AGRICULTURAL UNIVERSITY OF NORWAY
Department of Vegetable Crops
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HORTICULTURE IN TANZANIA

Paper by

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CONTENTS

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1. INTRODUCTORY REMARKS

In the more detailed analysis the term "Horticulture" in Tanzanian context includes the various other disciplines of Pomology, Olericulture and Floriculture. Although these disciplines are recognized as such, yet in most discussions the term horticulture is often used to embrace aspects of one or all the three. In most of the discussion that follows, this same line of thought will be adopted, though at times the individual sub-disciplines may be considered if necessary.

The Ministry of Agriculture in Tanzania is the parent body to which horticultural development policy finally depends. Although there has been a tendency in recent years for the Ministry of Agriculture to give due recognition to certain specific crops, e.g. tea, cotton, sisal, cashewnut, by forming individual crop authorities to forster the development of those crops, horticultural industry has never been fortunate to receive this attention. In practical terms this means that horticulture has not received as much emphasis as it should. But it should be added that there has been greater awareness in the last five years than before, and gladly this awareness is increasing continuously. This fact comes out very clearly in the Second Five Year Development Plan of Tanzania (1969-1974) in which horticultural crops (fruits and vegetables) are mentioned as having been neglected for too long, though their nutritional role has been realized for many years in the past. Thus, within the decentralized system of government machinery, the regional crop priority lists have mentioned horticultural crops in one form or another.

It is now realized that effort in this field will be concentrated in Ujamaa villages.It is further realized that not all Ujamaa villages can concentrate on horticultural crops. And therefore, it is hoped, when the industry gets on its proper footing, only some of the Ujamaa villages in the districts will concentrate on horticultural crop production as an economic activity. Already a good number of Ujamaa villages have each at least a small vegetable garden to produce some vegetables for consumption by the village population. This happens in the spirit of self-sufficiency.

At this point it needs to be mentioned that there is hardly any literature reference material on horticulture position with regard to Tanzania. The F.A.O. statistical books, f.ex., while showing product-

ion figures of horticultural crops for countries like Kenya, Ghana, Ethiopia, Zambia etc., have hardly any figures for Tanzania except an occasional mention. Even in the monthly and annual reports of regions and the Ministry, the terms "vegetable" and "fruit" are commonly used and only rarely one finds a breakdown into the individual kinds of crops. These observations merely go to, further, point out the juvenile stage of horticultural industry. In the light of this, the writer has to base his comments on bits of scattered information, experience of other countries and his own experience in Tanzania. The contents of this paper are therefore the sole responsibility of the writer and in no way does it involve or reflect on government policy.

2. BASIC FEATURES

2.1 Physical

Tanzania lies wholly in the tropical zone of the world just to the south of the Equator between approximate latitudes of 1°S and 11°50'S and longitudes 29°40'E and 40°30'E. The rift valley passes through the country including lake Manyara in the north and all the way down to lake Nyasa in the south. The country is endowered with various highlands and plateaus and a vast central plain. The highest point (Mt. Kilimanjaro, over 5776 m (19000 ft.)) in the country is found in the northern highlands forming a range of mountains and high plateaus with Mt. Meru (over 4570 m (14000 ft.)) and the Usambara mountains. The volcanic craters, e.g. Ngoro-ngoro crater, are found in the northern area. Just to the north of lake Nyasa are the southern highlands in the regions of Iringa and Mbeya. The Uluguru ranges rise above 2135 m (7000 ft.) in some parts and tend to join the southern highlands and the Usambara ranges towards the coast side. The greater part of the coastline is characterized by coral growth with harbours. The islands of Zanzibar, Pemba and Mafia are also characterized by coral growth with the highest point about 91,4 m (300 ft.) above sea level on Zanzibar Island. The greater part of the remainder of the country is composed of the vast lowland plain from the central part of the country westwards, north-westwards and south-west, and undulating lowlands to the south-east. Agricultural potential lies mainly in the highland and undulating lowland areas, although, as will be pointed out later (chapter 4), these areas tend to have serious problems of soil erosion and depletion of plant nutrients.

The inland waters of Tanzania cover a total area of 59052 sq. km (22800 sq. miles). This includes the waters of lakes Victoria in the north-west, Tanganyika in the west, Nyasa in the south-west and smaller lakes of Rukwa, Manyara, Natron and Eyasi. It also includes river waters of the Pangani, Rufiji/Ruaha, Ruvuma and several smaller rivers (see appendix 4). Flood problems are experienced every year from the big rivers during the heavy rain-season, and recently it has become an issue of national concern.

2.2 Population

The total area of the country is 945091 sq. km (364900 sq. miles) with 886039 sq. km (342100 sq. miles) of dry land and 590052 sq. km (22800 sq. miles) of water (mentioned above). According to 1971 cencus, the population is about 14 m. with an estimate of 2,6-3 percent increase annually. But the population is widely distributed over the country. The density is roughly about 13 people per sq. km (35 people per sq. mile), and some parts of the country are heavily populated, while others are only sparsely populated, especially in the central plains. For example, according to 1967 census, the following density figures were recorded (persons per sq. mile):

Kilimanjaro district	178
Bukoba	99
Ukerewe	506
Dodoma	35

Population tends to be more concentrated in areas of higher soil fertility and relatively more reliable rainfall. Thus almost two thirds of the area of the country carries less than quarter of the population while about 20% of the population occupies only 4,5% of the area. With more urbanization, there has also developed the tendency of concentration in and around the major urban centres of, f. ex., Dar es Salaam, Mwanza, Arusha, Morogoro, Mbeya and Tanga. But the population living in urban centres is comparatively low, i.e. less than 10% of total population. Largely, then, the majority of Tanzanians live in the rural areas where agricultural production is the major food and economic activity.

The neighbours of Tanzania include Kenya, Uganda (both also members of East African Community), Rwanda, Burundi, Congo, Zambia, Malawi and Mozambique.

2.3 Soils

It is remarkable that Tanzania has a greater variety of soils than any other country in Africa. Consequently, different soil classifications have been developed and used by various authorities. Some parts of the country's soils have only been partly classified, notably the southern-most areas. For purposes of this paper, the major soil types have been grouped according to areas where they occur most (appendix 1) and it is considered sufficient. The

different highly generalized groups of soils are briefly described on the Key to appendix 1. The more relevant point is the relationship between the various block soil types, and the distribution of horticultural crop potential indicated in appendix 2. It is clear that the areas with relatively greater soil fertility are also the areas with the highest potential for horticultural crop production. These include areas in the northern highlands, part of the area on the eastern side of lake Victoria (Musoma/Tarime), the southern highlands and the Usambara/Uluguru regions. As it will be mentioned elsewhere in this paper, these also happen to be the areas of higher rainfall, less temperature fluctuations and comparatively more reliable and equable distribution of rainfall. These are therefore the areas most suitable for agricultural enterprises other than horticultural. Consequently, major farming systems have tended to evolve in these parts of the country, and a rather complex crop competition that will be looked into more closely later (chapters 3 & 4) has developed. Suffice it to mention here that soil erosion and/or plant nutrient depletion is currently a very serious problem in parts of the areas indicated.

2.4 Climate

Generally, Tanzania has an equatorial type of climate. The major cause of rainfall is the convergence of air leading to an upward movement and resultant cooling. In most cases this involves the meeting of the airstreams from the N-E and S-E. This general pattern is greatly influenced by altitude in the highland areas of the north and southern highlands. Areas around the lakes - Victoria and Tanganyika - also have a slightly different pattern of rainfall. But on the whole, more than 2/3 of the country receives less than 1000 mm a year.

The regions around lakes Victoria and Tanganyika have a relatively high rainfall often with an annual figure of over 800 mm with most rain falling between March and May, with a fairly dry season June to October.

The north-eastern areas have their wettest season March-June with average annual totals often over 1000 mm. In some years the mountaneous slopes of Kilimanjaro can strike an annual total of well over 2000 mm, and the areas have a fairly clearcut cool and hot

season. The dry season runs between July and end of October, when the second lighter rains begin.

The costal strip has the most rain March-May with a tendency of showers even in the drier months of June to October, especially in Tanga region. Annual figures rarely fall far below 800 mm. The hottest months are October to January although temperature variations are not great. The islands generally have a stable annual figure of 1500 mm and above, with only a short dry season in July and August. With the influence of the ocean, temperatures tend to remain steady at 25°C round the year.

The central plain that covers the middle part of the country has low rainfall totals, often below 700 mm with the wettest season between December and February. There is a clear marked dry hot season between May and November when the daily temperature ranges are also highest - may go as high as 8°C. Unreliability of rainfall in these parts of the country is a common phenomenon - probably the major reason for least agricultural potential exploitation in this region (see appendix 2).

The southern highlands and surrounding regions show the greatest annual temperature variation with clearly cut long dry season May-November when it is hottest; and wet season December to February/March. Annual totals rarely fall far below 800 mm, and the area immediately on the shores of lake Nyasa (Kyela area) has about the highest rainfall total figure in the country, often over 2000 mm.

From the agricultural point of view a rainfall total figure of 750 mm or above is quite sufficient for most crop production activities. But the more relevant factors are

(i) Distribution
(ii) Variability and
(iii) Probability.

Very striking rainfall gradients occur over the highland areas. Many areas, notably the central part of the country, experience a series of consecutive dry years which may have drastic effects on agriculture. Only about 20% of the country has a 90% probability of receiving at least 750 mm a year. Suffice it to say that variability and reliability on a seasonal or monthly basis have meant leaving a considerable portion of the country's horticultur-

al potential unexploited.

In general, the other climatic factors - temperature, humidity, sunshine hours and wind velocity - are of limited importance to horticulture in Tanzania. Variation in mean monthly temperatures is small (about 5°) and the difference in day-length between the north and south-most parts of the country is $1\frac{1}{2}$ hrs. at most. Temperatures rarely fall below $15^{\circ}C$ in any month at any place in the country (except at very high altitudes).

3. FARMING SYSTEMS

In Tanzania, traditionally, the majority of the rural population lives in dispersed farmsteads and only in a few areas are more nucleated clusters to be found. Within these farmsteads and clusters different farming systems can be established based on major economic sectors in the rural areas. On economic considerations alone, the systems can conveniently be sub-divided into two, major groupings:

a. The crop-oriented systems
b. The livestock-oriented systems.

The division is fairly clear-cut although with economic development it is not rare to find the two inter-mingled within one system.

3.1 Crop-oriented systems

These systems are based on one or two cash crops that are meant for sale (often an export crop) to earn money. Very often great consideration is given to the production of food crops for the families. In case of any surpluses, the food crops will also be marketed locally to add to the cash income from the export crop. In fact, the more common practice is to consider the food crops first in allocation of production factors, especially labour. There is always land specially put aside for the production of food crops and, if it becomes inevitable, a portion of cash crop land may be re-allocated for food crop production. The reason for this may be found in the need for self-sufficiency in food within each homestead. Thus:

a. The North:

In the northern highlands around Mt. Kilimanjaro and Meru, coffee (arabica) is the chief export cash crop. The practice is for the coffee field to be near and if possible, surrounding the homestead. With the system of inheritance traditionally existing in this area, the fields tend to get smaller as the original homestead field is shared among members of the family when they raise their own homesteads. This is the beginning of fragmentation. After a number of years (generations) these units tend to become so small that they may no longer be economical to maintain. Hence the cry for shortage of land in the mountaneous areas of Kilimanjaro and Arusha. Also these areas are associated with comparatively high population densities with relatively high incomes. The main staple food crop

here is bananas which is often than not interplanted with coffee. Maize and beans and vegetables are other food crops which, if in surplus, are also sold in the local market.

b. The North-East:
Areas around lake Victoria particularly Mwanza region where the Sukumas is the main tribe, cotton is the main cash crop. In fact, about 80% of the total cotton crop in Tanzania comes from this area. These are also areas of high population concentration with medium income earnings. The food crops include cassava, maize and beans. This area also has a traditional tendency of including a livestock enterprise in the system with the primary objective of using the livestock for dowry-marriage purposes. Apart from pawpaws, horticultural crops are not commonly found in this system.

c. The South:
The southern highlands in Iringa and Mbeya regions are characterized by having more than one export cash crop in the farming system. In Iringa region which is only sparsely populated, tea is a major cash crop, but closely followed by tobacco and pyrethrum. The region produces the greatest share of maize in the country. Other food crops include Irish potatoes, cassava, beans and a wide variety of vegetables. Coffee and pyrethrum are the major cash crops in the nearby Mbeya region, in which rice, bananas and sweet and Irish potatoes are widely grown. The region has an excellent climate for horticultural crops and therefore on the local market a wide range of vegetables and fruits (temperate fruits like apples, plums and peaches included) tend to dominate.

3.2 Livestock-oriented systems

These are typically found among the Masais in the north and tribes in the central region of Dodoma. They are chiefly pastoralists and hardly grow any kinds of crops. Livestock are used mainly for sale; and meat and milk form the greater part of their diet. The system tends to be extensive and nomadic in practice.

3.3 Factors influencing farming systems

Generally, the various systems have basically been shaped by factors like:

a. Ecology - the rainfall pattern and distribution and soil type have played a considerable role. Thus in the Dodoma area where rainfall is unreliable one finds the extensive livestock system.

b. Agricultural product prices have tended to make systems move towards the more economical, high earning crops as f. ex. in the Kilimanjaro area where cardamon and tea crops are slowly being introduced to replace coffee as a result of unstable world market prices.

c. Population growth and urbanization has meant farm fragmentation in some areas and this finally leads to disguised labour underemployment in the rural areas leading to higher urbanization tendencies. Incomes tend to be higher in the urban centres and therefore farming systems tend to be adjusted to cater for them with more emphasis on short term and annual food crops. In this respect, vegetable growing tends to receive more emphasis than it used to be.

d. Marketing facilities and input prices have also made an impact recently.

e. Feeding habits - traditionally people would eat what they are used to. But this tendency is breaking down slowly. Thus where the staple food was traditionally bananas, maize has also entered the diet. Thus vegetables have been introduced in most farming systems except in strictly livestock areas, and rate of consumption of fruits and vegetables in the rural areas has risen (see chapter 4).

f. Education and diffusion of technical information has generally tended to affect all the systems positively although to a greater or lesser degree in some areas of the country.

It must be emphazised here that the above factors have tended to influence and re-shape the farming systems from what they used to be traditionally and that the systems are currently in a transitional period as higher economic development is realized, through research and extension services, manipulation of producer/consumer prices and social services.

Traditionally, however, the main features of the crop farming systems have been:

a. Small-peasant holding with semi subsistance production.

b. Cultivation tool is the hce with axe and bush-knife for bush clearing.

c. The working capital is minimal with minimum monetary investment in farm and buildings. The main agricultural inputs being land and family labour.

d. Production techniques tended to be extensive rather than intensive and yields often lower than what has been demonstrated possible.

e. Labour profiles variable with labour peaks in only a few months and hardly any in other months of the year.

In the predominantly livestock farming system areas the problem of over-population of animals and over-grazing has often led to erosion difficulties.

4. THE PRESENT STAGE OF HORTICULTURE

The nutritional contribution of horticultural crops has now been realized to a greater extent by a larger proportion of the population than it used to be in the past. The economic gains that can arise from horticultural enterprises have also been realized though to a lesser extent. In both aspects, however, something still remains to be desired. To many people in Tanzania, production of horticultural crops still remains a supplimentary activity using only the unallocated, if there are any, resources including labour. Hence production is still on peasant fields in small scale composed in most cases of a home garden of a few cabbage, tomato or onion seedlings. One or two single trees of fruit may also be seen in the same garden. In a few isolated cases, like in the Lushoto and Njombe areas, a greater number of fruit trees (temperate) may be seen in farmer's field, and even these have tended to grow naturally and to date some varieties have still to be identified and traced to source of origin. A similar situation more or less applies to some tropical and sub-tropical fruit trees like citrus and mango along the coastal areas and pawpaws and loquats in the central and western parts of Tanzania. Most schools (primary and secondary) have introduced some horticultural activities within their school farming systems and often both fruits and vegetables are included - based on ecological limits.

A very wide range of fruits and vegetables can be grown in Tanzania. It has often been said that at least one kind of fruit, one kind of nut and one kind of vegetable crop can be grown in every part of Tanzania. This is because the country is fortunate in having a temperate type of climate in the higher lands, sub-tropical type as in parts of northern highlands, and a tropical climate. Appendix 5 shows a sample of the horticultural crops that are currently grown in some parts of Tanzania (indicated examples), though not to a large extent. Floriculture industry is not mentioned anywhere in this paper because no attempt has been made to break through to any appreciable degree.

Traditional taboos have in the past tended to slow down the rate of consumption of fruit and vegetables. Currently, it is estimated the rate of vegetable consumption is 26 kg per head per annum in the urban areas, about 20 kg/head/annum in rural areas while the expatriates consume beyond 100 kg/head/annum. These figures are encouraging when we consider that none were consumed in some parts of the country

in the past. The figure for rural areas could be considerably higher if local indigenous types are also considered.

The increase in awareness for horticultural crop production among the majority of the farmers has partly or wholly been stimulated by one or a combination of the following factors:

a. Urbanization - has tended to stimulate mainly vegetable production where communication facilities are readily available.

b. The recent decentralisation system of government activity has put more emphasis on self-sufficiency in food crops in each region and district.

c. Formation of Ujamaa villages in various parts of the country has meant more influence by government agencies on production pattern.

d. Increased advisory services through governmental ministries especially on nutritional programmes has meant an improvement on the standard of diets of the people.

The only relatively large-scale projects and enterprises of horticultural interest existing include:

(I) Grape production centred in Dodoma mainly to feed the wine factory there. At the moment most farmers and Ujamaa villages in that region are considering vine growing. Already the District Development Corporation in the region has 111 acres of vineyard. Dodoma wine is becoming popular in East Africa and beyond.

(II) Tomato factory - also in Dodoma for tomato canning. At present, the factory has the problem for raw materials.

(III) LIDEP (Lushoto Inter-grated Development Project) in Tanga region is a marketing organization that encourages and advises farmers in Lushoto area to grow specific vegetable types. The organization then collects the produce from the farmers to market in urban areas particularly in Dar es Salaam under contract agreements.

(IV) Chanzema in Morogoro region is also a marketing organization on cooperative basis. It is about the only cooperative union that has managed to handle horticultural produce marketing to any considerable extent.

The Cold Chain Storage System proposed around the country and the processing activities of the National Canning Division (N.M.C.) will be considered in chapter 5.

5. HORTICULTURE IN THE FUTURE

The future of the horticultural industry in Tanzania has not been completely streamlined. There is only meagre scattered information that is known about the industry in aspects, f.ex., of production data, critical disease and insect infestations, and detailed production areas. What is least known is the economic production of horticultural crops in general. And even the cultural production recommendations in some cases are either unknown or have still to be standardized. These are problems to be looked into in the future. It is, however, generally known and accepted that the potential for horticultural crop production is immense in a good number of districts in the country. What would seem to be immediately required is a more fully empowered machinery to study more comprehensively and exploit this potential. This point poses some critical problems that will be outlined elsewhere in this chapter.

5.1 Cold Chain Storage System

For many years now, it has been observed in most parts of the country particularly in the urban centres that certain foodstuffs are critically in short supply at certain periods during the year, while the same items are over-supplied at other times of the year. The tendency being for a large percentage of these foodstuffs to go bad and rotten and wasted (not to mention extremely low prices) during the "abundant" period. Top among such foodstuffs are fruits and vegetables. Fruits like mangoes, oranges, plums, pawpaw etc. are strictly seasonal. The situation is often made worse by the unreliable distribution and marketing channels that exist within the country. The primary objective of the Cold Chain Storage System was one of tackling this situation in an attempt also to stabilize producers' and consumers' prices. The system is basically a chain of refrigerated rooms and stores, some of them mobile, to provide low temperatures in an attempt to control post-harvest physiological processes aiming at longer storage period before consumption without hampering quality. These storage centres are to be distributed widely in the country and there will be at least one in, f.ex., places like Morogoro, Mombo, Moshi, Arusha, Mwanza, Dodoma, Iringa and Mbeya. A marketing corporation has already been formed to handle these chain operations in different parts of the country. The corporation has not strict production responsibilities but will depend on farmers produce for the time being. The corporation has already

started functioning with more emphasis on perishable products, mainly horticultural, beef and fish, in some parts of the country. There is no reason to doubt that this innovation has wide chances of stimulating increased horticultural crop production in the future. It may then be possible also to control quality and grown varieties through the activities of this corporation.

5.2 Seed Production

The majority of the horticultural seed material that is grown by most farmers in Tanzania comes through foreign bodies like Kirchoff's Company based in Nairobi, Kenya, and Sluis Brothers Limited (Holland Co.) which has a subsidiary office in Arusha. In most cases seed is tested under tropical conditions. But the availability of different kinds of seed and variety, readiness to access and distribution system is so uncertain that often producers have to wait for a long time for seed to arrive or have to travel long distances to obtain seed. The problems associated with this kind of set up are obvious.

Recently established is the Tanzania Seed Company that is expected to handle this aspect of crop production, but the company has still to function properly. The company is expected to start its operations with a loan agreement between Tanzania government and the U.S.A.I.D. and will handle seed production of various crops including maize, soyabeans, wheat, sorghum, rice, etc. Horticultural seeds will certainly receive consideration.

A seed testing laboratory is also planned to be erected in the company's operations, probably in Morogoro region. The seed testing laboratory at Tengeru, Arusha, has proved too small in capacity to handle all the seed-work for the country. The company was recently established by an act of law.

As far as the horticultural industry is concerned, it can generally be said that lack of proper arrangements for seed production, testing and multiplication, has played a significant role towards the slow growth of the industry.

5.3 Processing

The wine factory based in Dodoma has already been mentioned. The tomato factory at the same place has also been mentioned. The activities of the Canning Division of the National Milling Cor-

poration (N.M.C.) are based in Dar es Salaam. The division mainly concentrates on pineapple canning and orange juice extraction and bottling. Mango juice is also handled by the same factory. The main problem being experienced by the division is one of seasonal work-peaks and possibly working half-capacity at times. The reason for this is to be associated with the seasonal production cycles of the fruit products being handled by the factory and the Cold Chain Storage operation is expected to alleviate this problem.

In the last two to three years, there has been a lot of discussion on the possibilities of intensifying processing operations within the country. The views and suggestions made are very positive and encouraging. Most parties have tended to foresee short and long term problems that may arise in an attempt to establish viable projects.

As far as horticultural processing is concerned, the potential and means of production is immediately available. With vegetables and tomatoes, f.ex., some parts in the northern and southern highlands and areas around Morogoro district can easily produce two to three crops a year, possibly supplemented with irrigation. And the land is available. This would avoid the possibility of factories having to work half-capacity at certain times. But the interests of the producer must be considered. These would include:

a. Assistance, at least initially, in opening up larger areas of production land by mechanical means; this would be concentrated on Ujamaa villages.

b. Reliable source of seed material at the time required.

c. Recommendations on varieties.

d. Economical crop husbandry techniques.

e. Sources of production inputs, e.g. fertilizer and fungicides and insecticides. These should be available readily within production areas. The only fertilizer factory in Tanzania is situated in Tanga, and distribution system has yet to be improved.

f. Intensive extension advisory service specifically for horticultural crops in the production areas.

g. Irrigation water facilities for off-rain seasons.

h. Reliable collection, marketing, grading and distribution system within easy reach.

The location of a processing plant will therefore probably be where these factors are not a serious obstable and/or where they only need to be improved. The northern area, Morogoro region and the southern highlands warrant consideration in this issue.

It is advisable to start with pilot processing project to evaluate the viability and pin-point more specifically the actual problems that are likely to be encountered. The following factors would need to be considered even at this pilot-project stage:

a. Distance from production area to the factory - to minimise transport costs and take into account product perishability.

b. Nearness to the Cold Chain Storage chambers mentioned earlier.

c. Availability of labour (population density).

d. Road communications - in the dry and wet season.

e. Water availability, reliability and quality.

f. Market potential (internal).

g. If exports are considered, the distance to aero-drome or harbours.

The pilot-project would design the processing plant in such a way that it can handle many different product-processing at one time or different times, i.e. processing and canning of fruits, beans and vegetables whenever possible to avoid the plant lying idle for part of the year. Probably all or some of the horticultural crops in the following list can be considered in this exercise.

Possible horticultural crops for processing:

1. Apples
2. Citrus
3. Pawpaw
4. Peaches
5. Pears
6. Beans (green)
7. Beans (dried)
8. Cabbage
9. Carrots
10. Tomatoes
11. Mangoes (handled by N.M.C.)

When finally different plants are established in different districts, the individual plants could specialize on two or three

crops from the list above, but detailed study and plans need immediate consideration.

The benefits to the economy that will accrue from establishment of horticultural processing plants in the country are many, among which are:

a. Creation of job opportunities - full-time and part-time.

b. Savings on foreign exchange caused by substitution of imports - a minimum of 6 million T. shillings will be immediately saved.

c. More utilization of local materials for packaging and canning and job-opportunities again arising.

d. Producers will be stimulated to provide more quality product and to produce more.

e. Internally, nutritional problems may be alleviated.

The single most serious problem that such a venture is likely to encounter is one of trained personell and technicians in various fields to handle the processing and marketing operations. Inevitably, therefore, a training programme for Tanzania personell must be incorporated in any arrangement concerning horticultural processing industry in the country.

6. SUMMARY

The paper is basically not a policy one. It merely attempts to put into perspective the existing situation regarding horticultural development in Tanzania with a mention of the potential that exists and awaits exploitation.

To achieve this, the paper has been divided into a number of sub-headings for convenience of presentation and discussion. As it is also generally true for most agricultural economic plants, horticultural crop production depends largely on the physical and climatic features prevailing. This aspect is considered in the first few pages of the paper. Soils have also been briefly explained, but it must be born in mind that the generalization adopted here is intentionally used to extrapolate on production potential. And of course the size of the internal market for horticultural products finally depends upon size and distribution of population. Although figures have been rounded-off, they are still found useful in illustrating the point.

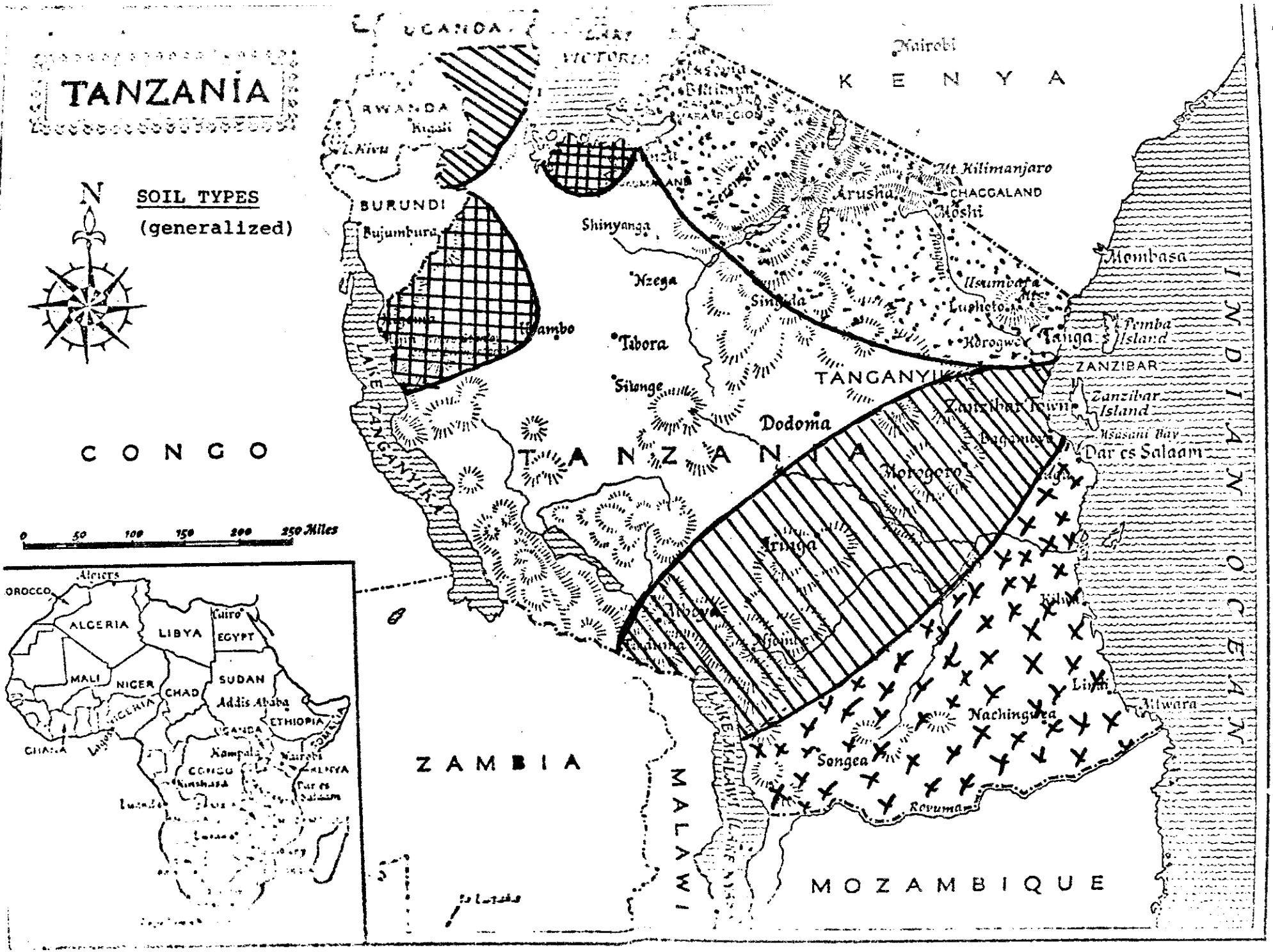
Any policy interested in rapid economic development of horticulture in Tanzania will definitely touch upon the existing structure of farming systems. It may influence such systems in form of an improvement or a transformation approach. An outline of the systems is therefore considered appropriate here. The transitional stage of the systems is mentioned with consideration of relevant factors.

The present and future lines of horticultural development are discussed in fair detail in the last two chapters of the paper. Nutritional and economic gains, large scale production, seed production and possibilities for processing industries are mentioned. The need to base future horticultural economic enterprises in Ujamaa villages all over the country is emphasized.

Throughout the paper, the embryonic stage of horticultural development is stressed, but that the potential for future rapid development is immense when considered in the light of favourable environment existing. Such environmental factors include favourable climatic features which eliminates the need for the expensive greenhouse commonly used in temperate regions for the same purpose, existing altitude range that permits wider spectrum of crops including temperate types, air export possibilities and potential for expansion, of internal market depending on overall rate of economic develop-

ment of the country. The potential of production further depends on educational programmes designed to encourage variety in traditional diets and introduction of new export crops that are likely to depend on studies on the requirements of the European market.

The apparent immediate problems would seem to be the need for intensification of production techniques, initiation of research and training programmes, organization of production and marketing aspects and certainly the need for a coordinating body of the developmental plans and activities of the industry.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SOIL TYPES
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RWANDA
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Arusha
CHAGGALAND
Moshi
Shinyanga
Nzega
Singida
Usambara Mts.
Lupheto
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Tanga
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Tabora
Silonge
TANGANYIKA
Zanzibar Town
Zanzibar Island
Dodoma
Morogoro
Dar es Salaam
TANZANIA
Iringa
Mbeya
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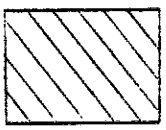
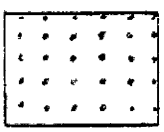
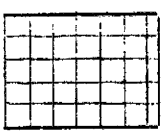
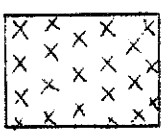
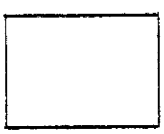
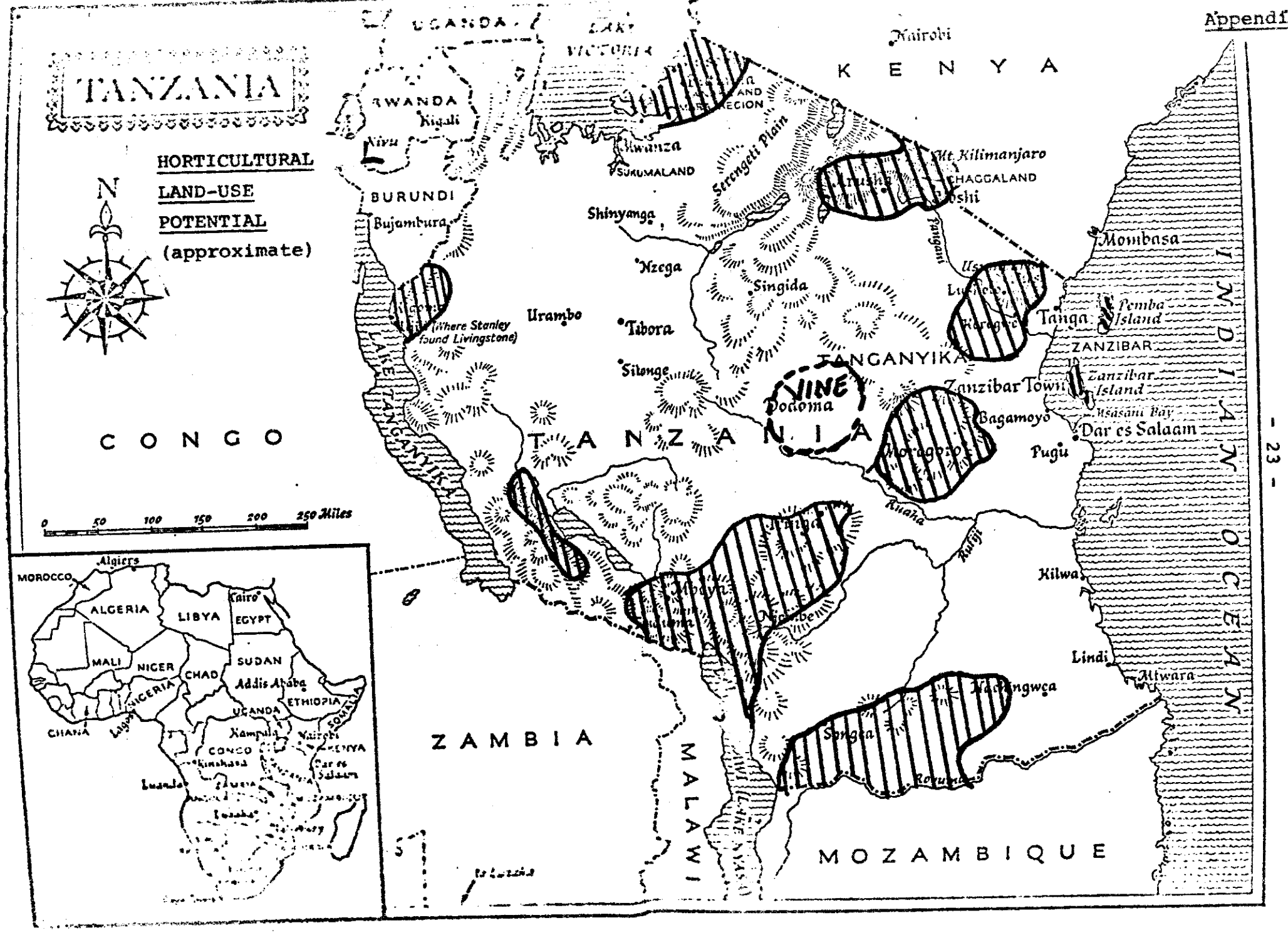
CONGO
ZAMBIA
MALAWI
MOZAMBIQUE
INDIAN OCEAN
Africa
MOROCCO
ALGERIA
LIBYA
Cairo
EGYPT
MALI
NIGER
CHAD
SUDAN
Addis Ababa
ETHIOPIA
NIGERIA
UGANDA
Kampala
Nairobi
KENYA
CONGO
Kinshasa
Dar es Salaam
ZAMBIA
Lusaka
MALAWI

Appendix 1.

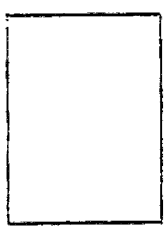
KEY TO SOIL TYPES (generalized)

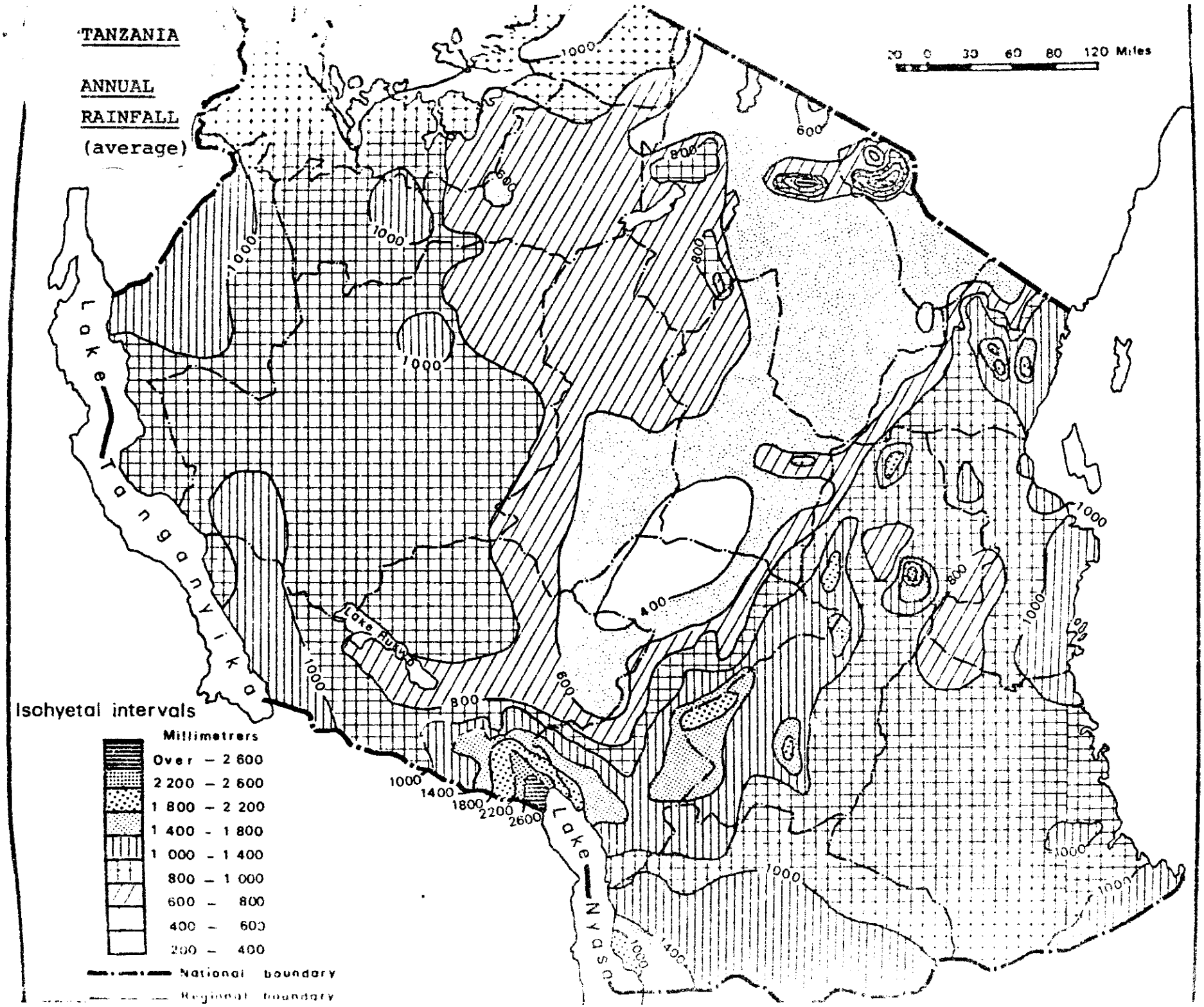
	FERRISOLS	These are humic soils in high altitudes with various gneisses, granites and lavas, humic clay loams with dark-brown colour; often freely draining with rolling topography; pH averages 6,o-4,5. Rainfall often above 1000 mm annually.
	FERUGINOUS	Loamy clays; brown-reddish; free draining on hilly slopes with pH values 5,5-4,o and rainfall annual over 800 mm.
	ALLUVIAL	Originally volcanic ash on underlating land; sandy-loam commonly dark-grey with pH above 6,5 and free draining. Rainfall total often less than 750 mm annually.
	FERRALITIC	Yellow-brown soils on undulating land; sandy-loam with pH values often less than 5 (acidic) and poor drainage at times. Rainfall total above 1000 mm.
	HYDROMORPHIC FERRISOLS	Sandy/clay loam; fairly flat land with tendency to compaction. Often dark-grey soils with pH values 4-7 with unreliable rainfall.

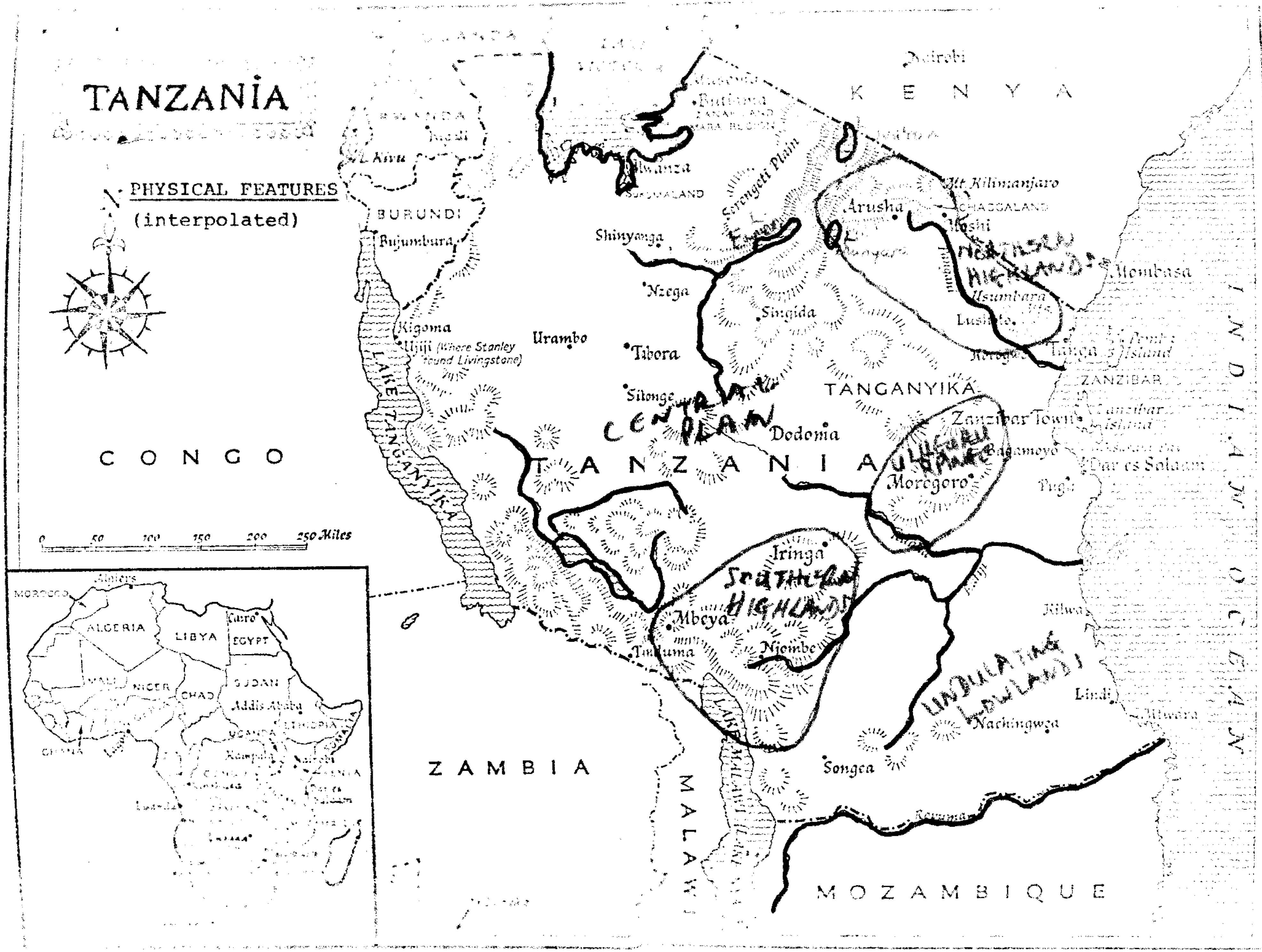

TANZANIA
HORTICULTURAL
LAND-USE
POTENTIAL
(approximate)
N
0 50 100 150 200 250 Miles
UGANDA
LAKE VICTORIA
Nairobi
KENYA
RWANDA
Kigali
Kivu
BURUNDI
Bujumbura
Kwanza
SUKUMALAND
Serengeti Plain
Mt. Kilimanjaro
CHAGGALAND
Moshi
Shinyanga
Mombasa
Nzega
Singida
Pangani
Usambara
Tanga
Pemba Island
ZANZIBAR
Zanzibar Island
Urambo
Tibora
(Where Stanley found Livingstone)
LAKE TANGANYIKA
Sitenge
TANGANYIKA
Dodoma
Zanzibar Town
Bagamoyo
Dar es Salaam
Morogoro
Pugu
CONGO
TANZANIA
INDIAN OCEAN
Ruaha
Rufiji
Kilwa
Lindi
Mtwara
Mahenge
Songea
Ruvuma
ZAMBIA
MALAWI
MOZAMBIQUE
MOROCCO
Algiers
ALGERIA
LIBYA
Cairo
EGYPT
MALI
NIGER
CHAD
SUDAN
Addis Ababa
NIGERIA
ETHIOPIA
UGANDA
SOMALIA
GHANA
Lagos
Kampala
Nairobi
KENYA
CONGO
Kinshasa
Dar es Salaam
Luanda
ZAMBIA
Lusaka

Appendix 2.

KEY TO HORTICULTURAL LAND-USE POTENTIAL

	Approximate arreas of greater horticultural crop development. Most of these areas have fairly heavy rainfall which is fairly reliable with marked hot and cool seasons.
	Special area in the middle of the country where grape-vine growing has been introduced and a wine industry is already growing fast. Presently the area around Dodoma monopolises the crop-industry.
	Areas where horticultural crop potential can be quite considerable but with limited crop range. Often unreliable rainfall coupled with fairly poor soil fertility limits hortcultural crop exploitation.


TANZANIA
ANNUAL
RAINFALL
(average)
30 0 30 60 90 120 Miles
Lake Tanganyika
Lake Rukwa
Lake Nyasa
Isohyetal intervals
Millimetrers
Over – 2 600
2 200 – 2 600
1 800 – 2 200
1 400 – 1 800
1 000 – 1 400
800 – 1 000
600 – 800
400 – 600
200 – 400
National boundary
Regional boundary


TANZANIA
PHYSICAL FEATURES
(interpolated)
CONGO
ZAMBIA
MALAWI
MOZAMBIQUE
KENYA
INDIAN OCEAN
TANGANYIKA
TANZANIA
ZANZIBAR
BURUNDI
Bujumbura
Kigoma
Ujiji (Where Stanley found Livingstone)
LAKE TANGANYIKA
Urambo
Tibora
Sitonge
Nzega
Shinyanga
Singida
Dodomia
Serengeti Plain
Arusha
Mt Kilimanjaro
Moshi
Mombasa
Usumbara
Tanga
Zanzibar Town
Bagamoyo
Dar es Salaam
Moregoro
Iringa
Mbeya
Njombe
Songea
Nachingwea
Lindi
Kilwa
Mikindani
CENTRAL PLAIN
NORTHERN HIGHLANDS
ULUGURU RANGE
SOUTHERN HIGHLANDS
UNDULATING LOWLANDS
0 50 100 150 200 250 Miles
ALGERIA
LIBYA
EGYPT
MALI
NIGER
CHAD
SUDAN
Addis Ababa
ETHIOPIA
UGANDA
Kampala
Nairobi
Cairo
Algiers
MOROCCO

Appendix 5.

SELECTED EXAMPLES OF HORTICULTURAL CROPS CURRENTLY GROWN IN TANZANIA IN VARIOUS AREAS

English name	Botanical name	Climatic area concerned
Apple	Malus domestica	Temperate
Banana	Musa spp.	Tropical
Grapefruit	Citrus paradisi	Tropical & sub-tropical
Guava	Psidium guajava	" " "
Lemon	Citrus limon	" " "
Lime	Citrus aurantifolia	Tropical
Mango	Mangifera indica	"
Mandarin	Citrus reticulata	Tropical & sub-tropical
Orange	Citrus sinensis	" " "
Pawpaw	Carica papaya	Tropical
Peach	Prunus persica	Temperate
Pears	Prunus domestica	"
Beans	Phaseolus spp.	Tropical & sub-tropical
Cabbage	Brassica oleracea var. capitata	Sub-tropical & temperate
Carrot	Daucus carota	" " "
Egg plant	Solanum melongena	" " "
Lettuce	Lactuca sativa	" " "
Onion	Allium cepa	" " "
Pepper	Capsicum spp.	Tropical & sub-tropical
Spinach	Spinicia oleracea	Sub-tropical
Tomato	Solanum lycopersicum	"

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