Sweetpotato in Tanzanian Farming and Food Systems: Implications for Research

Regina E. Kapinga, Peter T. Ewell, Simon C. Jeremiah,

and Robert Kileo

Tanzania National Root and Tuber Crops
and Farming Systems Research Programs
and the International Potato Center (CIP)

International Potato Center (CIP)
Sub-Saharan Africa Region
P.O. Box 25171, Nairobi, Kenya

Ministry of Agriculture, Tanzania
Department of Research and Training
P. O. Box 2066, Dar-Es-Salaam, Tanzania

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Abstract

This report synthesizes information gathered from nearly 900 farmers in surveys carried out between 1991 and 1993 in selected areas of Tanzania. The information obtained is intended to improve the relevance of research planning and priority setting for the increased production and marketing of sweetpotato. Sample areas were chosen to represent different agro-climatic zones, soil characteristics, topography, and socio-cultural conditions.

Sweetpotato is grown throughout Tanzania. Nationally, it is the third most important root and tuber crop after cassava and round (*Solanum*) potato. In national food production, it ranks fourth after maize, cassava, and beans. The crop plays an important role in household food security and is produced mainly for home consumption. It occupies approximately 14% of the total arable land of the farms surveyed. The crop is most important in the Lake and Eastern Zones, moderately important in Southern Highlands and Northern Zones; and less important in the Southern and Central Zones. Average yields of fresh sweetpotato storage roots are very low — a rough estimate of the mean yield at farm level is 5.5 tons per hectare.

Sweetpotato roots are primarily consumed fresh, most usually just boiled, although they are also roasted and used as an ingredient in some traditional dishes. Processing into sun-dried chips or slices, termed *Matoborwa* and *Michembe*, is common in the Lake Zone, but is completely unknown in the Northern Zone. Storage of fresh roots in pits is common in the Southern Highlands Zone. Leaves are used as a vegetable mainly in Central and Southern Zones, and as fodder in Northern Zone.

A major production constraint is the susceptibility of many of the varieties currently grown to sweetpotato weevils and diseases. Improved characteristics which farmers would like to see include: good root-cooking characteristics, extended in-ground storability, high market value, and drought tolerance. Major constraints limiting production in the order of importance mentioned by farmers include: sweetpotato weevils (*Cylas spp. and Blocyrus spp.*), drought, shortage of planting material, low root yield, vertebrate pests (moles, rats, pigs), viral and fungal diseases, poor market accessibility, storage pests (larger grain borers), and low soil fertility.

Sweetpotato is about equally likely to be grown as a sole crop or as an intercrop. Maize, cassava, and beans are the most common intercrops with sweetpotato. Harvesting is mainly carried out piecemeal, a few roots at a time, over an extended harvest period. Female farmers play a big role in sweetpotato production. Women contribute an average of 80% of the total labour in sweetpotato production, processing, and marketing activities.

A priority for research is the development of sweetpotato varieties with resistance to pests and diseases, high yields, and good root characteristics. Drought-tolerant varieties combined with early planting to avoid dry spells could alleviate widespread

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crop loss due to drought. Techniques in rapid multiplication of sweetpotato planting material should be extended to farmers and village extensionists for the sustainable and reliable supply of planting material. Post-harvest handling techniques should be improved to minimize losses. Diversified use of sweetpotato and the development of new products which use the crop as an ingredient would open up new markets, which in turn would be an incentive to farmers to increase productivity per unit area.

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Team members who participated in the survey and in report compilation are listed below by zone.

Lake Zone

S.C. Jeremiah - Tanzania National Root Crops Program, Ukiriguru, Mwanza.
R.E. Kapinga - Tanzania National Root Crops Program, Ukiriguru, Mwanza.
A. K. Nyango - Tanzania National Root Crops Program, Ukiriguru, Mwanza.
A. A. Murusuri - Tanzania National Root Crops Program, Ukiriguru, Mwanza.
C.K. Rugutu - Tanzania National Root Crops Program, Ukiriguru, Mwanza.
G. Kajiru - Tanzania National Farming System Research Program, Lake Zone, Mwanza.
C. Kalugaba - Tanzania National Farming System Research Programm, Lake Zone, Kagera
A. Ngaiza - District Agriculture and Livestock Development Office, Bukoba, Kagera

Northern Zone:

S.S. Kuoko - Tanzania National Horticulture Research Program, Hort Tengeru, Arusha.
J.S. Mbwambo - Tanzania National Farming Systems Research Program, Northern Zone, Arusha.
N.M. Meghji - Tanzania National Farming Systems Research Program, Northern Zone, Arusha.

Eastern Zone:

N.V.Chillosa - Dakawa Agroscientific Research Institute, Morogoro
A. Lipanda - Dakawa Agroscientific Research Institute, Morogoro
J.A. Zakayo - Dakawa Agroscientific Research Institute, Morogoro
L.B. Mbilinyi - Sokoine University of Agriculture, Morogoro.

E. R. Mgembe - Sokoine University of Agriculture, Morogoro.
M. Macha - Sokoine University of Agriculture, Morogoro.
F. Senkondo - Sokoine University of Agriculture, Morogoro.
K. Kivunge - Tanzania National Root Crops Research Program, Kibaha, Coast.
T. Leopold - Tanzania National Root Crops Research Program, Kibaha, Coast.
S. Tollano - Tanzania National Root Crops Research Program, Kibaha, Coast.

Southern Highlands Zone:

R.O.F. Mwambene - Tanzania National Root Crops Research Program, Uyole, Mbeya.
C.M. Mayona - Tanzania National Root Crops Research Program, Uyole, Mbeya.
C.M.A. Mwakyembe - Tanzania National Farming Systems Research program, Southern Highlands Zone, Mbeya.

Southern Zone:

E.E. Kanju - Tanzania National Root Crops Research Program, Naliendele, Mtwara.
A.S. Njapuka - Tanzania National Root Crops Research Program, Naliendele, Mtwara.
N.A. Katinila - Tanzania National Farming Systems Research Program, Southern Zone, Mtwara.

Central Zone:

L. B. Mbilinyi - Sokoine University of Agriculture, Morogoro
E.R. Mgembe - Sokoine University of Agriculture, Morogoro
M. Macha - Sokoine University of Agriculture, Morogoro
S.S. Kuoko - Tanzania National Horticulture Research Program, Hort- Tengeru, Arusha.
J.S. Mbwambo - Tanzania National Farming Systems Research Program, Northern Zone, Arusha.
N.M. Meghji - Tanzania National Farming Systems Research Program, Northern Zone, Arusha.

Report Compilation:

R.E. Kapinga - Tanzania National Root Crops Research Program, Ukiriguru, Mwanza.
S.C. Jeremiah -Tanzania National Root Crops Research Program Ukiriguru, Mwanza.
C. Mayona - Tanzania National Root Crops Research Program, Uyole, Mbeya
R. Kileo - Tanzania National Farming Systems Research Program, Lake Zone, Mwanza.
P. Makundi - Tanzania National Farming Systems Research Program, Lake Zone, Mwanza.
P. T. Ewell - International Potato Center (CIP), Nairobi, Kenya.

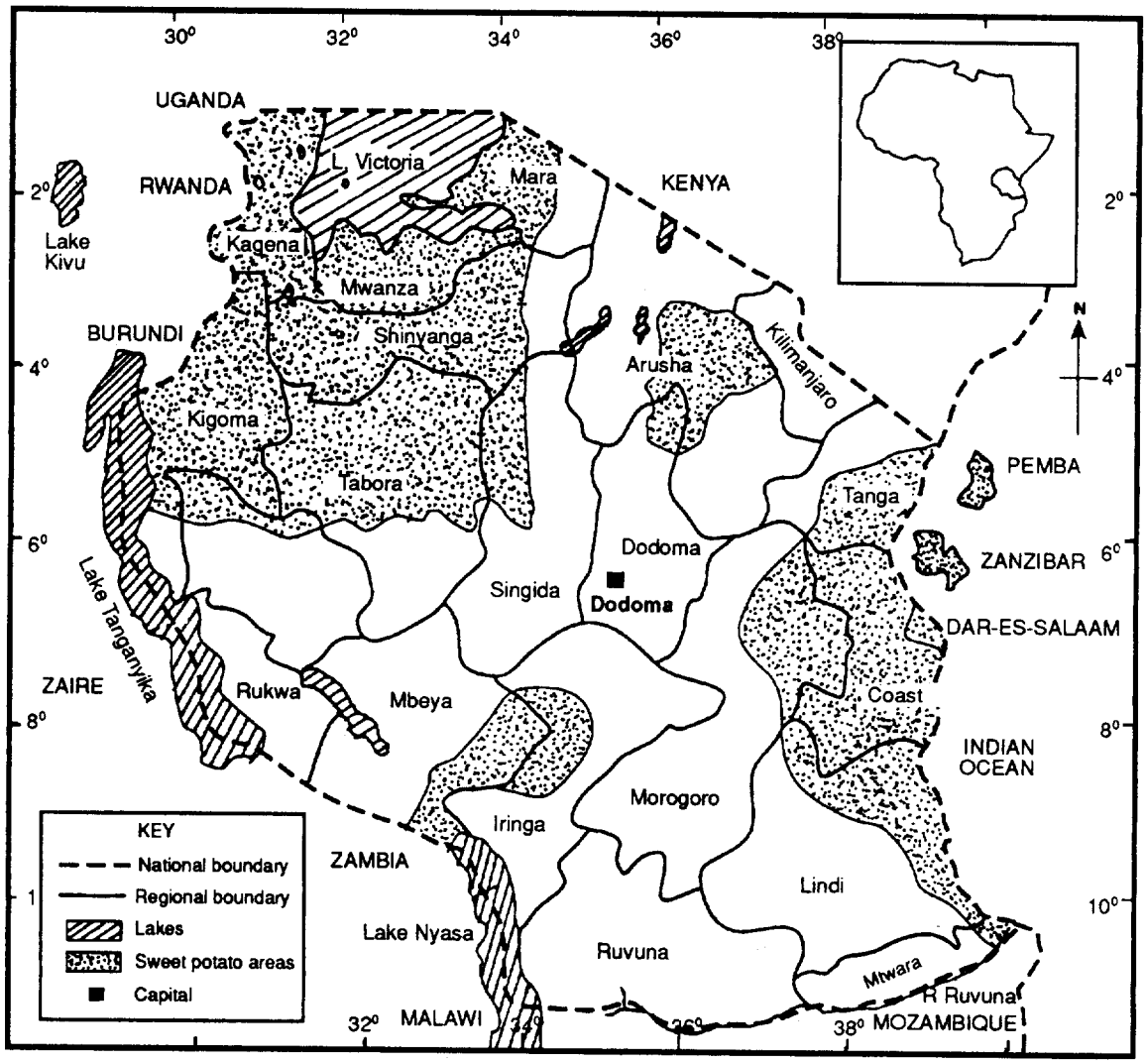
Introduction

Sweetpotato (*Ipomoea batatas*) is an important subsistence food crop grown in almost all agroecological zones of Tanzania. The equatorial type of climate existing in most parts of the country is favourable for sweetpotato production, in spite of the modifications caused by varied topography and the latitudinal position (Msabaha, 1979). Sweetpotato is grown at all altitudes, on all kinds of soils, and in areas where rainfall varies between 800 and 1,400 mm per year.

Sweetpotato has a short growing season, hence, it can avoid the long dry season (Jana, 1982). The crop provides a sustainable food supply when other crops fail. It is produced mainly in Shinyanga, Mara, Mwanza, Kagera, Kigoma, Tabora, Morogoro and Mbeya regions (Figure 1). It is the third most important root and tuber crop in the country, after cassava (*Manihot esculenta Crantz*) and round potato (*Solanum tuberosum L.*) [Appendices 1 & 2]. Sweetpotato is primarily grown for home consumption, though in some areas, it is produced for the markets in both rural and urban areas. Its commercial value is highest during the month of Ramadan. Sweetpotato storage roots and leaves are of major nutritional importance.

Sweetpotato is considered as a household food security crop by many Tanzanian farmers. It complements other food crops and serves to bridge "hunger periods" of food shortage before the next harvest of maize or other staple crop. In most areas, small, subsistence-oriented farmers practice both intercropping and monocropping. Crops found intercropped with sweetpotato include cassava, maize, beans, cowpea and groundnut. Sweetpotato is also grown under the shade of young perennials such as coconut, pawpaw, plantain/banana, and tree crops such as mango (Ndibaza, 1994). In areas surrounding both Lakes Victoria and Tanganyika, sweetpotato was reported to rank second to maize among the major crops in the cassava-based intercropping systems particularly in Kagera, Mwanza, Mara, Shinyanga, Kigoma and Tabora regions (Anonymous, 1990; COSCA Tanzania, 1993).

Generally, sweetpotato is grown in small fragmented plots and is fitted into the growing season in various ways. Studies conducted in the Lake Zone have showed that the planting of sweetpotato is flexible, as long as enough moisture is available for the establishment of the crop (Tanzania/Netherlands-FSR, 1989; Hart, 1991; Kapinga, 1992; Makula, 1994).



Adapted from: Msabaha, 1990.

Figure 1. Map of major sweetpotato-growing areas.

Despite its importance in food systems, there has been little expansion in the aggregate acreage of sweetpotato for several years and yield per unit area in farmers' fields is still low. This trend was noted by Msabaha (1979) and reconfirmed recently by the National Farming Systems Research teams who conducted studies in various parts of the country. It must be emphasized, however, that the yield of sweetpotato in farmers' fields is significantly underestimated, as it is very difficult to accurately measure production from piecemeal harvesting.

Limiting factors in sweetpotato production as outlined by Msabaha (1979) include diseases, insect pests, continuous use of varieties in spite of yield degeneration, poor storage, and inadequate utilization of the crop. The National Root and Tuber Crops Research Program was established in 1974 to address these issues. Although several approaches have been taken by the program to increase the productivity of sweetpotato per unit area, yields in farmers' fields have been increasing at a very slow pace as compared to other crops. Part of the problem has been a lack of farm-level information about the crop, cropping systems, and socioeconomic constraints in the major zones of production. This information is important to improve the relevance of research on sweetpotato.

This study got underway in 1991, when members of the National Root and Tuber Crops Research staff and members of the Farming Systems Research Program from various zones where sweetpotato is important gathered at Sokoine University of Agriculture in Morogoro to discuss the modalities for conducting baseline studies at the farm level. The workshop was sponsored by the Tanzania Government and the International Potato Centre (CIP) with support from GTZ. It was agreed that farm-level surveys should be done in selected sweetpotato-growing areas of the country. After a thorough discussion, a checklist was developed to serve as a guideline for the development of questionnaires. It was agreed that modifications should be made in each zone to address specific issues in particular areas.

The following objectives were set for the surveys:

- Describe the relative importance of sweetpotato compared to other food staples.
- Describe the sweetpotato production environment including edaphic, cultural, economic, and related factors.
- Describe sweetpotato production techniques including land use patterns, cropping patterns, calendar of operation crop varieties, and labour utilization.
- Investigate and prioritize the various problems that hinder the full potential of this crop under farmers' conditions.

- Identify and assess economic important pests and diseases of sweetpotato under different cropping systems with a view to developing management and control strategies.
- Identify socio-economic factors associated with sweetpotato production.
- Determine the sweetpotato production objectives of farmers of different types.
- Assess the demand for the crop for both household consumption and for the market.
- Assess to what extent marketing channels are constraining factors in the expansion of sweetpotato farming systems, as well as the implications for market diversification into alternative uses.

Methodology

Surveys were conducted between the period 1992 and 1993 in the following Zones and regions [Figure 2]:

Lake Zone - Kagera, Mwanza, Mara and Shinyanga regions,

Northern Zone - Arusha, Kilimanjaro and Tanga regions;

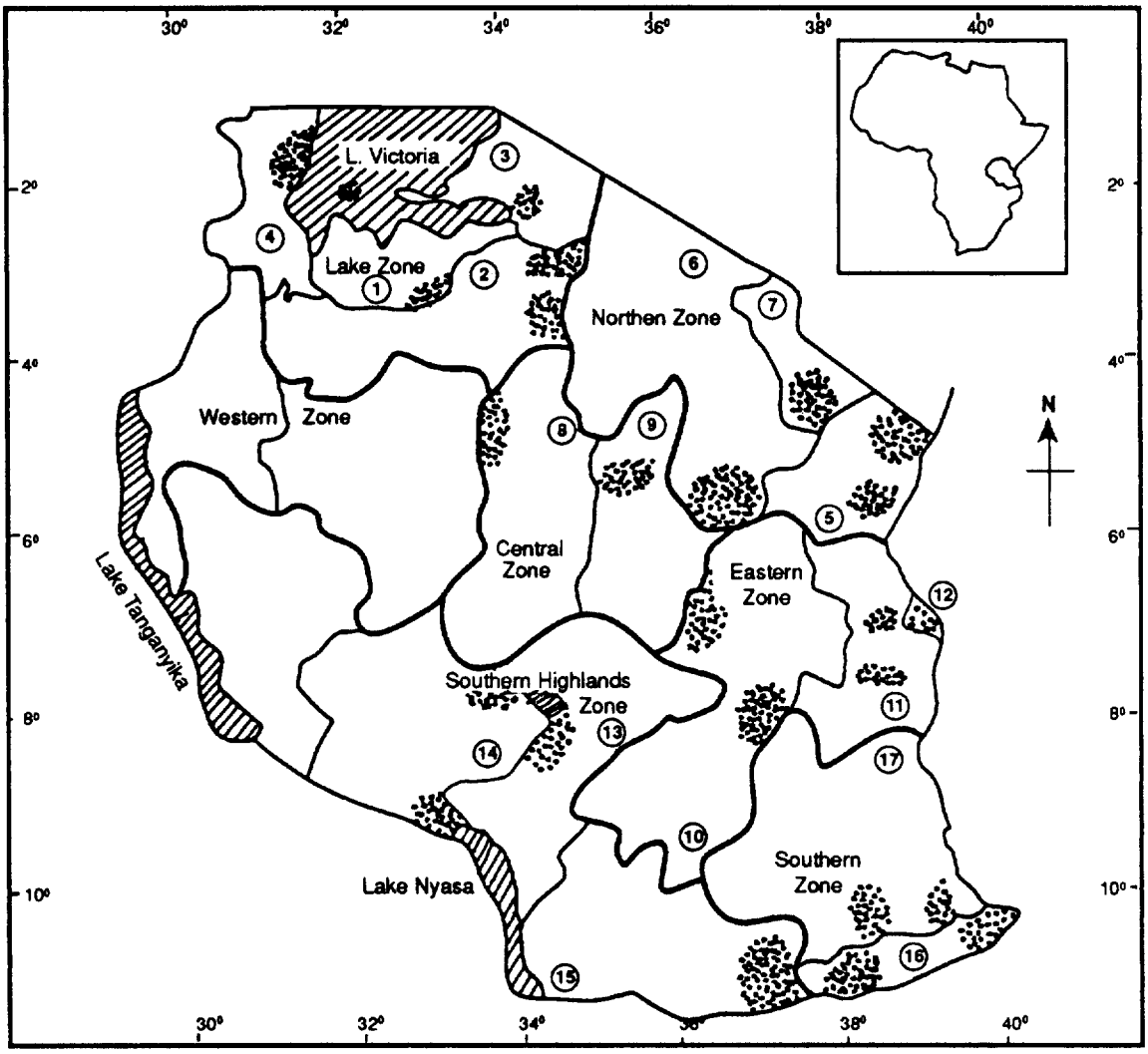
Eastern Zone - Dar es Salaam, Coast and Morogoro regions;

Central Zone - Dodoma and Singida regions;

Southern Zone - Mtwara and Lindi regions;

Southern Highlands Zone - Mbeya, Iringa and Ruvuma regions.

Similar information was collected separately in Kagera and Shinyanga regions by the Tanzania/Netherlands Farming Systems Research Project, and the Tanzanian-German Project for Integrated Pest Management. A list of surveyed regions districts, divisions, wards, villages and number of households is presented in Appendix 3. The choice of villages in each division and the choice of individual farmers selected for interview were randomized. In the Lake Zone, it is known that sweetpotato is a crop grown mainly by women. Hence, in this zone female farmers were targeted in each village visited. Climatic conditions, population density, altitude and soil types of the surveyed areas are presented in Appendix 4.



ZONE	REGION			
Lake	(1) Mwanza	(2) Shinyanga	(3) Mara	(4) Kagera
Northern	(5) Tanga	(6) Arusha	(7) Kilimanjaro	
Central	(8) Singida	(9) Dodoma		
Eastern	(10) Morogoro	(11) Coast	(12) Dar es Salaan	
Southern Highlands	(13) Iringa	(14) Mbeya	(15) Ruvuna	
Southern	(16) Mtwara	(17) Lindi		

Figure 2. Map of Tanzania showing areas surveyed

The selection criteria for the areas to be surveyed were as follows:

- The importance of sweetpotato relative to other food staples.
- The contribution of sweetpotato to household food security and rural income.
- The growing demand of the crop in sustaining the household earnings through the on-farm use and sale of roots and vines for livestock feed.
- Variations in climatic conditions, soil types, topography and altitude.
- Socio-cultural factors.

Secondary literature

The study made use of background information obtained from research institutes, extension agencies, and available literature. Particularly useful were the Tanzania National Agricultural Research Masterplan, national agricultural statistics, and COSCA working papers numbers 1 and 3 (Nweke, 1988; Nweke *et al.*; 1989). This information included the geographical distribution of sweetpotato production and compiled data on soils, weather , and market prices. The COSCA reference manuals provided a useful guide for the collection of this information.

Informal surveys

Informal surveys were an important part of the field methodology. Individual farmers were visited and discussions were held. Key persons including village leaders and village extensionists accompanied the interviewers in the villages. The general views on sweetpotato production and constraints were sought from the farmers in open-ended interviews. Direct observations was another tool that was used particularly during the field visits. This approach helped in getting some quantitative data on the crop. Important information from the fields was also gathered. For instance, some farmers were not aware of disease and pest problems in some of their fields. Direct observations during field visits documented that such problems existed.

Formal surveys

Formal surveys were conducted concurrently with the informal surveys. Questionnaires for each zone were developed on the basis of the checklist described above. The questionnaire for the Lake Zone was adapted from various check lists of previous related work by Farming Systems Research Program - Lake Zone and the COSCA studies of cassava (COSCA, 1989). Division and ward lists were used in drawing up a sample of respondents. In drawing up a sampling frame for each zone, areas important in sweetpotato production and those of less importance were selected. A total of 879

farmers were interviewed in all of the areas surveyed, which was considered adequate to meet the objectives of the study.

During the surveys, the information collected included: sweetpotato varieties grown, cropping systems, field sizes allocated to sweetpotato relative to other crops, age at harvest, field history, land tenure systems, calendar of farm activities, household consumption patterns, sweetpotato production trends, production objectives, uses, forms of sweetpotato consumed, ownership of sweetpotato produce, gender roles in sweetpotato production, marketing channels, labour use, etc. This information was collected from individual farmers and compiled to provide a clear idea on the general situation. Direct observations in the fields provided information on the sweetpotato varieties grown, the incidence of pests and diseases, types of seed bed, storage systems, etc.

The findings from each zone were tabulated, and individual draft reports were written. These data were then combined and retabulated for this report. The data for the Northern Zone were not available for this last step, so results from the preliminary survey report have been included in the tables and text where appropriate (Kuoko, S.S., J.S. Mbwambo and N.M. Meghji, 1993).

General Findings

Relative importance of sweetpotato

The farmers in the survey were asked to rank the major food crops in their area. The results by zone are shown in Table 1. Cassava, maize and sweetpotato were found to be grown in all the zones surveyed. The overall ranking has shown that the most important food crops in the country are maize, cassava, bean, sweetpotato, and sorghum/millet. Others are paddy rice, upland rice, and bananas. Although sweetpotato ranks fourth after maize, cassava and beans, it is plays a critical role in household food. This is mainly due to its short maturity period and flexible piecemeal harvest over an extended period (Ewell and Mutuura, 1991).

Table 1. Farmers ranking of crops on their farms by zone.

Crop	Ranking by Zone							
	Lake (N=186)	Southern (N=200)	Eastern (N=146)	Southern Highlands (N=101)	Central (N=109)	North -ern *	Mean score	Overall Rank
Maize	3	2	1	1	2	1	1.7	1
Cassava	1	1	3	4	5	5	3.3	2
Bean	6	-	-	2	4	2	3.5	3
Sweetpotato	4	5	4	3	3	3	3.8	4
Sorghum/mill	2	3	-	7	1	7	4.0	5
Paddy rice	5	4	2	-	-	6	4.3	6
Upland rice	-	6	5	-	-	-	6.0	7
Banana	7	-	-	6	6	-	6.3	8
Groundnut	8	-	-	5	6	-	6.7	9

- Not mentioned

* Source: Kuoko *et al.* 1993.

Land allocation to sweetpotato

The percentage of arable land allocated to sweetpotato on the farms sampled in each of the zones surveyed is shown in Table 2. The largest proportion in sweetpotato was observed in the Eastern (27%) and Lake (23%) zones. The lowest was observed in the Southern zone (3%). The estimate for the Eastern Zone may be have been biased upward by sampling only farmers growing sweetpotato. On the average in the sample, sweetpotato is allocated about 14% of the total arable land.

When asked on the type of land on which they prefer to grow sweetpotato, 66% of farmers said their best, and only 25% said their worst (Table 3). This preference is consistent with the observation that sweetpotato is often used to open up a plot after grass fallow.

Table 2. Percentage of total arable land on sample farms allocated to sweetpotato.

Zone	Southern (N=200)	Southern highland (N=101)	Central (N=109)	Eastern (N=146)	Lake (N=186)	Mean
Land allocation	3	9	10	27	23	14

Table 3. Frequency distribution of type of land allocated to sweetpotato production by zone.

Zone	Type of Land (% of farmers)		
	Best	Worst	Between rows of perennial crops
Eastern (N=219)	85	9	6
Lake (N=186)	80	12	8
Central (N=109)	63	27	10
Southern (N=200)	58	32	10
S. Highlands (N=101)	44	46	10
Sample mean (N=815)	66	25	9

Major production objectives

Farmers interviewed in all of the zones indicated that the major objectives of sweetpotato production are first, home consumption and second, sale to generate income. Table 4 shows the production objectives of sweetpotato farmers by zone. Only a small proportion of the farmers interviewed said that they were growing sweetpotato exclusively for sale. The majority produce sweetpotato for home consumption, and then sell some surplus in local markets. The percentage of farmers producing the crop for home consumption only was highest in the Southern highlands zone, where marketing channels for sweetpotato are underdeveloped and the crop is produced on a small scale.

Table 4. Percentage distribution of representative farmers by production objectives of sweetpotato by zone.

	Zones					
Production objective	Southern Highlands (N=95)	Central (N=109)	Eastern (N=238)	Lake (N=186)	Southern (N=200)	Mean
Home consumption only	61	4	22	20	11	24
Sale only	1	6	11	21	8	9
Both	38	90	67	59	81	67

Uses

Both the storage roots and green leaves of sweetpotato are of major nutritional importance. In rural areas, storage roots are most commonly used in boiled form. They are also eaten raw and processed by chipping and sun-drying into traditional products called *Michembe* and *Matoborwa*. Storage roots are consumed as a part of the main meal or as a snack. In urban centres sweetpotato slices are fried to make fried chips. Storage roots can also be roasted and eaten alone or in combination with other dishes. Leaves are eaten as a vegetable by 63% of the farmers interviewed (Table 5). This use is most common in the Central and Southern zones.

Table 5. Frequency distribution by zone of farmer's consumption of sweetpotato leaves as a vegetable.

Zone	Percent of farmers consuming sweetpotato leaves
Central (N=109)	98
Southern (N=200)	81
Southern Highlands (N=86)	74
Eastern (N=192)	50
Lake (N=186)	10
Sample mean	63

Feeding of sweetpotato foliage to livestock was reported to be a common practice in the Northern Zone, where zero-grazing dairy operations are important (Kuoko *et al.* 1993). It is also quite common in the Southern Highlands, but not elsewhere (Table 6).

Table 6. Frequency of feeding sweetpotato foliage to livestock by zone.

Zone	Percent of farmers who feed foliage to livestock
Northern *	90
Southern highlands (N=101)	40
Southern (N=200)	16
Lake (N=186)	2
Eastern (N=146)	0
Central (N=109)	0
Sample mean	25

* Source: Kuoko *et al.* 1993.

Sweetpotato production trends

Farmers interviewed in every zone were asked to give their views on the general trend of sweetpotato production over the past ten years. The general trend per zone is shown in Table 7. The highest percentage of farmers who indicated an increasing trend in sweetpotato production were reported in the Lake, Central, and Eastern zones. In all the zones, there were more farmers who said that production is increasing than those who said that it is decreasing.

The major reasons given for decreasing trends were labour and land shortages, difficulties in getting planting material, drought, pests and diseases, and illness or old age of key members of the family. In areas where farmers reported an increasing trend in sweetpotato production, the factors mentioned included increase in the area under cultivation, use of high yielding varieties that are tolerant to drought, pests and diseases, and improved market opportunities.

Table 7. Farmer's perception on sweetpotato production trend by zone.

Zone	Production trend (% of farmers)		
	Increase	Decrease	Constant
Lake (N=186)	76	20	4
Central (N=109)	75	5	20
Eastern(N=226)	46	48	6
Southern Highlands (N=90)	46	37	17
Southern (N=149)	37	35	28
Sample mean	58	26	16

Crop Husbandry Findings

Land preparation

The land for planting sweetpotato is prepared in various ways. In all cases, land is prepared using the hand hoe, which is the major tool of Tanzanian farmers. Land preparation is concentrated at the beginning of the rains when the soil is moist and workable, but can be carried out at any time. Most field work in sweetpotato production is carried out by women, but men often assist in the heavy work involved in land preparation.

There are four seedbed types used in the production of sweetpotato: ridges, mounds, raised beds, and flat (Table 8). Ridging is the most common form of land preparation throughout Tanzania. The farmer starts by scraping weeds from the side of the ridges into the old furrows, and then forms new ridges by splitting the old ones to

cover the weeds. Ridges have advantages such as protection against soil erosion and drainage improvement. The working and softening of the soil facilitates good bulking of the storage roots, which improves yield.

Mounds are made by hoeing the soil together from the surrounding area. Mounds are often found in intercropped fields with cassava or other crops. This seedbed type is commonly used in Lake Zone, where it was reported by 33% of the farmers surveyed.

Table 8. Percentage distribution of households by seed bed types used in sweetpotato production by zone.

Zone	Type of seedbed			
	Ridges	Mounds	Raised beds	Flat
Southern highlands(n=92)	83	7	10	0
Southern (n=200)	93	2	0	5
Eastern (n=238)	85	0	0	15
Central (n=109)	90	6	0	4
Lake (n=116)	11	33	27	29
Sample mean	72	10	7	11

Raised beds are cumbered. The land is cleared, weeds gathered and even more weeds collected from other areas and then spread on the field. Soil is then pulled up on to the beds to cover the organic matter. This type of cultivation is very prevalent in Kagera region, and Mwanza (Lake Zone) where 27% of farmers practise that type of seedbed. It is particularly important in wet areas.

Flat cultivation is the simplest form of land preparation. It consists of cultivating the land, making it fairly smooth and then planting.

Each type of seedbed preparation is based on traditional practices depending on the location. In the Lake Zone, all four types of land preparation are found. Elsewhere, ridges are by far the most common, reported by 72% of the farmers in the sample as a whole.

Cultivars

Many hundreds names for sweetpotato cultivars were given by the farmers interviewed in the course of this study (Appendix 5). In Bukoba alone (Kagera Region) over 57 varieties/cultivars were mentioned (Kapinga, 1992). In Maswa district (Shinyanga region), over 100 varietal names were collected (Hart, 1991). In the Southern Highlands over 37 varieties were mentioned (Mwambene *et al.* 1992). Similarly the rest of the surveyed areas indicated that large numbers of varieties/cultivars are grown by farmers.

Many variations in plant type, leaf shape, vine length, root flesh, skin colour, and other phenotypic characteristics were found. An analysis of the common names used by

farmers shows that there are two types of possible confusion. First, farmers in different villages or zones give different names to what in fact may be the same variety. Secondly, quite different varieties are often known by the same name in different localities. Some varieties bear names of their phenotypic characteristics, earliness, or yielding capacity. For example, the variety *mwezi gumo* implies very early maturity --that harvesting can start even one month after planting. In reality there is no variety that is harvested after one month, but the name indicates notable earliness.

Farmers indicated clear preferences for specific sweetpotato cultivars. In all of the zones sampled, they are constantly experimenting by introducing new cultivars with desirable attributes. These are not necessarily improved varieties from an experiment station, but they are landraces which vary significantly between villages and zones. Similar observations with regard to cassava cultivars were noted in the COSCA studies in Tanzania and in other countries (Nweke *et al.* 1994).

Farmers are selecting cultivars primarily for early maturity and high yield. Other important characteristics include culinary characteristics such as firmness, high dry matter content, good taste, and little or no fibre in the storage roots. A summary list of the characteristics desired in sweetpotato varieties is shown in Table 9.

Table 9. List of attributes of sweetpotato cultivars desired by farmers in order of importance

Desired Attribute	Remarks	Implications
1. High root yields, early maturity, and tolerance to diseases and pests	Mentioned frequently by most farmers in all zones	Research must be geared to the selection of cultivars with these characteristics.
2. Good root characteristics: firmness, high dry matter, low fibre, and moderate sweetness	Mentioned by most farmers	Culinary characteristics must be an integral part of all stages of varietal improvement.
3. In-ground storability, high demand in the market	Especially noted in Southern Highlands, Northern and Lake Zones	Research must be geared to the diversification of utilization through the improvement of traditional storage and processing techniques.
4. Drought tolerance	Noted in Central, Eastern, and Lake zones	Varieties with drought tolerance are needed in semi-arid areas.
5. Abundant leaf and forage production	Noted in Central and Northern zones	In areas where sweetpotato is used as a forage, dual-purpose varieties should be selected. Selection of varieties appropriate for use as a vegetable is a separate and important issue.

As new cultivars are introduced, farmers abandon other landraces with less desirable characteristics. A high degree of turnover was noted in all zones. The names of some of the cultivars abandoned and the reasons for so doing are shown in Table 10.

The reasons most frequently cited were late maturity and low yield of storage roots. Poor taste characteristics and susceptibility to drought were also commonly cited. In Central, Southern and Eastern zones farmers indicated that they were using low yielding cultivars and demanded improved varieties from research institutions. In the Central zone, 25% of farmers interviewed requested drought tolerant varieties.

Table 10. List of sweetpotato cultivars which are no longer grown and the major reasons for their abandonment by zone

Central	Southern highlands	Southern	Northern	Lake
Pumbaru, Chekundu asilia	Mboma, Sungapina, Semgovano, Ndekikiremi, Kayobe, Muhungu, Buluu	Viazi vyekundu, Chindolo	Katoje, Nakutua, Kabangili Kisumo, Bundala, Kishashi, Mjivya, Baraka, Matiwa	Tomora Nkunda, Kagole Mwasa Kibuyu, Kabota, Kashenshe, Simbeichumu
Reasons for Abandonment				
· Low root yield · Late maturity · Introduction of SITRA, SPN/O and other new varieties	· High fibre content · Watery roots · Poor taste	· Low root yield · High fibre · Late maturing · Lack of planting materials · Susceptible to diseases and pests	· Late maturity · Poor palatability · Heart burn · High fibre content · Low root yield · Susceptible to drought	· Susceptible to drought · Susceptible to disease and pests · Late maturity

Sources of planting material

Vegetative propagation is the only method practised by farmers in the production of sweetpotato. Apical cuttings, taken from mature vines, are the best planting materials. Vine cuttings of various lengths (15-50 cm) are usually made from the middle to the apex of the vine. For bigger areas, these cuttings are made a day before the planting, while for small areas they are made the same day of planting. Planting is made in the morning or in the afternoon depending on the weather. In most areas, planting materials are obtained from seed nurseries maintained during the dry season along river beds or wet spots. These are small areas and can only produce only small quantities of vines. This sometimes makes it necessary to plant only small areas at the start of the rains so as to generate more planting materials during the season itself.

The major source of planting material is from the farmer's own fields or nurseries (Table 11). Nevertheless, often there is not enough planting material available. Additional vines are then obtained from neighbours or from other villages. In some cases, farmers must travel significant distances to buy planting material. An important implication of chronic shortage is that if farmers are forced to look for vines off the farm, their choice of cultivars is restricted, and they are forced to plant whatever types available.

Table 11. Frequency distribution of sources of planting material by zone.

Zone	Source			
	Own field	Neighbours	Other villages	Purchase
Southern Highlands (n=82)	56	12	28	4
Central (n=109)	47	25	0	28
Eastern (n=238)	88	20	0	8
Lake (n=186)	43	38	1	19
Southern (n=200)	37	55	6	2
Sample mean	54	30	7	12

Lack of sufficient planting material was mentioned as a production constraint across all zones (Table 12), particularly in the Lake zone (66%) and Northern zone (70%). In all zones, the problem is most serious at the beginning of the growing season just after the long dry period. On the average, shortage of planting material ranked third in importance of the all constraints mentioned by farmers (Hart, 1991; Kapinga 1992; Makula, 1994).

Table 12 . Frequency distribution by zone of shortage of planting materials as a production constraint.

Zone	Percent of farmers that mentioned shortage of planting material as a constraint.
Central (N=109)	25
Southern (N=200)	26
Southern Highlands (N=102)	11
Eastern (N=238)	29
Lake (N=186)	66
Northern *	70
Sample mean	38

* Source: Kuoko *et al.*. (1993)

At present in the country there is no established formal seed multiplication unit for vegetatively propagated crops. Only few farmers in the immediate vicinity can obtain clean, healthy planting material from the research institutions. The National Root and Tuber Crops Research Program, in collaboration with Non-Governmental Organisations and extension agents, is starting to establish nurseries for planting material. The multiplication and distribution of vines is a key element in technology transfer, along with training and demonstrations for farmers in their villages.

Cropping systems

Two major cropping systems have been identified in the zones where this survey was conducted (Table 13). These are (1) monocropping and (2) intercropping sweetpotato with other crops, most commonly maize, beans, cassava, bananas and fruit trees.

Table 13. Frequency of sweetpotato grown in intercropping and in monoculture by zone.

Zone	Cropping System(percent of farmers)	
	Intercropping	Monocropping
Lake (n=186)	96	4
Central (n=109)	88	12
S. Highlands (n=101)	29	71
Southern (n=200)	19	81
Eastern (n=237)	16	84
Sample mean	50	50

Intercropping is the predominant system in the Lake and Central zones, and was reported less frequently elsewhere. On average, each practise was reported by half of the sample. When grown in monoculture, sweetpotato is often grown in small patches interspersed with other crops, which can be called "patch intercropping."

Crops which are commonly intercropped with sweetpotato are ranked in the order of their importance in each zone in Table 14. Maize, cassava, beans, and cowpeas are most common. Farmers said that the most important reason for intercropping is to obtain adequate yields of several crops on the same piece of land. Intercropping is a labour-saving practice and it helps to bridge the food shortage gap between cropping seasons. In the zones, where it is less common, farmers mentioned weed problems, competition with other crops, and reduced yields in intercrops as major limiting factors for intercropping.

Table 14 Farmer's ranking of crops intercropped with sweetpotato by zone.

Zone	Crop					
	Maize	**Cassava**	**Beans**	**Cowpea**	**Fruits**	**Banana**
Central (n=100)	1	-	3	2	4	-
Eastern (n=38)	1	2	-	3	4	5
S. Highlands (n=29)	-	2	1	-	3	4
Lake (n=179)	2	1	4	3	-	5
Northern *	1	-	2	-	-	3
Mean score	1.2	1.8	2.5	2.7	3.7	4.3
Overall rank	1	2	3	4	5	6

- Not mentioned
* Source Kuoko *et al.* 1993.

Weeding

Sweetpotato is weeded between 0 and 3 times. Table 15 shows the average weeding frequencies by zone. The time of first weeding varies greatly, but most of farmers weed between one and two months after planting.

Table 15. Weeding frequency by zone.

	Weeding frequency (percent of farmers)			
Zone	**Do not weed**	**Once**	**Twice**	**Thrice**
Southern (n=190)	5	50	35	10
S. Highlands (n=101)	0	50	50	0
Central (n=109)	20	70	10	0
Lake (n=186)	0	95	5	0
Eastern (n=220)	6	78	16	0
Sample mean	6	69	23	2

Use of fertilizer

The most common techniques used by farmers to maintain and improve soil fertility is the incorporation of crop residues, weeds, and other organic materials in the soil during land preparation. From the study, it was noted that the application of inorganic

were reported being used mainly in the production of high priced crops such as maize and rice. The lowest levels of use of inorganic fertilizers was noted in the Central, Lake, and Southern Highlands zones (Table 16), where sweetpotato is grown for household food security and is not a commercial crop.

Table 16. Use of inorganic fertilizer on sweetpotato by zone.

Zone	Percent of farmers who use inorganic fertilizer on sweetpotato fields.
Southern(n=181)	9
Eastern (n=221)	8
Southern Highlands (n=101)	4
Central (n=109)	1
Lake (n=186)	3
Sample	5

The higher level of fertilizer use in the Eastern zone may be attributed to the relative importance of marketing of sweetpotato, which creates an incentive to use purchased inputs to increase yield.

For the Southern zone, farmers indicated that they use fertilizers in home gardens. Sweetpotato was found grown near the homesteads in small fragmented plots, intercropped with maize and other crops, and farmers used fertilizers on these intensively cultivated plots.

These results should not imply that sweetpotato is poorly managed by farmers. It was noted above that sweetpotato is often the first crop opening up the new land, and thus benefits from the fertility accumulated in the fallow period.

Crop protection

The incidence of pests, diseases and vertebrate pests varies from farm to farm as well as from zone to zone. (Table 17). Sweetpotato weevils -- (*Cylas formicarius, C. puncticollis* and *C. brunneus*), - Striped weevil (*Alcidodes dentipes*), and rough weevil (*Blosyrus sp.*), are the most important pests of sweetpotato in Tanzania.

Table 17. Frequency of the most important pests and diseases reported by farmers.

Zone	Pests and diseases			
	Weevils	Virus disease	Vertebrate pests	Others
Eastern (n=223)	55	17	17	11
Central (n=109)	55	13	15	17
Lake (n=186)	54	12	24	10
Southern Highlands (n=101)	30	20	30	20
Southern (n=200)	20	28	0	52
Mean	42	18	16	24

The adults of *Cylas spp.* feed on the epidermis of vines and leaves, and also on the external surfaces of storage roots causing feeding punctures (Skoglund and Smit, 1994). The larvae are more destructive. They tunnel into the storage roots and feed on the sugars in the roots. The roots are turned sour and rendered unpalatable. The problem of sweetpotato weevils was mentioned by more than 50% of all farmers interviewed.

Rough weevils usually attack the storage roots on the skin, making shallow channels on the enlarging storage roots (Skoglund and Smit, 1994). Adult weevils feed on foliage but the larvae cause greater damage. Damaged roots are less marketable, although perfectly useable for home consumption. Striped weevils mainly attack the vines of sweetpotato. The larvae tunnels into the vines eating the contents and leaving hollow tunnels. The attack usually starts at the base of the vine, which can easily break away from the roots, killing the plant.

Vertebrate pests, most frequently mentioned by farmers were moles, wild pigs, porcupines, rats, and monkeys. These were often mentioned by farmers in the Northern Zone and Southern Highlands Zone. This high frequency of vertebrate pests in Northern and Southern Highlands zones is due to the presence of thick forests and bush, the natural habitants of wild animals. In the Kagera region, hippos were mentioned as a major problem in those areas near rivers and swamps (Kapinga, 1992). In the central zone, elephants were frequently mentioned destroying sweetpotato plots. Theft by human beings is a problem in some areas.

Vertebrate pests attack mainly the storage roots, except for hippos that go for the foliage. Theft was reported to be for planting material, storage roots and foliage for fodder.

The major diseases reported include sweetpotato viruses (of which the most common are mild mottle virus (SPMMV), sweetpotato feathery mottle virus (SPFMV)) and foliar and stem diseases caused by fungi. Although most farmers could not identify

the diseases specifically, many were able to describe the symptoms of the major diseases. Nevertheless, it was noted from field observations that many farmers were using unhealthy planting material. Viral disease were commonly reported by farmers in the Lake Zone. Fungal disease was most important in the Southern Zone.

Another disease mentioned was foot rot (*Plenodomus destruens*) that was observed mainly attacking the proximal end of sweetpotato storage root. This disease is caused by fungus. It is very common in the Lake Zone. Skoglund and Smit (1994) report that the disease is spread mainly by the use of infected cuttings especially those from the base of vine, and by contact with spores from infected roots.

Storage pests were mentioned in those zones where sweetpotato is processed and stored (Lake and Southern Highlands). Larger grain borers and other insects attack the dried sweetpotato chips. More information on these pests will be presented in the post-harvest section.

The major control methods for weevils are cultural practices, such as flooding the fields, early harvesting, and rotation (Table 18). Researchers in Shinyanga (Lake Zone) have shown that the damage from the sweetpotato weevil (*Cylas puncticollis*) can be reduced by hilling up (covering cracks that would otherwise allow easy entry of sweetpotato weevils to the roots). As a practical matter, hilling up is done primarily at the first weeding; too early in the season to be very effective.

Table 18. Control methods for weevils and vertebrate pests mentioned by farmers.

Zone	Pest	
	Weevils[1]	**Vertebrate Pests[2]**
Southern Highlands	Flooding the field, early harvesting	Traps, use of *intwitwi* as a repellent
Central	Early harvest	Baits, traps
Eastern	Rotations, clean materials, resistant local cultivar	None
Northern	Early harvest, flooding	Hunting, traps
Lake	Hand picking	Hunting, traps
Southern	None	None

1 Primarily the sweetpotato weevil (*Cylas puncticollis* and *Cylas bruneus*), but also rough weevil (*Blosyrus spp.*), and striped weevil (*Alcidodes dentipes*).

2 Primarily mole rats, porcupines, squirrels, and rats, but also large animals including hippos and elephants.

After the crop has covered the ground, stepping on the ridges can be an alternative method for covering soil cracks (Makula, 1994). In other areas of the Lake Zone, some farmers sometimes control weevils by hand picking and killing them. This method is tedious and difficult to practice. No control measures were mentioned against fungal

and virus diseases. For vertebrate pests, farmers reported trapping, hunting, spreading leaves of the local shrub *intwitwi* as a repellent (in the Southern Highland Zone only), and baits.

Cropping calendar

Figure 3 schematically outlines the predominant cropping calendar in the zones surveyed. Sweetpotato is a rustic crop, which can produce some yield at almost any time of the year. Nevertheless, the major cropping seasons depend on location and agroecological zone.

In the humid areas of the Southern Highlands, land preparation starts in December, and the major harvest extends from May through September. There is a second planting in May and June, which means that many farmers can stagger their harvest through most of the year. In the Eastern Zone, the major planting is in April and May, and is harvested in August and September. The second, smaller planting is in August with the harvest in November. There are also two planting seasons in most parts of the Lake Zone: November to February and April to July. In the Central and Southern Zones, farmers are limited to one planting because of the long dry season, unless they have a source of supplemental irrigation.

In the Kagera, region farmers indicated that sweetpotato production is distributed throughout the year (Kapinga, 1992). Adequate and evenly distributed rainfall means that a continuous and regular supply of sweetpotato is available, even during periods when other crops run short. Many small, fragmented fields of different crop maturities were found in Kagera and on Ukerewe island in Lake Victoria.

In drier areas, the cropping calendars are more strictly fixed by the seasonal rainfall pattern, unless disrupted by problems of planting material, labour shortages, particularly when planting coincides with other activities, or sickness of the key persons.

The sweetpotato crop, due to its short growth duration, can avoid the long dry season if planted on time. Late planting however, can affect establishment and drastically reduce yield. Drought was considered a main constraint by farmers particularly in the Central Zone (80%), the Lake Zone (80%) and the Northern Zone (55%). In these areas extended dry spell leads not only to low root yields but also to a shortage of planting material for the subsequent season. Dry weather also favors the build up of sweetpotato weevils and other insects. On the average, drought was ranked among all constraints. This calls for developing sweetpotato cultivars tolerant to drought.

In the Southern Highlands, farmers indicated that sweetpotato takes very long to mature, up to 12 or 13 months, due to very cold weather. This in turn ties up the land which could be put under other uses. The only type of cultivars currently available to

farmers are late maturing. Development of early maturing sweetpotato cultivars adapted to cold environments could be an answer.

Figure 3. Sweetpotato cropping calendar by zone.

Zone	N D J F M A M J J A S O N D J
Eastern	PPPPWWWHHHHHHHHHH LLLLLL LLLLLPPPPPWWWWWWW HHHHHH
Southern Highlands	HHHHHHHHHHHH HHHHHHH WWWWWWWWWW WWWWWWWW PPPPPPPPP PPPPPPPPPPPPPPP LLLLLLLLLLLLLL LLLLLLLLLLLLLL
Southern	LLLLL PPPPP WWWWW HHHHHHHHH
Central	LLLL PPPP WWW HHHHHHHH
Lake	HHHHHHHHHHHHHHHHH HHHHHHHH WWWWWWWWWWWW WWWWWW PPPPPPPPPPPP PPPPPPPP LLLLLLLLLLLL LLLLLLLLLL
Zone	N D J F M A M J J A S O N D J

Legend:: LLLLLL = Land preparation; PPPPPP = Planting; WWWWWW = Weeding; HHHHHH = Harvesting

Farm level yield

Under ideal weather conditions and management practices, sweetpotato has a yield potential of between 20 and 40 tons of storage roots per hectare (Ewell and Mutuura 1991). However yields obtained under farmer's conditions are much lower. During the survey, fresh storage root yields ranging from 3.5 to 9.5t/ha were obtained from key informants, primarily extensionists (Table 19).

Table 19. Indicative yield of fresh sweetpotato storage roots at farm level.

Zone	Yield of fresh storage roots (t/ha)
Southern	5.0
Southern highlands	9.5
Central	3.5
Northern	3.5
Eastern	na
Lake	6.5
Mean	5.6

na - not available.

These data are comparable with available national statistics. Preliminary indications show that there is a great need for systematic yield assessment in farmers fields. It is anticipated that yields of sweetpotato are significantly under-estimated, primarily because of the piecemeal harvesting method common throughout the country.

Many factors contribute to low farm-level yields. Sweetpotato is grown primarily for food security and is not normally managed for maximum yield. Many farmers plant varieties susceptible to diseases, pests, and drought. Late planting, use of poor quality planting materials, untimely weeding all lead to poor yield performance. Limited marketing opportunities are also a disincentive to invest labour time and inputs in sweetpotato production. For instance Mwambene *et al.* 1992 report that in the Ileje area of the Southern Highlands zone, there is high potential for expanding sweetpotato production. Weather conditions are good, and farmers are familiar with pit storage. However, due to their total dependence on local markets, which cannot absorb all that farmers produce, sweetpotato production is still very low.

Another aspect on the low level of yield in farmers fields, might be due to lack of alternative uses of sweetpotato at both household and national levels (Mwambene *et al.* 1992). The narrow range of utilization restricts market opportunities, which in turn contributes to the stagnation of productivity.

Constraints

The factors mentioned by farmers which limit the production of sweetpotato at the farm level are summarized in Table 20. Insect pests (sweetpotato weevils), drought, shortage of planting materials, low root yield and vertebrate pests were frequently mentioned by farmers in almost all zones. Details of each factor have been discussed under their respective sections.

Table 20. Major production and post-harvest constraints as mentioned by farmers per zone.

Constraint	Percent of farmers							
	CEN	SHL	SOU	LAK	EAS	NOR	Mean	Rank
Biotic								
Insect pest	52	57	50	77	58	80	62	1
Viral and fungal diseases	25	28	26	63	16	20	30	5
Vertebrate pests	20	56	6	21	11	60	30	5
Abiotic								
Low soil fertility	0	8	6	11	11	40	13	9
Drought	80	25	10	80	29	55	47	2
Shortage of planting material	25	11	26	66	29	70	38	3
Low root yield	25	28	31	90	11	10	33	4
Lack of improved varieties	25	0	13	0	11	0	8	13
Socio-economic								
Limited consumption	25	20	0	9	0	9	11	11
Poor market accessibility	0	20	40	20	22	20	27	6
Storage problems	0	0	23	0	11	70	17	7
Lack of good processing techniques	15	11	0	24	11	9	12	10
Low market prices of produce	20	28	17	0	0	20	14	8
Labour shortage	0	0	12	24	0	20	9	12
Land shortage	0	0	12	0	11	40	11	11
Lack of capital	20	0	12	0	0	20	9	12

Key: CEN = Central Zone (n=109); SHL = Southern Highlands Zone (n=102)
SOU = Southern Zone (n=200); LAK = Lake Zone (n=186); EAS = Eastern Zone (n=238)
NOR = Northern Zone (Source Kuoko *et al.* 1993).

Postharvest Findings

Because of its short maturity, high calorific value, tolerance to drought, and absence of toxic materials in the storage roots, sweetpotato is an important food security crop. However, it is highly perishable once harvested. Therefore, farmers have invented traditional methods for extending the shelf life of sweetpotato storage roots and leaves through processing.

Processing of storage roots

In-ground storage is limited by sweetpotato weevil infestation, vertebrate pests, root rot and human theft. In overcoming these constraints many farmers (64%) in the Lake Zone indicated that they process sweetpotato storage roots (Table 21). In the other zones sampled, between 3% and 33% of farmers reported processing sweetpotato. A survey in the Northern zone reported no processing at all (Kuoko, *et al.* 1993).

Table 21. Percentage distribution of farmers who process sweetpotato roots by zone.

Zone	No. of respondents	Number and percent of farmers who process sweetpotato roots
Central	109	3 (3%)
Southern	200	40 (20%)
Lake	186	119 (64%)
Eastern	209	21 (10%)
Southern highlands	101	33 (33%)
Overall mean	805	216 (26%)

Techniques for processing sweetpotato storage roots (Fig. 4) were first developed by the Sukuma and Nyamwezi tribes in Lake and Western Zones. These techniques have now spread to other zones. Wherever these tribes settled, sweetpotato processing techniques were introduced. For instance in the Southern Highlands, Mwambene *et al.* 1992 reported that sweetpotato processing is very common in the Usangu Plains that are mainly inhabited by the Sukuma people.

Figure 4 . Flow chart of the traditional sweetpotato processing techniques.

<table>
<tr><td colspan="3">Fresh storage roots
Sundry for 1- 2days</td></tr>
<tr><td>1.</td><td>2.</td><td>3.</td></tr>
<tr><td>Peel</td><td>Parboil for 30-60 min</td><td>Peel</td></tr>
<tr><td rowspan="2"></td><td>Peel (optional)</td><td rowspan="2">Soak in water for
3 - 4 days</td></tr>
<tr><td>Slice</td></tr>
<tr><td>Slice</td><td rowspan="2"></td><td>Ferment</td></tr>
<tr><td></td><td>Squeeze & drain out moisture</td></tr>
<tr><td>Sun-dry</td><td>Sun-dry</td><td>Sun-dry</td></tr>
<tr><td></td><td></td><td>Pound into
flour</td></tr>
<tr><td colspan="3">Store in bags or baskets</td></tr>
</table>

Note: 1. Product called *'Michembe'*. This can store for 3 to 6 months.
2. Product name *'Matoborwa'*. This can store for more than 6 months.
3. Product made from soaked and fermented roots reported only in Ukerewe island, Lake Zone.

Two product types are locally termed *Michembe* and *Matoborwa*. *Matoborwa* slices are much sweeter and much harder than *michembe*. Hart (1991) noted that *matoborwa* slices are better protected against insect attacks and can be stored for a longer time. Hart (1991) observed that when preparing a meal with processed sweetpotato, women prefer to cook the two types mixed to lower the sweetness of *matoborwa*. Children are more

fond of eating *matoborwa* than *michembe* because of the taste. Although these techniques are available, the processed products are not commonly marketed. For instance, of the all districts surveyed, *Michembe* and *matoborwa* products were found marketed at a very small scale in Kwimba district only. It was also noted that these products are frequently used during food shortages and extended dry spell periods. Otherwise sweetpotato storage roots are commonly preferred in fresh form. A detailed study on the acceptability of processed products and consumer demand needs to be conducted in various areas.

Processing of leaves

Leaf processing is limited to drier areas of the Lake Zone and Western Zone (Tabora region). Processing of leaves is done in the following steps (Figure 5).

Figure 5. Flow chart of the traditional sweetpotato leaves processing techniques.

Fresh leaves
Wither in sun to soften
Parboil for 20 - 30 minutes
Squeeze out water
Sun-dry
Prepare *Matembele, Nkalango*, or *Sansa*
Store in baskets, gunny bags, etc.

It has been noted in the previous sections that in the Lake Zone there is limited use of sweetpotato leaves as a vegetable. Farmers in this zone indicated that leaves of other crops like cowpea, cucumber, pumpkins, cassava and wild plants, e.g. *Corchorus olitorius*, are preferred to sweetpotato leaves (Hart, 1991). In areas where the use of sweetpotato leaves for vegetable is common, some varieties are preferred to others. In Maswa and Meatu districts (Lake Zone), the cultivars *Yanga, Ipembe, Njugu, Njemu* and *Ngosha* are commonly used (Hart, 1991). All of these have narrow leaves with deep lobes. Heart-shaped leaves like *Ntulwawima* are not preferred because they are bitter. Farmers indicated that processing narrow leaves into a '*sansa*' is easier than broad leaves. Lack of knowledge in improved storage techniques was reported almost in all zones surveyed. Many farmers who use sweetpotato leaves as a vegetable consume the leaves in dry form unlike other vegetables. These farmers indicated that the dry leaves are preferred because of good taste, reduced bitterness, reduced viscosity, increased firmness, and other related good cooking qualities.

Storage

As noted earlier in previous sections, sweetpotato roots are commonly harvested piecemeal. Mature storage roots on each plant are harvested individually, leaving immature roots to continue bulking. In this way the plot is used as a store. Nevertheless, attack by sweetpotato weevils, rats, and moles, as well as theft, can cause serious losses when the crop is harvested late. On small farms, it is inefficient to tie up a plot of land for several months after the crop is mature. Some cultivars, particularly some which are early maturing, do not store well in the ground. This problem was mentioned particularly by farmers in Northern Zone (70%).

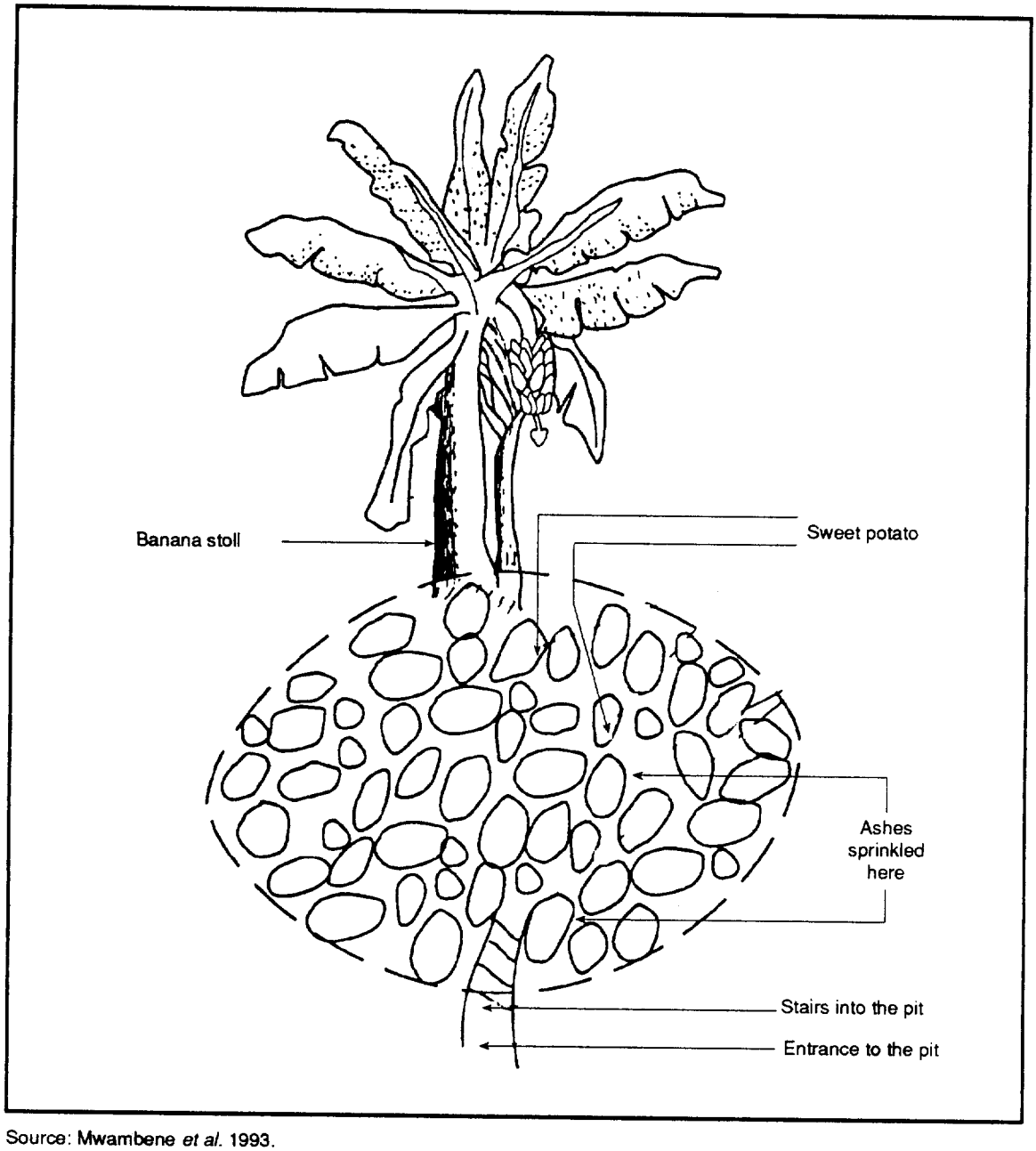
Pit storage of fresh roots

The storage of roots in underground pits during the cool, dry winter season is a common practice in Usangu plains located in the Southern Highlands. Figure 6 illustrates the steps involved.

Figure 6. Steps followed in the in-ground storage of sweetpotato roots

Fresh storage roots
Selection of undamaged roots
Bagging (optional)
Dig a shallow pit
Pile/stake storage roots in pit
Sprinkle ashes
Cover the pit with soil

In the Usangu plains, farmers use shallow pits dug close to a banana plant (Figure 7). This method is mainly used to store sweetpotato that are planted between January and March and harvested during July and September. It is hypothesized that banana stems and suckers produce liquid exudate that help to keep the soil moist. This moisture may prevents the sweetpotato storage roots from withering (Mayona, 1995 personal communication). Sweetpotato can be stored in these pits between five and six months. Beyond that period the deterioration in root quality occurs, mostly in the rainy season (Mwambene *et al.* 1992). The pit storage method is found mostly in cool, upland areas.



Source: Mwambene *et al.* 1993.

Figure 7. Sweetpotato Storage pit in the Southern Highlands

Storage of dried chips

Processed products *Michembe* and *Matoborwa* are stored in *vihenge* (big storage baskets), tins, gunny bags, heaps, and in other types of containers. Dried chips can be stored for two to eight months, depending on the type of the product and climatic conditions. Several storage pests, particularly rats and the larger grain borers (*Scania sp.*) and lesser grain borers attack the processed products and render them into unpalatable flour (Table 22). *Michembe* is more vulnerable than *Matoborwa* (Hart, 1991).

Table 22. Percentage distribution of farmers who mentioned sweetpotato storage pests in Maswa and Meatu districts.

Pests in store	% mentioned
Rats	23
Insects	77
Larger grain borer *Dumuzi*	32
Tembo	30
Funza	15

Source: Hart, 1991.

Marketing

Sweetpotato is marketed at the homestead, in small local markets, or to larger regional and urban markets through middlemen (Table 23). In the Southern Zone, middlemen are the main buyers of sweetpotato, whereas most farmers in the Lake zone (59%) sell their sweetpotato at home. In the Southern Highlands, most farmers (75%) sell their sweetpotato directly in the local markets. The price per kilogram ranged from 10 to 70 Tshs (3 to 18 U.S. cents) depending on location and season.

Table 23. Frequency distribution of sweetpotato selling points by zone.

Zone	Selling Points		
	Middlemen	At Home	Local Market
Southern (n=200)*	86 (43%)	64 (32%)	50 (25%)
Southern Highlands (n=101)	10 (10%)	15 (15%)	76 (75%)
Central (n=109)	35 (32%)	49 (45%)	25 (23%)
Eastern (n=146)*	61 (42%)	23 (16%)	62 (42%)
Lake (n=186)	45 (24%)	109 (59%)	32 (17%)
Mean	239 (32%)	260 (35%)	245 (33%)

* urban market mentioned but very negligible.

Poor market infrastructure was one of the major constraints reported by farmers. Many have to travel long distances on foot to markets. Poor market accessibility was mentioned by some farmers in all zones except the Central zone. On the average, this problem was mentioned by 27% of the total farmers visited.

In the Lake Zone, few people sell sweetpotato through formal market channels. They usually sell what they call surplus in order to earn some cash for household expenses. In other cases, sweetpotato is exchanged for fish or given to hired casual labourers to cover labour costs (Kapinga,1992). Processed sweetpotato and planting materials in some parts of the Lake Zone (Shinyanga) are sold only when the household is in need of money, mostly to buy small household needs.

For the Central zone, 45% of the households visited sell sweetpotato produce at home where buyers come and purchase the produce, 32% sell their produce to middlemen and 23% to local markets. In the Eastern zone, sweetpotato is mainly sold to local market and middlemen (42% each); and only 16% of households sell the sweetpotatoes at home. In the Northern Zone two types of selling methods were observed (Kuoko *et al.* 1993):

- Individual sale system; farmer takes his/her products to the local market.
- Barter system; sweetpotato is bartered for maize, sorghum, millet, onions, (Arusha and Singida) and the exchange rate depends on the availability of the product, climatic condition and consumer income.

Transportation of fresh sweetpotato storage roots to the markets is another problem. Due to the lack of care in harvesting and loading, and the lack of good packing methods, losses in transit over bumpy roads and in subsequent handling are high. This means that the shelf life of roots in the market is short — a week or ten days at most. Research towards improvement of shelf-life of fresh roots in the market chain has been initiated.

The price in urban markets, particularly in the capital city of Dar es Salaam, increases dramatically during the month of Ramadan (Ndunguru, 1992). Ndunguru noted that the prices of sweetpotato in the retail markets of the city do not seem to follow the laws of supply and demand as one would expect. During the month of Ramadan, both the supply and the price of sweetpotato storage roots increase dramatically. During the rest of the year there is often a scarcity of sweetpotato in the market, but the price remains constant. The urban marketing system is informal, and does not involve standardized grading, storage for more than a few days, or any system for the diffusion of information on supply and price. Further studies in this area are required to identify how and where the marketing systems for fresh sweetpotato storage roots could be improved.

Socioeconomic factors

Gender

In many parts of the country, sweetpotato is still regarded as women's crop, and women are responsible for the lion's share of the work (Table 24). This was noted in many areas visited. Hart (1991) noted that in Shinyanga region in the Lake zone women are still doing most of the work in this crop. Women are responsible for the production, decision making and sometimes can control the produce. Similarly, in Kagera region of the Lake Zone, Kapinga (1992) noted that in some cases where men have no wives, they have to request assistance from women of their neighbours during planting, weeding, and harvesting of sweetpotato. In this area, it is a shame for a man to plant or weed a sweetpotato field.

Table 24. Percentage distribution of representative farmers by labour division in sweetpotato production, processing, and marketing activities by zone.

Activity	Central (N=109)	Lake (N=186)	Northern *	Southern (N=200	Eastern (N=146)	Overall mean
	F (M)	F (M)	F (M)	F (M)	F (M)	F (M)
Field preparation	60 (40)	52 (48)	50 (50)	50 (50)	50 (0)	52 (48)
Planting	100 (0)	100 (0)	100 (0)	100 (0)	80 (20)	96 (4)
Weeding	100 (0)	90 (10)	60 (40)	80 (20)	50 (50)	76 (24)
Harvesting	80 (20)	100 (0)	100 (0)	100 (0)	50 (50)	86 (14)
Processing	100 (0)	80 (20)	na (na)	100 (0)	100 (0)	100 (0)
Storage of processed product	100 (0)	100 (0)	na (na)	80 (20)	60 (40)	85 (15)
Rural area marketing	30 (70)	50 (50)	50 (50)	40 (60)	50 (50)	44 (56)

na = not applicable, F- Female, M - Male
*Source: Kuoko *et al.*, 1993.

In the Northern zone, apart from land preparation, other activities are carried on mainly by women (Kuoko *et al.* 1993). Women are normally assisted by their children, especially girls. However, in areas, such as Kiteto district, where sweetpotato is grown for the commercial sale of both vines for fodder and storage roots, there is a tremendous shift of responsibilities in sweetpotato production. In this area together with the Eastern zone, men are actively involved in sweetpotato production for the market (Table 24). Kuoko *et al.* (1993) noted that in the Singida region the crop is attended to by both sexes.

Land preparation in this zone is done by both men and women. Both participate in weeding but harvesting, which is always piecemeal, is done by women. Marketing of the produce and decisions about the use of the income generated are the men's responsibility.

In all zones surveyed, female farmers are responsible for finding a suitable plot of land for sweetpotato cultivation. Women are also usually responsible for obtaining planting material. Hart (1991) remarked that this exercise can cause considerable delay in planting. Sometimes, delay in planting can be caused by illness or labour shortage due to other field activities. Also, when time and planting materials are available, the rain might not be enough to plant. Hence these factors contribute to low yield and establishment of small, fragmented plots. In intercropped fields, sweetpotato is weeded by both sexes at the same time as other crops such as maize, bean, and coffee. Sometimes, women play a big role in selling sweetpotato planting material and vines for fodder. Similarly, the exchange of sweetpotato storage roots for labour or fish is usually supervised by women.

Labour

The average family size per household varied with zones, and averaged between 5 to 8 persons per household. This does not imply that every person in the family participates in sweetpotato production. Many young people have migrated to urban areas to look for employment, and the involvement of children in field activities is limited by their attendance at school. Labour shortage was cited as a problem in the Southern (12%), Lake (24%), and Northern Zones (20%). Hiring of labour, especially during peak periods, (November-March) is quite common although expensive. Sometimes sweetpotato cultivation period coincides with that of other food and cash crops, which take precedence.

Utilization

Sweetpotato is mainly limited to rural areas except in the holy month Ramadhan when the consumption rate increases even in the urban areas. Limited consumption of sweetpotato was indicated by farmers in Central Zone (25%) and Southern Highalnds Zone (20%).

In the Southern Highlands, Mwambene *et al.* 1992 reported lack of alternative sweetpotato recipes apart from boiling. At present, there are few foods to combine with sweetpotato. Similarly, due to lack of knowledge, in the semi-arid areas very few households feed their children with sweetpotato. In the Southern Zone, a few people (4%) reported other uses of sweetpotato e.g. medicinal use, making of sweetpotato buns, and flour for porridge. This is the only zone that mentioned diversified uses of sweetpotato.

Low consumption rates are influenced by many factors such as availability of alternative foods, eating preferences, and local food customs. The major preparation method is by boiling. Lack of other attractive methods of preparation in the rural areas may contribute much to low consumption of sweetpotato. In some areas, consumers complained of flatulence, heart burn, and constipation when they eat sweetpotato (Kuoko *et al.* 1993).

Conclusions and Recommendations

Sweetpotato is an important food security crop for small holders in Tanzania. It is a major root crop, third in importance after cassava and round (*Solanum*) potato. Although research on sweetpotato has been going on since 1974, relevant information from the farm level had not been adequately documented. To improve the relevance of research planning for increased sweetpotato production, surveys were conducted in key sweetpotato-producing areas. The major components of the study were secondary data and key informant and formal survey techniques. From the findings, the following issues require immediate intervention for increased sweetpotato production and utilization in Tanzania.

1. Pests and diseases of sweetpotato are major factors limiting production. Flexible integrated pest management packages, which combine varieties with resistance or tolerance with improved cultural control practices, could significantly increase yield. Sweetpotato weevils cause a lot of damage to sweetpotato storage roots in the field. In the stores, larger grain borers attack and reduce yield and quality of dried chips. Early planting and early harvesting in order to avoid the peak of pest population during dry season, can also help to alleviate the weevil problem
   Virus diseases are common in farmers' fields and cause a lot of damage. The possible way to reduce the problem is through training farmers to identify diseased plants and rouging them in order to reduce the rate of spread of the disease. Selection of healthy planting materials is another option.
   Researchers should emphasize the use of improved cultural practices as the pests and disease control strategies. These include good weed management, as some weeds act as hosts for various pests and disease. Other advantage of clean weeding helps to prevent vertebrate pests (moles and rats) from entering the field. The increased use of traps and formation of hunting teams on the community level have also proven useful. Another option which needs to be investigated further is the use of natural repellents like ntwintwi, a plant which is used in the Southern Highland Zone.
2. Researchers are urged to develop high yielding varieties which are acceptable to consumers for various uses. Important characteristics are high dry matter content,

drought tolerance, good root characteristics, low fibre content, and good in-ground storability.

3. Inadequate material at planting time is a problem for many farmers. The introduction of community nursery and distribution systems based on rapid multiplication techniques could have a major impact. Training of farmers in these techniques and in the management of nurseries at farm level is a key element. The use of healthy, clean materials at farm level should be encouraged through extension and training demonstrations with farmers.
4. The limited range of ways in which sweetpotato is utilized and the limited storage and processing technologies available prevent sweetpotato from achieving its potential importance. The quality of processed products needs to be improved and the development of new products which incorporate sweetpotato as an ingredient should be promoted. Examples include chips and crisps, composite flours incorporating dried and milled sweetpotato, animal feeds, and starch. Baseline information is needed to assess the acceptability of the developed products.
   It is expected that it would be most efficient to chip and dry on the farm level in the major areas of production, and to make the processed products in or near the major urban market centres. This strategy would require the improvement of on-farm storage of dried chips. Post-harvest research must include market assessment of the tastes and preferences of consumers, which are expected to vary in different parts of the country.
5. Large areas of Tanzania are semi-arid. Extended dry spells can wipe out a sweetpotato crop if the plants are not well established. In many cases the crop survives, but yields are chronically reduced due to drought stress and increased attack by pests, particularly sweetpotato weevils. At the other extreme, in the Southern Highlands and Northern Zones low temperatures lead to slow growth and low bulking rates. Research intervention should focus on developing varieties adapted to a wide range of environments, and extension needs to help farmers to overcome constraints to timely planting.
6. Poorly developed marketing systems is another important constraint. Sweetpotato is bulky in nature, and perishable fresh roots and leaves need to reach the final consumer within a week of harvest. Improved transport and better information would open up new markets for farmers in many areas of Tanzania. Research should focus on extending the shelf-life of fresh storage roots through improved handling and packaging techniques to minimize damage during transport.
7. Socio-cultural habits have an important impact on sweetpotato production and marketing. It was noted that men contribute little in sweetpotato production because the crop is regarded as women's crop. For increased production of this crop, this attitude has to change. Men must be enlightened and mobilized about the importance of sweetpotato for household food security. This needs support of policy

makers and extensionists. Sweetpotato should be valued like other crops such as sorghum and maize, and both women and men should play an equal role sustainable crop production. Increasing market potential for sweetpotato inevitably changes traditional concepts about the crop. This has been observed in Gairo in the Eastern Zone, where men are actively engaged in sweetpotato production for commercial purposes.

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Appendix 1. Area under food crops on Tanzanian mainland, 1993/94 (000 Hectares).

ZONE	CROPS								
	Maize	Sorghum	Cassava	Pulses	Paddy Rice	Banana	Sweetpotato	Millet	Wheat
Northern	175.4	107.1	9.9	53.1	7.3	84.5	4.8	8.3	29.9
Eastern	158.2	4.5	137.8	34.1	29.2	23.1	5.8	1.0	0.0
Central	109.9	158.4	20.2	12.0	7.4	0.4	10.6	167.1	0.0
Southern	100.1	499.9	237.9	47.8	14.3	0.0	0.1	0.9	0.0
S.Highlands	397.5	39.4	39.2	115.7	66.8	34.9	40.3	4.5	3.1
Western	232.4	141.0	94.1	92.1	57.8	16.3	23.97	64.3	1.8
Lake	455.5	61.7	153.9	129.4	116.5	174.2	119.6	94.3	0.0
Total	1629.0	1052.0	693.0	484.2	299.3	333.4	205.1	340.4	34.8

Adapted from: Basic Data Agriculture and Livestock Sector. 1995. Statistics Unit, Planning Marketing Division.

Appendix 2. Estimated production of major food crops in thousands of tons of maize equivalent (1993/94).

ZONE	CROPS								
	Maize	Sorghum	Cassava	Pulses	Paddy Rice	Banana	Sweetpotato	Millet	Wheat
Northern	91.6	10.7	25.7	23.9	26.7	253.6	6.3	3.8	55.4
Eastern	236.4	27.3	207.2	11.9	144.9	58.9	7.6	0.1	0.0
Central	140.1	41.3	52.6	5.6	6.6	4.1	13.8	76.8	0.0
Southern	90.1	19.7	618.7	1.3	19.4	0.0	0.1	0.5	0.0
S.Highlands	680.3	39.8	171.9	85.9	134.3	102.8	52.4	4.1	2.8
Western	358.2	141.0	244.7	11.6	56.2	35.6	31.1	76.8	1.3
Lake	562.1	61.7	400.3	40.5	226.2	376.3	155.4	55.8	0.0
Total	2158.8	341.5	1721.1	180.7	614.3	831.3	266.7	217.9	59.5

Adopted from: Basic Data Agriculture and Livestock Sector 1995. Statistics Unit, Planning and Marketing Division.

Appendix 3. List of areas surveyed.

Zone	Region	District	Division	Ward	Village	No. of Households
Southern	Mbeya	Ileie	Bundali	Kafule	Kapelekesi	9
			Bundali	Kafule	Isoko	9
		Rungwe	Bukukwe	Kiwira	Syukula	9
			Bukukwe	Kiwira	Ibula	9
		Mbozi		Ruanda	Njelenje	9
		Mbeya		Mslewe	Mshewe	8
				Utengule	Azimio	8
				Utengule	Utengule	8
	Iringa	Iringa		Ifunda	Mibimitali	7
				Ifunda	Kibena	9
		Mufindi		Mafinga	Luganga	8
				Mafinga	Rungemba	8
	Ruvuma	Tunduru	Nakapany	Nakapanya	Namakamba-le	10
			Namasakat	Namsakata	Tuwe macho	10
			Nampung	Kidodoma	Nandembo	10
			Lukumbul	Lukumbulemb	Lukumbule	10
			Ruponda	Ruponda	Namanga	2
Estern	Morogor	Kilosa	Gairo	Gairo	Ibuti	4
			Gairo	Gairo	Chakwale	3
			Gairo	Gairo	Gairo	2
			Gairo	Gairo	Msingisi	1
			Gairo	Rubeho	Rubeho	3
			Mikumi	Mikumi	Kihelezo	3
			Mikumi	Mikumi	Malolo	3
			Mikumi	Mikumi	Msimba	3
			Mikumi	Kadodi	Kidogo basi	3
			Mikumi	Kidodi	Kifinga	3
			Mikumi	Kidodi	Ruhembe	3
			Mikumi	Mikumi	Kidoma	3
			Mikumi	Kododi	Tundu	3
			Mikumi	Mikumi	Mikumi mjini	2
			Mikumi	Mikumi	Kis`anga	3
			Mikumi	Malolo	Mgogozi	3
			Rudewa	Rudewa	Batini	3
			Kilosa	Mkwatani	Mkwatani	3
			Masanze	Masanze	Kivungu	4
			Masanze	Kilangali	Kilangali	3
			Masanze	Mabwerebwer	Mamoyo	3
			Masanze	Masanze	Changarawe	2
			Magole	Magole	Dumila	3
			Magole	Magole	Magole	3
			Magole	Mamboya	Mtumbatu	3
			Magole	Mamboya	Kiegeta	2
			Magole	Magubike	Magubike	1
			Kimamba	Chanzuru	Chanzuru	3
			Magole	Berega	Berega	2
			Ulaya	Ulaya	Kibaoni	3
			Kimamba	Chanzuru	Ilonga-	2
			Ulaya	Ulaya	Misongeni	1
			Ulaya	Ulaya	Mbuyuni	2
			Ulaya	Ulaya	Ilakala	3

Zone	Region	District	Division	Ward	Village	No. of Households
			Ulava	Ulava	Mhenda	3
			Ulaya	Zombo	Zombo	4
			Ulaya	Zombo	Kigunga	2
			-	Berega	Kiegea	1
			Kilosa mjini	Mkwatani	Mtendeni	3
			Matumbo	-	Misongeni	1
		Morogoro	Mlali	-	Tangeni	4
			Mlali	-	Changarawe	3
			-	-	Mkundi	2
			Mvomero	Mvomero	Mvomero	2
			Matombo	-	Misongeni	2
		Kilombero	Mangula	Kisawa-sawa	Ichonde	6
			Kidatu	Sanje	Sanje	4
			Ifakara	Kibaoni	Mbassa	6
			Kidatu	Kidatu	Kidatu	7
			Mgeta	Mbingu	Mbingu	6
			Ifakara	Kibaoni	Kikwawila	6
			Ifakara	Idete	Namawala	6
			Mgeta	Chita	Chita	6
			Mangula	Mangula	Mangula B	6
			Mangula	Mkula	Mkula	6
			Mgeta	Mgeta	Mchombe	5
			Kidatu	Sanje	Msolwa	4
	Coast	Kibaha	-	-	Visiga	5
			-	Tumbi	Pangani	5
			-	Tumbi	Twende pamoja	5
					Mkuza	4
		Kisarawe	-	Kibuta	Kibuta	13
			-	-	Masanganya	1
			-	191 KJ	Kibasila	3
			-	Kisarawe	Jeshini	3
		Bagamoyo	-	Yombo	Matimbwa	10
			-	Yombo	Yombo	10
			-	Yombo	Kongo	10
	Dar es Salaam	Temeke	-	Kigamboni	Gezaulole	7
			-	Kigamboni	Kibugumo	4
			-	Kigamboni	Kimbiji	5
			-	Kigamboni	Mbutu	6
			-	Mbagala	Mbande	4
		Kinondo-ni	-	Kibamba	Kibamba	11
			-	Kibamba	Mbezi	3
			Kibamba	Kibamba	Kibamba	3
			-	-	Goba Kisauke	3
Central	Dodoma	Kondoa	Bereko	Bereko	Bereko	3
			Bereko	Bereko	Masawi	3
			Bereko	Mnenia	Mnenia	4
			Bereko	Kisesi	Huruwi	3
			Bereko	Kikilo	Ororimo	3
			Kondoa mjini	Suruke	Mluwa	3
			Kondoa mjini	Kingale	Chemchem	3
			Kondoa mjini	Kingale	Kingale	3

Zone	Region	District	Division	Ward	Village	No. of Households
			Mondo	Dalai	Tandala	3
			Mondo	Paranga	Kelemabalai	3
			Mondo	Paranga	Isini	2
			Mondo	Dalai	Dalai	3
			Goima	Goima	Mirambo	3
			Goima	Chemba	Chemba	3
			Goima	Chemba	Chembalu	3
			Kolo	Kolo	Kolo	3
			Kolo	Kolo	Bolisa	3
			Kolo	Soera	Bukulu	3
			Pahi	Pahi	PahiIkova	2
			Pahi	Haubi	Mafai	3
			Pahi	Haubi	Haubi	3
			Pahi	Bumbutu	Bumbuta	2
			Pahi	Isumbuta	Isumbuta	1
			Pahi	Kalambe	Kalambebasi	2
Lake	Mwanza	Kwimba	Mbarika	Mbarika	Mbarika	3
			Mbarika	Sumbugu	Ikula	3
			Inonelwa	Kasololo	Nduha	3
			Inonelwa	Buhingo	Kabale	3
			Inonelwa			3
			Inonelwa	Kijima	Isakamawe	3
					Chasalawi	3
			Ngula	Sumve	Sumve	3
			Ngula	Walla	Walla	3
			Ngudu	Ngudu	Kilyaboya	3
			Nyamilama	Hundi	Jojiro	3
			Nyamilama	Hungumalwa	Kibililwa	3
		Ukerewe	Murambo	Bukindo	Kagunguli	3
			Ilangala	Nwiro	Bwasa	3
			Mumbuga	Mkanda	Muhula	3
			Mumulambo	Murutunguru	Bugolola	3
			Mumulambo	Bukindo	Kagunguli	3
			Ilangara	Muriti	Muriti	3
			Ilangara	Nduluma	Kameya	3
			Ilangala	Mumulambo	Bugolola	3
			Ilangala	Mumulambo	Murutunguru	3
	Mara	Musoma	Makongoro	Busuguru	Busegwe	3
			Makongoro	Nyakongo	Nyabangi	3
			M. urban	Bweri	Bweri	3
			Musoma	Makoko	Makoko	3
			Nyanja	Kiriba	Nyangoma	3
			Nyanja	Tegeruka	Maneke	3
			Nyanja	Bukumi	Chitale	3
			Nyanja	Suguti	Suguti	3
			Makongoro	Buluma	Isaba	3
			Makongoro	Buluma	Byamugambo	3
	Shinyanga	Maswa	Mwagala		Masanwa	3
					Somanda	3
					Maragane	3
					Nguliguli	3

Zone	Region	District	Division	Ward	Village	No. of Households
					Ipililo	3
			Sengerema		Shishiyu	3
					Mwanhegele	3
					Mwabagalu	3
			Nunghu		Isanga	3
		Meatu	Kimali		Mwanhuzi	3
					Bulyashi	3
			Kisesa		Mwandoya	3
	Kagera	Bukoba	Bugabo	Buhendangabo	Rushaka	3
					Kibale	3
				Kaagya	Mushozi	3
					Katangarara	3
				Kishanje	Bumai	3
					Rubafu	3
				Nyakato	Kiilima	3
					Ibosa	3
			Katerero	Ibwera	Kibona	3
					Karonge	3
					Kitahya	3
				Kaibanja	Nyakigando	3
				Kasharu	Kasharu	3
					Ntoija	3
				Katerero	Kyema	3
					Rwagati	3
				Katoro	Ngarama	3
					Ruhoko	3
				Mikoni	Mikoni	3
					Kahyoro	3
			Rubale	Butelankuzi	Mishenye	3
				Izimbya	Kyaitoke	3
				Ruhunga	Ruhunga	3
				Rubale	Mshenshe	3
					Rukoma	3
Southern	Mtwara	Mtwara	Mayanga	Mayanga	Msijute	10
			Ziwani	Ziwani	Ziwani masakala	5
			Ziwani	Ziwani	Nambeleke-tela	5
			Kitaya	Kitaya	Ngonja	10
			Dihimba	Dihimba	Mpondomo	5
			Dihimba	Dihimba	Dihimba	5
		Masasi	Lisekese	Marika	Namatunu	10
			Lisekese	Lisekese	Mkapunda	10
			Nanyumbu	Nangomba	Ngalinje	10
			Chikundi	Chigugu	Chikukwe	10
		Newala	Mahuta	Makukwe	Makukwe	10
			Newala	Luchingu	Tupendane	10
			Kitangari	Mchemo	Mdimba	10
			Newala	Makote	Mahumbika	10
	Lindi	Nachingwea	Ruponda	Ruponda	Namanga	8
			Nambambo	Stesheni	Songambele	10
			Naipanga	Ndomoni	Ndomondo	5
			Nambambo	Ndomoni	Ndomondo	4
			Ruponda	Marambo	Rupota	10

Appendix 4. Population density, climatic conditions and soil classification of the surveyed areas.

Zone	Region	District	Population density +	Mean growing season temp. +	No. of dry months (<60mm) +	Climatic Class +	Altitude Range (m) *	Soil parent material *
Lake	Kagera	Bukoba	H	>22°C	<4	H. H	1,200-1,900	Volcanic
	Mwanza	Ukerewe	H	>22°C	4-6	L. Sh	1,000-1,300	Granites
		Kwimba	H	>22°C	4-6	L. Sh	1,000-1,300	Granites
	Mara	Musoma	H	>22°C	4-6	L. Sh	1,000-1,300	Granites
	Shinyanga	Maswa	L	>22°C	4-6	L. C	1,000-1,300	Granites
Northern	Arusha	Arusha	L	>22°C	4-6	H. C	1,000-2,300	Volcanic
	Kilima-njaro	Mwanga	L	>22°C	4-6	L. C	150-1300	P. M
		Same	L	>22°C	4-6	H. C	150-1300	P. M
	Tanga	Muheza	H	>22°C	<4	L. H	<750	P. M
		Lushoto	H	>22°C	<4	L. H	1000-2300	P. M

Legend:
L = Low population<50 persons/sq.km.
L. Sh = Lowland semi humid
L. St = Lowland semihot
L. Sa = Lowland semi arid
P. M = Precambrium metamorphic
* From NALRM Document (1991)

H = High population > 50 persons/sq.km.
H. H = Highland humid
L. C = Lowland continental
L. H = Lowland humid
H. C = Highland continental
+ Adapted from: Carter and Jones (1989)

Zone	Region	District	Population density +	Mean growing season temp. +	No. of dry months (<60mm) +	Climatic Class +	Altitude Range (m) *	Soil parent material *
Southern Highlands	Mbeya	Rugwe	L	<22°C	4-6	H. C	1,000-1,300	Volcanic/ Alluvial
		Usangu plains	L	<22°C	4-6	H.C	1,000-1,300	Alluvial
	Iringa	Mufindi	L	<22°C	4-6	H.C	1,550-2,500	
	Ruvuma	Tunduru	L	>22°C	6-9	L. Sa	1,000-2,500	
Central	Dodoma	Musoma	L	>22°C	6-9	L. Sa	1,000-1,300	
	Singida	Singida	L	>22°C	6-9	L. Sa	1,000-1,300	

Legend:

L = Low population<50 persons/sq.km.
L. Sh = Lowland semi humid
L. St = Lowland semihot
L. Sa = Lowland semi arid
P. M = Precambrium metamorphic
* From NALRM Document (1991)

H = High population > 50 persons/sq.km.
H. H = Highland humid
L. C = Lowland continental
L. H = Lowland humid
H. C = Highland continental
+ Adapted from: Carter and Jones (1989)

Appendix 5. List of sweetpotato variety names cited by farmers by zone.

LAKE ZONE

1. Alinyikira
2. Bagaramentukuru
3. Bahege
4. Balozi
5. Bandama
6. Barabapu
7. Beri
8. Berita
9. Bila shaka
10. Bitambi
11. Bubele
12. Buchunga
13. Budagala
14. Budagara
15. Buditiri
16. Bugobogobo
17. Buhombi
18. Buhungukila
19. Bukoba
20. Bunzari
21. Bururi
22. Busito
23. Buziba
24. Bwaigolo malumbyo
25. Bwankyamoyo
26. CCM
27. Chakula na bwana
28. Chilihoma
29. Chilile
30. China
31. Dagaa
32. Dilu
33. Dundugala
34. Fela
35. Gahendeka
36. Gaholo
37. Gindu
38. Hapana nzala
39. Haraka
40. Hibada
41. Hodi
42. Holo
43. Holo nkondu
44. Ibahuli
45. Iboja
46. Idutu lya munhya
47. Igembe lya sheli
48. Igokolo
49. Ikalinga
50. Ikoboko
51. Ipembe lya mbogo
52. Ipembelya ngholongo
53. Juli
54. Julias
55. Kabibiya
56. Kaboja
57. Kabota
58. Kadogo
59. Kaganja
60. Kagingo
61. Kagole
62. Kahama
63. Mtendeni
64. Muhehe
65. Mwana usagala
66. Mwanahanga
67. Mwanza
68. Mwezigumwe
69. Mzuri hajikoshi
70. Nagato
71. Nylon
72. Sahani ya mwinyi
73. Sanagole
74. Shangazi
75. Sindano
76. Sinia
77. Tito
78. Zahani
79. Kaizila aha magaga
80. Kajungu
81. Kalamu ya Nyerere
82. Kaligulia
83. Kamenemene
84. Kamogori
85. Kamogoti
86. Kanenagule
87. Karai
88. Kashenshe
89. Kasinia
90. Katerani
91. Katoke
92. Katutu
93. Kaungezi
94. Kebuya
95. Kenge zibwa
96. Kenya
97. Kibiriti
98. Kibuyu
99. Kidumu
100. Kigambilenyoko
101. Kilyaibare
102. Kipiga basami
103. Kishiga mdege
104. Kishokyamaria
105. Kitulatuzi
106. Kizimbani
107. Koroboi
108. Kwisekwa
109. Kya Yosefu
110. Kyaizile
111. Kyakabwanga
112. Kyalwangono
113. Kyantemiliemikono
114. Likenejo
115. Lintinje
116. Lubembela
117. Longwanyerere
118. Lugendolwa nyau
119. Lumala
120. Lunda
121. Lung'ando
122. Lupondagesengi
123. Lutambi
124. Naonao
125. Nchambi
126. Ndasilaakataka
127. Ng'wana sabina
128. Ng'wanabubele
129. Ng'wanabushole
130. Ng'wanaditiba
131. Ng'wanagusa
132. Ng'wanagwani
133. Ng'wanakabelele
134. Ng'wanakisambale
135. Ng'wanalimbo
136. Ng'wanalugoye
137. Ng'wanalupuzi
138. Ng'wanamakimu
139. Lyankwani
140. Ng'wananenge
141. Ng'wanang'hondi
142. Ng'wanasasi
143. Ng'wandindai
144. Ng'wejigumo

Appendix 5. List of sweetpotato variety names cited by farmers by zone.

145. Ngikolo
146. Ngikulu obundaga bulongo
147. Ng'wanamhande
148. Ng'wanamhindi
149. Ng'wanamhulwa
150. Ng'wanamulagwa
151. Ng'wanandito
152. Mwananzoka
153. Mwanasai
154. Mwanayagela
155. Mwanidako
156. Mabati
157. Mabunu
158. Magai
159. Magili
160. Mahelebe
161. Maherebe
162. Mahoboga
163. Maholela
164. Makenzi
165. Makisasa
166. Makuluhama
167. Malahya
168. Malomo ya mhunu
169. Malugumba
170. Malya
171. Malya Mtuka
172. Mamaheri
173. Mwanza
174. Mwarabu
175. Mwasa
176. Mwezi mmoja
177. Mwiguzantukuru
178. Mwiyandu
179. Mwiyanga
180. Nginghinaji
181. Ngofila
182. Ngolomole
183. Ngongoseke
184. Ngosha
185. Ngw'anabudigu
186. Ngwanaditiba
187. Ngwanamitinje
188. Ngwanawale
189. Ngwanawalwa
190. Nihambage sengi
191. Njemu
192. Njubu
193. Njugu mawe
194. Njugu
195. Nkeo katibu
196. Nkima alinasiri
197. Nkima atina chupi
198. Nkunda
199. Nshashi
200. Ngoshaatina kaji
201. Ngosha atinanimo
202. Ngosha gagaga
203. Nguluke
204. Mzalendo
205. Mzondwa
206. Ntulwawima
207. Nyabusami
208. Nyachitekelo
209. Nyakwekwimo
210. Nyamigamba
211. Nyamonde
212. Nyantanye
213. Nyasinde
214. Nyau azunile tako
215. Nyerere
216. Nzegamatolo
217. Pipi
218. Risasi
219. Roza
220. Ruganza
221. Rushuri
222. Rutumba
223. Rwasa
224. Sabina
225. Sahani
226. Sai
227. Sama ya nyabu
228. Sayi ntubu
229. Sembe
230. Sengi
231. Senyenye
232. Sevena
233. Shamba
234. Shija
235. Shimbe onela
236. Shina
237. Shinyanga
238. Sida
239. Sigaoyalilile
240. Simama
241. Simbe ichumu
242. Sinia
243. Sister
244. Sita
245. Suguti
246. Suluba
247. Suzanna
248. Taiti
249. Taabu
250. Tala
251. Tangolyanhuli
252. Tarehe
253. Tarime
254. Teena
255. Tundinsa nagaja
256. Tutomushako
257. Ua la nyerere

NORTHERN ZONE

258. Buruga
259. Dosidosi asilia
260. Kandoo
261. Karoti
262. Katibu kata
263. Kihalu
264. Kwata nyeupe
265. Kwata nyekundu
266. Majani mapana
267. Manjano
268. Mayai
269. Mhaya
270. Mheruka
271. Mombasa
272. Muumpoka
273. Mwaka kubwa
274. Mwezi mmoja
275. Nyekundu
276. Nyeupe
277. Tengeru moja
278. Tengeru nyekundu
279. Tengeru mbili
280. Tengeru njano

Appendix 5. List of sweetpotato variety names cited by farmers by zone.

EASTERN ZONE

281. Ali mtumwa
282. Budagala
283. Canada
284. Chanzuru II
285. Chanzuru IV
286. Chanzuru I
287. Chanzuru V
288. Chanzuru III
289. Cheupe
290. Chipeko
291. Dumila I
292. Dumila II
293. Dunga
294. Eliasi
295. Esta
296. Furahisha
297. Gairo
298. Hali mtumwa
299. Hamgegelesengi
300. Hapana nzala
301. Jumga
302. Karroti
303. Kasimama
304. Khaki
305. Kinahaha
306. Kipiga basami
307. Machawa
308. Matembele
309. Mbegu ya Tanga
310. Mbegu ya Morogoro
311. Mkombozi
312. Moyo wa simba
313. Msufi

S. HIGHLAND ZONE

314. Bapina
315. Bululu
316. Kabeja
317. Kajobe
318. Kambofi
319. Kandoro
320. Kinahaha
321. Lubisha(si)
322. Magoba
323. Mahondora
324. Mahungo
325. Mandovisi
326. Mapufya
327. Masambungu
328. Masyabala
329. Matagasa
330. Mboma
331. Mbulukutu
332. Mdeki
333. Mufelekesha
334. Mupufya
335. Mwamba
336. Mwambasa
337. Mwera
338. Mwitika
339. Piremi
340. Semgovano
341. Sinia
342. Songea
343. Songwe
344. Sungabapina
345. Swila/sunga
346. Twalwawima
347. Vidwidwi
348. Vimbisi
349. Vindungu
350. Yai

SOUTHERN ZONE

351. Gandamoja
352. Jeshi mbatata
353. Kambi
354. Karoti manjano
355. Karoti vyeupe
356. Katungali
357. Kigumu
358. Kikwadu
359. Kizimbani
360. Kombati
361. Mamalengedi
362. Mangambilla ongamba
363. Mantaro
364. Mayai
365. Mbatata (W) Mbatata Red
366. Mitundi
367. Mnamba
368. Mreteta
369. Mwanduwa
370. Namatengeda
371. Namelela
372. Njano
373. Njano nyeupe
374. Nkabinne
375. Nkwawiwila Majoni
376. Orange
377. Purple
378. Red skinned
379. Red type
380. Red instant
381. Songea
382. Viazi Jeshi
383. Viazi njano