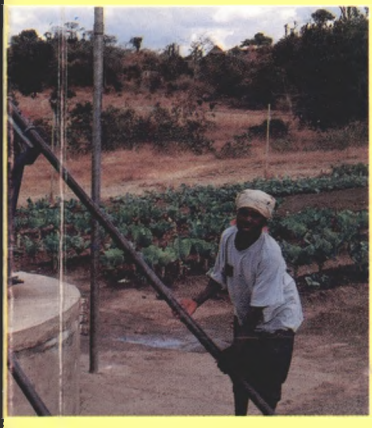
Smallholder Horticulture

in ZIMBABWE



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SMALLHOLDER VEGETABLE PRODUCTION IN NORTHERN TANZANIA: CONSTRAINTS AND OPPORTUNITIES

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ABSTRACT

A detailed survey of vegetable production in four villages in Arumeru District near Arusha was conducted by research and extension personnel of the Ministry of Agriculture, in collaboration with Cornell University. Households growing vegetables had access on average 7 to 13 acres of land (2.8 to 5.3 ha), and grew from four to six crops. Maize, beans and bananas were common to most households, but the list of other commodities produced varied widely from village to village. Major constraints to production included a lack of access to information on pest and disease identification and control, to timely knowledge of commodity prices, and to alternative market outlets for the production. A district staff of six extension horticulturists served an estimated 6 000 growers in 132 villages in the district. This coverage was not nearly enough to adequately impart information to growers, particularly since telephones were not available, and the extension staff had few vehicles with which to make their rounds. Nevertheless, growers were enterprising and willing to take risks, producing some commodities such as tomatoes during the rainy season, when the chance of crop failure was high but prices advantageous. Further work is needed to assess the impact of increased production on labour allocation. The survey indicated that expanding production could well be limited by the increased burden placed on women to manage both production and household sustenance. In addition, research to identify adapted, high-yielding varieties, and economical and safe methods of disease, insect and weed control are also needed.

INTRODUCTION

Smallholder agriculture plays an important role in the production of virtually all crops in Tanzania. Small-scale growers produce about 85% of the maize, 90% of legumes and 95% of the drought tolerant staple foods including sorghum and millet in the country, as well as 85% of all export crops (Bukuku, 1993). The scale of vegetable production is relatively small (Verheij, 1982) but vegetables are a growing proportion of food and cash crop production and a direct source of food and/or income for the almost 80% of the population residing in rural areas of Tanzania (Bukuku, 1993). Thus there is the need to identify:

1) constraints to expanded vegetable crop production,
2) the range of production techniques and inputs owned and used by vegetable growers, and
3) the household and labour use strategies that families employ in realizing their productive capacity.

With this new information, more appropriate and sustainable agricultural needs might be identified, extension information and inputs required by rural households might better reflect the needs of vegetable producers, and planning and policy agendas might better meet the needs of rural clientele.

Little detailed information is available about vegetable production and decision-making by smallholders in any African country, although some preliminary surveys have been conducted on gardening in the Nyanga area of Zimbabwe (Chipika and Sarupinda, 1987). The present work may thus provide insight into the constraints faced by smallholder horticulturists in countries like Zimbabwe, and identify opportunities to improve the economic well-being of these producers.

Ecology of Arumeru District

Arumeru district is located in northeastern Tanzania. It has an area of about 300 km^2, contains 132 villages, and has 143 primary schools. The district population of 293,000 inhabitants is estimated to be increasing at an average of 3.3% per year. Population density is about 100 persons per km^2, but varies widely, with highest densities occurring in the coffee-banana belt. Age distribution of the population shows 49% below 15 years of age, 43% between 15 and 58, and only 7.5% above 58.

About 95% of the population of the district is engaged in agriculture. Thirteen percent of the total land area of the district is used in agriculture. The estimated acreage in crop production is distributed as follows:

Coffee	40 300 acres
Maize	38 300 acres
Bananas	17 800 acres
Vegetables	741 acres

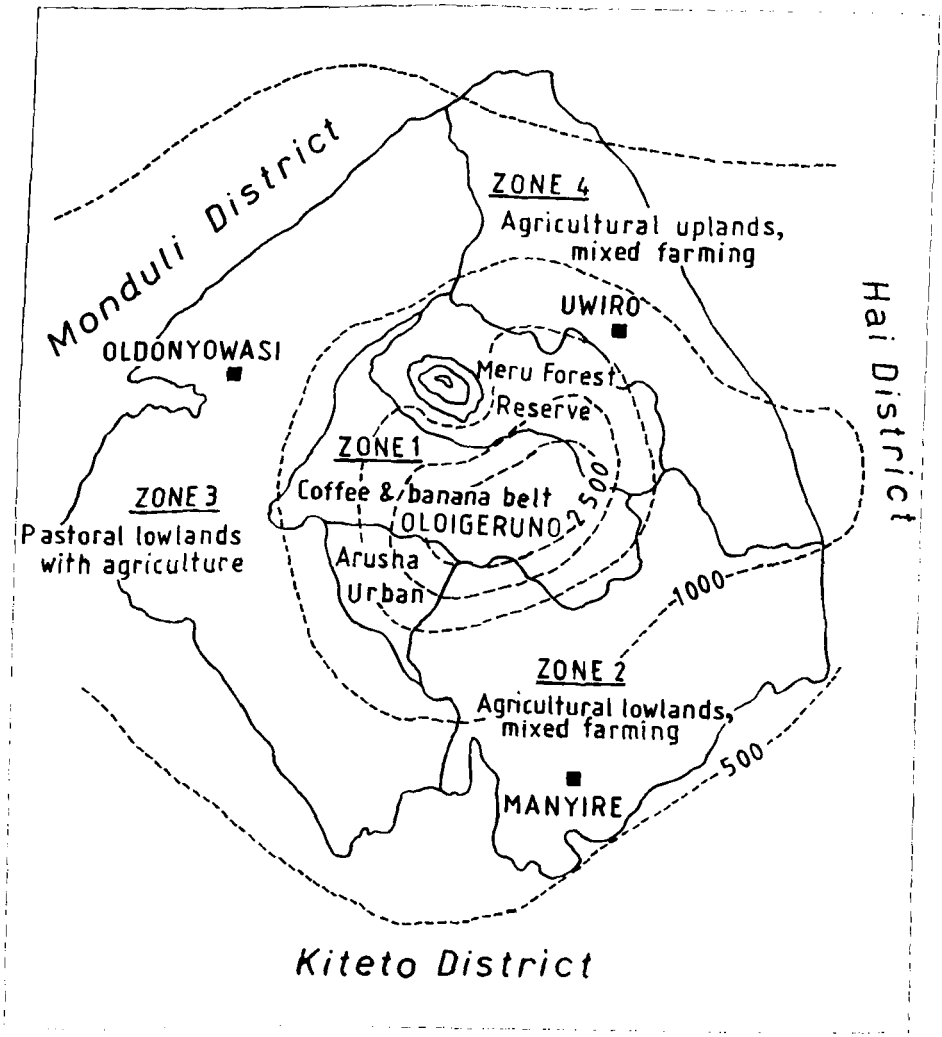
Of total crop land, 17,500 acres are irrigated.

Acres are used as the measurement of land area in this paper because this is standard in Tanzania, one acre is 0.405 hectares.

Arumeru District has Mt Meru, the second highest peak in Tanzania, [4 562 metres above sea level (m.a.s.l.)], and the fifth highest mountain in Africa at its centre. Much of the district is comprised of sloping terrain of the formerly volcanic peak. The mountain exerts a profound influence on the district's climate, soil, physical infrastructure such as roads and the availability of irrigation water. These influences account for much of the agricultural diversity in Arumeru District.

Rainfall amounts are highest in the areas south-east of the peak and are sharply reduced both farther away from the mountain, and on its northern and western sides (Fig.1). Rainfall in the entire district has a bimodal distribution, with the "long rains" occurring from February through May, and the "short rains" showing a maximum in November and December (Coutts, 1969; East African Met. Dept., 1975) (Fig. 2). Oloigeruno is located in the zone of highest rainfall (> 2500 mm annually, Fig.1),

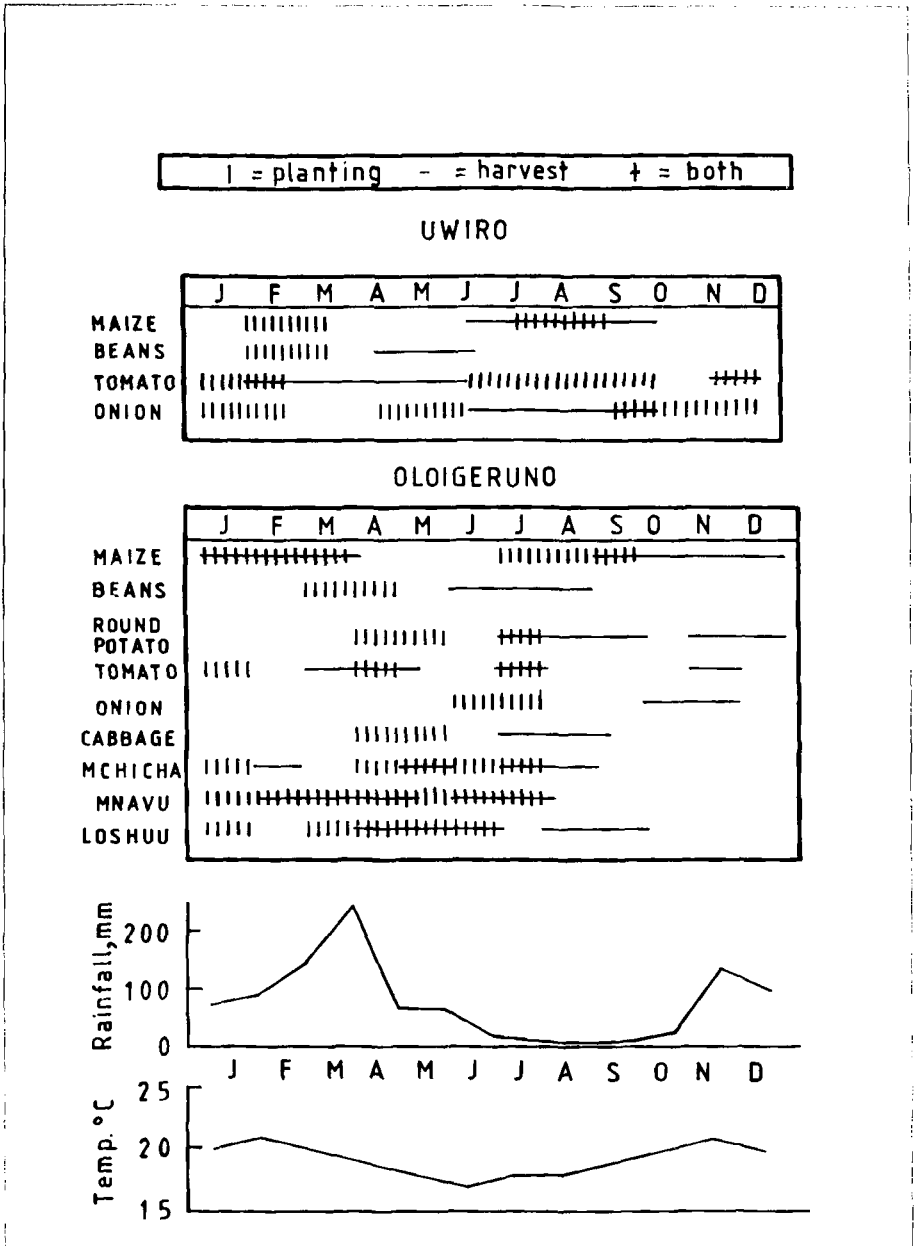
Figure 1: Map of Arumeru District and Arusha Urban district, showing locations of the four villages surveyed. Dotted lines link areas of similar annual rainfall totals (from Coutts, 1969)



Temperatures in the district vary little through the year (Fig. 2), with only a 4°C difference at Arusha in mean air temperatures. Differences in altitude of the village sites modify temperatures considerably. For every 100 m increase in altitude, temperature decreases by 0.6°C.

Soils of the district were formed from ash deposited by volcanic action of Mt. Meru. The soils are relatively young, fertile, with high porosity and low bulk density (Lundgren, 1978). Erosion appears to be the most important soil management problem (Lundgren, 1978), especially on the sloping fields and higher rainfall amounts of

Figure 2: Cropping calendar of the major crops in the two sample villages, along with monthly average rainfall and mean temperature, taken at Arusha airport, 1960-70 (East African Met. Dept., 1975)



METHODOLOGY

The principal goal of this study was to collect baseline data from a selection of vegetable growers in four villages in Arumeru District. After a preliminary survey of the four villages in the early summer of 1990, questionnaires were designed and field investigators collected information on a sample of 120 growing households in August of that year, 30 from each village. The data collected focused on agricultural production practices and household demographics (Feldman *et al.*, undated). The present report describes the findings of the survey with regard to two of the villages, Oloigeruno and Uwiro, and examines the implications of this study on what one might expect in similar studies of smallholder horticultural production in Zimbabwe.

The villages were selected after visiting a range of villages where vegetable production was assumed to be a significant part of the agricultural production system. Reconnaissance with village leaders, regional extension agents and community members from the Tengeru Research Station helped in the village selection process. After the four villages Oldonyowasi, Oloigeruno, Manyire and Uwiro were chosen to ensure agroecological diversity, permission to work in the village was secured by an initial visit to each village where we met with village leaders. During this period of reconnaissance a questionnaire was pretested and refined to ensure that both the breadth and detail of the data for this survey could be assured. Among all vegetable growers in each of the representative villages 30 were selected by purposive sampling, to be interviewed.

Of the two villages chosen for this report, *Oloigeruno village* is located about 5 km north of Arusha town. It lies between 1450 and 1800 m.a.s.l. and is bounded by Mount Meru on its north side. Oloigeruno was registered by the government during villagization in 1975. The village presently has one dispensary and a primary school and has a population of 1200 people in 360 households. The village is ethnically homogeneous and is inhabited by the "Waarusha" tribe. *Uwiro village* is located about 36 km outside of Arusha town in the northeastern region of the district at about 1500 m.a.s.l. It lies on the slopes of Mount Meru and is bounded by Arusha National Park. Historically this village was a settler farm area which was taken over by the Wameru in the early 1960's. Some Chagga also live in this village. The total population of 1932 is composed of 566 males, 500 females and 866 children. There are 338 households with average household size of 6 members.

Interviews with farm households were carried out in August, 1990 with the assistance of both biological and social scientists from Horticultural Research Training Institute Tengeru, Ministry of Agriculture Arumeru District and Sokoine University of Agriculture. The survey data were coded for computer entry at Sokoine University of Agriculture, Morogoro and then shared with colleagues at Cornell University. The data were analyzed at Cornell University by a multi-disciplinary team of researchers from the biological and social sciences.

SURVEY RESULTS

A. Landholding patterns

The size of land holdings in the villages surveyed rarely exceeded 25 acres (Table 1.) Oloigeruno had the largest number of holdings less than 5 acres in size, and also accounted for those owning the smallest [illegible]

Table 1: Land holding patterns of surveyed households in the sample villages

Households with acreage owned	Village Name	
	Oloigeruno	Uwiro
< 5 acres	20	14
5 ≥ 25 acres	9	15
> 25 acres	2	1
Land holding/household, acres[1]	8.1 ± 16.4	7.0 ± 6.2
Land holding/household, acres[2]	5.4 ± 7.0	6.2 ± 4.6
Largest land holding acres	87	29
Smallest land holding acres	0.25	1

[1]Mean ± standard error, calculated including all households.
[2]Mean ± standard error, calculated by omitting largest landholding in each village.

Table 2: Major and minor crops grown in the survey villages

Crop	Village Name	
	Oloigeruno	Uwiro
Major food crops		
Coffee	+++	+
Banana	+++	+++
Maize	+++	+++
Beans	+++	—
Commercial vegetables		
Round Potato	+++	—
Tomato	+++	+++
Onion	++	+++
Cabbage	+++	—
Green leafy vegetables		
Amaranthus	+++	—
Nightshade	+++	—
Brassica carinata	++	—
Minor crops		
Sweet pepper	+	—
Cowpea	+	—
Eggplant	+	—
Spinach	+	—
Sweet potato	—	+

Grown by:
- less than 10% of households
+ between 10–33% of households
++ between 34–50% of households
+++ more than 50% of households

B. Crop production

Production and utilization of major crops

A majority of households surveyed produced maize, beans and bananas (Table 2).

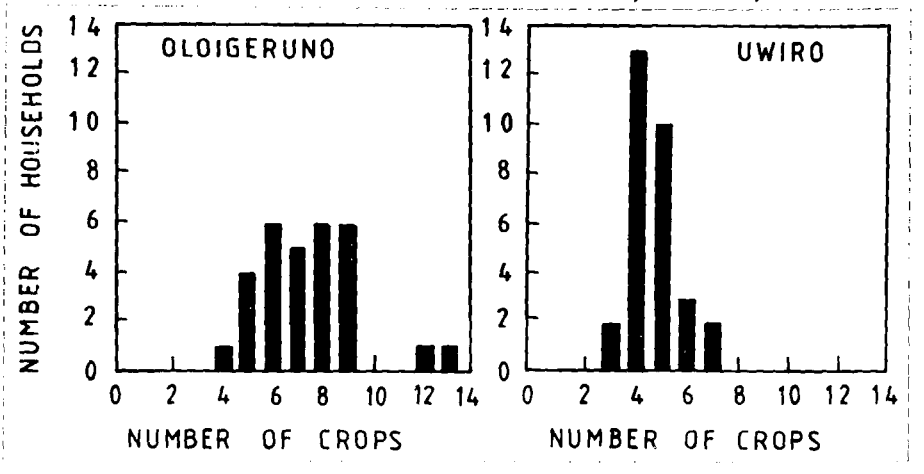
the sample households both consumed and sold these crops. Vegetables harvested as greens (amaranth *Amaranthus* spp., nightshade *Solanum nigrum*, and *Brassica carinata*) were concentrated in Oloigeruno, which is located near the large market of Arusha, where these perishable commodities can be sold before excessive loss of quality. The leafy greens are both consumed and sold. Other vegetables such as okra, or cucumber were grown in significant quantities in only one of our selected villages. These were generally sold rather than consumed locally.

Other factors which determine choice of crop by villages are the climate, the soil conditions, and the other crops already being grown. Cabbage, *Brassica carinata* and other crops thriving in cool temperatures are most important in the higher altitude village (Oloigeruno).

From the above, it becomes apparent that the number of crops grown in the highland village of Oloigeruno is high, with 11 crops being grown by more than a third of the households.

Uwiro is farther from Arusha, has lower rainfall and a warmer climate. As a result, only five crops are grown by more than a third of the farmers interviewed. A frequency distribution of the total number of crops grown per household shows similar trends (Fig. 3).

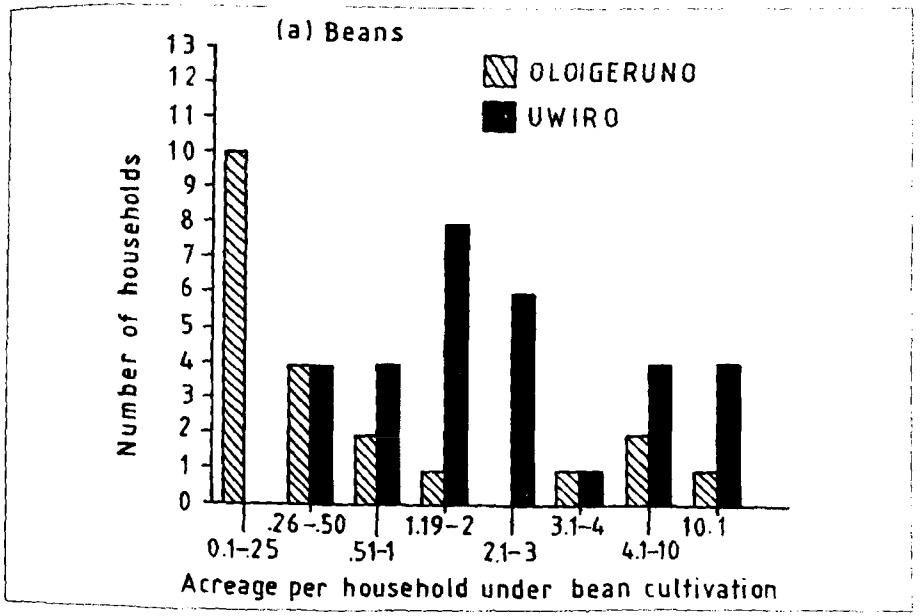
Figure 3: Number of crops produced per household, for Oloigeruno, and Uwiro villages. Totals include minor crops not considered in detail in subsequent descriptions.

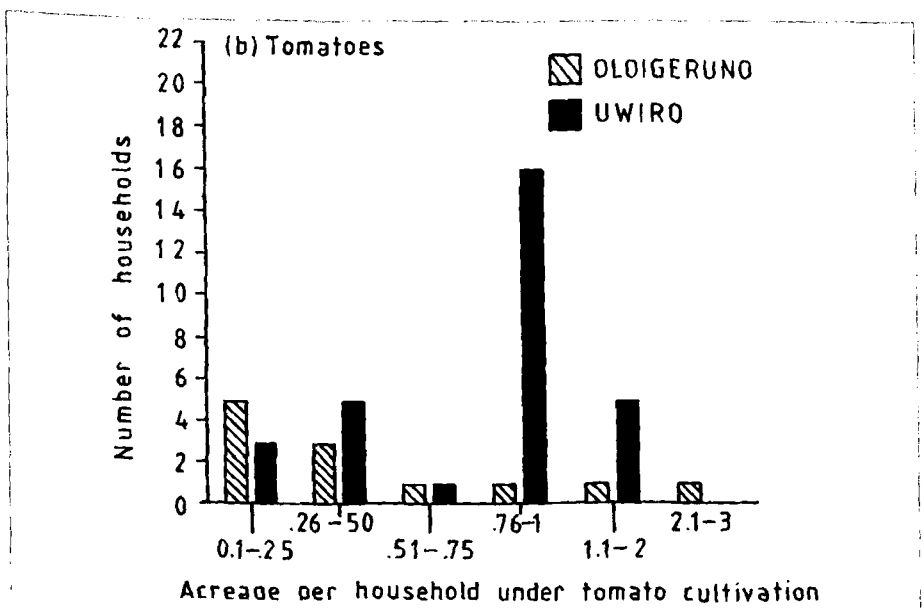


Land holdings per crop

Given the small size of land holdings per household, and the number of crops grown by the farm family, the size of plots planted to particular crops is generally small. For instance, of the 21 households growing beans in Oloigeruno village, only one has more than 10 acres of beans (Fig 4.) In Uwiro village, land holdings and consequently bean acreage tends to be larger. A similar trend is found with tomato (Fig. 4), with acreage per household averaging between 0.26 and 0.5 for Oloigeruno, and 0.76–1.0 acres for Uwiro. In Oloigeruno village, tomatoes are commonly grown on a trellis, a practice which requires much hand labour which tends to restrict the acreage under production. In Uwiro village, tomatoes are allowed to sprawl on the ground, requiring no labour in either staking or pruning.

Figure 4: Frequency distribution of acreage per household of bean and tomato production in Oloigeruno and Uwiro villages.





The acreage under cultivation of crops other than beans and tomatoes is even smaller. The majority of households growing nightshade or onions, for example, grow less than 0.25 acres of these crops. In the case of onions, a constraint and disincentive to expand production is likely to be one of labour since weed control for these crops is entirely by hand and dependent on available family labour time. Also, onions grow very slowly in the seedling stage and are only weakly competitive with weeds. As we will see in Section D, to remain economically viable these crops need frequent and time-consuming manual weeding.

Labour constraints also appear to be a factor limiting cultivation of leafy greens such as nightshade which, coupled with the perishable nature of the harvested product, make production of large quantities of this product risky. The strategy of most growers is to grow small amounts of nightshade and *Amaranthus* at one time, but plant frequently.

Production of most vegetables in the survey area is monocrops, except for small patches of leafy greens growing between longer-season cole crops. These leafy green vegetables may have arisen as volunteer plants from seeds of previously grown crops. The exception to this practice is in the production of traditional staples of maize and beans which are frequently intercropped in the survey area (Due *et al.*, 1984).

C. Cropping calendar

The period of the year during which particular crops are grown is determined by the distribution of rains and temperature (Fig. 2), the availability of labour, and competition with other crops and by the nature of the crops grown. Staple food crops such as maize and beans are generally planted at the start of the long and short rains (Fig. 2), and are grown without supplemental irrigation. Maize can be harvested either as immature cobs, as is common in Oloigeruno, or left until the grain is dry, about a month later. Planting dates for the major vegetables are not dependent on climatic conditions because supplemental irrigation is frequently used in their production, and temperatures are not limiting throughout the year.

Planting and harvesting dates for tomato frequently overlap and extend over most of the year. The same is true for leafy green vegetables which are planted and harvested continuously. One exception to this is during periods when labour is needed for the harvesting of maize and other crops.

Planting dates for onions are similar in the villages surveyed, falling in the cool dry months of June through August. During this time, the incidence of diseases is reduced and there is less tendency for bulbing because of the cool temperature. The low temperatures may, however, increase the incidence of bolting. A small part of the planting also is made in October (Uwiro), for reasons that still remain unclear.

The timing of potato and cabbage production coincides with the lowest temperatures of the year, a period favourable for growth of these cool season crops.

D. Inputs

Production of vegetables for sale requires a high degree of crop care to ensure that diseases and insect pests that might spoil the appearance or palatability of the harvested product are kept at a low level. In conformance with this view, nearly all farmers in the sample villages used insecticides and fungicides on vegetables produced for the market (Table 3). A majority also purchased seeds for planting. In

use on these vegetables was more variable. Both Oloigeruno and Uwiro farmers used sulphate of ammonia on vegetables, but only Oloigeruno households made heavy use of complete (NPK) fertilizer. Manure was commonly applied to vegetables, even on farms where sulphate of ammonia is used. Herbicides were not used to any extent on vegetables nor on non-vegetable crops.

Table 3: Inputs used on vegetables as proportion of households growing the particular crops

	Percent using inputs	
Input	Oloigeruno	Uwiro
Herbicide	7	7
Insecticide	100	100
Fungicide	96	100
Seeds	96	96
S/A[2]	96	82
TSP[2]	33	4
NPK[2]	85	4
Manure	96	88
Hired Labour	79	58

[2]S/A - Sulphate of ammonia; TSP - Triple super phosphate
NPK - complete fertilizer

In general, application of inputs to non-vegetables is similar to that on vegetables (not shown). Although use of insecticides and fungicides was lower on non-vegetables, their application still involved a majority of growers. Coffee growers have ready access to pesticides through their growers' cooperative, and use them for control of coffee berry disease, rust and leaf miner.

Farmers gave a number of reasons to explain the pattern of use of inputs. Herbicide use was very restricted because farmers were not aware of chemical weed control methods. Constraint on fungicide and insecticide use was due to a combination of lack of availability and high costs. Purchase of seeds was also constrained by high costs and limited availability. Few farmers were unaware of fungicides and insecticides, and the possibility of purchasing seeds. Some farmers produce their own seeds, albeit in limited quantities.

The limited awareness of the possibilities of chemical weed control implies that farm households must rely on manual weed control methods. Weeding frequencies for the major crops common to most villages vary with the crop. For maize and beans, farmers generally weed once or twice per season. Long season vegetables such as tomato, and crops that are poorly competitive with weeds such as onions require more frequent weed removal. Such crops are therefore more demanding of labour. The need for frequent weeding may be the principal factor restricting the size of the individual fields of onions. Weeding frequencies averaged three times per season for nightshade and amaranth.

Among other inputs used by households in the sample villages [illegible]

unavailable and only a few households owned donkeys. Ownership of sprayers wa widespread in all villages, reinforcing the finding of the common use of chemica insect and disease control methods.

Table 4: Ownership of farm machinery, draft animals and tools by households in the four villages, as percentages of households surveyed

Type of input	Percentage of households owning input by village	
	Oloigeruno	Owiro
Tractor	0	0
Donkey	7	10
Oxen	60	53
Cart	13	3
Plough	67	47
Sprayer	77	53
Hoe	97	97
Sprinkler	0	0

E. Labour use

Eighty-three percent of the Tanzanian labour force in 1980 consisted of smallholders of which only 1.9% were wage workers (Bukuku, 1993). The remainder, 98% of the working population, were non-wage agricultural labourers who sustain the country's rural productive capacity.

Recalling Table 1, average landholdings per household range between 5.4 acres in Oloigeruno to 6.2. acres in Uwiro. Oloigeruno has large proportion of households owning less than 5 acres (20 vs. 14%). Oloigeruno also has the most intensive cropping pattern (Fig.3). This concentrated land use may be facilitated by larger average family size (6.0 compared to 4.7 for Uwiro) (Table 5).

Table 5: Frequency distribution of household size by village

No. of persons per household	No. of households	
	Oloigeruno	Uwiro
2–3	0	2
3–5	11	17
6+	19	11
Mean	6.0	4.7
Mode	7	4

Large household size is likely to be the consequence of the relative stability of Oloigeruno. It is the oldest settled village in our sample and has a homogeneous population, two factors likely to limit out-migration. Its land productivity, moreover, demands a large per household labour input which enables producer households to utilize their sources of unpaid family labour. It is also noteworthy that these villages

79% and 71% of Oloigeruno households hire labour for vegetables and non-vegetable production, respectively (Table 3). For Uwiro village 54% and 59% of households hire labour for vegetable and for non-vegetable production, respectively.

In addition to the distinction between unpaid family and hired labour it is important to differentiate the ways in which different household members allocate this labour to tasks in the production process. While tasks can be categorized in a variety of ways, we have chosen to differentiate tasks in the production cycle into 11 categories: ploughing, harrowing, sowing, transplanting, spraying, watering, weeding, applying fertilizer, harvesting, processing and selling. This recognizes at the outset that processing work can be further desegregated into processes of selection for sale and consumption, selection and drying, and, where appropriate, storage.

The purpose of these broad distinctions is to draw attention to the range of tasks comprising the agricultural production cycle and to signify the diversity of labour contributions required to ensure that the production process be fully realized. We anticipate that these broad findings will lead to more focused studies on the complexities of household production systems and intra-household gender and generation divisions of labour.

Other tasks engage both adult males and adult females. Our findings also suggest that children too are involved in the range of activities associated with vegetable production. It is also not surprising to note that both men and women engage in sowing and transplanting activities. This finding is similar to that found in the Transhumance sector in Southern Dafar, Sudan where summary data on the gender division of labour indicates that 53% of the labour of women and 26% of the labour of men is used for sowing and planting (FAO, 1990:15). Both findings show that a rigid division of labour does not define selected agricultural tasks. However, in interpreting this finding we might benefit from the caution taken in a study of dairy husbandry in the Arusha region where survey results reported that men and women participated equally in dairy cattle husbandry activities. Actual observations by contrast revealed that women did the main part of the dairy production work (Laurent and Centres, 1990).

What is clear from our survey data is that the intra-household division of labour differs according to the crop produced (Table 6). Those crops produced primarily for household consumption usually are under the control of women, whereas the crops produced primarily for sale are usually controlled by male household members. Informal discussions with household members also revealed that traditional crops such as amaranth which have generally been produced for home consumption are increasingly being sold on the market. There is some anticipation among household members that this might portend a change in the division of labour in amaranth production.

The participation of women and men in almost all crops produced means that it is impossible to characterise tasks as predominantly female or male. Our data, however, do make quite clear that the production of two crops, amaranth and nightshade, are defined as the sole responsibility of women in Oloigeruno where these vegetables are grown primarily for consumption. It is noteworthy that these crops are also the only two vegetables which are grown by most households for both consumption and sale; all other vegetables are grown for sale only by the majority of households. As suggested

Table 6: The division of labour for selected crops[1] by village

	Land preparation*	Sow or Transplant	Spray & Water	Weed	Fertilize	Harvest & Process	Sell
Oloigeruno							
Maize & Beans	MF	MF	M	MF	M	MF, F	
Marketed Vegs	MF, F	MF	MF, M	MF	MF	MF	MF
Consumed Vegs	F	F	F	F	F	F	F
Uwiro							
Maize & Beans	M	MF	M	MF	MF	MF	M
Marketed Vegs	MF	MF	M	MF	MF	MF	MF

men and women = MF; men = M; women only = F

[1]Marketed vegetables are those which over 50% of households reported producing for sale only (e.g. tomato, onion, cabbage) consumed vegetables are those for which over 50% of households reported producing for consumption as well as sale (e.g. green vegetables such as amaranth and nightshade).

** Includes ploughing and harrowing*

earlier, this finding suggests the need to explore differences in the labour strategies employed by household members when they produce consumption and market crops.

For all other crops grown in the survey villages, discussions with villagers confirm that men and women are involved in almost all of the activities related to crop production and processing. The extensive participation of women in Arusha is similar to the more specific findings from a study of the Morogoro region of Tanzania. Due and Anandajayasekeram (1984) found that while the overall contribution by women to agricultural labour was 48%, 67% and 59% of the labour for rice and bean production (respectively) was contributed by females, in contrast to 37 to 40% of the labour for sorghum, cotton and sunflower production.

DISCUSSION AND CONCLUSIONS

Vegetables production in Tanzania has had growing importance as a complement to diets and consumption practices as well as for sale in the domestic and export market. In the sample villages studied we have identified the use of vegetables grown in the Arusha region and note that the majority are grown primarily for sale to local town markets and to the capital city. Selected vegetables such as tomatoes, onions, and round potatoes are likely to be sold in Arusha town and Dar es Salaam through middlemen from these cities. The role of the middleman, who controls access to these markets, has limited the control farm households have over prices and therefore incomes. Control by smallholders of both production and increased sales also have to be ensured, however, if increased production is to benefit income, consumption and nutritional status of small producing families.

The study has also highlighted a number of significant constraints which limit productive capacity. Most notable among the constraints identified was marketing, especially visible in Uwiro village which has the most limited number of crops for sale in local markets. The lack of

inhibit information flows, particularly with regard to the market price of tomatoes. Infrastructural limits also affect extension information regarding pest and weed control methods and the proper use of inputs including inorganic fertilizer. Infrastructural limitations also constrain timely marketability of such crops as tomatoes and green leafy vegetables which, because of their rapid perishability depend on accessible markets to ensure quality, to generate demand and maintain favourable prices.

In Oloigeruno village, despite the wide range of vegetables produced, limited land holdings — where a majority of households (67%) own less than 5 acres — inhibits expanding productive capacity. An additional land constraint is limited holdings within each village. Some households, for example, own land located more than four hours walk from their place of residence, thus constraining labour availability and the range of crops produced, and the security of harvest. Maize and beans as well as round potatoes are grown in the land some distance from the village proper.

Another set of constraints identified by the growers was limited access to credit and to extension services. Institutionally, limited infrastructural capacity such as lack of available transport and petrol reduce the access extension agents have to villages under their responsibility. Discussion with members of the extension service indicate that Arumeru district has about 6000 vegetable producers in 132 villages but is only served by a staff of six district horticulturists, three of which are stationed in Arusha town and the remainder posted in the district.

It is anticipated that in the future increased attention will be placed on the question of labour allocation and labour constraints limiting vegetable production for both consumption and sale. This new focus will have important implications for improving our knowledge about the availability of unpaid family and the need for hired labour. Understanding labour demand and availability is especially crucial for the expansion of both subsistence and commercial crop production. To date, evidence suggests that expanding production will likely increase the burden women have for production and for household sustenance (Swantz, 1985).

Implications of the study on the investigation of smallholder horticulture in Zimbabwe

The study of smallholder horticulture in Arumeru District of Tanzania illustrates the diversity of conditions faced by vegetable farmers in two villages only about 20 km apart. The presence of Mt Meru in the district causes profound differences in rainfall, temperature, relative humidity, and determines the distance and quality of roads to allow produce to get to market. We have seen that as result of these differences, the farm families have made very different choices in the way they produce and market their crops, and in the choice of crops grown. The survey thus cautions us to avoid sweeping generalisations about smallholder production in even a relatively small area, and to respect the innovation and adaptation capability of the growers. The greater homogeneity among producers within than between villages indicates that some consolidation is possible even in this diverse environment. That finding should facilitate the design of extension programs at village level. Nevertheless, the small size of the individual holdings, and the large number of producers is a formidable obstacle to effective sharing of extension information.

More importantly, the high degree of regional diversity increases the difficulty of

constraints on production and marketing of horticultural products in a region. This may increase the resources and time needed to plan and carry out applied research and extension programs appropriate to the region. Specific needs of vegetable producers identified in the present survey (see below) are remarkably similar to those found to be important in smallholder horticultural production in Zimbabwe (Andreini, 1993; Chipika and Sarupinda, 1987). Infrastructural constraints, such as lack of timely market information, lack of access to water for irrigation, and poor transport facilities, are common constraints to African agriculture that are fortunately being recognized as major bottlenecks to rural development (Blackie, 1987; Wanmali, 1992).

RECOMMENDATIONS FOR POLICY MAKERS, RESEARCHERS AND TRAINERS

After sharing the results of the survey with a steering committee for the Sokoine University-Cornell Collaborative Project, the following recommendations were made:

1. The number of extension agents trained in horticulture and posted to horticultural crop producing areas needs to be substantially increased.
2. Training of farmers in the specific skills of vegetable production, including pest control, irrigation, post-harvest handling and storage should be given high priority.
3. Increased emphasis is needed on finding adapted cultivars, popularizing these among growers, and assuring that seed or disease-free planting materials of these cultivars are readily available to producers.
4. Farmers should be assisted in obtaining sources of water for supplementary irrigation during the dry season.
5. Improvement is needed in supplying farmers with information on commodity prices, and the availability of supplies of inputs necessary for timely production.
6. Means should be sought to allow growers to market their produce more efficiently, such as the establishment of cooperatives, buying clubs, communal packing and storage sheds, etc.
7. The improvement of infrastructure in vegetable producing areas should be given high priority by local and regional authorities to ensure that roads, transport and communication facilities are functioning well.

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