legumes (National Research Council, 2006).

Depending on regional use, species may have primary or secondary use as vegetables: capsicum may be used as a spice or vegetable depending on the amount of capsaicin present; cassava and cowpea are primarily considered as a starch and legume respectively,

while their leaves serve a secondary purpose of a vegetable. This study categorized vegetables as understood by the residents of Meatu in Shinyanga province.

**Categorizing Vegetables: Traditional, Wild or Modern**

What are considered as "indigenous African vegetables" depends on the extent that one wishes to trace botanical origins. It has been suggested that out of the 100 most commonly known traditional African vegetables, only cowpea, okra and yam truly originate from the continent; vegetables traditionally considered as being African indigenous vegetables such as moringa tree leaves, are in fact naturalized from Asia (Schippers, 2002; National Research Council, 2006). Defining the precise taxonomy of what constitutes an "indigenous" vegetable is not in the scope of this paper. Rather, vegetable categories follow the categories described by Meatu residents and are discussed in the **Results** section, where Objective 1, identification of vegetables and their common uses is addressed. A full list of vegetables, their species and features is included in **Appendix 3: Guide to Common Vegetables in Meatu with Descriptions.**

# 4. Methodology and Materials

To gain insight to agricultural habits and practices of smallholder farmers, research was begun with a round of focus groups in Meatu villages. Focus groups allow access and understanding of activities and knowledge of the community, which cannot be easily gained from direct observation. These focus groups informed the group semi-structured interviews and individual research survey which had been prepared according to principles of participatory rural appraisal (PRA) and basic statistical data surveys (Molteberg, 1995; PROFOR, 2009). The breadth of focus groups and depth of individual surveys complement each other and allow for a holistic understanding of the topic at hand (Morgan, 1996).

## 4.1 Focus Groups

### Methodology: Focus Groups

Focus groups are advantageous as they maximize the ability to collect broad information efficiently from a large number of subjects. However, the group dynamics offered in focus groups is useful also to benefit research methodology. Within a positive environment, the exchange and interaction between respondents can promote transparency and places an emphasis on consensus building as respondents have to qualify their answers to each other (Morgan, 1996; Kreuger & Casey, 2008). Furthermore, group discussions can foster an environment for mutual support and empowerment, while prompting the exploration of structural systems, rather than relying on just personal stories (Kitzinger, 1995).

### Drawbacks of Focus Groups

The potential weaknesses of focus groups are strongly tied to the role of the moderator and in this context, the translator, and the environment they foster (Kreuger & Casey, 2008). Focus groups may be skewed by the domination of a few members who inadvertently prevent less dominant members of the group from vocalizing their opinion, especially when in sole opposition to the consensus. There may also be a tendency to disclose inaccurate or fabricated information to not appear ignorant or to prevent shame when discussing sensitive topics. Careful moderation in the meetings sought to include all members of the focus group and use culturally-appropriate tact when discussing gendered roles with female focus groups and in constructing a wealth ranking (Otsyina & Rosenberg, 1999).

## Organization and Participants

Initial meetings and preliminary focus groups in all the villages were organized with the assistance of local NGO, International Child Support – Tanzania (ICS), with respective Village Executive Officers (VEOs). The VEOs arranged preliminary focus groups with key informants, which included chairpersons and elders of the villages and sub-villages. Each meeting always had female representation. After the initial meeting, subsequent focus groups were requested and organized by the VEO, village elders and other respected members of the community. Their assistance was invaluable to get a representative sample of members from all sub-villages, a mix of wealth levels and to include women.

Customary initial meetings were conducted in two villages with VEOs and elders, to introduce the researcher and the purpose of the research project to the communities. Bulyashi and Mwambegwa villages were chosen for the household survey as they

represented two agro-ecological zones and were accessible within the time constraints. Preliminary focus groups were held in all villages. Their function was for gathering general information on the villages and agricultural practices of the three agro-ecological zones, especially of villages that would be host to household surveys later in the research session.

The second stage of the semi-structured focus groups was held in four villages, Bulyashi, Mwambegwa, Mwakaluba and Mwakasumbi, representing all three agro-ecological zones. The semi-structured sessions included closed questions and followed with open questions that allowed the facilitator to guide the discussion as needed. The framework allowed some topics to be expanded on or limited depending on the depth of the discussion desired.

**Table 4.1 Order of Focus Groups and Interviews**

| **Activity Type** | **Village** | **Ward** | **Zone** |
|---|---|---|---|
| Focus groups | Bulyashi | Mwanhuzi | Southern |
| Focus groups, Household interviews | Mwambegwa | Mwanhuzi | Central |
| Focus groups, Household interviews | Mwakaluba, | Mwandoya | Northern |
| Focus groups | Mwakasumbi | Mwabuma | Northern |
| Key informant interview | Mwabuma | Mwabuma | Northern |

## Material: Focus Groups

The function of the second-stage focus groups was to gain consensus agricultural characteristics of their village. Topics and leading questions as shown in **Appendix 1** guided the conversation. In general, discussions related to the varieties and local names of vegetables and cash crops grown, the production and harvesting habits of the village,

rainfall patterns, abiotic and biotic stresses and local diets. Respondents were asked naming in both Kiswahili and Kisukuma, the regional dialect. Where there was confusion with vegetable characteristics, focus groups or key informants would be asked to make clarifications. Positive and negative characteristics of the vegetables were described to ascertain local preferences.

In addition, focus groups were asked to discuss general production practices, stresses and attitudes towards the vegetables over the past ten years. Another round of semi-structured focus groups was held with only female members of the communities: roles and responsibilities of household members, gendered analysis of agricultural responsibilities, and knowledge of traditional vegetables. The last round of focus groups was to gain an understanding of socio-economic wealth classifications in the community: local definitions of wealth, perspectives on education and priorities based on wealth groups.

PRA visualization methods were used informally to aid information-gathering where appropriate during focus groups. Matrix scoring and seasonal diagramming were the most commonly used methods in gathering information on cropping calendars and constructing the socio-economic wealth ranking (Molteberg, 1995). An exercise was conducted in each village to better understand how the communities perceived wealth and value. Focus group members were asked to imagine three wealth categories in their village and to describe what the distinguishing characteristics would be among them. The 3-tier wealth ranking was based on a composite of factors that villagers felt important.

## 4.2 Household Interviews

## Methodology: Comprehensive Household Survey

The comprehensive survey aimed to collect data to form the basis of a baseline of traditional vegetable consumption production and marketing habits that could be done only through individual household visits. The regimented use of open-ended qualitative questions, to lead into focused close-ended questions allowed consistent data gathering with flexibility as the conversations progressed. Many questions such as those about agricultural labour hours were suitable only in this context and would have been tedious if asked in a focus group setting. Questions regarding household output and sales would only have been suitable in private were understandably challenging for respondents to answer to at times. The basis of those quantitative questions was to construct a rough cost-benefit comparison of agricultural labour hours and costs associated with the benefits of vegetable output or sales according to the three vegetable groups.

### Organization

Household visits were coordinated by sub-village chairpersons who met with the interviewer and translator in the morning and graciously led them to households in their sub-villages during the day. In general one sub-village was visited per day. As the team walked from household to household, it was often possible to visit villagers at both their home and farm. This proved very useful in approximating field acreage, understanding production practices and tacitly identifying various wild and traditional vegetable species. In general, households were not picked ahead of time. The sub-village chairpersons respected the wish to visit households that were varied in size, wealth-ranking and spatial distribution. The team would be lead to different areas of the sub-village and interviews

were conducted at random based on whoever was at home or if a farmer was working at his field and could accommodate the length of the interview.

## Material: Re-Design and Content

The results of the focus groups informed and improved on the content of the comprehensive household survey prepared prior to the field visits in Meatu. The nature and relevance of questions were edited for survey conciseness and relevance to the communities at hand. More questions were included regarding wild vegetables (WVs) and modern vegetables (MVs) as their prominence in diets and livelihoods became apparent. It also was important to gather detailed information about MVs to make a proper cost-benefit comparison between MVs and traditional vegetables (TVs).

The survey initially was designed for households to respond in depth, to two of the following surveys: consumption, production and marketing. Based on insight gained from the focus groups, the survey was edited to include the most relevant questions from all three topics in a singular survey for consistency and completeness results. Expectations for results were also modified as it became clear that it would be difficult to gain completely detailed quantitative information regarding land acreage, vegetable output, and exact expenses of agricultural inputs among others. Even with the less demanding quantitative questions, some answers are more akin to approximates rather than exact values.

The final modified survey began with questions regarding the household: number of household members that were adults or children, and number of livestock, though for

cultural sensitivity, this was often left to the end. It then led to general questions about vegetable consumption and preferences according to vegetable category (TV, WV and MV). The discussion was steered towards questions surrounding production and agricultural practices. The last section of the survey regarded vegetable harvests and marketing behaviour.

The sample size of respondents in the household survey varies for each question grouped according to vegetable category, as the questions did not apply to each household interviewed. The sample size is smaller for questions regarding modern vegetables as they were not grown by every household. In addition, the sample size for some questions is smaller than the total number of households interviewed as some questions were added after the interview had begun, or households were not able to give answers.

## 4.3 Participants and Considerations

Where possible, the researcher intentionally sought out female members of the household, whom focus groups agreed would be the most knowledgeable about wild and traditional vegetables and household weekly consumption habits. It was sometimes the case that male household members were knowledgeable, but in most cases, they would call on the female household members to join or take over the interview especially for the information about production habits and harvested amounts. Interviews were intended to be no more than 60 minutes. This was to take in consideration the opportunity cost of the household members in sacrificing their time and prevent fatigue of the farmers.

## 4.4 Challenges in Research

During the course of the research, several challenges were encountered, resulted from a lack of uniformity in terms and measurements as well as translation errors.

Based on household interviews, observation and key informant assistance, it was noticed that some households tended to mis-state the true state of affairs in regards to harvest amounts and income generated from vegetable sales. As an outsider, it was imperative to strive to build a sense of trust among village members and elders to make survey respondents at ease in answering survey questions without under-exaggeration or embellishment.

As survey questions were translated first from English to Kiswahili by the translator, and sometimes, again to the local language, Kisukuma by the sub-village guide, it was important to keep questions as simple as possible to prevent mistranslations and lose the nuances of the discussion. It was also important to clarify common local measurements and understandings of measurement terms with the households, for example: a bunch (*fungu)*, an acre, a basin (*shamba*).

Furthermore, the translator would try to simplify responses of interviewees to a standard form of answer rather than directly translating then letting the interviewer ask clarifying questions. It was not until the interviewer had a better command of Kiswahili halfway through the household interviews that this was rectified. As a result, some answers, especially measurements such as declared land areas, may not be accurately reflective of villager responses.

The number, names and description of WVs used in Meatu was difficult to determine comprehensively. Only several out of the many known species are consumed throughout the year in Meatu diets. Most WVs are gathered on an as-seen and as-needs basis, especially as many WVs only grow during the wet season and is subject to changing rainfall patterns. Their short availability makes identification difficult. Therefore many varieties recorded in this study do not have a photo that can be used for identification, but have only a name and brief description to the best recollection of respondents.

As the usage of many WVs is irregular, many vegetables were not readily listed during an interview. When asked what species are available in the area, respondents would initially just list a few varieties. As the research team became more familiar with WVs from other interviews, after asking what WVs they consumed, households would occasionally be prompted to confirm a verbal list of WVs that they regularly use. This would have affected research methods as earlier households had smaller lists of WVs to confirm than households surveyed later in the research period and supplied some answers by autosuggestion. This could be taken to indicate that those WVs are not significant for diets, however key informants insisted it not so, but reflected a perception that WVs would not be of interest to the research team.

Even in the local Kisukuma language, the names of some vegetables vary between wards or even villages. In addition, some varieties of vegetables had no specific names. Naming was

done according to physical characteristics of the vegetable such that a name was more akin to a description: the leaves of the wild cucumber with spiny hairs.

Figure 4a. A focus group in Mwakaluba discuss and arrange the wealth and well-being ranking for their village

Figure 4b. A women's focus group presenting different sweet potato leaves in Bulyashi

Figure 4c. Household field visits to observe plot size and production habits in Mwambegwa

# 5. Description of the Research Site: Meatu District, Shinyanga

## 5.1 Meatu District

Meatu is characterized by a strong agro-pastoral tradition with the livelihoods of over 90% of the population deriving from raising crops (primarily maize and cotton) and livestock in the rural area (Meatu Regional District Commissioner's Office, 2010). It is one out of 8 districts in the Shinyanga province of Tanzania and has its administrative headquarters in Mwanhuzi town.

### Area

Meatu district has an area of 8,835km$^2$ of which, about half, 4,582km$^2$, is agricultural and pastoral land (MRDCO, 2010). The elevation ranges between 1,000-1,400m above sea level. The vegetation varies between bushland, and scrubland and generally has low soil fertility. According to residents, Meatu has suffered from significant deforestation as a result of land clearing for livestock rearing and firewood over the past several decades; along with loss of natural habitats, has been the decrease in WV biodiversity (Mareezi, 2011).

### Population

The 2002 national census indicated that Meatu had a population of 250,513, and is estimated at 315,186 as of the year 2010, residing in 35,238 households (Meatu Regional District Commissioner's Office, 2002; Meatu Regional District Commissioner's Office, 2010). The Wasukuma ethnic group who are mostly agro-pastoralists comprise the majority of population. Minority groups of the Wanyiramba (agriculturalists and fishers), Wataturu (pastoralists) and the Wahadzabe (hunter/ gatherers) are however present in

the west of Meatu. While Meatu is the least populated district of Shinyanga region, it also has the highest poverty rate; 48% of the population live below the basic needs poverty line[1] (Economic Development Initiatives, 2004).

## Villages

Meatu has 100 villages in 19 wards in 3 divisions. In Kimali Division, Mwambegwa was the subject of focus groups and household surveys, while focus groups were held in Bulyashi. In Kisesa Division, Mwakaluba was the subject of focus groups and household surveys, while focus groups were held in Mwakasumbi. A visit to interview the Ward Executive Officer was held in Mwabuma.

## Climate

Meatu is divided into 3 agro-ecological zones based on annual rainfall (Mchana, 2011).

**Table 5.1 Villages Surveyed According to Agro-Ecological Zone**

| **Zone** | **Rainfall/ annum** | **Villages by Zone** | |
|---|---|---|---|
| **Northern Zone** | 800-1,000mm | **Ward** | **Village** |
| | | Mwandoya | Mwakaluba, Mwandoya |
| | | Mwabuma | Mwakasumbi, Mwabuma |
| **Central Zone** | 600-800mm | Mwanhuzi | Mwanhuzi, Mwambegwa |
| **Southern Zone** | 600>mm | Mwanhuzi | Bulyashi |

The seasons are determined by rainfall. The dry season, *kiangazi*, begins in May after the TV harvests have begun, continues during the cotton and maize harvest (June and July), and lasts until November to December. Light *vuli* rains in November to December, ushers the time to prepare the land for the next harvest. Heavy *masika* rains beginning in December persist until February and decrease in intensity until April. There was consensus among focus groups and households interviewed in all the villages visited that the

[1] Set at 7,253TZS/ adult per 28 days using 2001 prices for what a household needs to satisfy its basic food needs (2200Kcal/ adult/ day) and non-food expenditures. This amount was determined using the food basket of the poorest 50% of the population and the non-food expenditures of the poorest 25% of the population.

beginning of the *vuli* was getting later each year and that rainfall frequency and intensity had a severely decreased over the past years, though some acknowledged this may be cyclical. 2005, 2009, 2010 were listed by 4 villages as being the worst for water availability.

## Vegetable Availability

Meatu's geographic profile and climate makes it suitable for a limited number of drought tolerant, and seasonal species. TVs are grown by virtually all households in rural communities regardless of income level, and some households in ward-towns. They are consumed fresh during the *masika* months, and some species can be harvested during *kiangazi* with irrigation. The greatest availability of WVs is during *vuli* and *masika months,* while some can persist throughout some of the *kiangazi* months. WVs compose an important part of rural diets especially before TVs are ready for harvest and *kiangazi* supplies are low. Many WVs serve dual purpose as medicinal plants and are described in **Appendix 3.4**. Many vegetable species which are not immediately consumed by the household are dried by the sun, usually on roof tops or on the ground surrounding the house. Dehydrated vegetables become the principle source of green vegetables during most of *kiangazi.*

The availability of cultivated TVs are uniform throughout the 5 villages studied. The variety of WVs varied slightly based on proximity to water sources. Based on this and discussions with residents, the vegetation observed is taken to be representative of the district. Local tastes have been affected by the introduction of MV species with modern agriculture practices. MVs are grown for local sale and are used to improve the flavour of TVs and

complement meat dishes. There is also a greater market for MVs than TVs in general as there are many farmers who do not grow MVs.

### Food Security

Despite being an community dependent on agriculture for livelihoods, Meatu experiences the most food shortages in Shinyanga region and also has the highest rate of chronic malnutrition (Economic Development Initiatives, 2004, p. 185). 3% of households are fully food secure, lower than the regional average of 11%. Prices for all vegetables are uniform as across the 5 villages, with differences occurring only between the farmgate and town centres. The price difference ranged between 35% (an average of 6500 versus 9000-10000TSh market value of a pail of tomatoes) and 50% (100 versus 200 TSh for a bunch of amaranth).

## 5.2 Research Area: Mwambegwa and Mwakaluba Villages

**Table 5.2 Village Vital Numbers, Based on Key Informant Interviews with Village Executive Officers**

| **Mwambegwa** | | **Mwakaluba** | |
|---|---|---|---|
| **Population** | 4940 (as of 2009) | **Population** | 5748 (as of 2009) |
| **Households** | 413 | **Households** | 744 |
| **Sub-villages** | 5 | **Sub-Villages** | 7 |

### Education and Schools

Meatu's literacy and primary school access rate are below the Shinyanga rural regional average and non-attendance among primary school-aged children and secondary school dropout rates are highest in the region (Economic Development Initiatives, 2004, p. 184). Primary school is free in Tanzania, though there are supplementary costs required for uniforms, shoes, school supplies, books, and other contributions to the school. Both Mwambegwa and Mwakaluba each have 1 primary school and 1 secondary school.

## Medical Facilities

Mwambegwa:
There is no clinic in the village itself. About 70% of the villagers use traditional medicine from wild plants to treat most ailments or to consult with traditional medicine practitioners. However, many choose to go to dispensaries with more serious ailments or hospital in Mwanhuzi (about 7km away from the village centre) when they have serious health problems such as when malaria is contracted.

Mwakaluba:
Almost everyone uses traditional medicine for treating ailments. There are 13 traditional medicine practitioners known by the Council. People will not go to a clinic or dispensary unless the sickness is severe, such as malaria. The closest health centre and dispensary is 12km from the Mwakaluba village centre in Mwandoya town centre.

## Water and Sanitation

Irrigation:
The chief water sources during the dry season are dry river channels. During the wet season, the same river channels are used to supplement rainfall as needed. Hand irrigation is needed for periods of irregular rainfall and in accordance with a planting schedule. The time needed to collect water increases in the dry season when first holes are dug in river channels the evening. Overnight, water rises through the sand layers to the surface for collection in the morning.

Water is drawn by women and girls by carrying 16-20L buckets on their heads and with their arms. This bears the risk of neck and back injury over time. At times, carts are used to

collect many containers of water at a time. A handful of members of each village visited have gasoline powered water pumps to extract water from the river channel through a tube into a receptacle. It is especially convenient for farms adjacent to a river and was a factor frequently listed that would assist in expanding vegetable production. They cost about 500,000TSh depending on the size and capacity.

Mwambegwa:
There are no public wells or pumps. 1 pump has been out of order for 10 years (Philimon, 2011). Toilet facilities are outhouses away from homesteads using the same tembe[2] bricks as are used for houses. Water is gathered from dry river channels where several feet of top layers of sand are dug up. Water surfaces by the next day. This water is used for personal home usage, as well as irrigation.

Mwakaluba:
Every sub-village has access to at least 1 water pump that is used for domestic purposes. Some households which are far from the pumps still use water from dry-river channels however. The dry river channels are also used for irrigation and for tending to livestock.

## Wealth and Well-Being Ranking

A wealth and well-being exercise was conducted in focus groups in Mwambegwa, Mwakaluba and Bulyashi to understand how the communities perceived wealth and value. The charts for Mwambegwa and Mwakaluba are of relevance as they are the villages which were surveyed at the household level.

**Table 5.3 Mwambegwa: Wealth and Well Being Ranking According to Focus Groups**

[2] The bricks are made from the earth, which is principally sand, clay and rock with water, and baked in the sun.

| Ranking | Acreage | Cattle | House | Schooling | Notes |
|---|---|---|---|---|---|
| **Highest 10%** | 50-100 | 50-3,000 | House made of tembe, though they could afford a house with a zinc roof and red bricks if they wanted to. | Most send their children to primary school. Can afford to send children to secondary school, but the kids may not try hard because they don't need education to get ahead. May just want to get married | Some grow vegetables for livelihood; food is no problem; income can be about 1-10 million Tsh in the wet season |
| **Middle 20%** | 5-50 | 5-50 | All live in tembe houses | Most can afford to send their children to primary school. Only some can afford to send them to secondary school. | Grows many vegetables for generating income; income can be about 500,000 - 1 million TSh in the wet season |
| **Lowest 70%** | 0-5 Could be borrowing or renting land | 0-5 | Tembe | Some can afford to send their children to primary school. Most cannot afford to send their children to secondary school unless they are successful in receiving scholarships through the WEO office | Grows a lot of vegetables for generating income; income can be about 250,000 - 500000Tsh in the wet season |

**Table 5.4 Mwakaluba: Wealth and Well Being Ranking According to Focus Groups**

| Ranking | Acreage | Livestock | House | Schooling | Notes |
|---|---|---|---|---|---|
| **Highest 20% Pop** | 50-100 | 100-1,000 or more heads of cattle and 100-300 goats | Tembe, 30% have metal roof; 70% has straw even if they could afford metal | About 25% of villagers send their children to primary school and 1% send their children to secondary school though they can well afford it. | Most of the children become livestock keepers and do not have an incentive to put in effort at school |
| **Middle 30% Pop** | 30-50 | 25-100 heads of cattle and 25-100 goats | About an 1/8 or 12.5% of villagers have a metal roof or can afford to have it; live in tembe houses | Just about 50% of villagers send their children to primary school and 25% to secondary school. Many more would like to go, but cannot afford it | |
| **Lowest 50% Pop** | 0-30 | 0-25 heads of cattle and 0-25 goats | None of the villagers can afford to have a metal roof ; live in tembe houses | Just about 100% of villagers send their children to primary school and 60% to secondary school. | Kids will work to afford to go to school; see schooling as an opportunity to |

| | | | | | |
|---|---|---|---|---|---|
| | | | | Many more would like to go, but cannot afford it | make better lives |

Figure 5a. View from Mwambegwa village of the landscape

Figure 5b. A hole dug in a dry river channels where water is sourced for hand irrigation, personal and household consumption

Figure 5c. Tembe house in Mwambegwa village

Figure 5d. Example of a tembe house compound in Meatu

# 6. Results and Discussion of Focus Groups

## 6.1 Identification of Common Vegetables and their Uses

### Classification, Naming and Identification:

Many traditional wild and cultivated vegetables are available to all the villages surveyed. Focus groups and individual households were asked to name all of the vegetables they grow, the wild vegetables which they collect, and the area over which they grow. A list of the names and descriptions can be found in **Appendix 3: Vegetable Guide** and are described in **Section 3: Background to the Vegetables**.

### 6.1.1 Common Cultivated Traditional Vegetables:

Traditional vegetables, (Kiswahili: *mboga asili*) (TVs) encompass both indigenous vegetables such as okra and cowpea as well as vegetables which have become naturalized to the region, such as pumpkin and traditional cucumber. The distinction is understood by the communities visited. One key informant insisted sweet potato had always been growing in Meatu until this analogy was asked: if sweet potato was old like the cotton plant, introduced by the colonials, or old like the acacia tree? It is apparent that the usage of sweet potato and its numerous varieties has been so well incorporated into local usage to consider it as a traditional food. Traditional vegetables are recognized for numerous advantages such as being best adapted to local environments, having resistance to pests and disease superior to modern vegetables necessitating less chemical inputs and having exceptional nutritional values (Shao, Nyomora, Mlay, & Kasunga, 2002; Lyimo, Temu, & Mugula, 2003)

In the villages visited, traditional vegetables, commonly referred in a group as *mboga asili* (natural vegetables), are commonly understood as the following set of vegetables intercropped with cash crops such as maize, pigeon pea and cotton: okra, cowpea leaves, pumpkin and its leaves, and traditional cucumber leaves.

**Table 6.1.1 Names of Traditional Cultivated Vegetables**

| **English Name** | **Kiswahili Name** | **Kisukuma Name** | **Latin Name** | **Number of Varieties** |
|---|---|---|---|---|
| **Okra** | Bamia | Bamia | *Abelmoschus esculentus* | 2 |
| **Cowpea**<br>**Leaves** | Kunde<br>Majani ya kunde | Mashili (mashiri) | *Vigna unguiculata* | At least 2 |
| **Pumpkin**<br>**Leaves** | Maboga<br>Msusa | Moli (mori), Mahabi | *Cucurbita pepo, cucurbita moschata* | At least 2 |
| **Traditional Cucumber**<br>**Leaves** | Matango<br>Majani ya matango | Limbe | *Cucumis melo?* | 1 |

Sweet potato leaves was an outlier in vegetables considered as traditional in the communities visited. Sweet potato is seen as traditional but at the same time it was not considered as part of the group of *mboga asili.* This is not due to the knowledge that sweet potato is not indigenous to Shinyanga or Tanzania, but rather from Central and South America, but due to cropping patterns. Sweet potatoes are not intercropped with the rest of the group of TVs but its vines are planted according to a different schedule and on different plots. As a consequence, sweet potato leaves, *matembele* is excluded from the calculation of cost-benefit ratios of TVs to MVs as their labour effort is separate from the rest of the intercropped TVs.

## 6.1.2 Common Wild Traditional Vegetables

Wild vegetables, (Kiswahili: *mboga pori),* (WVs) are any vegetables which have not been domesticated, but are gathered from the environment where they naturally occur. This category includes many vegetables with medicinal purposes and mixed uses. Many WVs are seasonal and have very limited availability according to the seasons and rainfall. Some WVs are specifically collected, while others are collected if convenient. There are many species of WVs available in the Meatu area; the following list describes the most commonly consumed WVs.

**Table 6.1.2 Names of Most Commonly Used Wild Traditional Vegetables**

| English Name | Kiswahili Name | Kisukuma Name | Latin Name | Number of Common Varieties |
|---|---|---|---|---|
| **Jute mallow** | Mlenda | Bunani Makonda | *Corchorus olitorius* | At least 2 |
| **Wild amaranth** | Mchicha pori | Makangwanzoka Mohga | *Amaranthus* spp. | At least 2 |
| **Spider Plant/ Flower (Cat's Whiskers)** | Mgagani | Mgagani | *Cleome gynandra* | 1 |
| **Wild traditional cucumber Leaves** | Matango pori<br><br>Majani ya matango pori | Limbe lugulu, Gasalasala | *Cucumis anguria* | At least 3, possibly gemsbok cucumber, and bur gherkin |

WVs are recognized by focus groups in Mwambegwa, Mwakaluba and Bulyashi villages as being most resistant compared to other vegetables; during famine years there are WVs that can be relied on such as *ntagwasa* (Refer to Appendix 3.1 for description). However, WVs have also been vulnerable to climate change. *Kwanzaa* used to be common throughout the Southern Zone of Meatu. Residents in a Bulyashi focus group mentioned that while it used

to be very common and began to decline from 1990 as rainfall patterns became irregular. Its name is taken from the Swahili word for first, and was among the first vegetables to appear after the early *vuli* rains after the dry season, relieving exhausted dry vegetables stores. The WV is rarely seen in the drier areas of Meatu such that it did not warrant a single mention in household surveys in Mwambegwa, and it took some time for key informants to remember it. *Kwanzaa* is still common however in the village of Mwabuma in the Northern Zone of Meatu.

Along with environment driven factors, consumption of WVs and TVs has reduced as villagers have options to meet their needs for vegetables and nutrition. The trend away from many WVs is in the accessibility to MVs in the villages and nearby townships. Foods such as dried fish and tropical fruit through transport networks offer variety to daily diets and are viewed as special items. Consumption of WVs are seen by some of the younger generation as being backward and less valuable.

### 6.1.3 Modern Vegetables

Interestingly, some vegetables typically classified as traditional African vegetables, such as common amaranth or African eggplant, were categorized by all villagers as modern vegetables (Kiswahili: *mboga kisasa* or *mboga kwa biashara)* (MVs). The terms are used interchangeably. *Kisasa* literally means modern, while *biashara* simply means business; MVs are commonly grown for generating income and are sold in their village or nearby township. The rationale is that if seed was purchased from a vendor, and not locally available, the vegetable was considered a modern, introduced species.

**Table 6.1.3 Names of Most Commonly Grown Modern Vegetables**

| English Name | Kiswahili Name | Kisukuma Name | Latin Name | Number of Common Varieties |
|---|---|---|---|---|
| **Tomato** | Nyanya | - | *Lycopersicon lycopersicum* | 1 |
| **Amaranth** | Mchicha | - | *Amaranthus spp.* | 1 |
| **Cabbage** | Cabbagi | - | *Brassica oleracea* | At least 3: Copenhagen, drumhead and "Chinese" |
| **African eggplant** | Nyanya chungu | - | *Solanum aethiopicum* | 1 |

## 6.1.4 Use of Dried Vegetables

The long dry season prevents the broad cultivation of vegetables for most villagers as adequate water sources for irrigation are too scarce. Villagers in Meatu practice open sun and shaded drying of TVs and WVs during harvest months to keep in storage. The vegetables are typically sunned for a few days on cloths on thatched roofs of homes throughout the harvest season. Some recipes specifically call for the usage of dry vegetables.

Jute mallow, traditional cucumber leaves, okra, cowpea leaves, pumpkin leaves, *songha*, wild amaranth, *twegay*, *kubita*, *maguluyanhanga* and spider flower are all commonly dried vegetables and can be combined in various combinations to produce the vegetable sauce dish, *mlenda* which has a mucous-like consistency. The store of dried vegetables is meant to last through the entire dry season: a minimum of 6 to an average of 7 month's worth of vegetables. Only in exceptional circumstances, such as years with very late *vuli* and *masika*

rains, will households run out of this supply. As one respondent described, “we cannot afford for it to run out. It must last.”

Drying vegetables is a common practice though not unproblematic (Gudrun Keding, 2007). Open-air sun drying makes vegetables prone to contamination and subject to pecking by birds and pests. Furthermore, the loss of nutrition is high especially if vegetables are not first processed by blanching for example (Mulokozi & Svanberg, 2003; Maeda & Salunkhe , 1981). Nonetheless, they are the chief source of nutrition during the dry season as many meals consist of *mlenda* and *ugali*.

### 6.1.5 Production and Marketing Considerations

Villagers who were interviewed often emphasized that they continue to grow TVs because it was important to them as Sukuma people as part of their culture and tradition. However, they preferred to grow TVs because of their low maintenance requirements. TVs do not need to be tended to, transplanted, given costly fertilizers or pruned the same way that MVs do and exhibit greater tolerance to biotic and abiotic stresses in comparison. Because of their low-maintenance nature, they can be easily intercropped with cash crops and benefit from maintenance activities such as the laying of manure or weeding. Many farmers reported the only activities required for TVs was to simply scatter the seeds in a section of a field and leave them be until harvest time.

In addition, many farmers recognized the benefits of intercropping TVs with their cash crops. While it could not be explained, villagers expressed that their crops grow better with

vegetables growing among the fields. The vegetables and the crops each utilize a niche for physical space, nutrients, water, and sunlight. Furthermore, the presence of a legume such as cowpea is beneficial for performing nitrogen-fixation.

Respondents in Mwambegwa and Mwakaluba reported that in general, farmers slowly began to adopt MVs in their agriculture in 2003 and increased rapidly around 2008. Respondents noted that financial incentive was the greatest motivation as tastes became increasingly accustomed to MVs. Many farmers start by growing MVs such as tomatoes for their household first, then in successive years increase production for sale in their community. A key informant, Emmanuel Madirisha from Mwambegwa noted the shift in growing MVs for sale was in part spurred on by the scarcity of WVs and changing rainfall patterns. 2005 was one of the worst years for water availability and WVs were very difficult to find.

It is ironic that villagers turned to growing MVs which have high water demands. Individual respondents from Mwambegwa and Mwakaluba admitted that since beginning to grow MVs, income has not changed by very much. MVs are labourious and need initial investment for seeds and other inputs compared to TVs, though less so compared to cash crops, depending on household agricultural practices.

Contributing to the higher cost of growing MVs is the perceived need to use chemical pesticides, fungicides and fertilizers. Some farmers have begun to notice resistance effects of other food and non-food crops. The demand for water is another factor for

consideration. MVs require strict adherence to a watering schedule while TVs are far more tolerant to irregular rainfall. Hand irrigation out of the rest of the agricultural activities exacts the highest labour cost in the calculation for labour hours as it includes the time spent hauling water from dry river channels or other water sources as well as the act of watering the vegetables itself.

Emmanuel Madirisha, who has been growing MVs since 2000 and is oft-touted as the most successful farmer in Mwambegwa, explains that most farmers are not using good practices on their MVs. Despite the heavy labour and input costs required, it is possible that farmers place a high value on diversifying their income away from just maize, cotton and pigeon pea which are sold during a short harvest duration. MVs have a market throughout the year and can be sold locally in villages or nearby townships for a quick income supplement.

Emmanuel Madirisha gave the example of growing amaranth which exemplifies the benefits of growing MVs for income rather than cash crops:

**Amaranth**

Amaranth is the most common green vegetable at local markets and is favoured for ease in cooking; it requires little preparation or additional cooking ingredients. Other reasons for its preference included the short time needed between sowing and harvesting, making it ideal to supplement incomes during emergencies. It takes three weeks to reap rather than months it takes for cash crops such as cotton, maize, and tomatoes. While the labour effort for growing amaranth is less than those cash crops, at the same time, it has higher demand on labour compared with traditional

vegetables which are intercropped and do not require irrigation. One has to personally weigh out the costs and benefits of their agriculture.

### Marketing TVs

It has been expressed by farmers in all four villages surveyed in household interviews and focus groups that if a farmer manages the TVs properly, they can yield more harvest than can be consumed. This is noted especially in Mwakasumbi where respondents noted their ability to grow pumpkin successfully. While their household dietary needs are met, the excess produce goes to waste as there is no market for it. The same is said in Mwakaluba for the fruit of traditional cucumber which cannot be preserved.

There is a small market for traditional vegetables in town centres such as that of Mwanhuzi and Mwandoya where TVs are not commonly grown, but not enough to meet the supply of the surrounding villages. Modern vegetables are clearly preferred for income-generation, though the productive capacity has not yet reached its potential due to biotic stresses and management practices which could be improved. This is based on comparisons of average output with that of successful farmers in Mwambegwa, Mwakaluba and Mwakasumbi. Both TVs and MVs are important to Meatu households and they present opportunities for income-generation given the right prospects and management.

## 6.1.6 Gender-Based Roles

While it was not initially admitted, there was broad consensus that women are the knowledge-holders of vegetable cultivation and gathering (Nekesa & Meso, 1997). A gender-based analysis with a female focus group in Bulyashi revealed that while

agricultural roles are shared among the family, parents and children, there is a definite perception that women usually hold the responsibility for vegetable cultivation. The prevailing attitude is that men are in charge of the livestock, maize and cotton, while women are in charge of the vegetables and household affairs. A possible explanation is that women are in charge of TVs and WVs used in the household that they have to cook, while men are tasked with crops, including MVs which have income-generating potential (Obuobie, et al., 2006).

There was much demonstrated evidence for this, especially when men would try to answer questions about TVs and WVs, and eventually call their wives or mothers to take over the interview. In focus groups as well as household interviews, it was emphasised that women possessed the specialized knowledge about different TV and WV species and their preparation. Women for the most part were observed as being chief in marketing traditional and modern vegetables in village and town centre markets; this observation is common to other regions of East and West Africa (Schippers, 2002). However, there proved many exceptions to this rule. Many men were knowledgeable about TVs and were seen in their fields tending to TVs which they had grown in the dry season and reported selling the TVs during the harvest seasons. Furthermore there were many female respondents fully knowledgeable about proper MV cultivation. It was described during household visits and observed in field visits that gender norms did not always hold for typically male dominated tasks such as seed-bed preparation and chemical input application and female dominated tasks such as vegetable harvesting. There was even a household where the wife could not describe any detail about agriculture at all. This is much in contrast to some other

communities in Tanzania such as Arumeru, where men shy away from green leafy vegetables to the extent that they do not even touch them (Keller, 2004, p. 11). Whatever the reason for the change in practices, it is apparent that gender-based roles and norms are not static in Meatu.

# Results and Discussion of Household Survey

## 6.2 Consumption Practices

### 6.2.1 Preference Rankings and Favoured Traits

In both villages, the most preferred vegetables were traditional vegetables and jute mallow, except for the village of Mwambegwa, who included the common modern variety of amaranth (*mchicha kisasa* or *mchicha biashara*) in their ranking (Table 6.2.1). The first most important vegetable was assigned a value of 5 points; the second most important was assigned a value of 4 points and so forth. The 4 most popular vegetables were indeed traditional vegetables, both cultivated and wild, by a large consensus in the 4 villages visited.

**Between the Villages:**

The respondents were asked to list the most key reasons why the aforementioned vegetables in Table 6.2.1 were the important for their households. Twenty-four traits were listed altogether in the two villages (Table 6.2.2). The score was determined by each mention of a trait warranting 1 point. Respondents in Mwakaluba were more varied in their answers of favoured traits than those in Mwambegwa. The scores for the favoured trait rankings are therefore lower compared to the responses in Mwambegwa. The majority of favoured characteristics of traditional vegetables were production oriented

rather than consumption oriented. While taste was the top reason for respondent preferences, production

Most of the traits apply to TVs or WVs with only one trait referring to MVs (market demand) Taste led as the most important trait in both villages. How easy it is to grow TVs compared with MVs, scored in the top five traits for both villages. The next most important trait is drought resistance, followed by a tie for fourth place with the availability of WVs and preference for household consumption. There was also a tie for fifth place for favoured traits between growing vegetables to meet market demand and the reliability of traditional and wild vegetables.

**Table 6.2.1 Vegetables Ranked According to Preference**

| 6.2.1 Rank | Mwambegwa | | | Mwakaluba | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Vegetable** | **Score** | **Sample Size** | **Vegetable** | **Score** | **Sample Size** | **Vegetable** | **Score** | **Sample Size** |
| **1** | Traditional Cucumber and leaves | 111 | 34 | Jute Mallow (2 varieties) | 162 | 35 | Traditional Cucumber and leaves | 241 | 69 |
| **2** | Cowpea and leaves | 87 | | Traditional Cucumber and leaves | 130 | | Jute Mallow (2 varieties) | 234 | |
| **3** | Pumpkin and leaves | 79 | | Cowpea and leaves | 111 | | Cowpea and leaves | 198 | |
| **4** | Jute Mallow (2 varieties) | 72 | | Pumpkin and leaves | 96 | | Pumpkin and leaves | 175 | |
| **5** | Modern Amaranth | 32 | | Okra | 16 | | Modern Amaranth | 42 | |

**Table 6.2.2 Favoured Traits of Preferred Vegetables**

| 6.1.2 Rank | Mwambegwa | | | Mwakaluba | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|
| | Trait | Score | Sample Size | Trait | Score | Sample Size | Trait | Score | Sample Size |
| 1 | Taste | 22 | 35 | Taste | 14 | 35 | Taste | 36 | 70 |
| 2 | Easy to grow | 22 | | Availability of WVs | 10 | | Easy to grow | 29 | |
| 3 | Drought resistance | 17 | | Reliability of TVs/ WVs | 9 | | Drought resistance of TVs | 17 | |
| 4 | Convenient for household consumption | 13 | | TVs are Easy to Grow | 7 | | -Availability of WVs<br>-Household Consumption | 13<br>13 | |
| 5 | Market demand | 11 | | WVs are easy to find/ no cost | 6 | | -Market Demand<br>-Reliability of TVs/ WVs | 11<br>11 | |

## 6.2.2 Consumption Frequency and Amount

**Between the Villages:**

The traits listed by respondents reaffirm the consumption patterns in households in the two villages as shown later in Tables 1.3 and 1.4: a slightly higher consumption rate of MVs in Mwambegwa and of WVs in Mwakaluba. It is worth noting that individuals who listed marketability as an important trait were more likely to list modern vegetables such as tomatoes or modern amaranth among their preferred vegetables; this response was exclusive to respondents in Mwambegwa with an accessible market. Drought resistance was another trait listed only by respondents in Mwambegwa. These preference rankings demonstrate the importance of vegetables for household consumption and the emergence of vegetables for income generation when possible.

Focus groups conducted in 3 villages held consensus that other favourable traits include the ease of cooking preparation. No costly additives such as tomatoes or onions are needed

to make TVs more palatable, just salt or groundnuts to make a sauce to accompany *ugali,* a maize based, most common starch in their diet. Other favourable traits included the ability to preserve TVs through solar-drying for the dry season months where fresh vegetables would be difficult to grow, and costly to buy. An unexpected trait listed by several respondents was the value of TVs for ties to their culture as Sukuma people; TVs were grown by their ancestors and found to be best suited to the land, thus they should continue in that tradition.

**Between Traditional and Modern Vegetables:**

A focus group in Mwambegwa noted however that TV and WV consumption has been in decline over the past decade. As evidenced by village preference ranking and consumption frequency, they are still popular, however the quantity consumed has reduced due to the increase in the local availability of MVs and the availability of affordable substitutes such as dried fish or sardines consumed for flavour and nutrition. Locally available vegetables are no longer the choice by default. Far from acting as complete substitutes, MVs such as tomatoes and onions are not eaten by themselves but are used as flavourings to counter the bitterness of some TVs and to complement meat dishes. MVs are viewed as a special food that households use to make a dish more special, and limit purchases when they have less money.

**Availability and Usage of Wild Vegetables:**

Concerning WVs in particular, focus groups and individual farmers in Mwambegwa and Mwakaluba noted the decline in their consumption was in part due to changing availability of some WVs from increased drought making them more difficult and less convenient to find. The decline is also in part due to growing disinterest among younger generations to

learn about such vegetables. One WV in particular which has had a marked decline in availability is *makwanzaa.* It was never mentioned in Mwambegwa as it had long been scarcely available and some younger villagers had difficulty identifying it. It is more available in Mwakaluba and Mwakasumbi, villages in the Northern Zone of Meatu, which capture more annual rainfall, though villagers in those areas noted it was also less available than in the past. Focus groups in Bulyashi, noted that it had all but disappeared.

Households who use WVs for medicinal purposes emphasized not only the effect on diets, but also increased difficulty in treating health concerns as a result for the decline in WV availability. This affects rural villages broadly because of the high percentage of villagers who seek these treatments over Western medicine due to personal preference and the difficulty in obtaining Western treatment. Western treatment is often only sought after traditional medicine has not been successful and the household can afford the treatment. Furthermore, many villages are located far away from clinics or pharmacies disabling convenient consultation.

Despite factors reducing consumption preferences, household consumption of TV remains the highest in total amount consumed and in consumption frequency (Tables 1.3, 1.4). Households were asked to list how many times in a week each vegetable category: TVs, MVs and WVs are typically consumed in the dry season and in the wet season. Then they were asked how many standard portions of vegetables are consumed for the whole household. A standard portion for leafy vegetables refers to the approximate size of a 200TSh bunch that uniformly characterises vegetables sales at markets. A heap of okra

conversely, is approximately the size of two large fists (Photos in **Appendix 1**). Based on earlier collected data about household membership, a per capita weekly average was determined and articulated in Tables 1.3 and 1.4.

### Consumption of Modern Vegetables

Farmers in Meatu pride themselves in producing much of what their household needs. Alongside their production, some food items are purchased to supplement diets. Some food items are consumed infrequently, considered a treat or for entertaining guests, such as tomatoes, African eggplant, carrots or rice. Some items such as dried fish and dried anchovies, are considered a cheap replacement when there is poor availability or affordability of meat or vegetables. The replacements are to supplement nutrition and flavour to diets. Part of the reason some goods may not be eaten frequently is also that few villagers grow modern vegetables such as nightshade, carrots, or onions, while they may be available in the town centre, if one were to make the long journey there.

## Food Budgets between Mwambegwa and Mwakaluba:

For weekly planned consumption, Mwambegwa allots a higher food budget during the dry season, while Mwakaluba allots a higher food budget during the wet season (Table 6.2.5). The combined result of the two villages however shows food budgets within 6% of each other between seasons. Reasons for increased budgets vary between needs basis, market prices and cash liquidity. Over the course of the dry season, the market price of vegetables increases not insignificantly from 200 to 300 TSh per bunch of leafy vegetables or heap of non-leafy vegetables.

**Table 6.2.3 Summary Results: Weekly Home Consumption of TVs, MVs, WVs Per Capita (In bunches)**

| 6.2.3a Mwambegwa | | | | | |
|---|---|---|---|---|---|
| | **Season** | **Sample Size** | **Mean** | **Standard Deviation** | **% of V Consumption/ Season** |
| **TV** | Dry | 34 | **1.5395** | 0.9764 | 0.3946 |
| | Wet | 34 | **1.7346** | 1.3843 | 0.4249 |
| **MV** | Dry | 33 | **0.9579** | 1.0182 | 0.2455 |
| | Wet | 33 | **0.9893** | 1.0795 | 0.2423 |
| **WV** | Dry | 18 | **1.4043** | 1.7424 | 0.3599 |
| | Wet | 18 | **1.3588** | 1.7145 | 0.3328 |
| **6.2.3b Mwakaluba** | | | | | |
| | **Season** | **Sample Size** | **Mean** | **Standard Deviation** | **% of V Consumption/ Season** |
| **TV** | Dry | 34 | **0.9764** | 0.4377 | 0.3611 |
| | Wet | 34 | **1.5709** | 1.3927 | 0.4592 |
| **MV** | Dry | 34 | **0.7683** | 0.5871 | 0.2841 |
| | Wet | 34 | **0.7392** | 0.6501 | 0.2161 |
| **WV** | Dry | 34 | **0.9595** | 0.8370 | 0.3548 |
| | Wet | 34 | **1.1109** | 1.0704 | 0.3247 |
| **6.2.3c Combined** | | | | | |
| | **Season** | **Sample Size** | **Mean** | **Standard Deviation** | **% of V Consumption/ Season** |
| **TV** | Dry | 68 | **1.2580** | 0.8028 | 0.3891 |
| | Wet | 68 | **1.6528** | 1.3806 | 0.4453 |
| **MV** | Dry | 67 | **0.8617** | 0.8271 | 0.2665 |
| | Wet | 67 | **0.8624** | 0.8900 | 0.2323 |
| **WV** | Dry | 52 | **1.1134** | 1.2293 | 0.3444 |
| | Wet | 52 | **1.1967** | 1.3173 | 0.3224 |

**Table 6.2.4 Summary Results: Weekly Household Consumption Frequency of TVs & WVs, and MVs (Number of times per week)**

| 6.2.4a Mwambegwa | | | | |
|---|---|---|---|---|
| | **Season** | **Sample Size** | **Mean** | **Standard Deviation** |
| **C Frequency of TVs** | Dry | 34 | 4.1471 | 1.5002 |
| | Wet | 34 | 4.3382 | 1.5893 |
| **C Frequency of MVs** | Dry | 34 | 2.8235 | 1.9920 |
| | Wet | 34 | 2.8529 | 2.1339 |
| **C Frequency of WVs** | Dry | 19 | 3.1053 | 2.2582 |
| | Wet | 19 | 3.1053 | 2.2582 |
| **6.2.4b Mwakaluba** | | | | |
| | **Season** | **Sample Size** | **Mean** | **Standard Deviation** |

| | | | | |
|---|---|---|---|---|
| **C Frequency of TVs** | Dry | 34 | 3.5735 | 1.4149 |
| | Wet | 34 | 4.0441 | 1.4162 |
| **C Frequency of MVs** | Dry | 34 | 2.3382 | 1.2596 |
| | Wet | 34 | 2.1618 | 1.3636 |
| **C Frequency of WVs** | Dry | 34 | 3.0441 | 1.6067 |
| | Wet | 34 | 3.0882 | 1.7773 |
| | | | | |
| **6.2.4c Combined** | | | | |
| | **Season** | **Sample Size** | **Mean** | **Standard Deviation** |
| **C Frequency of TVs** | Dry | 68 | **3.8603** | 1.4758 |
| | Wet | 68 | **4.1912** | 1.5013 |
| **C Frequency of MVs** | Dry | 68 | **2.5809** | 1.6720 |
| | Wet | 68 | **2.5074** | 1.8110 |
| **C Frequency of WVs** | Dry | 53 | **3.0660** | 1.8451 |
| | Wet | 53 | **3.0943** | 1.9416 |

## 6.2.3 Contribution of Traditional and Wild Vegetables for Household Food Budgets

Traditional and wild vegetables contribute significantly to diets and savings to household food budgets. They present such savings because vegetables are a food category which does not have to be purchased, as villagers of all wealth ranks grow their own. Traditional vegetables are purchased only in town centres where fewer households grow crops and depend on the market for most of their goods. During the dry season, the value of fresh and dried TVs and WVs consumed in a household is equal to 31% of a per capita weekly food budget, and 40% in the wet season (Table 6.2.5). Over the course of a month for a household of nine people, the average over both villages, the values become a significant savings for their expenditures. This is especially so as the dry season progresses and buying or finding vegetables proves increasingly difficult. Self-sufficiency is valued as a virtue; consequently, households aim to meet their needs for vegetables during the dry season by consuming vegetables dried during harvest months.

Table 6.2.5 is determined solely based on the market value of the harvested TVs or gathered WVs. The value of the food budget saved from producing instead of purchasing vegetables does not take into account the value of the labour hours and input needed. This will be discussed in Section 6.3. There was insufficient information to fully determine the contribution of MVs to the food budget.

**Table 6.2.5 Summary Results: Contribution of Home-Grown Traditional and Wild Gathered Vegetables to Weekly Food Budget Savings Per Capita***

| **6.2.5a Mwambegwa** | | | | | |
|---|---|---|---|---|---|
| **Season** | **Average Food Budget (Per capita; TSh)** | **Av Consumption of TVs (Per capita; portion)** | **Av Consumption of WVs (Per capita; portion)** | **Total Value of Vs (200Tsh/ portion)** | **% of Average Food Budget Saved (Per Capita)** |
| **Dry** | 1844.0895 | 1.5395 | 1.4043 | 588.7558 | **31.9266** |
| **Wet** | 2022.8030 | 1.7346 | 1.3588 | 618.6684 | **30.5847** |
| **6.2.5b Mwakaluba** | | | | | |
| **Season** | **Average Food Budget (Per capita; TSh)** | **Av Consumption of TVs (Per capita; portion)** | **Av Consumption of WVs (Per capita; portion)** | **Total Value of Vs (200Tsh/ portion)** | **% of Average Food Budget Saved (Per Capita)** |
| **Dry** | 1206.8153 | 0.9764 | 0.9595 | 387.1724 | **32.0822** |
| **Wet** | 950.2858 | 1.5709 | 1.1108 | 536.3518 | **56.4411** |
| **6.2.5c Combined** | | | | | |
| **Season** | **Average Food Budget (Per capita; TSh)** | **Av Consumption of TVs (Per capita; portion)** | **Av Consumption of WVs (Per capita; portion)** | **Total Value of Vs (200Tsh/ portion)** | **% of Average Food Budget Saved (Per Capita)** |
| **Dry** | 1530.0703 | **1.2580** | **1.1134** | 474.2772 | 0.3100 |
| **Wet** | 1443.9842 | **1.6528** | **1.1967** | 569.8818 | 0.3947 |

*This table assumes that in these communities, all traditional vegetables are home-grown and include both fresh and dried vegetables during both seasons.

## 6.3 Production and Marketing Values

Production issues surrounding labour effort, input costs, production output and returns to effort were discussed first in focus groups and in detail during household visits.

As traditional vegetables are intercropped with annual crops, most farmers grow TVs only in the wet season, and gather them throughout the harvest season. In addition, some farmers monoculture TVs and MVs during the dry season. The influential factors are firstly if their land is in close proximity to a water source, if their dry vegetable stores are inadequate or if they retail MVs at a market. The land areas relevant to this production survey are describing the wet season plots.

After identifying the crops grown by farmers, the total area over which those crops grown was asked. There was difficulty in determining exact areas in acres among some households, as not all persons interviewed knew the value of their land area in acres. When possible, interviews occurred on the physical location of the farm, rather than the homestead to more accurately gauge land area. In some results, estimates are used, especially where intercropping is practiced. Intercropping is common for traditional vegetables with cash crops, especially maize, but also pigeon pea, sunflower, mung bean and to a lesser extent, cotton. Recording the farming area as accurately as possible was important to determine the cost of growing TVs in labour hour valuation (Tables 6.3.1a-b) as well as input cost per acre (Tables 6.3.2a-b).

### 6.3.1 Labour Hours of Agricultural Activities per Acre

The activities included to determine total labour hours includes farming activities such as seed bed preparation, seeding, irrigation and the application of pesticides and fertilizer. Time to walk to the water sources and to the farm from the farmstead is not to be discounted from labour hour cost input; however this information was excluded due to

conflation between household usage and mixed usage between crop types. Time used for harvesting the vegetables is another activity which was difficult to accurately calculate due to the ongoing and sporadic nature of harvesting and joint harvesting of various crops. Some intensive activities such weeding and harvesting of cash crops is a corporal affair requiring the hands of extended family to make light work. Harvesting of vegetables is done only by the household. The total value of the hours is included in the labour hour calculation. A schedule of planting and harvesting crops is included in **Appendix 2: Cropping Calendar**.

**Between the Villages:**

Between the villages, it was apparent from observation that villagers of Mwambegwa put in more labour hours than the villagers of Mwakaluba, owing to the demands of a relatively more arid climate and higher production demands for marketing purposes. Through casual observance, it was apparent that Mwakaluba is more accommodating to agriculture than Mwambegwa by noting the health and stature of vegetable and cash crops in comparison to those of Mwambegwa and the prevalence of succulent vegetables grown during the dry season. In Mwambegwa, the labour hours were high because of the effort taken to administer the chemical inputs and spreading of manure for TVs compared with Mwakaluba who did not report chemical input and manure spreading with the same regularity (Tables 2.1bi-ii).

**Between Traditional and Modern Vegetables:**

Between MVs and TVs, more labour hours per acre on average are used to cultivate MVs, as compared between Table 6.3.1ai and Tables 6.3.1bi-ii. Especially pronounced in Mwakaluba, farmers did not think it necessary to do activities such as prepare seed beds

for, apply chemical inputs to, or irrigate TVs. The activities most common for TVs in Mwambegwa and Mwakaluba were weeding and manure spreading. The expression verbalized by respondents was that, all one has to do is scatter the TV seeds, wait for sunshine, the rains and TVs will grow. Whereas MVs require more nurturing than the environment naturally provides. In addition to all the labour activities mentioned, the most common MV, tomatoes, require seedlings to be grown in a nursery, transplanting at a later time, more frequent application of chemical inputs and water as well as more frequent weeding and higher susceptibility to pests and disease.

**Production Consequences:**

The labour hours per acre described for Mwakaluba (Table 6.3.1aii) vary from that of Mwambegwa (Table 6.3.1ai) as if to suggest that one village is far more efficient than the other. However, the lower input hours reflect the effort needed for their desired output. Simply put, due to limited marketing potential for MVs in Mwakaluba, with the nearby town Mwandoya, the output needed in Mwakaluba is merely for personal household consumption or small sales at the farmgate. The farmer with the highest MV labour input hours in Mwandoya was the only farmer who reported growing them for marketing in his village and the nearby town. It is a given that agricultural income derives from cotton and maize as principle cash crops. Whereas Mwambegwa's agricultural income derives from a basket of cash crops and vegetables. Twenty-six out of the twenty-seven farmers interviewed who grow MVs, reported selling them in the town centre also. Mwambegwa`s incentive to exhaust the productive capability of its vegetables owes to its proximity to Mwanhuzi, Meatu district's administrative headquarter. This trend is applicable for traditional vegetables as well.

Furthermore, less input hours for both modern and traditional vegetables in Mwakaluba reflect a lower concern for wet season production to last for the whole year as growing vegetables during the dry season is feasible. Indeed, the TVs and WVs preserved for dry season consumption by Mwakaluba are almost half that of Mwambegwa as shown in Table 6.3.8ai and 2.8aii.

**Table 6.3.1a Modern Vegetables: Hours of labour per acre in the wet season**

| **Labour Hours** | **6.3.1ai Mwambegwa** | | | **6.3.1aii Mwalakuba** | | |
|---|---|---|---|---|---|---|
| | Sample Size* | Mean (Hours) | Standard Deviation | Sample Size** | Mean (Hours) | Standard Deviation |
| **Average Total Hours** | 26 | 89.5769 | 44.0720 | 9 | 112.9153 | 103.0247 |
| **Hours/ Acre** | **26** | **281.1415** | **266.5914** | 9 | 475.0750 | 790.4682 |
| **Hours/ Acre excl extreme cases** | **24** | **229.7367** | **201.7452** | **7** | **231.5008** | **126.6715** |

*Only 29 out of 38 farmers surveyed cultivate MVs
**Only 9 out of 35 farmers surveyed cultivate MVs

**Table 6.3.1b Traditional Vegetables: Hours of labour per acre in the wet season**

| **Labour Hours** | **6.3.1bi Mwambegwa** | | | **6.3.1bii Mwakaluba** | | |
|---|---|---|---|---|---|---|
| | **Sample Size** | **Mean (Hrs)** | **Standard Deviation** | **Sample Size** | **Mean (Hrs)** | **Standard Deviation** |
| **Total Hours** | 34 | 56.0716 | 42.7770 | 34 | 78.8332 | 49.2324 |
| **Hours/ Acre** | 34 | 164.1261 | 194.4854 | 34 | 115.8325 | 73.1137 |
| **Hours/ Acre excl extreme cases** | **32** | **142.7253** | **131.4255** | **30** | **111.4573** | **60.5171** |

## Irrigation Water Collection

It was not possible to fully approximate the amount of time needed for harvesting or the time taken to walk to water sources for hand irrigation as part of irrigation duties in the rainy season. Nonetheless, this activity is very time consuming for women and girls whose responsibility it is to collect water throughout the day for domestic and agricultural

purposes. The average time needed to walk to dry river channels from the vegetable farming plots is 11 minutes in Mwambegwa, and 20 minutes in Mwakaluba altogether. This was not included in Tables 6.3.1a-b as it is not possible to differentiate between the different purposes of the water. While a shorter distance and time is taken to get to water sources in Mwambegwa, there is also no alternative water source. Each subvillage in Mwakaluba however, has access to a water pump for household usage.

**Table 6.3.1c Labour hours required for fetching water for hand irrigation from farming area**

| Labour Hours | 6.3.1ci Mwambegwa | | | 6.3.1cii Mwakaluba | | |
|---|---|---|---|---|---|---|
| | Sample Size* | Mean | Standard Deviation | Sample Size** | Mean | Standard Deviation |
| Minutes | 21.0000 | 11.0476 | 8.9413 | 27 | 20.37037 | 18.653 |

*Out of 34 respondents, 28 rely on rainfall and water from dry river channels; 6 rely solely on rainfall.
**Out of 29 respondents, 20 rely on rainfall and water from dry river channels; 6 rely solely on rainfall; 2 rely on rainfall and water pumps; 1 relies on rainfall, dry river channels and well water. Due to translation errors, there may be confusion among respondents who included water pumps or wells in their answers.

**Sales and Transport to the Market:**
Twenty-six Mwambegwa households on average spent 12.60 hours per week concerning marketing activities in the nearby town centre of Mwanhuzi about 7km away from the village centre (Table 6.3.2a). In contrast, Mwandoya is 12km away from the village centre of Mwakaluba, whose sub-villages are more widely spread; it is worthwhile for fewer farmers in proportion to sell produce there. There is a concern with the data in Tables 6.3.2a-b that the hours stated may include time spent selling other farm output such as food cash crops as revenues from some vegetable sales are low compared to the marketing hours declared.

**Table 6.3.1d Labour Hours of Marketing/ week (Wet Season)**

| Labour Hours | 6.3.1di Mwambegwa | | | 6.3.1di Mwakaluba | | |
|---|---|---|---|---|---|---|
| | Sample Size | Mean (Hours) | Standard Deviation | Sample Size* | Mean (Hours) | Standard Deviation |
| Sale and Transport to Market | 30 | 12.6028 | 13.0202 | 5 | 18.0000 | 21.5145 |

*Only 5 out of the 35 households interviewed sell their produce in town or in the village centre, while 2 sell at the farm-gate. These are all households who grow and sell MVs.

## 6.3.2 Value of Agricultural Input Costs per Acre

### Calculating the Input Cost of Agriculture per Acre

The cost of agriculture includes values of land rent, seeds, chemical pesticides, chemical fertilizer and manure as is applicable to each household. TV seeds are not purchased, but saved over time from previous harvests, while MV seeds are purchased at the beginning of the season to get the most modern and resistant variety. Tomato seeds bought without a government subsidy retails for 200TSh per gram. Onion has the most expensive seeds and cost 480TSh per gram with a small government subsidy. Commonly available pesticide brands are Ramdex and Firstex purchased at approximately 3,000Tsh per 250ml bottle dosage. While most households raise cattle, those without typically pay a customary sum to neighbours for their excess manure. It is common to hire help for short periods during the harvest season. Wages vary according to the task and duration. An average wage for 10 hour work day of medium level intensity, such as weeding is 10,000TSh. However, there was insufficient information collected to include this input cost as many tasks included labour done for different crop types.

**Between the Villages:**

Farmers in Mwambegwa grow modern vegetables over larger plots, have grown for 2 years longer on average and reap economies to scale. It is likely that they are deliberating

between scaling down cereals and cotton and increasing MVs as their cash crop. Farmers in Mwakaluba who grow modern vegetables are either growing them seriously as a main source of income or very casually, noted by the amount of labour hours given and inputs used. In Mwambegwa, a third category exists of farmers who grow modern vegetables for casual marketing to supplement incomes. Until the same is true for Mwakaluba, their costs per acre on average will be disproportionately higher, with a small sample size inaccurately representing values.

**Between Modern and Traditional Vegetables:**

As mentioned regarding Tables 6.3.1bi-ii, the perception from villagers in Meatu about traditional vegetables is that chemical inputs and pesticides are not necessary, unlike modern vegetables which have high maintenance needs (Tables 6.3.2a-b). Traditional vegetables are perceived as naturally being resistant to pests, disease, fungus and water stresses compared with modern vegetables. Traditional and wild vegetables were the top vegetables listed as having the highest tolerance to biotic and abiotic stresses and as a result, pesticides, fungicides and fertilizers do not often feature in the calculation of agricultural input costs in Tables 6.3.2bi-ii as they did for Tables 6.3.2ai-ii. Other costs such as rent and seeds do not feature as traditional vegetables are intercropped with ubiquitous cash crops and seeds are saved from year to year. Table 6.3.2bii demonstrates this very clearly as none of the villagers interviewed declared any input costs whatsoever. In Mwambegwa, villagers had the perception that due to the dry environment, some inputs were needed obtain an acceptable minimum output (Table 6.3.2bi).

**Table 6.3.2a Modern Vegetables: Cost of Agriculture per acre in the wet season**

| Cost/ Acre | 6.3.2ai Mwambegwa | | | 6.3.2aii Mwakaluba | | |
|---|---|---|---|---|---|---|
| | Sampl | Mean | Standard | Sampl | Mean (TSh) | Standard |

| | e Size | (TSh) | Deviation | e Size* | | Deviation |
|---|---|---|---|---|---|---|
| Total Cost | 28 | 13791.7381 | 15136.1791 | 9 | 30555.5556 | 59985.6464 |
| **Total Cost/ Acre** | 28 | 49841.0553 | 83311.8231 | 9 | 106062.1117 | 172733.4743 |
| **Total Cost/ Acre Excl extreme cases** | **26** | **37328.8288** | **40888.3360** | **8** | **62819.8757** | **121926.6025** |

*A common means of growing MVs in the dry season in Mwakaluba, especially sweet potato leaves, *matembele,* is to transplant them on to common shaded areas on or around dry river channels. This negates the need to pay for rent and provides a convenient source of water for hand irrigation. The vines are transplanted to their own land during the wet season, or kept on the common land where possible.

**Table 6.3.2b Traditional Vegetables: Cost of Agriculture per acre in the wet season**

| **6.3.2bi Mwambegwa** | | | | **6.3.2bii Mwakaluba** | | |
|---|---|---|---|---|---|---|
| | **Sample Size** | **Mean (TSh)** | **Standard Deviation** | **Sample Size** | **Mean (TSh)** | **Standard Deviation** |
| Total Cost | 35 | 2631.1987 | 5422.8637 | 34 | 0.0000 | 0.0000 |
| **Total Cost/ Acre** | **35** | **22893.8863** | **67699.9148** | 34 | **0.0000** | **0.0000** |
| **Total Cost/ Acre Excl extreme cases** | **33** | **13220.7885** | **33158.2256** | 34 | **0.0000** | **0.0000** |

**Table 6.3.3 Pesticide Usage**

| **Pesticide Usage** | **6.3.3a Mwambegwa** | | | **6.3.3b Mwakaluba** | | |
|---|---|---|---|---|---|---|
| **Crop** | **Sample Size** | **# of Farmers Using** | **Concerns** | **Sample Size** | **# of Farmers Using** | **Concerns** |
| MV | 33 | 20 | Aphids, American bollworm, grasshoppers | 34 | 5 | American bollworm, aphids, catworms, stem borers, blight |
| IV | 34 | 8 | | 34 | 0 | |

## 6.3.3 Comparing Total Output Values with Input Values

**Calculating the Ratios:**

The ratios of Tables 6.3.4 to 6.3.7 compare the different costs and benefits between growing TVs and MVs. The Costs category is a combination of values from earlier tables, while the Value category is the market value of declared produce in the wet season. The

value of input cost per acre in Tables 6.3.4 to 6.3.7 is taken from the data described in Table 6.3.1a-b; the value of marketing cost per acre is from Tables 6.3.2a-b and Tables 6.3.3a-b; the value of labour cost per acre is taken from the data described in Tables 6.3.2a-b. Marketing was excluded from the total number of labour hours for traditional vegetables in Tables 6.3.6a-b, as few households sold them at an actual market. Tables that describe average and ideal output are contained in **Appendix 4: Optimum Seasonal Output Guide.**

Including the market value of the labour hours of farmers spent on agricultural activities as well as marketing is a deliberate attempt to recognize the value of farmers` time and efforts for their occupation. It is also an attempt to not take for granted the value of the time of household members who contribute to labour efforts, who have an opportunity cost. Agriculture in Meatu requires the participation of all household members whether they are school-aged children, or grandparents. At times, participation from extended family, neighbours and friends is expected and their efforts will be returned in kind, or in hosting a feast.

The value of labour refers to the cost of labour if it were valued at the market rate of 10000TSh/ day for a 10 hour work day. Marketing refers to the number of market hours valued at the same labour rate. In the Mwambegwa sample of 36 households, only 6 hired labour to assist with activities. The employment was piecemeal, for a few days out of the season to help with intensive tasks such as harvesting or weeding. Only one wealthy household hired labour on a continual basis for hand irrigation.

**Comparing Ratios Between Modern and Traditional Vegetables:**

The ratios between traditional vegetables, Tables 6.3.4 and 6.3.6, and modern vegetables, Tables 6.3.5 and 6.3.7, albeit, with an imperfect set of data, show the former set as having higher ratios of returns to physical inputs and labour hours than the latter set. Despite the higher costs to returns ratio and start-up costs needed compared to TVs, the wish to grow modern vegetables was a commonly mentioned sentiment. It is possible that farmers and their households do not fully value their time given to their agriculture. This would explain their willingness to put a lot of effort into growing modern vegetables.

Only a few farmers interviewed experiment with alternative forms of agricultural supplements, water management or seed types to what is locally available to increase their output or reduce the necessary labour hours for all vegetable crops. The only variant from this was a shared sentiment to purchase gasoline powered water pumps to save labour effort for irrigation. In response, it was expressed by respondents that the necessity of their efforts are a "just the way it is", due to culture and their heritage as agro-pastoralists. This fatalistic view among many households is grounded in their perspective that wealth and attaining a different livelihood will come through the accumulation of wealth from cash crops, measured in the number of cattle.

Their value-cost analysis includes the cost of inputs and the benefit generated by market sales, without considering the value of the time needed to plant, maintain and sell their produce. Modern vegetables are grown by villagers for reasons other than efficiency of labour hours. Taste preferences are among the main incentive for farmers who do not sell this produce. Income generation is slowly becoming the next reason.

**Attaining Wealth**

The hierarchy of wealth is foremost dictated by the head of cattle a household possesses. While wealth with that measure can be attained through success in growing cash crops or raising cattle, a parallel measure of wealth is emerging where wealth is acknowledged by success in growing modern vegetables, acquiring an urban trade such as tailoring and opening a café or provision shop. One farmer who was described as being very poor in Mwakaluba was in fact the most successful vegetable farmer visited there. Not only were his traditional vegetables fruitful, but he grew several modern vegetables not grown by anyone else in the village. His willingness to experiment with exotic varieties such as a white amaranth from Zanzibar (*mchicha wa Zanzibar*) in addition to growing popular but not commonly grown vegetables such African eggplant, cabbage and Chinese cabbage, ensures him good sales.

**Growing Modern Vegetables as a Stepping Stone**

An advantage of modern vegetables is a stable market price. Cotton and maize prices fluctuate throughout the harvest season according to principles of supply and demand subject to market influences all over East Africa. As vegetables are marketed locally, prices are constant and subject only to expected price change between the dry and wet seasons. Furthermore, the turnaround from sowing to reaping income is one to three months, compared with cotton taking twice as long. Income can be earned at several times during the year and not be wholly dependent just one harvest period. Short growing periods allow for flexibility in planting schedules which becomes increasingly important as *vuli* and *masika* rains becomes more unpredictable.

As mentioned repeatedly, modern vegetables have greater marketability than traditional vegetables. Modern vegetables can be sold at the farmgate, in the village and also in the town centre throughout the year. Traditional vegetables and wild vegetables on the other hand are consumed primarily in the household, with some produce sold in the town centre. Villagers in Mwakasumbi particularly noted that their capacity to grow pumpkins and lisegwe (a squash-like not included in the data sets) grossly outweighed their opportunities for marketing their produce. The same is said about the fruit of traditional cucumber where much of the output is often left in the fields unharvested in Mwakasumbi and Mwakaluba. Being a successful farmer of modern vegetables is preferred over being a successful farmer of already plentiful traditional vegetables. Though the value-cost ratios of growing modern vegetables, are between 28% (Mwakaluba: 1.2845:4.5098; Tables 6.3.7b and 6.3.6b) to 76% (Mwambegwa: 3.2020:4.2095; Tables 6.3.7a and 6.3.6a) that of the value-cost ratios of growing traditional vegetables, the significance and potential from the income generated is worthwhile cost.

**Considerations Regarding Modern Vegetables**

Something further to be reflected upon is the value-cost ratio over several years. When asked what proportion of modern vegetable crops succumbed to pests, diseases, fungus, or general loss, many households interviewed declared they lost, everything, or a very high percentage. At first, this seemed to be exaggeration, until we were shown fields with highly diseased plants due to improper crop management meriting some degree of those claims. In these cases, the first growing season often incurs large losses until a management strategy is learnt through trial and error. The value-cost ratio of modern vegetables is skewed even more unfavourably in these cases over several seasons.

**Table 6.3.4 Comparison: (Monetary Value of Inputs) versus (Value of TVs)**

| **6.3.4a Mwambegwa** | | | | | |
|---|---|---|---|---|---|
| **Input Costs/ Acre** | | | **Value/ Acre** | | |
| Sample Size | Mean (TSh) | Standard Deviation | Sample Size | Mean (TSh) | Standard Deviation |
| 33 | 13220.7885 | 33158.2256 | 33 | 656447.9997 | 519011.4228 |
| **Value to Cost Ratio** | **49.6527** | | | | |
| **6.3.4b Mwakaluba** | | | | | |
| **Input Costs/ Acre** | | | **Value/ Acre** | | |
| Sample Size | Mean (TSh) | Standard Deviation | Sample Size | Mean (TSh) | Standard Deviation |
| 34 | 0.0000 | 0.0000 | 34 | 502648.3427 | 585062.4287 |
| **Value to Cost Ratio** | | | | | |

(The monetary value of inputs refers to the cost of agriculture as described in 2.2. Value of TVs refers to the value of total output according to market rates during the wet season)

**Table 6.3.5 Comparison: (Monetary Value of Inputs) versus (Value of MVs)**

| **6.3.5a Mwambegwa** | | | | | |
|---|---|---|---|---|---|
| **Input Cost/ Acre** | | | **Value/ Acre** | | |
| Sample Size | Mean (TSh) | Standard Deviation | Sample Size | Mean (TSh) | Standard Deviation |
| 26 | 37328.8288 | 40888.3360 | 28 | 1291037.3400 | 1324489.9964 |
| **Value to Cost Ratio** | **34.58553** | | | | |
| **6.3.5b Mwakaluba** | | | | | |
| **Input Cost/ Acre** | | | **Value/ Acre (Excl extreme values)** | | |
| Sample Size | Mean (TSh) | Standard Deviation | Sample Size | Mean (TSh) | Standard Deviation |
| 8 | 62819.8757 | 121926.6025 | 5 | 444139.4124 | 567677.5514 |
| **Value to Cost Ratio** | **7.070046** | | | | |

**Table 6.3.6 Total Comparison: (Monetary Value of Inputs, Labour Value) versus (Value of TVs)**

| **6.3.6a Mwambegwa** | | | | | | |
|---|---|---|---|---|---|---|
| **Total Cost/ Acre** | | | | **Value/ Acre** | | |
| | **Sample** | **Mean (TSh)** | **Standard** | **Sample** | **Mean (TSh)** | **Standard** |

| | Size | | Deviation | Size | | Deviation |
|---|---|---|---|---|---|---|
| **Input** | 33 | 13220.79 | 33158.23 | 33 | 656447.9997 | 519011.4228 |
| **Labour Hours** | 32 | 142725.3 | 131425.5 | | | |
| **TOTAL** | 155946.1 | | | 656447.9997 | | |
| **Value to Cost Ratio** | **4.2095** | | | | | |

| **6.3.6b Mwakaluba** | | | | | | |
|---|---|---|---|---|---|---|
| | **Cost/ Acre** | | | **Value/ Acre** | | |
| | **Sample Size** | **Mean (TSh)** | **Standard Deviation** | **Sample Size** | **Mean (TSh)** | **Standard Deviation** |
| **Input** | 34 | 0 | 0 | 34 | 502648.34 | 585062.43 |
| **Labour Hours** | 30 | 111457.35 | 60517.10 | | | |
| **TOTAL** | 111457.35 | | | 502648.3 | | |
| **Value to Cost Ratio** | **4.5098** | | | | | |

The value of labour refers to the cost of labour typically owing to the farmer's family if it were valued at the market rate of 10000TSh/ day for a 10 hour work day for medium-difficulty rated work.)

### Table 6.3.7 Total Comparison: (Monetary Value of Inputs, Labour Value, Marketing Labour) versus (Value of MVs)

| **6.3.7a Mwambegwa** | | | | | | |
|---|---|---|---|---|---|---|
| | **Total Cost/ Acre** | | | **Value/ Acre** | | |
| | **Sample Size** | **Mean (TSh)** | **Standard Deviation** | **Sample Size** | **Mean (TSh)** | **Standard Deviation** |
| **Input** | 26 | 37328.8288 | 40888.3360 | 28 | 1291037.3400 | 1324489.9964 |
| **Labour Hours** | 24 | 229736.6564 | 201745.2002 | | | |
| **Marketing (4 weeks)** | 27 | 136131.1124 | 115451.4350 | | | |
| **TOTAL** | 403196.5976 | | | 1291037.3400 | | |
| **Value to Cost Ratio** | **3.2020** | | | | | |

| **6.3.7b Mwakaluba** | | | | | | |
|---|---|---|---|---|---|---|
| | **Total Cost/ Acre** | | | **Value/ Acre** | | |
| | **Sample Size** | **Mean (TSh)** | **Standard Deviation** | **Sample Size** | **Mean (TSh)** | **Standard Deviation** |
| **Input** | 8 | 62819.8757 | 121926.6025 | 5 | 444139.4124 | 567677.5514 |
| **Labour Hours** | 7 | 231500.8075 | 126671.4552 | | | |
| **Marketing * (4** | 4 | 51444.7889 | 37324.615 | | | |

| | | | | |
|---|---|---|---|---|
| **weeks)** | | | | |
| **TOTAL** | 345765.4721 | | | 444139.4124 |
| **Value to Cost Ratio** | **1.2845** | | | |

*Only 5 out of the 35 households interviewed sell their produce of modern vegetables in town or in the village centre, while 2 sell at the farm-gate. 4 out of the 5 households had sufficient data on their marketing labour effort.

## 6.3.4 Preserved Wild and Traditional Vegetables for the Dry Season

Households were asked to list the number of pails per leafy vegetable type dried during the wet season to keep for the dry season. The value was totaled between wild and traditional vegetable to determine how many 20L pails per capita were dried on average (Tables 6.2.8a-b). Commonly dried vegetables are listed in section 6.1.4. Traditional cucumber fruit and sweet potato root are also ubiquitously dried, though excluded from this sample set of just leafy vegetables.

Respondents described the difficulty in knowing how many hours a week they take to gather wild vegetables. The gathering of wild vegetables can be specific or generalized regarding species of vegetable collected and the area that they are collected in. Collection can be sporadic as and when the rains prompt a crop to emerge, or routine. Collection may also be a search in general for whatever is available or dedicated to looking for a certain kind of wild vegetable, especially for medicinal purposes. It is for this reason that the labour effort for the production of dry vegetables could not be surmised and included in the values for Tables 6.3.1bi-ii and Tables 6.3.7a-b.

### Between Wild and Traditional Cultivated Dried Vegetables

The majority of vegetables dried are for consumption purposes rather than medicinal purposes. Villagers did not explicitly describe a preference between either wild or

traditional cultivated dried vegetables. Many vegetables can be eaten in isolation or in combination to make *mlenda*. Both villages consume marginally more traditional vegetables than wild vegetables in total (Tables 6.2.3a-c), though the output of dried traditional vegetables was greater than the output of dried wild vegetables in both villages (Tables 6.3.9a-b). It appears that wild vegetables are more often consumed as fresh, rather than dried.

### Between Mwambegwa and Mwakaluba

Respondents in Mwambegwa overall save more than double the amount of dry vegetables compared with respondents in Mwakaluba (Tables 6.3.8a-b). This was described by respondents as reflecting the general characteristics of the environment in Mwakaluba permitting vegetables to be more available throughout the wet and dry seasons such that it is not necessary to dry vegetables.

**Table 6.3.8 Output of Dried TVs and WVs/ capita in 20L pails**

| Output | 6.3.8a Mwambegwa | | | 6.3.8b Mwakaluba | | |
|---|---|---|---|---|---|---|
| | Sample Size* | Mean (Hours) | Standard Deviation | Sample Size* | Mean (Hours) | Standard Deviation |
| TOTAL TV Pails per capita | 32 | 1.9193 | 1.4688 | 34 | 0.9318 | 0.6291 |
| TOTAL WV Pails per capita | 28 | 0.5234 | 0.5279 | 34 | 0.4148 | 0.3247 |

## 6.4 Production Stresses

Tables 6.4.1a-b rank farmers' concern for abiotic and biotic stresses during production. These complications are factors which were reported as leading to the greatest output losses each growing season and were asked near the beginning of the interview to preface questions about production methods. Tables 6.4.2a-b refers to factors which limit

agricultural activity and growth from season to season. This was the last question asked in the interview for an overall reflection of general production constraints. While pests and diseases are immediate concerns, long-term concern lies with water resources limiting expansion.

### 6.4.1 Short-Term Concerns: Pest Outbreaks

In the short-term, primary production stress was highly contested between drought and pests, such as aphids, the American bollworm, and catworms. Next of concern are plant diseases, especially late blight, which affect fruiting vegetables, rather than leafy vegetables the most. According to farmers, MVs such as tomatoes and African eggplant are the most affected by pests and require the most attention to control an outbreak. 20 farmers of modern vegetables out of a sample size of 33 in Mwambegwa control pests using chemical pesticides, whereas the usage is only 8 out of 34 farmers for traditional vegetables. However, inadvertent application may occur due to intercropping with cash crops, which regularly receive pesticides. Pest outbreaks are reported by focus groups and respondents as increasing among all traditional vegetables and affecting modern vegetables the worst, especially in the past five years which is when modern vegetable agriculture was also adopted.

Many farmers are at a loss controlling these outbreaks by either changing pesticide according to whichever brand the government Agricultural Field Officer recommends that season, or selecting the brand there is a government subsidy for. Common brands are *Ramdex* and *Firstex*. Few farmers are equipped to get off the pesticide treadmill or see the danger in becoming reliant on them.

The alternative that the most successful farmer in Mwambegwa, Emmanuel Madirisha, employs is to concoct his own pesticide formula using neem tree leaves, hot peppers, and a small bar of soap. He has also had success with making his own fertilizer out of fermented vegetation waste to supplement manure applications. He applies both homemade supplements to all of his crops. Despite his success, other villagers are not keen to abandon chemical inputs. As TVs are primarily intercropped with maize, which routinely receives pesticides, it is possible that TVs are victims of an unintentional push-pull strategy.

### 6.4.2 Long-Term Concerns: Water Scarcity

When asked why he mentioned water as his greatest concern for agriculture, Saka Sogosogo of Mwakaluba plainly stated that there are solutions for every agricultural stress, except drought. To paraphrase his words, there are pesticides and fungicides to tackle biotic stresses, but money cannot buy the rain. Instead, when asked what they considered as limiting factors to production, the leading answers pertained to water resources.

Overall, limited water availability is the chief issue that prohibits more vegetable production throughout the year. Vegetable production is kept at a minimum for seven months from May until December while most of the precipitation falls from January to March. During the dry months, water is harvested from holes dug up to 9 feet deep in dry river channels. Hauling this water for agricultural purposes is labourious and time-consuming even if farms are situated close to dry river channels. Only two households in Mwambegwa own diesel powered water pumps that save the labour of hauling water from

dry river channels to fields. During the wet season, when rain does not fall according to the expected watering schedule, households must similarly manually irrigate.

Farmers in all four villages visited agreed that rainfall has steadily declined over the past decade and that rainfall in the 2010/2011 season was almost as poor as it was in 2005, the driest year in recent times. The older farmers in focus groups noted that over 10 years ago, *vuli* rains used to begin in October, and the *masika* would end in May. Now the rains are expected to last from December to April, shortening the growing season. Accommodating expanding vegetable productive land area or plant productivity is a challenge in Meatu, already facing water scarcity compounded by competing uses for agriculture, household water needs and livestock water requirements.

**Table 6.4.1 Ranked Production Stresses**

| 6.4.1a Mwambegwa | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Ranking** | **Sample Size** | **Pests** | **Drought** | **Disease** | **Technical Knowledge** | **Weeds** | **Environmental Degradation** |
| **1st** | 35 | 23 | 9 | 3 | 0 | 0 | 0 |
| **2nd** | 35 | 10 | 9 | 15 | 1 | 0 | 0 |
| **3rd** | 30 | 2 | 10 | 15 | 0 | 2 | 1 |

| 6.4.1b Mwakaluba | | | | | |
|---|---|---|---|---|---|
| **Ranking** | **Sample Size** | **Pests** | **Drought** | **Disease** | **Weeds** |
| **1st** | 34 | 21 | 8 | 4 | 1 |
| **2nd** | 32 | 8 | 16 | 7 | 1 |
| **3rd** | 11 | 3 | 1 | 7 | 0 |

**Table 6.4.2 Limiting Factors to/ Solution for Agriculture**

| 6.4.2a Mwambegwa | | | | |
|---|---|---|---|---|
| **Limiting Factor** | **Solution** | **Number** | **Total Category** | **Sample Size** |
| Water | Water Pump | 7 | 10 | 14 |
| | Dam | 3 | | |
| Pests | Pesticides | 2 | 2 | |
| Land | More land | 1 | 1 | |

| | | | | |
|---|---|---|---|---|
| Ignorance | Education | 1 | 1 | |
| | | | | |
| **6.4.2b Mwakaluba** | | | | |
| **Limiting Factor** | **Solution** | **Number** | **Total Category*** | **Sample Size** |
| Water | Lack of Water | 6 | 17 | 31 |
| | Water Pump | 11 | | |
| | Dam | 0 | | |
| Production Factors | Insufficient Land | 7 | 13 | |
| | Tractors | 3 | | |
| | Oxen | 3 | | |
| Pests | Pests | 5 | 10 | |
| | Lack of pesticides | 5 | | |
| $ | Lack of Access to Capital | 2 | 3 | |
| | Lack of Market | 1 | | |
| Climate | Climate | 1 | 1 | |

*The number of responses outnumbers the village sample size as the respondents in Mwakaluba listed more than one limiting factor for their agriculture.

# 7. Considerations for Potential Partners from Respondent Feedback

During the course of focus groups and the household interviews over one month, several observations about production patterns and production capabilities stood out. Firstly, although the climate is harsh and not generally suited to agriculture, farmers in the rural areas demonstrated a tremendous capacity for production. Secondly, rainfall during the wet season is significant and many areas are subject to flooding. Comments from many farmers expressed affirmation about these observations that have many opportunities for local government and local organizations to engage with communities in sustainably developing Meatu's liveability and agricultural potential.

**Increasing Access to Markets**

Several farmers in Mwambegwa, Mwakaluba, and Mwakasumbi noted the output of traditional vegetables sometimes exceeded their needs. While many households expressed dismay about low maize harvests over the past few years, however, there was little concern over vegetable stores running out; very few reported ever being in want of vegetables during the dry season. The vegetables that had the highest reported occurrence of over-production were traditional cucumber, pumpkin and *lisegwe.* The leaves of those vegetables are readily preserved, but drying the fruit proves more difficult. Improving the efficiency of drying facilities for increasing the retention of nutritional values is an important consideration as much nutritional content is lost through traditional solar drying methods (Mulokozi & Svanberg, 2003).

At first glance, the reported high production of traditional vegetables countered the narrative of poor production capacity in semi-arid regions of Shinyanga province, but villagers were certain that if there was a market for traditional vegetables, they would surely have supply by which to generate income from lower labour effort compared with cotton or maize. Promoting the use of traditional vegetables in producing and consuming communities can help this. Importance can be conferred on traditional vegetables by providing services to farmers typically associated with modern vegetables such as making high-yielding traditional vegetable seeds available or including them on seminars on increasing vegetable output. Education among consumers of the nutritional values of traditional vegetables in comparison with modern vegetables can also promote their use.

As for vegetable marketing, leafy vegetables would not survive travel over long distances to national markets, though, regional and provincial markets are a consideration. Aggregating dried vegetables stores for emergencies and periods of low harvest is a potential use for the excess produce within wards and other communities. In addition, as Western markets increase their knowledge of the nutritional values and uses of traditional vegetables and wild vegetables, an overseas market could in the long term emerge. As it stands, Western food markets commonly incorporate dried vegetables for soup bases, confectionary and pet food (SME Competitiveness Facility, 2008). Access to markets for all vegetable types could benefit from improved market linkages and responds to calls to create an enabling environment for promoting pro-rural economic growth in a way that promotes biodiversity, conservation and food security (Will, 2008).

**Water Storage Facilities**

Villagers in Mwambegwa and Mwakaluba listed water availability and accessibility as the top factor limiting their production as described in Table 6.4.2. It is also one of the most labour intensive activities in production. Cost effective water storage or ergonomic water gathering equipment would have tremendous social impact and positive impact on production.

There are experiments with water storage and gathering initiated by the Meatu Agricultural Field Office as well as by a few farmers. An interview with Agricultural Field Officer for Mwanhuzi, Hamis D. Mshana revealed that his office is looking into solar powered water pumps to assist with dry season agriculture. They are in the process of selecting a village for this pilot with the eventual hope that each village can have one such pump to replace the need for gasoline-powered water pumps. While this technology will have lesser variable costs from not requiring gasoline, it will be difficult to share this device among villages large in area and that have populations of less than 1500 people.[3] They also cost considerably more than what is currently available.

The District Field Office has also allocated 800 million TSh for the pilot of a dam in Mwaguila village. Construction is anticipated to be completed between 2012 and 2013. Centralizing water collection leaves the possibility of piped irrigation during the wet season and stretching out water availability through to some of the dry season. Such a large

[3] At the time of the 2002 census. Meatu District Commissioner's Office, 2002.

scale project is not feasible for individual villages or districts to engage with themselves, nor is it foreseeable to construct dams throughout the region. However, it may be more cost-effective to investigate water storage and collection on a smaller level whether it is within a sub-village or even between neighbours, especially as most survey respondents mentioned flooding as a common occurrence by their fields or households.

One farmer in Mwambegwa has experimented with water collection facilities on his own farm for a few years and in the dry season of 2011 was working on digging a larger series of trenches and irrigation channels. He intends to use this to harvest rainwater in the wet season and also to tap into ground water sources to keep for drier periods. The soil mounds surrounding the entrance of the ditch will filter acidic and saline substances from contaminating the water source. He tried to enlist the partnership of other farmers in the community to no avail, though he hopes that after seeing his success, they will follow suit.

**Long-Term Sustainability through Reforestation**

Phoebe Marco, a member of a household in Mwambegwa offered a simple, yet ambitious goal for improving the agriculture of her area: to rehabilitate the land, soil and streams by reforesting it. According to her, the cycle of ignorance and poverty has led to the abuse of the land through deforestation to clear land for raising cattle and for making charcoal. Her solution echoes the work of 2004 Nobel Peace Prize winner Wangari Maathai whose Green Belt Movement combined an environmental conservation with capacity building and community-based development, starting with reforestation by rural women.

# 8. Conclusions

The respondents in the household surveys and focus groups have described their consumption preferences of vegetables and revealed the labour and monetary inputs involved in production of these vegetables. Determining factors for their preferences and practices are neither simply dictated by economic return nor large production yields. Farmers make a decision to rationalize their labour hours and input costs for production against the predicted value of their output as well as their needs.

Farmers in Meatu value the ties to their heritage through the traditional knowledge associated with the foods that they grow and collect. They value food that can be used in different ways to suit dietary needs and that can be preserved for consumption over long periods of time. Income generating potential is also of significance.

Modern vegetables are seen as an occasional food when it can be afforded, suitable to compliment meat and vegetable dishes. Traditional and wild vegetables are viewed as multi-purpose, dependable and resilient to the environment. For these reasons, while personal tastes shift to incorporate more modern vegetables into local diet and household income-generating strategy, traditional and wild vegetables will persist in consumption and production habits of Meatu households.

From discussions in focus groups and personal interviews, all accounts conclude that most households in the rural villages of Meatu grow traditional vegetables and collect wild

vegetables. The value of traditional vegetable output offers higher returns to input costs and labour hours needed for production and marketing compared with the value given by modern vegetables. While there is capacity to expand production of growing traditional vegetables, villagers aspire to become adept at growing modern vegetables and use chemical inputs to achieve results. Modern vegetables are an income-generating solution as they have a short production period and high marketability compared with their other options even though they are more difficult to grow and maintain. Chemical inputs are seen as a means to control output and not fully depend on environmental conditions throughout the year.

Between the villages visited, each maximizes the potential from their location and environmental characteristics. Mwambegwa, which has close proximity with town centres, make the most of its access to markets and generates household income by selling vegetables there in addition to its cotton and maize cash crops. Mwakaluba, with higher relative precipitation expends less labour hours on its crops and enjoys higher overall crop yields, reducing the need to diversify its income through selling vegetables. Both villages maintain the importance of traditional vegetables for their consumption and production during both frugal and plentiful seasons.

The main challenges to agriculture in Meatu remain to be water availability limiting production potential as well as agricultural pests destroying crops. Climate change is pronounced in changing rainfall schedules over the past decade putting pressure on rural farmers to produce more during a short growing season. In attempting to maximize their

shortening growing seasons by using chemical pesticides, villages are on the pesticide treadmill.

Vegetable consumption, production and marketing habits are changing in Meatu as climate change continues and eating habits increase in diversity. Traditional and wild vegetables are the vital source of nutrition in Meatu diets and central to the lifestyle. Modern vegetables are increasing in their importance for income generation. Both sustain households such that they can increase savings in the form of purchasing more livestock or apply their savings on education for their children. Traditional vegetables have the potential to increase their importance to household income generation if farmers are given the incentive to expand their production and given the opportunity to market these nutritionally dense crops.

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# Appendix 1: Participatory Action Plan for Second Stage Focus Group Dialogue

## Target areas for discussion

**Focus groups of 5 to 7 people will be categorised by gender, and wealth & well-being ranking, determine from the First Stage. A total of 6 focus groups will be met with.**

**Area #1: Identification and Consumption**
To identify the species and varieties cultivated and gathered by households; popularity; preferences; habits; availability

**Area #2: IV Cultivation and Production**
To identify important basic aspects of production; scheduling; stresses; yields; gender-based and household member roles

**Area #3: IV Marketing**
To identify basic household marketing activities; gender and household member roles; effects on incomes

## Focus Group Activities

The facilitator will first, introduce the purpose of the meeting and attempt to foster an atmosphere of mutual respect and sharing. To break the ice, visualisation activities will be conducted with the posture of the facilitator as the learner and the focus group participants as the expert. An exercise such as social mapping or resource mapping can involve all potential focus group members and provide a comfortable starting place for the rest of the discussion.
The result of these activities will provide a visual reference for daily activities and responsibilities as revealed by focus group participants.

The visualisation methods may act as a catalyst to discuss the rest of the discussion topics in a semi-structured interview (SSI) format. Themes for conversation have been drawn from Appendix 2 for the researcher to be aware of, and not used as a checklist. The purpose of the SSI is to allow community members to discuss what they feel is important about the production of their traditional vegetables through revealing their actions.[4] Three questions will be used to begin the SSI :

- What are you growing now?
- What was it like the past?

[4] (Pretty, Guijt, Thompson, & Scoones, 1995)

- What will you do in the future?

Visualisation methods may alternatively, serve as the primary vehicle to gain knowledge of the target areas.

Possible visualisation activities include:
Participatory census; Mapping of the village and surrounding areas which are relevant for cultivation and gathering; Geographical transects or farm profiles; Seasonal/ monthly diagramming (cropping calendars, labour, irrigation schemes, agricultural restraints); Mobility maps; Daily activity profiles; Crop preference ranking matrix; Forcefield analysis; Trend analysis; Spider diagrams.

## Focus Group Framework

| INDIGENOUS VEGETABLES | | | |
|---|---|---|---|
| **TARGET AREA** | **TOPIC** | **QUESTIONS** | **POSSIBLE VMS** |
| **Area #1: Identification and Consumption** | To identify the species and varieties cultivated and gathered by households | - What IVs are available in the area?<br>- What IVs do you cultivate?<br>- What are favourable traits of IVs?<br>- What are the most popular IVs (Rank AMAP) | - Geographical transects of cultivated land or area where gathering occurs<br>- Farm profiles<br>- Matrix scoring |
| | Consumption practices | - What IVs were consumed in your household yesterday?<br>- What are they consumed for?<br>- How often do you consume IVs?<br>- How do you prepare it?<br>- Are there any taboos for these IVs? | - Timeline/ Historical profile<br>- Visual ranking<br>- Matrix scoring (scale, either/ or) |
| | Changes over time | - How has consumption preferences changed over the past 20 years?<br>- How has IV availability changed over the past 20 years? | - Historical profile/ Timeline |
| **Area #2: IV Cultivation and Production** | To identify important basic aspects of production by the household | - Where are the IVs cultivated/ gathered?<br>- What land is considered good for cultivation?<br>- What is the cropping calendar?<br>- What is the irrigation schedule?<br>- What is the fertilization schedule?<br>- Are they grown regularly or ad-hoc?<br>- What are the negative production aspects of each IV | - Mapping<br>- Seasonal diagramming<br>- Matrix scoring<br>- Forcefield analysis |

| | | | |
|---|---|---|---|
| | | species and variety?<br>- What are the positive production aspects of each IV species and variety? | |
| | Harvesting | - How much land is allocated for IVs?<br>- When and how often are harvests?<br>- Describe yields throughout the year.<br>- What biotic and abiotic stresses are common? | - Seasonal diagramming<br>- Mobility map |
| | Participation | - What responsibilities are there for production?<br>- How long do these responsibilities take?<br>- Who in the household is responsible for it?<br>- Are there shared responsibilities with other households? | - Activity profiles (Daily/ weeklong)<br>- Spider diagrams |
| | Changes over time | - How has rainfall changed over the past 20 years?<br>- How have pest and disease stresses changed over the past 20 years? | - Historical profile<br>- Trend analysis |
| **Area #3: IV Marketing** | To identify basic household marketing activities | - How much of the harvest is marketed?<br>- What is sold?<br>- Where is it sold?<br>- How many days are allocated for sales? | - Mobility maps<br>- Seasonal diagramming |
| | Household and livelihood impact | - How do prices change throughout the year?<br>- What affects the price of IVs?<br>- How much household income comes from sales? | - Seasonal diagramming<br>- Forcefield analysis<br>- Pie chart<br>- |
| | Participation | - What are the responsibilities?<br>- Who in the household is responsible for the tasks? | - Activity profiles (Daily/ weeklong)<br>- Spider diagrams |

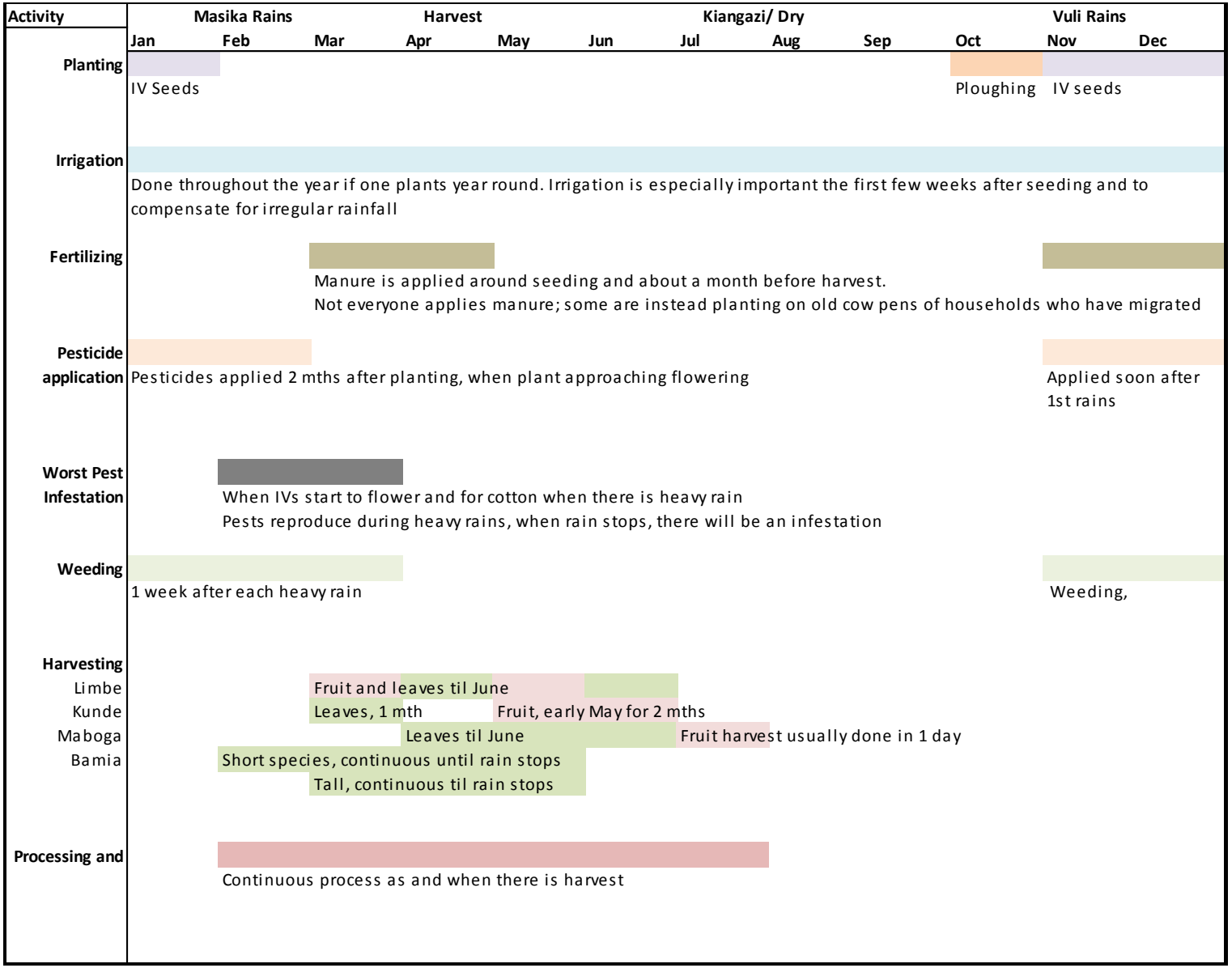
## Time Needed

120 - 180 minutes

## Materials Needed

Locally available items: Paper, coloured pencils, cards.

# Appendix 2: Cropping Calendar



# Appendix 3: Guide to Common Vegetables in Meatu with Descriptions

General note: The affix "ma-" denotes plurality in naming. All photographs are taken by the author.

## A3.1 Wild Traditional Vegetables

25 most commonly used varieties of 22 species identified.
Notes: Table of wild traditional vegetables whose leaves and some other parts are consumed as vegetables. Wild vegetables are typically not marketed, so prices are not available.

**A3.1 Wild Traditional Vegetables In Meatu, Shinyanga**

| English | Scientific Name | Swahili | Sukuma | Availability | Medicinal Use | Description and Notes |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Amaranth (Wild)** | Amaranthus spp. | Mchicha pori | Mohga | From first rains to late April, scarcely distributed during dry season | Y | White-green broad leaves, bitter tasting, closely spaced; stalk also white-green; black seeds ; light-green inflorescence; grows portrait style |
| | Amaranthus spp. | Mchicha pori | Makakwangazoka | From first rains to late April, scarcely distributed during dry season | Y | Leaves are narrow and have a blend of green-yellowgreen-red tipped leaves attached to stalk; very red stalk; seeds black; red inflorescence; grows portrait style |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Blackjack** | Bidens pilosa | Mashona nguo/ kishona nguo | Malamata | Early rainy season | Y | Grows erect, with several branches, compound leaves are purple-green, growing in groups of 3 with scalloped edges; has small yellow flowers with white outer rays; fruit have black and yellow-tipped bristles which can catch onto fur and clothes to aid dispersal - these fruit extend the highest above the flowers. Leaves and young shoot are consumed |
| **Home Lettuce** | Sonchus luxurians | Mchunga | Lusunga | Wet season | Y | Grows erect, leaves are very narrow with sparse narrow lobes almost extending at right angles; flowers are yellow with narrow petals, has white wooly inflorescence clusters below yellow flowers; bitter leaves with milky sap eaten as vegetable in some areas; used to treat malaria; common fodder plant |
| **Jute Mallow** | Corchorus olitorius | Bunani/ Lubambe | Ibubila | Early December to late May | Y | Grows erect with thin stalk; green narrow leaves grow sparsely interspersed on stalk; fruit capsules are smooth and grow in clusters throughout the stalk with a pointed tip |
| | | | Makonda | All year round | Y | Grows erect on a single stalk with very narrow green leaves sparsely distributed; has purple tubular flowers with white outer lip, flower has 5 sepals; fruit capsules are narrow also with 4 deep grooves and have a triangular beak; eaten in mlenda daily |
| **Kubita** | | | Kubita | Nov to Jan | N | Looks like Kwaanza; grows portrait style; leaves are narrow; absence of spikes; has small inflorescence like amaranth and has small round fruits; can be added to mlenda |
| **Kwanzaa** | | Kwanzaa | Kwanzaa | From first rains to late April | N | First to emerge after the rains, hence the name meaning "first"; leaves look like onion leaves and are very short; severely affected by climate change and currently very difficult to find in Bulyashi, increasing difficulty in Mwambegwa, not well-known in Mwakaluba |
| **Lundunta** | | | Lundunta | Dec-Jan | N | Grows as a cover plant; has leaves like cowpea, no spikes |
| **Makorongoma** | | | Makorongoma | Beginning Sep to end of May | N | Leaves can be used in mlenda |
| **Maguruyanhanga** | | | Maguluyanghanga/ magulugangha nga | Feb-April | N | Ground cover, grows like traditional cucumber on a thin vine with no spikes, fruit or flowers. Has leaves like cowpea and cooked in the same way - boil for about an hour, or dry then store; or fry and add to stews |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Mkwaju** | | Mkwaju | Bushishi | | N | Leaves are used during famines when there is nothing else to eat. Add groundnuts to boiled leaves |
| **Ngalagahisanga** | | | Ngalagahisanga | Feb-April | N | Grows creeping style; leaves are like sweet potatoes, smooth though stiff leaves; oval/ eye shaped, not more than an inch long; grows on a thick branch extending from thick trunk |
| **Punching Vine** | Tribulus terrestris | Mbigili | Shokoro | Nov to Dec | N | Grows as a cover plant with a thick vine, thick as a groundnut; branches have thorns, leaves are very small, half the size of grape seeds; vine has short thorns few mm in length |
| **Puze** | | | Puze | Nov-Dec | N | Grows as a bush with many branches up to a metre; has no thorns; leaves are like that of tagwasa, small and rounded at end; used in mlenda |
| **Sanangombe** | | | Sanangombe | Oct to Jul | N | Leaves are dark green and broad like Mohga though longer and with spikes on leaf edge and midspine; has thin stem; looks like rice paddy grain; harvested when immature |
| **Songha** | | Masongha | Masongha | From first rains to about May | Y | Grows portrait style as a bush; leaves are used as a vegetable |
| **Spider Plant/ Flower (Cat's Whiskers)** | Cleome gynandra | Mgagani | Mgagani | When rain starts to about May | Y | Leaves can be used medicinally to treat diarrhoea, especially in children; grows especially well in highland areas; subject of current research in part due to its quinine content having potential to treat malaria |
| **Ndagwasa/ Ntagwasa** | | Mkole | Ndagwasa | All year round | Y | Mentioned in Mwakaluba; consumed during times of very low food source; can be cooked in mlenda mix; possible multiple medicinal purposes; grows as a bush; small narrow light green leaves (0.5x2cm) grow directly on main branches |
| **Traditional Cucumber (Wild)** | Cucumis angularia or Marah macropcarpus | Matango pori | Limbe lugulu | All year round | N | Leaves are popular to gather and eat and keep dry for dry season; leaves are furry and slightly maple shaped; stems have small spikes; vine has small spikes; LSV is lightgreen; fruit is lime green to yellow with thin bristle spikes; creeps along the ground |
| | | Matango pori | Gasalasala | All year round | N | Leaves are green thick and furry, with spikes on underside spine and fringe of leaves; vine also has little spikes; fruit is lime green with waxy skin, rounded spikes; grows as a ground vine; not first choice vegetable, leaves can be used in mlenda and fruit is not consumed |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Twegay** | | | Twegay | All year round | N | Looks like a short jute mallow, up to 12" tall, leaves 2 inches long, 1/4 inch wide like tagwasa; cooked in mlenda |
| **Upuna** | | | Upuna | Jan-Mar | N | Grows as a ground cover; leaves are smooth and look like sweet potato variety: Masagala, leaves are small and heart shaped; has white flowers which resemble that of cotton flower; roots are used as traditional medicine for stomach aches |
| **Wild Pumpkin** | | | Mayoba Poli | | N | Only leaves are consumed. Leaves are very big, larger than the size of the pumpkin itself and are striped |
| **Zenzela** | | | Zenzela | Dec to early May | N | Grows as a ground cover; leaves are iridescent and shape is like lobed sweet potato leaves; no spikes or flowers |

Figure A3.1a Makonda variety of jute mallow

Figure A3.1b Gasalasala variety of traditional cucumber

Figure A3.1c Makakwangazoka variety of wild amaranth

# A3.2 Cultivated Traditional Vegetables

15 of the most commonly used varieties of 5 vegetable species identified.
Notes: Pails have the capacity of 20L; 1 trailer is equivalent to 34 pails; Sacks are 100kg maize or cotton sacks.

- In Mwanhuzi, dry vegetables, whether mlenda mixes or single vegetable types are sold for about 100TSh per 150ml cup portion. In general, bunches of traditional vegetables are sold for 200TSh in the wet season and 300TSh in the dry season. The prices may vary up to 100TSh less when sold in villages or at the farm gate compared with sales in the town centres such as Mwanhuzi or Mwakaluba.
- The descriptive names of the vegetable varieties in Kiswahili often revealed descriptive characteristics which may be most valued to farmers (Van Dorp et al., 1993, in Keller, 2004).

| A3.2 Cultivated Traditional Vegetables In Meatu, Shinyanga | | | | | | |
|---|---|---|---|---|---|---|
| **English** | **Scientific Name** | **Swahili** | **Sukuma** | **Market Price** | **Harvest Duration** | **Description and Notes** |
| | | | | | | |
| **Cowpea** | Vigna unguiculata | Kunde inayotaamba | Shiri dundugala | 1kg = 1000 TSh | Peas harvested around May-June | This variety grows as a ground cover; the pea can be stored for about 1 year before insects infest the lot |
| | | Kunde isiyotaamba | Shiri kindika (nghulu/ mnhila/ yabulande) | | | This variety grows portrait style |
| **Cowpea Leaves** | | | | 1 bunch = 200 TSh | Leaves harvestable in March | Leaves can be consumed fresh or dry and can be used in mlenda |
| **Okra** | Abelmoschus esculentus | Bamia fupi | Bamia nguhi | 8000-10000/ pail; 1 heap = 300 TSh (Mwanhuzi) | Harvestable around mid-February until ~ May | Short, early maturing variety; best for frying |
| | | Bamia ndefu | Bamia ndihu | | Harvestable in March until ~ May | Long, skinny variety |
| **Pumpkin** | Cucurbita moschata | Maboga habi | Mayoba mahabi | Large fruit, 12-15", nyang'wanga, | Fruit is harvestable during May and June | Plain skin variety; fruit is supposed to be not as sweet as the striped skin variety, though leaves are better aroma and taste |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Maboga maboga | Mayoba | about 1000TSh; price differs based on size (Mwanhuzi) | | Striped skin variety; fruit is supposed to be sweeter than the striped skin variety, though leaves are not preferred |
| | | Maboga mumunye | Mayoba itanga | | | Fruit has a oval shape, seeds are often roasted like peanuts |
| | | | Mayoba habi dihu | | | Plain skin, with dark leaves, long fruit |
| | | | Mayoba moli/ mori | | | Fruit can be kept for up to a year if in dry and dark conditions with stem still attached. Pumpkin had very local terminology with much debate and discussion regarding the naming depending on physical characteristics; Generally understood that Mayoba = Moli = Nyang'wanga |
| **Pumpkin Leaves** | | Msusa | | 1 bunch = 200 TSh | Leaves are harvested around March-April until June | Leaves can be consumed fresh or dry and can be used in mlenda |
| **(Squash)** | | | Masindi/ Lisegwe | It is not sold | Over 1 day in June | Possibly a variety of squash; fruit looks like plain skinned pumpkin, leaves are like smaller watermelon leaves, some varieties have many white stripes while some others have none, leaves are very soft with little hairs/ fur; only the fruit is consumed; usually is intercropped with maize during the wet season unless irrigation is possible in dry season |
| **Traditional Cucumber** | Cucumis sativus | Matango tamu | Limbe mholo/ nono | About 3000/pail; 1 fruit = 100 TSh; 30 fruit/ pail | Fruit harvestable around March until about June | Sweet variety; fruit can be stored for about a week and is usually sun-dried for preservation |
| **Traditional Cucumber Leaves** | | | | 1 bunch = 200 TSh | Leaves harvestable around March ~ June; every 2 weeks | Leaves can be consumed fresh or dry and can be used in mlenda; eaten in mlenda daily |
| **Traditional Cucumber (Bitter)** | | Matango chungu | Limbe lolo/ ndolu | | From the wet season until the first half of the dry season | Bitter variety of fruit is not consumed. Leaves are consumed fresh typically in mlenda |

Figure A3.2a A heap of okra and a bunch of pumpkin leaves

Figure A3.2b Traditional cucumber

Figure A3.2c Mlenda mix of dried traditional cucumber leaves and other vegetables

## A3.3 Cultivated Modern Vegetables

17 varieties of the 11 most commonly used species identified.

| A3.3 Cultivated Modern Vegetables In Meatu, Shinyanga | | | | | |
|---|---|---|---|---|---|
| **English** | **Scientific Name** | **Swahili** | **Sukuma** | **Market Price (Mwanhuzi)** | **Description and Notes** |
| | | | | | |
| **African eggplant** | Solanum aethiopicum | Nyanya chungu | | 1 heap of 5 = 200TSh | The fruit of this variety is just like a tomato apart from its oval-shape and colour which ranges from pale yellow to red |

| | | | | | |
|---|---|---|---|---|---|
| **Amaranth (Modern)** | Amaranthus cruentus | Mchicha mchicha | Mchicha yabatungua | 1 bunch = 200TSh | Literally: Prisoner's amaranth as it is the easiest vegetable to grow and serve; long red stem with green leaves; very marketable; considered a modern variety |
| | | | Mchicha yape | | White-ish stem with light green leaves; grows portrait |
| | | Mchicha wa wapemba/ Mchicha Zanzibar | | 1 bunch = 200TSh | White-green stem with narrow, green leaves which are spaced closely; grows like a bush, many branches extending from central branch; tufts are light green; seeds are grey/ pale named after an ethnic group on Zanzibar |
| **Amaranth - Maadira 1** | Amaranthus spp. | Mchicha bangi | | 1 bunch = 200TSh | Light green stem with light green leaves, leaves are long but thin; from Iringa region according to Emmanuel Madirisha; AVRDC says origin is Zimbabwe; grown by 1 farmer in Mwambegwa, was not popular as it was a new variety |
| **Cabbage** | Brassica oleracea | Cabbagi | | 1 = 500 TSh | Copenhagen and drumhead varieties grown |
| **Cassava Leaves** | Manihot spp. | Kisamvu | Gabeya | 1 bunch = 200 TSh | Grown by few farmers, roots not commonly eaten |
| **Eggplant** | Solanum melongena | Biringania | | 1 fruit = 100 TSh Depending on size, Pail = 30-40 fruit | |
| **Onion** | Allium cepa | Vitongu | | 1 pail = 15000 TSh; 1 heap = 200 TSh | Very profitable vegetable as it is very easy to market; few farmers can afford the startup inputs and dedicate enough time for the maintenance of the crop |
| **Tomatoes** | Solanum lycopersicum | Nyanya | | 1 heap = 200 TSh; Mwanhuzi: 1 pail = 7000-12000, average price 9000; Mwandoya: 1 pail = 5000-8000, average price 6500 | Very profitable to grow as it is easy to market; usually the first modern vegetable farmers try to grow for personal use, and then for sales |
| **Spinach** | Spinacia oleracea | | | 1 bunch = 200 TSh | Common confusion in naming with a vegetable commonly referred to as “Chinese cabbage” |
| **Sukuma wiki** | Brassica oeleracea var. acephala | Sukuma wiki | Madoto mado/ Madoto matari | 1 bunch = 200 TSh | Grows as a leafy vegetable; introduced species; 1 variety has broad, dark green leaves; 1 variety has narrow, silver like leaves |
| **Sweet Pepper** | Capsicum annuum | Piri piri hoho | | 1 heap of abt 5 = 300 TSh. 40 heaps per pail ~ 12000TSh/ pail | |

| | | | | | |
|---|---|---|---|---|---|
| **Sweet Potato (Root)** | Ipomoea batatas | Viazi vitamu | Nhumbu | | Over 20 varieties in Bul & Mwambegwa; mechembe are sun-dried sweet potato chips that can be rehydrated and consumed as a starch |
| **Sweet Potato (Leaves)** | Ipomoea batatas | Matembele/ marando | | 1 bunch = 200 TSh | Matembele refers to leaves, marando refers to the vine. Leaves are eaten fresh and are not dried. Eating the leaves are a recent introduction and more common practice on the coast of Tanzania |
| | | Marando madogo | Marando madogo | | Narrow leaves/ lobes |
| | | Marando makubwa | Marando matale | | Broad leaves/ lobes |

Figure A3.3a A "heap" of African eggplant from the market


Figure A3.3b Mponela hado variety of sweet potato


Figure A3.3c Itege variety of sweet potato

## 3.4 Popular Vegetables With Medicinal Uses

10 varieties of the 8 most commonly used species with medicinal uses identified.

| 3.4 Popular Vegetables with Medicinal Uses in Meatu, Shinyanga | | | | | |
|---|---|---|---|---|---|
| **English** | **Swahili** | **Sukuma** | **Vegetable Part Used** | **Availability** | **Description** |
| | | | | | |
| **Amaranth (Wild)** | Mchicha pori | Mohga | Leaves | From first rains to late April; more difficult to find during dry season | Used to restore appetite after illness |
| | Mchicha pori | Makakwangzoka | Roots, or whole plant | From first rains to late April; can be found throughout much of dry season with less ease | Used for aches in les and head, as well as stomach ache. Boil the roots, or the whole plant if possible and drink. |
| **Blackjack/ Biden pilosa** | Mashona nguo | Malamata | Leaves | Early in the rainy season | Leaves are crushed for the juice and the pulp applied to cuts and wound as pain management and treatment |
| | | | Leaves | | Can be used as a medicine for stomach aches, intestinal worms, excessive stomach gas and recurring fevers |
| | | | Roots | | Can be used to treat constipation and malaria |
| **Home Lettuce** | Mchunga | Lusunga | Leaves | Wet season | Leaves boiled like tea and is used for malaria prevention |
| | | | Leaves and root | | Hot or cold tea from leaves and root is used for stomach upsets and fever |
| **Jute Mallow** | | Bunani/ Lubambe | Leaves | Early December to late May | Used to prevent deterioration of eyes |
| | | Makonda | Leaves | All year round | Used to prevent deterioration of eyes |
| | | | Leaves | | Used to soothe aches in legs, feet and stomach ache. Take dried, ground roots and boil with water |
| **Songha** | | Masongha | Leaves | From first rains to about May | Used to restore appetite after illness |
| **Spider Plant/ Flower (Cat's Whiskers)** | | Mgagani | Roots | From first rains to about May | Used for headaches, chest pain, joint pain and backaches, and for difficulties with breathing. Boil the roots from morning until night. Subject of current research in part due |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | to its quinine content having potential to treat malaria |
| | | | Leaves | | Used to treat diarrhoea in children and stomach ulcers |
| | | | Leaves | | Leaves are crushed and rubbed, to treat sores in the nose and ears. |
| **Ndagwasa/ ntagwasa** | | Ndagwasa | Roots | All year round | Used to help infertility in women. Take roots, dried and ground and mix in cold water. |
| **Upuna** | | Upuna | Roots | Jan-Mar | Used to help with stomach aches. Boil roots |

Figure A3.4a Ndagwasa branch

Figure A3.4b Blackjack (photographed in Arusha)

Figure A3.4c Spider plant

# Appendix 4: Optimum Seasonal Output Guide of Vegetable Production

## A4.1 Optimum Wet Season Output In Mwakasumbi, Northern Zone

**A4.1 Focus Group Results: Optimum Output per Season From a Half-Acre Dedicated Plot in Mwakasumbi**

| | Dried Leaves (sacks*) | Dried Leaves (equivalent in pails) | Unit Value | Total Value | Fruit | Fruit (kg) | Unit Value | Total Value |
|---|---|---|---|---|---|---|---|---|
| **Okra** | None | None | 10,000/ pail | 0 | 3 sacks | ~70kg each | 10,000/ pail | 180,000 |
| **Cowpea** | 3 | 18 | 10,000/ pail | 180,000 | 1 sack | ~100kg each sack | 16,000/ pail | 96,000 |
| **Traditional Cucumber** | 1 | 6 | 10,000/ pail | 60,000 | 2 sacks | | 2,000/ pail | 24,000 |
| **Pumpkin** | 6 | 36 | 10,000/ pail | 360,000 | 1.5 trailers | Each trailer measures 9x5x3.5 feet | Av 500/ fruit | 225,000 |
| **Masindi** | None | None | No market value | | 1 sack | | | |
| **Total (TSh)** | | | | 600,000 | | | | 525,000 |
| **Grand Total Value of Output** | | | | | | | | **1,125,000** |

*Sacks mentioned are 100kg sacks used to pack maize or cotton; have the capacity of about 6 pails; a sack of dried vegetables weighs approximately 20kg

| | Per Plant | Per 1/2 acre | Unit Value | Total Value | | | | |
|---|---|---|---|---|---|---|---|---|
| **Tomatoes** | 1/2 pail = 10L | 200 pails | 9,000/ pail | 1,800,000 | | | | |

## A4.2 Optimum Wet Season Output in Mwambegwa, Central Zone

| A4.2 Focus Group Results: Optimum Output/ Season From a Two-Acre Intercropped Plot** in Mwambegwa | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Dried Leaves (sacks)** | **Dried Leaves (equivalent in pails)** | **Unit Value** | **Total Value** | **Fruit** | **Fruit (kg)** | **Unit Value** | **Total Value** |
| **Okra** | None | 2 pails dried | 10000/ pail | 20,000 | 2 pails | ~16kg each | 10000/ pail | 20000 |
| **Cowpea** | 1 | 6 | 10000/ pail | 60,000 | 2 sacks | ~100kg each sack | 16000/ pail | 192000 |
| **Traditional Cucumber** | 3 | 18 | 10,000/ pail | 180,000 | 1 sack | | 2,000/ pail | 12,000 |
| **Pumpkin** | 1 | 6 | 10,000/ pail | 60.000 | 1/2 trailer | Each trailer measures 9x5x3.5 feet and carries about 250-300 fruit | Av 500/ fruit | 75,000 |
| **Masindi** | None | None | No market value | | 3 sacks | | | |
| **Total (TSh)** | | | | 320,000 | | | | 299,000 |
| **Grand Total Value of Output** | | | | | | | | **619,000** |
| | | | | | | | | |
| **A two-acre intercropped plot is typically less than a half-acre dedicated plot that the villagers of Mwakasumbi referred to | | | | | | | | |

## A4.3 Real Optimum Wet Season Output in Mwambegwa, Central Zone

| A4.3 Optimum Output/ Season From a Half-Acre Intercropped Plot in Mwambegwa. Actual Output According to a Key Informant | | | | |
|---|---|---|---|---|
| **Key Informant: Emmanuel Madirisha, Mwambegwa** | | | | |
| | **Fresh leaves (bunches)** | **Fruit** | **Unit Value** | **Total Value** |
| **Okra** | NA | 30 pails | 10,000/ pail | 300,000 |
| **Traditional Cucumber** | 100 | | 200/ bunch | 20,000 |
| **Pumpkin** | 200 | 1 trailer/ 300 fruit | Av 500/ fruit | 100,000 |
| **Total (TSh)*** ** | | | | **420,000** |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| ***Does not grow cowpea | | | | |
| | | | | |
| | **Per Plant** | **Separate 1/2 acre** | **Unit Value** | **Total Value** |
| **Tomatoes** | At best, 1 plant = 250 fruit = 1.75 pails of 20 L pails | 700 plants yield 400 pails | 9,000/ pail | 3,600,000 |

# Appendix 5: Traditional Vegetable Cooking Guide

Traditional vegetable cooking methods as described by women in a focus group from Mwakasumbi.

## Mlenda:

Essential vegetables for the dish to be considered mlenda are makonda, bunani, okra or twegay. Added items can include traditional cucumber leaves, wild traditional cucumber leaves and pumpkin leaves. When any or any combination of these items are prepared in the above manner, it constitutes Mlenda. Bunani itself may be prepared as mlenda with very little water making it suitable for periods of very low water availability.

1. Add fresh cut leaves to boiling water, cover and simmer for 2-5 minutes
2. Optional - Add crushed peanuts
3. Boil for another 2 minutes. If leaves are dry, longer boiling time may be required. (Dry leaves may be first ground and crushed into smaller pieces).

## Traditional Cucumber:

The cucumber can be eaten by itself, usually without the skin. It can be added to raw salads or cachumbali salad (tomatoes, onions, salt, seasoning). Cucumber seeds can be roasted for eating as a snack. Oil can also be extracted from the seeds using a sunflower seed press.

## Cowpea Leaves:

**Method 1.** Boil cut leaves in water for 30-60 minutes, add salt. Ready
**Method 2.** In a hot pan, fry for a few minutes, add crushed peanuts, then onion, fry for a few minutes, then tomato. Ready
**Method 3.** Dry leaves in the sun for a few hours, boil leaves until they are soft, leave it in the pot for a day. The next day, dry it in the sun (Cannot dry it straight away)

## Cowpea:

Can be cooked like maharagwe, common beans
**Method 1**. Remove skin by crushing with mortar as if maize; crush only enough to remove skins. Boil until almost soft, then, fry with onion and tomato
**Method 2.** Boil with skin, then, fry with onion and tomato
**Method 3.** Boil maize kernels for about an hour, and then boil the cowpeas for 30 minutes to make socotas porridge which is eaten in hard times

## Pumpkin Leaves:

**Method 1.** Boil leaves, then, fry with onion and tomato. Add peanuts at the end
**Method 2**. Can also complement samaki, dried fish, by frying with the pre-soaked fish

## Pumpkin:

**Method 1**. Boiled
**Method 2**. Peel skin of unripe pumpkin, cut into cubes, boil. Next, fry with onion and tomato, or, mix with blanched pumpkin leaves
**Method 3.** Boil seeds with pumpkin
**Method 4.** Mix sweet potato with pumpkin and boil together
**Method 5.** Roast seeds

## Lisegwe:

**Method 1.** Peel skin, cut small, boil, then, fry with onion and tomato
**Method 2.** Fry it plain or with onion and tomato

## Okra:

**Method 1.** Heat oil, fry onion, then, tomato until soft, then fry the okra for 5 minutes
**Method 2.** Prepare as mlenda

## Sweet Potato Leaves:

**Method 1.** Fry by itself with oil
**Method 2.** Heat oil, fry onions, and then tomatoes until soft, next fry with the sweet potato leaves for about 5 minutes