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FINAL REPORT

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AN ANALYSIS OF THE TANZANIAN FOOD-CROP SUBSECTOR

BY

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FOREWORD

The paper is one of a series of technical publications dealing with the different descriptions of agriculture, health, education and family planning to be presented by the Sector Problem Analysis Division, Office of Development Services, Bureau for Africa, Agency for International Development.

The purpose of the paper is to provide guidelines on alternative approaches to the development of the basic food crop sector using Tanzania as a case study. The paper covers a range of policy choices and project activities considered as alternative strategies to increase cereal production in the short, medium and long-run.

Work on this paper has been accomplished by a University of Missouri Team under the leadership of Dr. Melvin Blase. Extensive consultations were held with staff members of the Bureau for Africa.

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PREFACE

Begun in January, 1973, the bulk of the field work for this inquiry was conducted in Tanzania during the period March through May, 1973. The report was delayed to include the summaries of the Regional Census of Tanzania. However, these data continued to be unavailable. Therefore, the report was completed with the best information available at this time.

In spite of the secondary data limitations, several strengths characterize the analysis. It is based on considerable data gathered at the regional level. In addition, the agronomic section is based on the most comprehensive analysis of food crop trial data attempted in the country. The nutrition analysis provides a national estimate of caloric and protein deficiencies prior to the drought years in which these problems undoubtedly became more pronounced. Regional surpluses and deficits of major food crops for several years are identified in the marketing phase of the report. Both formal and informal institutions are included in the consideration of the strengths and weaknesses of the institutional infrastructure. Alternative strategies for developing the food crop subsector are outlined--in light of the subsector's constraints amenable to solution in both the short and long run--prior to presentation of the recommended strategy. Perhaps the most important strength of the analysis, however, is the

systems perspective taken of the subsector. This view, plus the use of a multi-disciplinarian team, enabled a more comprehensive inquiry to be undertaken than if only economists, for example, had been involved.

The analysis did not attempt to formulate new methodology designed to impress academicians; rather it focused on a vexing problem with a view to assisting policy-makers deal with hard choices. In the process it determined that most underlying causes of the food problem have a substantial history and are not of recent origin. Accordingly, they can not be overcome soon--not even during this decade. Nevertheless, the severity of the problem demands urgent attention and persistent efforts. Since human capital must be developed in order to utilize the country's ample natural resource base, time will be needed. Moreover, a comprehensive national strategy, as outlined, must be implemented as not only a context for the human capital development but also as a means of systematically attacking the host of constraints now inhibiting the subsector. Such a strategy will be successful only if it results in more actual food production which is ultimately consumed. The place to start, as suggested in the recommended strategy, is with farm-level efforts to produce more food.

Since the field work was completed, Tanzania has experienced a devastating drought. Consequently, the food problem

currently is more severe than this analysis indicates. Such a severe food problem emphasizes the importance of policy-makers' seriously considering the strategy recommended in the final Chapter. The urgency of initiating this strategy cannot be over-emphasized.

This report is submitted to USAID in fulfillment of Contract AID/CM/Afr-C-73-11, 74-6, 74-12 (Blase). USAID provided excellent support in the undertaking of this analysis and the Tanzanian government was most helpful in assisting with it. To say that the cooperation of the Tanzanian government was splendid would be an understatement.

Finally, we want to acknowledge and thank the untiring effort of Mrs. Ruth Mutert and other members of the secretarial staff who spent a considerable number of hours in the editing and typing of this document.

Melvin G. Blase
Project Director

CHAPTER I: THE TANZANIA FOOD PROBLEM: SHORT AND LONG RUN ASPECTS

The food problem in Tanzania became highly visible in 1973-74. Of its many manifestations, the sheer unavailability of some important foodstuffs for substantial periods in Dar es Salaam was the most telling. Some said these shortages were caused by unsatisfactory weather conditions in the major food producing regions of the country. Weather, however important it may have been, does not tell the entire story.

Rather, it brought to the forefront a series of interacting forces that have been causing the country's food position to deteriorate for several years. No single source of data can be relied upon to gain insights into this deterioration. However, evidence from independent sources are mutually supportive in emphasizing the growing nature of Tanzania's food problem.

Long Run Dimensions of the Food Problem

Several factors contribute to an insight into Tanzania's growing food problem. The first is crop production estimates themselves. A second is food crop marketing statistics (perhaps more reliable than crop figures because they contain accounting data rather than estimates). Third, estimates of per-capita consumption of calories and protein support the above inference that a substantial problem exists. Fourth, infant and child mortality

statistics provide instructive insights into nutritional problems that likely will grow out of inadequate food supplies. Finally, the inability of food production to keep pace with rapid population growth suggests an impending food crisis of major proportions and long duration. Each of these elements of evidence will be discussed, followed by comments regarding the food problem in Tanzania.

Production Trends for Selected Food Crops

The production of maize, Tanzania's most important staple, has been quite variable over time, as indicated in Table 1. For the period from the mid 1960's to the early 1970's, estimates of production vary widely. For example, 1969 production is estimated at only 60% of the 1966 production. A growing population coupled with the general decline in the production of this important crop suggests a decline in either per-capita consumption or exports (or both). Or, at minimum, it suggests a highly erratic consumption/export pattern.

In recent years, wheat production has followed a similar pattern. The table indicates that production in 1971 was substantially lower than in 1970, for example. If the data were in per-capita terms, the downturn would have been even more pronounced.

Paddy rice and sorghum displayed a positive production trend during the late 1960's and early 1970's. Between 1967 and 1971, paddy production

is estimated to have increased by almost 50%, totaling 150,000 metric tons in 1971. During the same period, sorghum production grew from 135,000 to 190,000 metric tons.

Millet production declined by nearly 50% during the 1968-1971 period. (See Table I.)

The lack of a consistent positive trend in food crop production, most importantly in the case of maize, shows a general deterioration of food crop production on a per-capita basis since the mid 1960's.

Trends in Volume Marketed

Although much of Tanzania's food grains are produced and consumed on subsistence farms, records of purchases by government agencies provide useful estimates of the available food supply. While Appendix tables I through XIII provide the details by commodities, highlights of these statistics for the period from the mid 1960's to the early 1970's are noteworthy.

While the volume of maize marketed by National Agricultural Products Board (NAPB) from various sources tended to be highly variable, substantial imports were required toward the end of the period. Wheat production, also, failed to keep pace with a rapidly growing demand, necessitating substantial imports. Even domestic sugar production failed to expand as rapidly as consumption, consequently, imports grew rapidly. As expected from the

TABLE I

HARVESTED PRODUCTION ESTIMATES FOR MAIZE, WHEAT, PADDY, SORGHUM AND MILLET, 1966-71

Crop	1966	1967	1968	1969	1970	1971
	(Metric Tons)					
Maize[a]	739,000	550,000	638,000	487,000	719,000	621,000[c]
Wheat[b]			41,518	38,174	53,110	33,486
Paddy[a]	129,500	103,600	126,100	131,500	155,000	150,000[c]
Sorghum[b]			135,020	125,555	190,455	193,838
Millet[b]			130,183	108,091	89,740	77,022

[a]P.M. Newhouse, A Review of the Production and Marketing Arrangements for Maize, Paddy and Wheat with Particular Reference to the Milling Sector, Volume 1, Dar es Salaam: Marketing Development Bureau, June, 1972.

[b]Regional Planning Division, Dar es Salaam: Ministry of Economic Affairs and Development Planning, Regional Statistical Abstract, 1968-1971, August, 1972.

[c]Not yet revised.

crop production data cited above, paddy rice represented the exception to these trends.

Calorie and Protein Consumption

Although many more details of the Tanzanian nutritional situation will be provided in Chapter VII one indication of the nutritional situation is worthy of note. The 1969 per-capita calorie and protein consumption was 2076 calories and 57.4 grams of protein, even though stocks were drawn down and significant quantities imported. When contrasted with the nutritional requirements of an average Tanzanian (estimated at 2170 calories and 60 grams of protein per person per day), the implication becomes clear that Tanzania's nutritional problem pre-dates 1973. This is especially true when one realizes that these figures are averages and many families and individuals fall far below these consumption estimates. The average infant mortality of 140 per 1000 live births bears this out. Given the shortfall in maize production in 1973-1974, the nutritional problem is further intensified.

Infant Mortality

A meaningful indicator of nutritional adequacy is mortality data for infants and children, especially in the age ranges of 0 to 1 and 0 to 5 years. When deaths in the 0-to-1-year-age range exceeds 40-per-1000 live births, an inadequate nutritional status is indicated. Frequently, nutritional problems are associated with potentially fatal childhood diseases such as measles, respiratory infections, and gastroenteritis. Inadequate calorie and protein comsumption during pregnancy increases the number of

low birth weight infants which, in turn, contributes significantly to infant mortality. In addition, in countries with high child mortality statistics, protein-calorie malnutrition frequently occurs in which the intake of these nutrients drops below subsistence levels. Food taboos, improper preparation of food, and lack of knowledge about the nutritional quality of available foods can be major contributing factors to this type of malnutrition Likewise, food shortages plus unequal food distribution within the family (caused by such customs as children eating last) can be major causative factors for high death rates. In addition to these nutritionally related factors, such things as inadequate sanitation, lack of adequate medical facilities as well as congential malformations also can contribute to high death rates.

Mortality data for 0-to-1-year-old infants in Tanzania clearly indicates that a nutritional problem exists. In some regions, death rates approximate 200-per-1,000 live births--far in excess of the 40-per-1,000 norm mentioned above. (See Appendix Table XIII for selected regional and district mortality statistics.)

Considering the quantitative nutritional data above, evidence indicates that nutritional problems are partially responsible for the excessive death rate. Especially in light of the uneven distribution of food both among (due to differences in income, for example) and within families, there is a high probability that the already inadequate calorie and protein

consumption mentioned above grossly overestimates the nutritional intake of many Tanzanian children.

One further disturbing aspect of inadequate nutrition must be mentioned. Generally, studies show that for every child who dies of malnutrition, three or four survive who are mentally and/or physically handicapped. Improved nutrition would not only markedly decrease the death rate but would also improve the future production potential of these survivors.

Population Versus Food

The rate of population growth relative to agricultural production trends is central to Tanzania's achieving its objective of improving the level of living of all the people. Taking 1967 as the base year with a population of 11,946,000, and the increasing population trend (percentage increases from 1967-70 of 2.8%; 1971-75 of 3.0%; 1976-80 of 3.2%[1]), Tanzania's population in 1980 will reach 17,611,000. 1966-72, agricultural production grew at a rate of only 2.7%, which is less than the population growth rate. That means a decline in per-capita food production. With the 1973-74 drought not only is agricultural production down, but it is not likely to return to the 1966-72 trend line for some time.

---

[1] T. J. Aldington, Letter to Dr. Melvin Blase, regarding legal purchases and Sales, May 15, 1974.

Summary and Conclusion

Tanzania has a major food problem. It is not one of recent origin. Rather it has deep roots in history. To blame unfavorable weather for all of Tanzania's current food problems would be both unfair and incorrect. The five sets of data mentioned above--each independently prepared--reinforce each other regarding this conclusion: Providing all the people adequate food is Tanzania's number one problem.

Unless agricultural production significantly exceeds population growth, Tanzania's now poor people will sink still further into poverty; the quality of life for all the people will deteriorate, and economic growth will be faltering and persistently low. Until this problem is resolved, food crops will continue to be a millstone around the neck of the Tanzanian economy.

CHAPTER II: ANALYTICAL OBJECTIVES, METHODOLOGY UTILIZED AND DATA COLLECTED

In light of the longevity and severity of Tanzania's food problems, panaceas suggesting a simple solution do not exist. Rather, multiple obstacles will need to be overcome if this complex food crop subsector with its numerous decentralized decision makers is to be rid of those bottlenecks responsible for the deterioration of its performance. The general objectives of this analysis were to 1) identify these bottlenecks and 2) suggest remedial measures for them.

Objectives of Analysis

A more comprehensive statement of the overall objectives of the analysis is found in the study's contract:

> The objective of the technical services required by this contract is to systematically analyze the production, marketing, and various delivery systems comprising the food crops subsector (emphasis to be placed upon maize, wheat, rice, millet, sorghum, and major edible oil seed crops), analyze the subsector's performance, project the subsector's performance and capacity levels required to meet national goals, identify the components (including policy) of the systems which are constraining the development of the subsector and to specify (including policy) investment priorities which are designed to correct or lessen the effect of those constraining elements of the system.[1]

The objectives of the Tanzanian government this study is designed to contribute toward are:

1) Primary goal: To increase the supply of domestically produced food crops, including edible oil and processed products, to the

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[1]Taken from Contract AID/CM/Afr-C-73-11 (74-6) between USAID and the University of Missouri at Columbia, p. 2.

population of Tanzania for the purpose of raising the nutritional level of the country and increasing income and employment generated from the production and marketing of such crops.

2) Secondary goal: To improve the export trade in food crops, including processed products from agriculture, in which Tanzania can establish a comparative advantage as a means of improving rural income, employment, and resource allocation.[2]

The specific objectives identified in the contract are as follows:

1) Identification of the major constraints (gaps in the production and marketing system and in each of the supporting sub-systems of the food crops subsector).

2) Identification of the kinds, nature, and magnitude of development resources (investments) required to improve constraining and institutional factor gaps in the respective systems and attain desired performance level goals.

3) Determination of which constraints must be addressed first, second, third, so on and provide the rationale (economic, political, and social) as to how such inputs can improve upon the constraining and institutional factor gaps in the respective programs.

4) Determination of the technological potential of output with existing and with improved inputs for further development of food production for both domestic consumption and export and to assess the economic validity of technological improvements of various combinations.

5) Provide the Tanzanian government with a well-defined factual basis for policy decisions leading to improved programming of a planned food production, distribution and supply management program.[3]

Method of Analysis

Accomplishment of these objectives required that a choice had to be made between a nationally focused quantitative analysis and a series of

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[2]USAID-UMC Contract, p. 2.

[3]USAID-UMC Contract, p. 3.

partial analyses with professional judgments. The former was rejected due to repeated delays in the summarization of the agricultural census data. In lieu of the national simulation model originally planned, a series of analyses were performed by groupings of the eight-member team from the University of Missouri at Columbia, with the assistance of its Tanzanian counterparts. These sub-analyses were undertaken in order to investigate 1) production problems, 2) marketing difficulties, 3) nutritional inadequacies, and 4) institutional constraints. Initially, each sub-committee focused on a bottlenecks to improve performance of the food-crop subsector in its respective area.

Subsequently, these were integrated by the entire team together, taking into account the reaction of key Tanzanian policy makers to a set of preliminarily identified bottlenecks and remedial measures. Throughout, a systems view was taken of the subsector and its component parts. The results of this integrative effort can be found in this report with regard to 1) the priorities attached to constraints and 2) recommended actions for their resolution.

Hence, the analysis was not restricted to one single methodology or set of computational procedures. Instead, a variety of approaches was used. They included summarizing production and marketing statistics, projecting numerous indicators of food requirements and production possibilities, using the computer to calculate national food consumption in terms of per-capita intake of calories and grams of protein. And budgets of representative farm firms were used to obtain insights into the economic feasibility of adopting various practices. Analysts involved were free to use any of the

analytical techniques they felt were appropriate in the Tanzanian setting. This eclectic approach was consistent with the overall goal that the analysis be designed to produce useful information for policy makers.

Sources and Types of Data Collected

Data were assembled from three principal sources. These were 1) previous analyses; 2) national data, primarily from government agencies; and 3) regional information obtained from regional government officials. Each will be expanded briefly.

Previous Analyses

Given the resource constraints of the inquiry, substantial dependence had to be placed upon work previously done. This ranged from relatively raw data from crop trials to relatively comprehensive work such as that by Newhouse.[4] Consequently, in some instances a considerable amount of analysis of the data was required while in others professional evaluation of prior analyses was sufficient. Tanzanian officials were most helpful in assembling the information needed.

National Data Source

National data were obtained from personal interviews and from secondary sources. A systematic effort was made to interview government officials at the national level who had unique expertise in the food crop area.

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[4]P. M. Newhouse, A Review of the Production and Marketing Arrangements for Maize, Paddys, and Wheat with Particular Reference to the Milling Sector, (Dar es Salaam: Marketing Development Bureau UNDP/FAO, June, 1972).

Further, all secondary sources, such as census data, were obtained and pertinent information gleaned from them.

Sources of Regional Information

As a consequence of the recent emphasis given decentralization by the government, considerable effort was expended in obtaining data at the regional level. Regional officials were interviewed using the questionnaire in Appendix B as a guideline. And team members visited individual farms and held discussions with marketing personnel at the regional and local levels. In other words, the plan of data acquisition was developed to obtain information at the local levels, as well as the national.

Outline of Report

Subsequent chapters of this report focus on 1) the agricultural resource base, 2) production aspects of food crops, 3) marketing and supporting institutions, 4) the nutritional dimension, 5) production and marketing constraints, 6) alternative strategies for resolving the problem, and 7) a recommended strategy for dealing with the Tanzanian food problem.

Before proceeding, a qualifying word is in order. It deals both with the Tanzanian setting and the approach taken in the analysis.

A Qualifying Word

As is typical of many African economies, Tanzania is heavily dependent upon agriculture. Moreover, within the agricultural sector, a rather pronounced division exists between the food crop subsector and the cash

(export) crop subsector. Hard choices among policy goals are required. For example, improved nutrition must be weighed against expanded production for exports.

The Tanzanian economy has made creditable growth overall Although low in an absolute sense, the per-capita gross domestic product has grown at slightly more than 7 % in recent years. However, the agricultural sector has been relatively sluggish in terms of its growth performance. As suggested in Chapter I, erratic performance verging on stagnation has characterized the food crop subsector. Hence, this sector has represented a millstone around the neck of the entire economy. That alone makes it worthy of attention, to say nothing of the nutritional problems for which it is partially responsible.

The Unfortunate Cash Crop Versus Food Crop Dichotomy

In much of Africa but more especially in Tanzania an unfortunate dichotomy has been carried over from colonial times. It characterizes export crops as "cash" crops, implying that food crops are not part of the money economy. Consequently, many decision makers are predisposed to relegate food production to a category of minimal importance. Herein lies the source of some of Tanzania's food problem.

Some perspective may be gained by imagining this counter-productive dichotomy in use in one of the world's largest agricultural countries: Suddenly, the vast majority of their production--maize and wheat, for example--would not be considered cash crops. Yet, unquestionably, they bring in

high profits. Clearly, in the world agricultural economy, to suggest that food crops such as these are not cash crops is illogical.

In the past, this tradition of dichotomy has prejudiced Tanzanians against using resources in food crop production. However, the broadening of government pricing policy to include food crops should partially remedy this problem. Further emphasis of the commercial potential of food crops should not be delayed. Although a considerable amount of economic growth may be required prior to eliminating subsistence agriculture in Tanzania, the recent revisions in price policy should speed progress toward emphasizing the commercial potential of food crops.

However, the tradition of dichotomy will be slow to die.

Nutritional Versus Other Objectives

One of several consequences of the de-emphasized food crop subsector can be measured in nutritional terms. Though improving the nutritional level of the population is obviously not the sole objective of any government, still it cannot be overlooked. Put simply, the goal of the Tanzanian Government is to improve the quality of life or the level of living of all its people. Specifically, they want to increase per-capita income; to improve the income distribution; to increase employment opportunities; and to increase the opportunities for a large number of Tanzanians to participate in group decision making.

Improving nutrition by emphasizing food crop production will directly contribute to increasing per-capita income and improving its distribution. It also has implications in improving employment opportunities. Each of

these objectives complement one another to varying degrees, to the extent that hard decisions are not required. That does not mean that difficult decisions regarding resource allocations need not be made. For example, improving the entire population's nutritional level means sacrificing foreign exchange earnings to improve the distribution of production gains. Obviously, then, clear competition would exist for available resources. In such instances, weights must be placed on Tanzania's various objectives to systematically allocate these resources. In this analysis, the dominant weight is assigned to nutritional objectives.

Specifically, the analysis is designed to examine the possibility of nutritional deficiencies; to probe the gap (if any) expected by 1980 between the nutrition supplied by specific food crops and the amount required (expressed in calories and proteins) for nutritionally adequate diets; to identify bottlenecks or constraints that must be overcome to eliminate such a gap; and to recommend strategy for solving the problem, especially with regard to implications for technical and capital assistance. This framework of analysis stems from the weighting given the nutritional objectives above. Clearly, different results and recommendations would be forthcoming if different weights were assigned.

CHAPTER III: THE AGRICULTURAL RESOURCE BASE

nzania faces three broad options with regard to methods for closing its nutritional gap. These are 1) to expand domestic food crop production and improve its marketing so that a larger volume of food is available to consumers, 2) to increase food imports with concomitant improvements in marketing efficiency, 3) to lower the rate of population growth, or 4) to use combinations of these.

Attention will be focused on the first of these, especially the production dimension, rather than on strategies for either expanded imports or population control. This is not to imply that either of these is not a feasible alternative. However, two factors suggest the more logical approach is to investigate the expansion potential for food production. They are these: 1) An import strategy requiring precious foregin exchange when world food supplies are precariously low and food prices are high in international markets has serious implications. 2) Population control is primarily effective as a long-run measure.

A logical first step in identifying Tanzania's food crop potential is an assessment of the production resource base in the agricultural sector, Initially the, focus will be on farm production resources and subsequently marketing resources will be assessed. Before turning to these detailed discussions, however, attention will be given to a summary overview of the Tanzanian resource situation.

Summary Overview

Tanzania is well endowed with natural resources for expanded food production, especially in the perimeter of the country. Nevertheless, two problems emanate from them. One is the multitude of research results needed concerning how to use natural resources in the many combinations in which they occur, resulting in numerous micro-climates. The second is the dispersed location of the resources resulting in long transportation distances when commodities are traded among regions. In spite of these difficulties, Tanzania's natural resource base is not the subsector's most important constraint.

The man-made resources in the subsector are in short supply, however. Within this category, the lack of adequate human capital is quite pronounced. In addition, there is a shortage of physical capital; however, it is not as widespread as the human capital problem. Nevertheless, the resource potential, if developed, exists for solving Tanzania's food problem.

Production Resources

Since resource availability is so crucial to higher food production, the most essential resources and their current status in Tanzania will be reviewed. The natural resources of soil, water, and climatic conditions will be given first consideration. The availability of improved inputs for

modernizing production--such as fertilizer, pesticides, high quality seeds of improved varieties, irrigation water, tools of production, etc.--also will be given attention. Together with these resources, the supply of agricultural labor and of trained manpower for managing the production, processing and marketing of food crops will be considered.

Soil Resource

About twenty million acres in Tanzania are in the high production potential class according to a "Potential Land Use Map" included in the 1967 Atlas of Tanzania. Derived from a preceding soil map, it attempts to group the soils into eight potential land-use categories. Only ten million acres are now under cultivation, and much of the area cultivated is classed in less productive categories. (Appendix Table XIV.) Rather large portions of Iringa, Morogoro, Ruvuma, Mbeya, Kilimanjaro, and Tanga fall in Category 6, high potential. Some regions have large areas in categories 1 and 2 indicating little land is suitable for crop production. Sizeable areas in most regions fall in Category 8 indicating these soils have considerable potential, but drainage, flood control, or other special management often is needed. Suffice it to say, the soil resource is heterogeneous.

This variability is due to a variety of factors, including such things as parent material (age as well as elevation), topography, and drainage. Some of the alluvial soils in the large river valleys and some volcanic soils

in the eastern rift are highly fertile, for example. Soils of the central and eastern plateaus are varied, but drainage is often poor, thereby--together with irregular precipitation--limiting productivity. Many coastal soils are light and sandy with poor moisture-holding capacity and extreme alkalinity in some areas.

Little soils research has been done in Tanzania, especially in the areas devoted to food crop production. The Mlingano Research and Training Center has been given the responsibility for coordinating soils research work in the country. Limited fertility studies have been initiated at a few research stations, but most areas and crops are not represented. Soil testing laboratories have been started at five locations--Mlingano, Lyamungu, Ukiriguru, Ilonga, and Mtwara. Each laboratory is designed to serve the surrounding regions. The Mtwara and Ilonga laboratories were not yet staffed in early 1973, however. A complete soil testing laboratory at Ifakara (KATRIN) helps to service the Morogoro region. In addition to these important starts, for verification purposes, chemical methods of soil analysis need to be correlated with crop response under different soil conditions. Little of this has been done, although, in three regions a few correlation studies have been made on maize, rice, and cotton.

Available Moisture

Rainfall is a major factor influencing variation in food crop production

both over time and from region to region. With regard to regional variation, rainfall tends to decrease with movement from coastal areas and with decreases in elevation. (See Figure 1.) The coastal and northern regions tend to have bimodal rainfall patterns as contrasted with a unimodal one elsewhere. Frequently the precipitation obtained during the short rainy season is deficient.

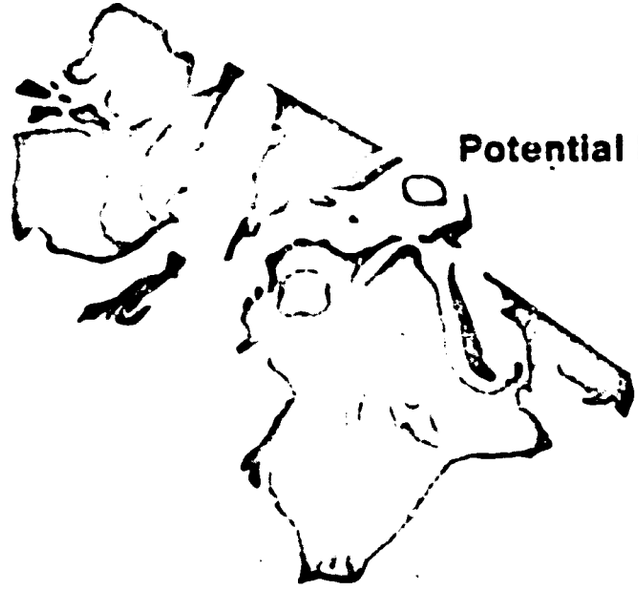
In order to overcome precipitation deficiencies, approximately 4% of the cultivated land, much of which is planted to rice is intermittently irrigated. Hence, the contribution of irrigation to food crop production is extremely limited.

Rainfall distribution and its relationship to soil productivity potentials, are two basic natural determinants of agricultural productivity. However, additional man-made components, namely, physical and human capital, of Tanzania's agricultural potential must be recognized

Commercial Fertilizer

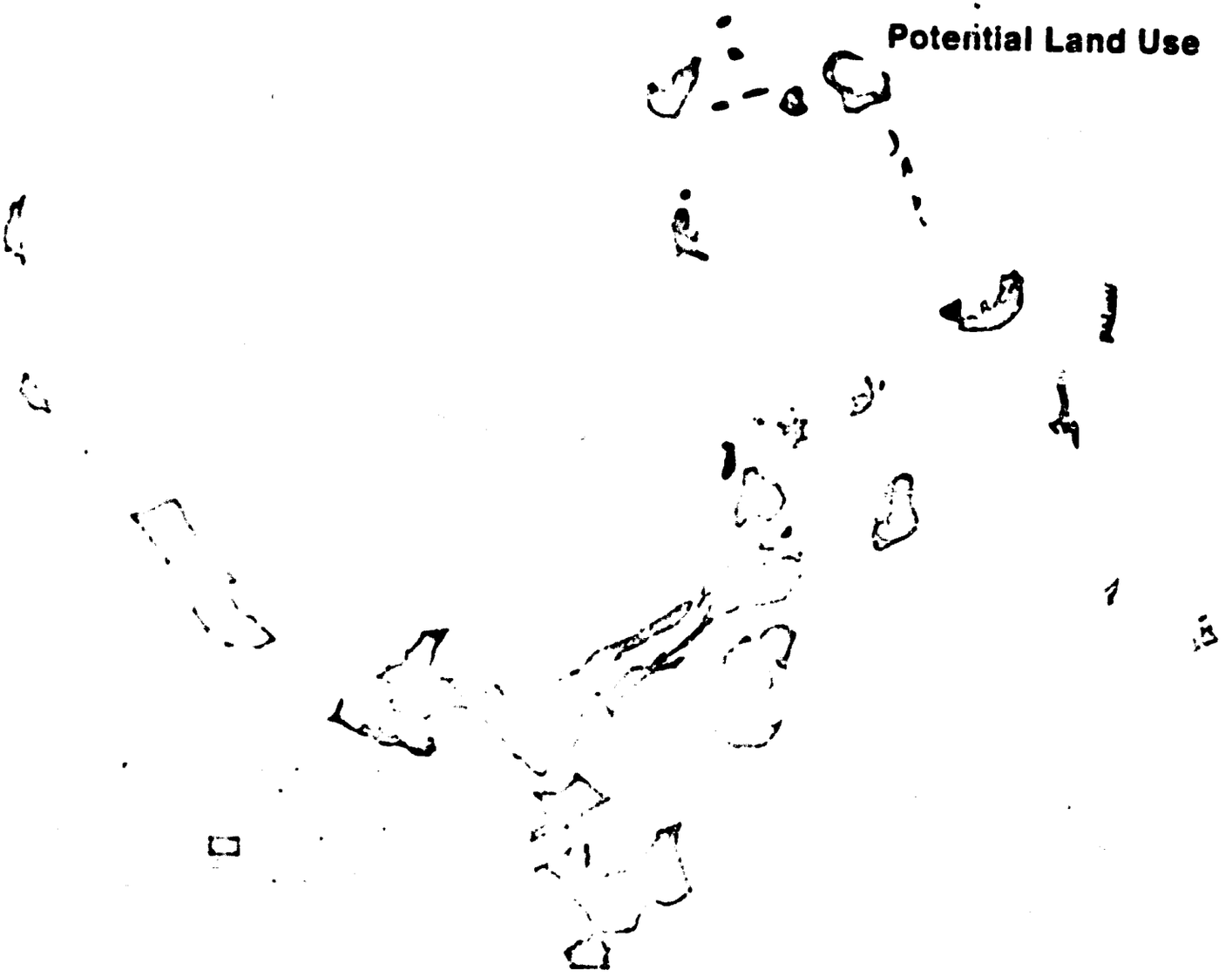
Commercial fertilizer must be combined with other improved inputs and agronomic practices to achieve dramatic increases in food crop production. Although increased quantities of fertilizer have been used in recent years in Tanzania, most has been applied on tea, coffee, tobacco, and cotton and little directly on the food crops. Past fertilizer use and projected sales by the Tanzania Fertilizer Company are shown in Table II. The

Potential Land Use



Potential Land Use

GROUP OF SOILS REFERENCE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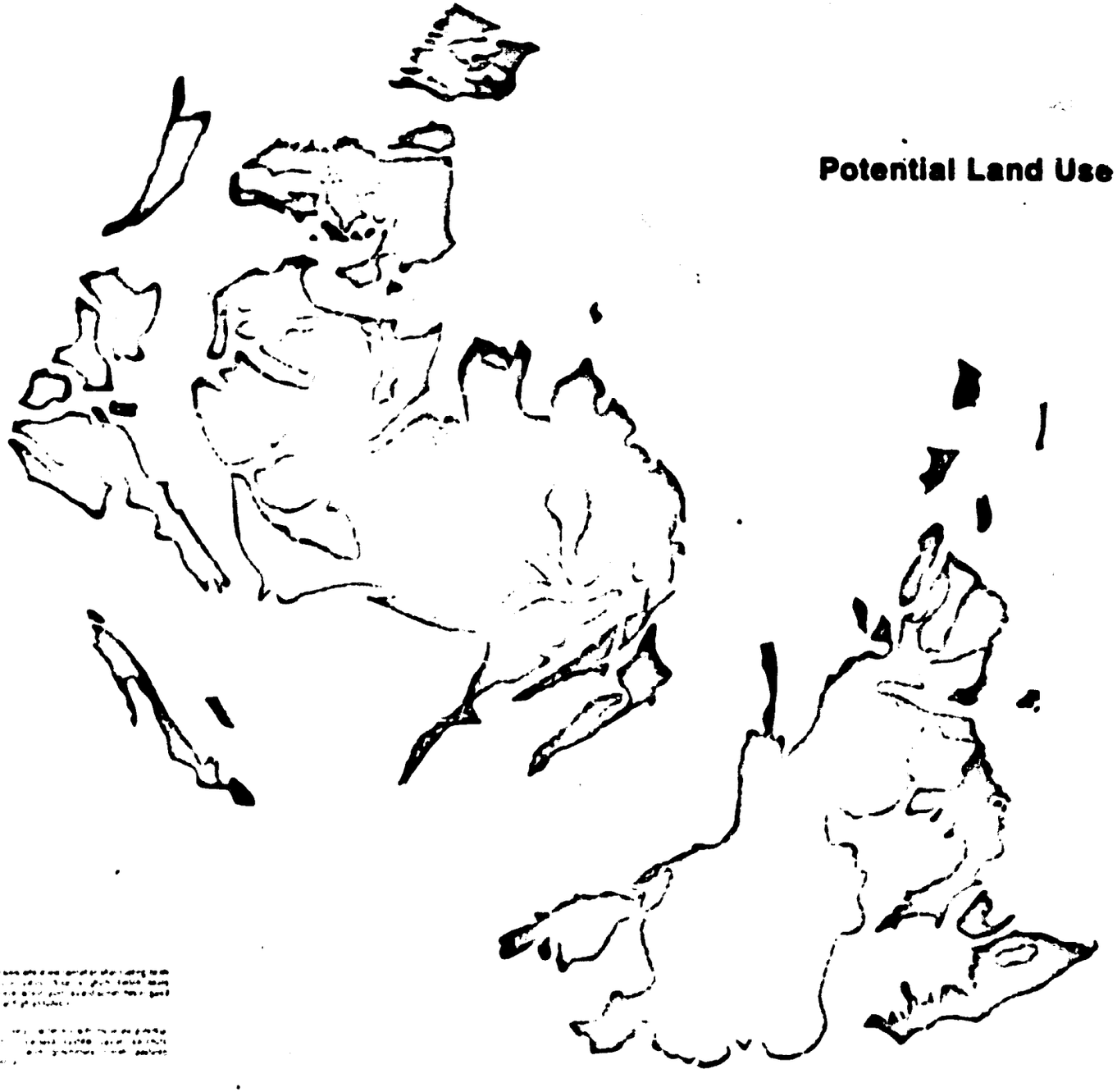
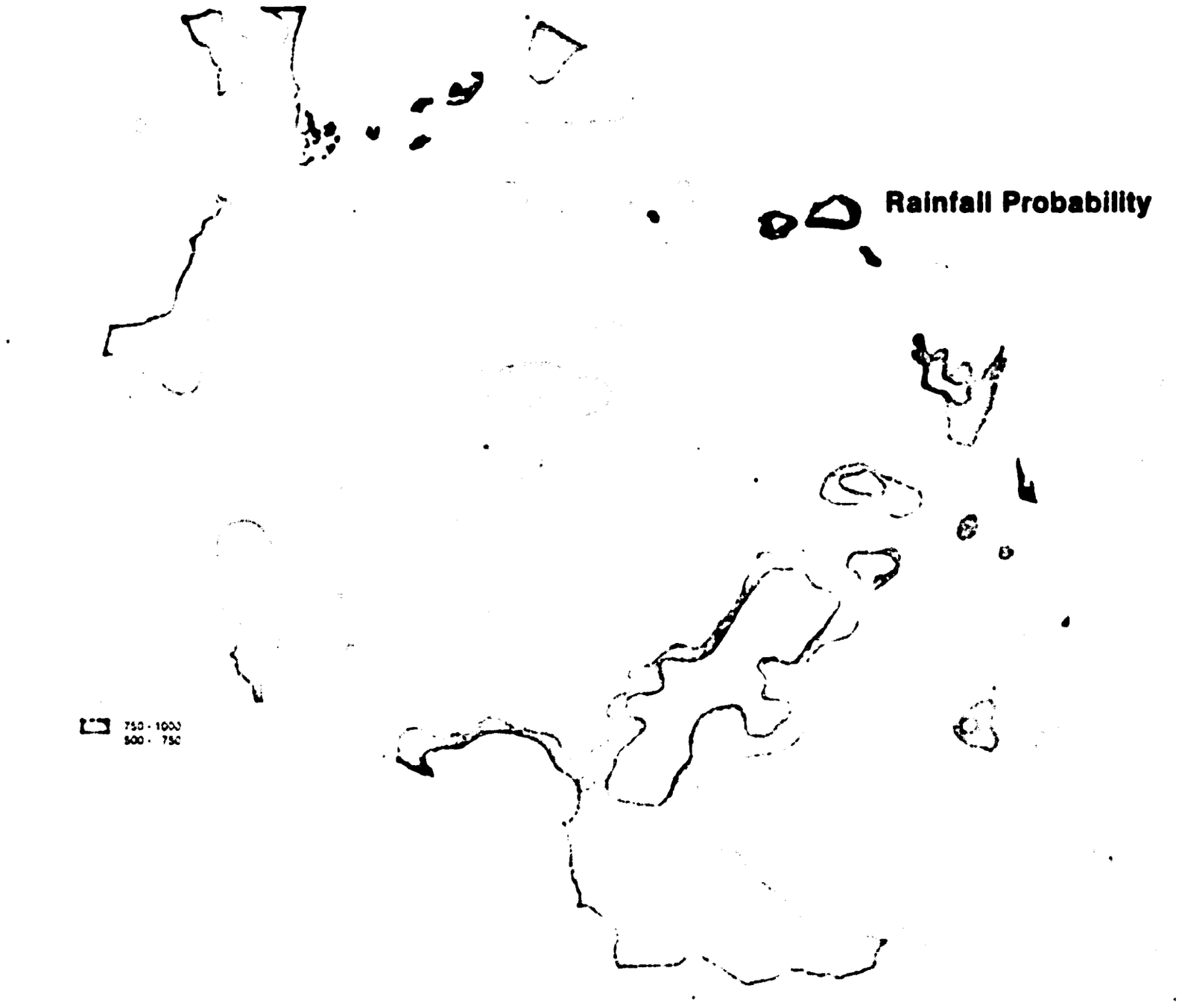
Potential Land Use




Rainfall Probability
750 - 1000
500 - 750

Rainfall Probability

Rainfall Probability

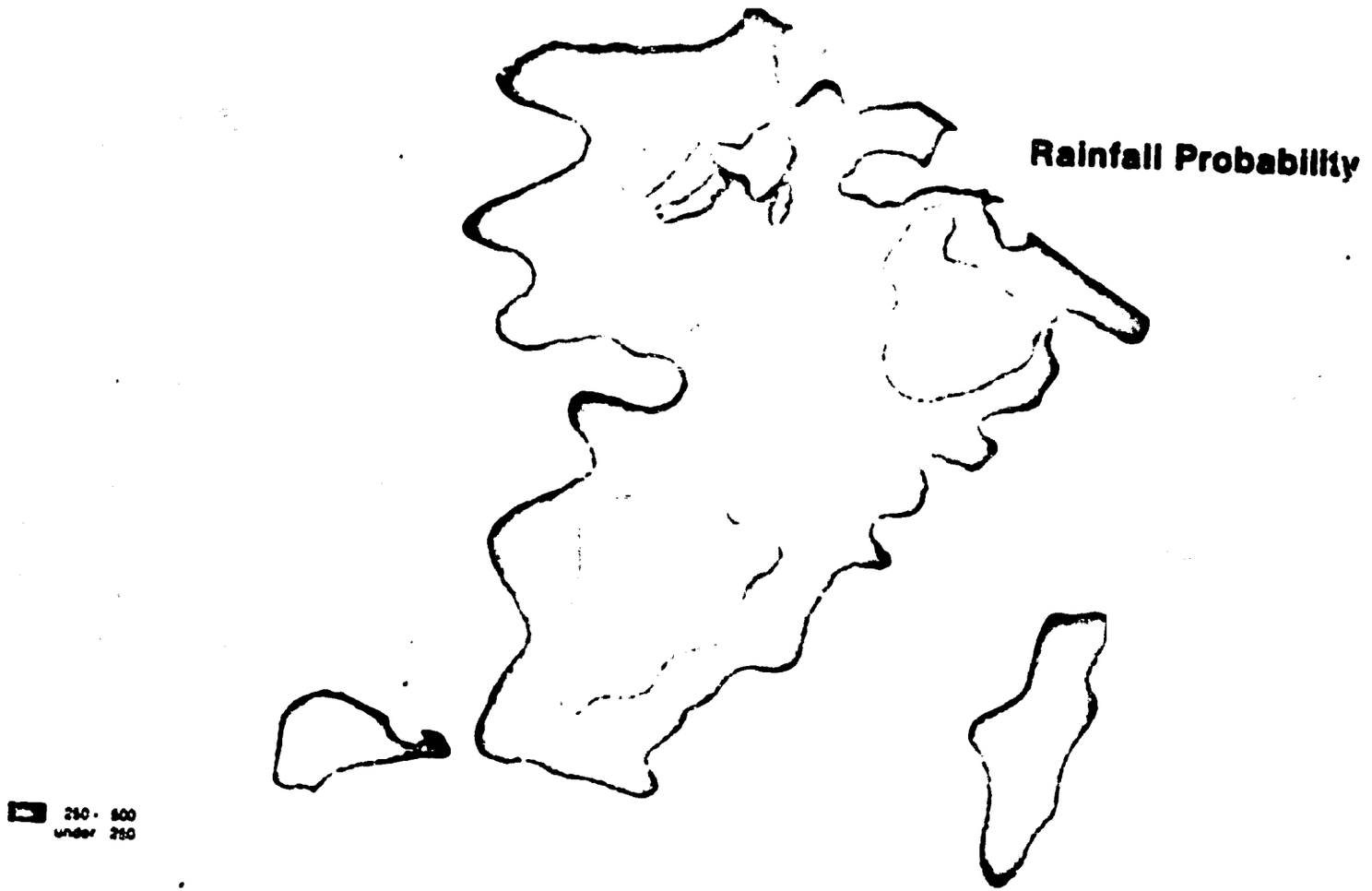
REFERENCE

Isohyets: Intervals

over 1750

1500 - 1750

18% PROBABILITY OF ANNUAL RAINFALL


Rainfall Probability
250 - 500
under 250

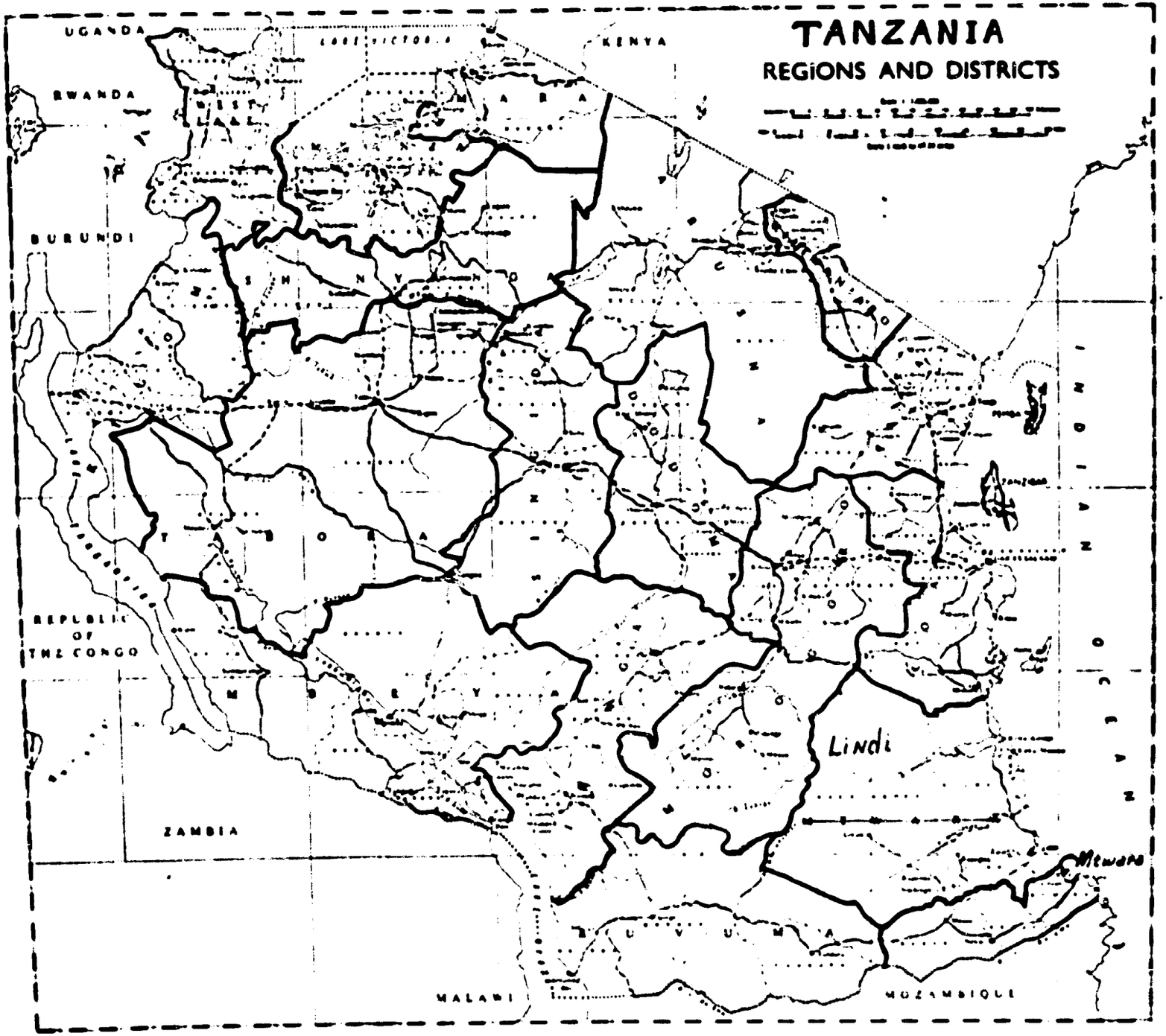

TANZANIA
REGIONS AND DISTRICTS
UGANDA
KENYA
RWANDA
BURUNDI
REPUBLIC OF THE CONGO
ZAMBIA
MALAWI
MOZAMBIQUE
Lindi
Mtwara

TABLE II

FERTILIZER SALES IN TANZANIA IN METRIC TONS (1965-1972) AND FORECASTED SALES OF TANZANIA FERTILIZER COMPANY UP TO 1975[a]

Year	Total	Ammonium Sulphate	Other Nitrogen Fertilizer	Super Phosphate	Potassium Fertilizer	Other Fertilizer
1964	18,911	8,199	5,192	852	965	3,703
1965	31,406	8,748	5,771	11,633	1,363	3,891
1966	23,629	8,043	5,935	1,978	1,357	6,316
1967	21,429	6,990	4,313	1,387	1,436	7,276
1968	31,315	7,478	6,103	3,078	1,449	13,207
1969	31,785	9,421	6,337	2,943	1,688	11,396
1970	38,300	8,850	7,700	4,900	1,800	15,050
1971	42,886	12,315	8,569	2,356	1,965	16,681
1972	55,200	20,000	7,000	6,800	2,500	18,900
1973	61,000	20,000	7,000	8,000	3,000	23,000
1974	78,000	25,000	7,000	12,000	4,000	30,000
1975	83,000	25,000	7,000	12,000	4,000	35,000

[a]From Tanzania Fertilizer Company report.

fertilizer plant at Tanga started production in mid 1972 and has a planned annual production capacity in 1974 of nearly 100,000 metric tons. Products manufactured are sulphate of ammonia, diammoniumphosphate, triple superphosphate, and blended fertilizers. Plans are underway to increase the plant's capacity by an additional 40,000 metric tons. The plant depends upon imported raw materials although phosphorus sources are known to exist within the country.

Seed Production Capability

Seed of food grains has been in short supply and often of questionable quality in Tanzania. Recently, however, a seed law governing the sale and movement of seed within the country was passed. It is designed to deal with several problems. They include inadequate varietal purity and germination and importing seeds without quality restrictions.

The production unit in the Ministry of Agriculture has established a seed multiplication unit, and seed farms have been started at Msimba and Arusha.[1] A third farm is being located near Njombe and a fourth is planned in the Tanga area. Production on the seed farms is expanding and is projected to meet the national seed requirements for most food crops. (See Appendix Table XV.)

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[1]USAID has been providing assistance in this endeavor.

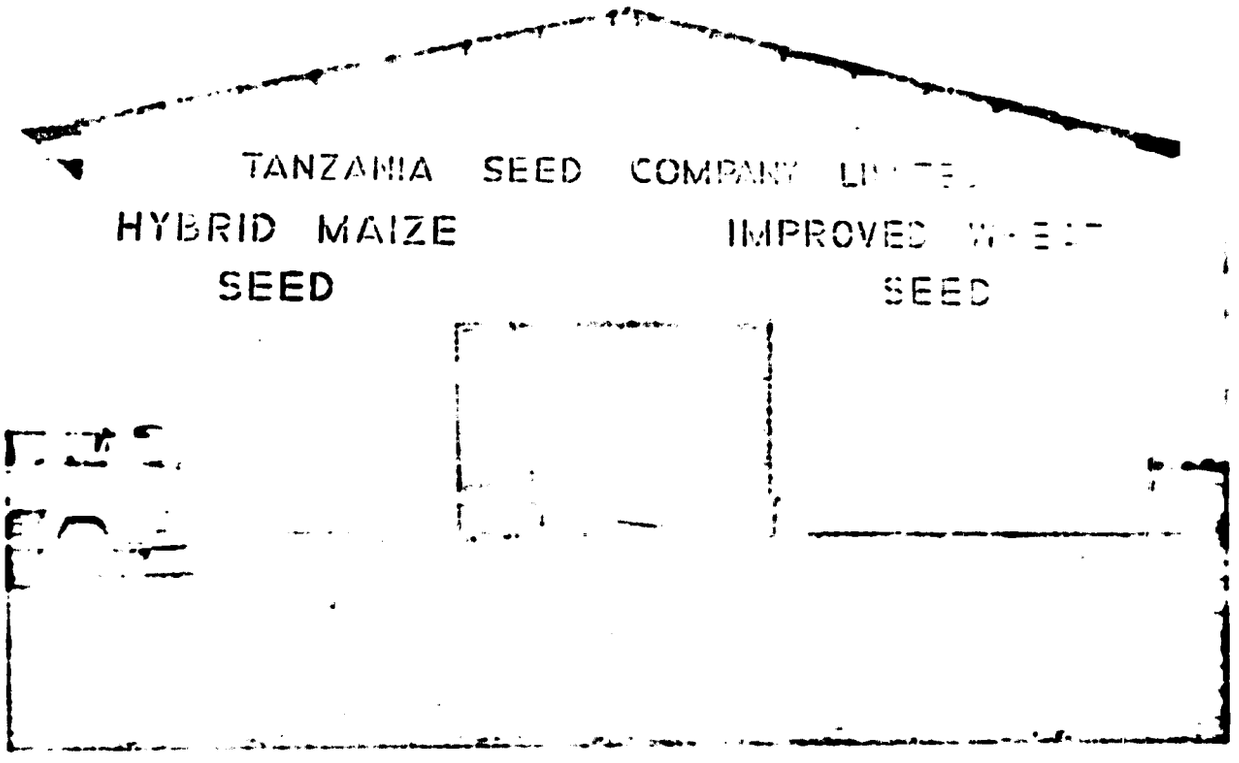
The Tanzania Seed Company was established to multiply foundation seed through selected certified seed growers. Such multiplication involves the selection of growers, field inspections, harvesting, processing, storage, and distribution. Headquarters and facilities of the Tanzania Seed Company are located at the Wattles Company near Njombe. Good facilities are available, but similar facilities at other locations will be needed as the seed production program expands. The seed program must be implemented in its entirety if adequate quantities of high quality, genetically pure, seed are to be available.

Systems of Operation

Smallholder operations are predominant in food crop production in Tanzania. Almost 90% of the total production comes from these smallholder operating units, ranging from one-half to three hectares in size. Large-scale operating units in food grain production are rare and widely scattered, consisting largely of a few institutional and state farms. Only in wheat production have larger-scale units been of major importance and these have been concentrated mainly in parts of the Kilimanjaro and Arusha regions.

The nature of the smallholder operating systems must be recognized in future planning for food grain production. They are largely subsistence units, consequently production of surplus grain for sale is incidental to

Picture I



Tanzania Seed Company, Ltd. is a modern processing facility primarily for maize and wheat seed.

providing the family food supply. For the most part, they are non-cash operating units. Capital investments in the tools of production are nominal and cash income is quite low. Farming methods and practices are those traditional for the tribe and often have prevailed for many centuries. The sense of security associated with traditional methods, together with the high rate of illiteracy among older farmers, creates a strong resistence to change and adoption of modern farming methods.

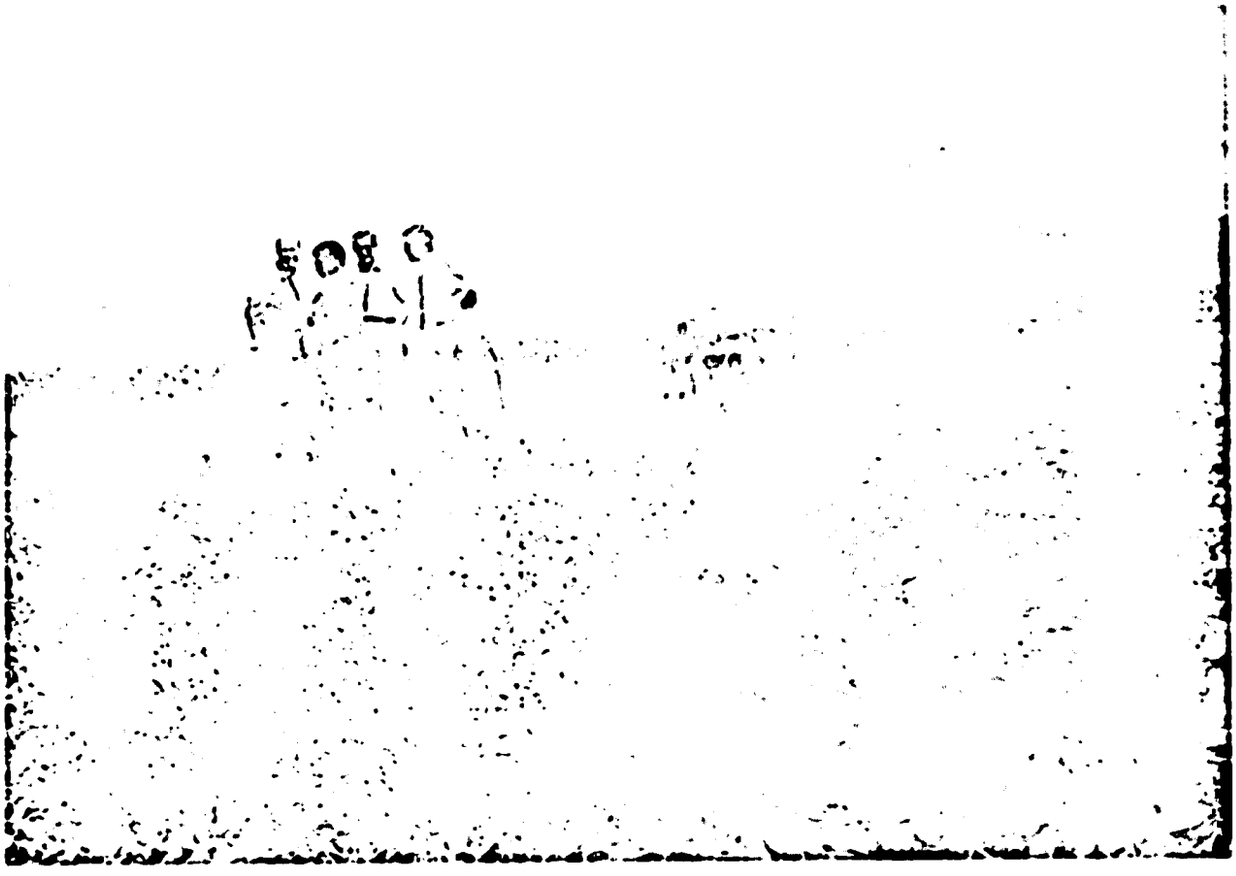
Farm Equipment

Farm equipment is a very scarce resource for the production of food crops in Tanzania, especially for the "smallholders". Hand tools are used almost exclusively for production operations on small farms.

In some areas, limited tractor power is avaliable for cultivation (plowing) and other special jobs. In many cases, this equipment is available only for cash (export) crops (occasionally for wheat) on large farms. In a few cases, tractor power has been made available to ujamaa villages on either a purchase, rental, or custom basis. Individual farmers, in some cases, have been able to rent such services for their own fields. However, this has created problems because the equipment is not well suited for small tracts of land, and credit is unavailable to many smallholders for this purpose.

Another method of making tractor power available for more producers

Picture II



Inspection of Research Plot Work at the Nordic Center
Near Mbeya

is through an arrangement referred to as "block farming," in other words, collections of smallholder tracts for specific operations.[2] This method of mechanization, especially if adapted to large tracts of land such as those operated in ujamaa villages, appears to be economically feasible, if properly organized and managed.

As indicated above, tractors have been assigned to a few ujamaa villages for cultivation of large tracts for maize and other food grains. In a few cases, planting equipment also has been made avaliable, but seldom is this the case for cultivating (weeding) equipment. Regardless, maintenance and operation of equipment is a problem since breakdowns and lack of repairs sometimes make it unavailable at crucial times. Another problem occurs in weeding operations. Here sufficient labor is not available to weed by hand the larger acreages planted with mechanized equipment.

Since production of food crops must rely upon human power for a decade or more, an urgent need exists for research to develop innovations that will make human power more productive. Research is also needed to develop supplementary and complementary sources of power such as power

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[2] J. D. Heijnen, "The Mechanized Block Cultivation Schemes in Mwanza Region, 1964-69." Research paper number 9, (Dar es Salaam: Bureau of Resource Assessment and Land Use Planning (BRALUP), University College, December 1969). In 1964, approximately 50 block cultivation schemes were established in Mara, Shinyanga, and Mwanza Regions. A special five-year study of this experience (1964-69) by Heijnen revealed many problems in organizing and carrying out this method of mechanization.

from animals.

Manpower

Both agricultural labor and technically trained manpower are constraints in the subsector. Both warrant brief discussion.

Farm labor. Labor is one of the most critical resources in the production of food grain crops in Tanzania, given the technology employed. Labor was identified by all persons interviewed at the regional level as a very scarce resource--especially during peak labor-requiring periods.[3] However, farm labor was reported to be underemployed during much of the rest of the year.

Technically Trained Manpower. In addition to the severe shortage of seasonal labor at the farm level, a critical shortage of technically trained manpower was found in practically all phases of the agricultural sector. Many capable people were found in government positions at the national,

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[3]Some statistical data on hired labor were available from the Regional Statistical Abastrac, 1968-71. Appendix Table XVI includes a summary of data for both regular and casual workers by regions and the average earnings per month and per day of work. It is assumed that a substantial part of this hired labor was used in the production of cash crops, rather than food grains.

regional, and district levels but, in many situations, up to one-half of the authorized positions were not filled because qualified people were not available. This staff shortage severely handicapped extension and research as well as service activities. Many people trained in and experienced with agriculture have been shifted to other areas of government due to a similar shortage there.

Currently, programs to increase the yields and total production of food crops have been severely restricted by a lack of qualified manpower. In the past, for example in the assignment of extension personnel, cash crops have taken precedence over food grains. In some regions, one extension worker had been assigned for each 50 to 150 producers of cotton, tobacco, and other cash crops. On the other hand, the ratio of extension workers to farmers who produce food grains varied from 1,000 to 1,500 farmers per extension worker.

Management

An important limiting resource to increasing the production of food grain crops is management experience in producing for the market. Currently, most of this production is accomplished on individual smallholder farms (estimated at almost 100% in some regions). For the most part, these farmers have little formal education and lack the knowledge required for adopting modern farming methods. They farm according to

the traditional methods of the tribe and village of which they are part.

Some progress has been made in recent years in training more capable managers for the future. Of particular importance in the field of farm management, is the special Mlingano Training Center near Tanga in which young men are given very intensive instruction in the field of farm management. Students who come there already have had secondary level education, certificates from one of the training institutes, and at least two years of actual field experience in either extension or management positions with state farms. This school has a staff of Tanzanian and expatriate instructors, together with adequate facilities for an excellent training program.

The actual on-farm management decisions will be made by the two and one-half million Tanzanian farmers. The professionally trained farm manager can advise and point out the advantages of alternatives, but what farm practices are followed on the land will continue to be made by the farmers themselves.

It seems reasonable to assume the farmers' decisions to apply the new technology or to continue with their traditional practices will be greatly conditioned by their capacity to understand the new technology--what it will do, how to apply it, and why. This understanding and the feeling of confidence needed in its application brings to the forefront primary and secondary education as resources for agricultural development.

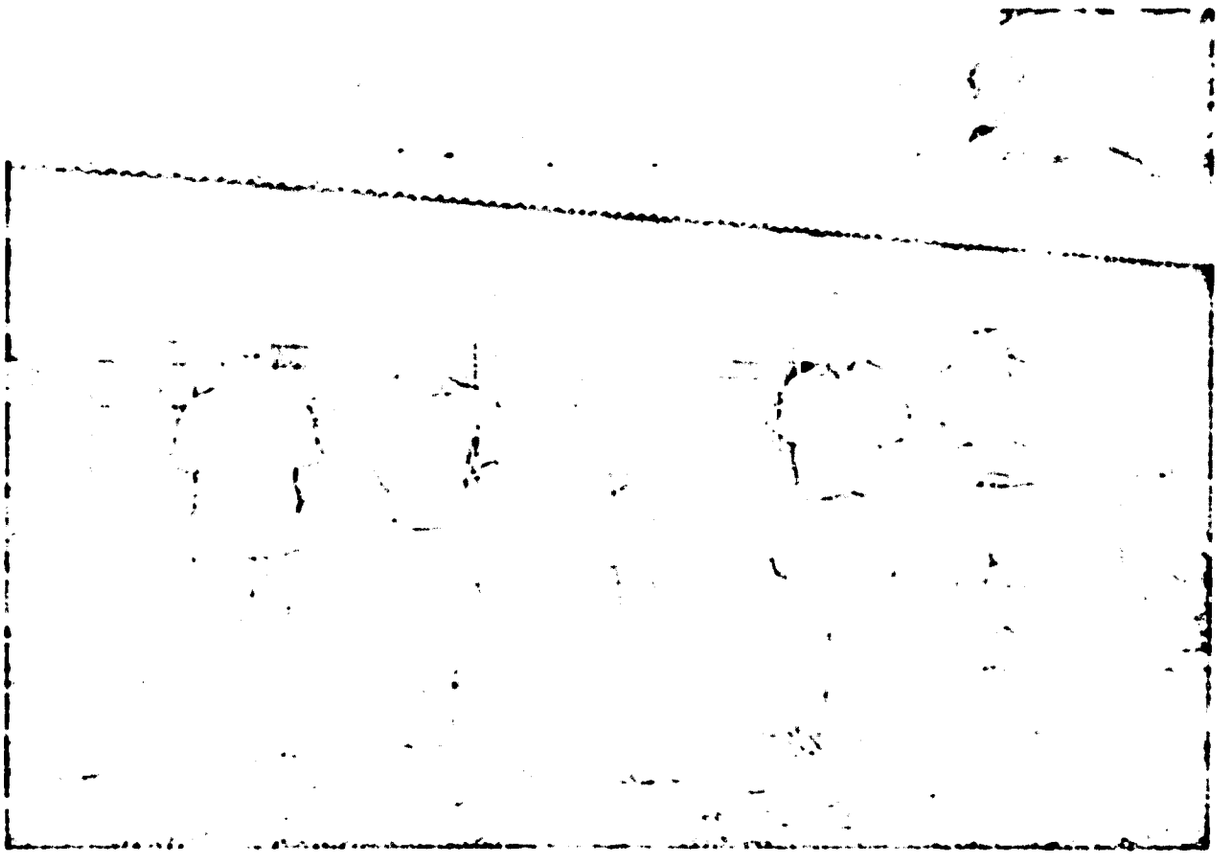
In appraising primary and secondary education as important resources related to the country's capacity to increase the production of food crops, little is to be gained by reviewing the limitations of education under colonial rule. What is important and relevant, however, is the emphasis and new direction Tanzania is now giving to primary and secondary education.

As the new policy guidelines for primary and secondary education become operational, one can visualize how education will in the future prepare farmers to understand the new technology and to have confidence in applying it on their farms.

Selected quotes from President Julius K. Nyerere's policy statement on "Education and Self-Reliance" provide evidence that, in the future, primary and secondary education will be increasingly more relevant and, therefore, will provide a strong resource base for the growth and modernization of Tanzania's agriculture:

> The education must therefore encourage the development in each citizen of three things: an inquiring mind; an ability to learn from what others do, and reject or adopt it to his own needs; and a basic confidence in his own position as a free and equal member of the society, who values others and is valued by them for what he does and not for what he obtains.
>
> However much agriculture a young person learns, he will not find a book which will give him all the answers to all the detailed problems he will come across on his farm. He will have to learn the basic principles of modern knowledge in agriculture and then adapt them to solve his own problems.
>
> Education given in primary schools must be complete education in itself.

Picture III



Teaching staff of the Farm Management Training Center, the Mluigano Research Training Institute near Tanga.

> Similarly, secondary schools must not be simply a selection process for the university, teachers' colleges, and so on. They must prepare people for life and service in the villages and rural areas of this country.
>
> On a school farm pupils can learn by doing. The important place of the hoe and of other simple tools can be demonstrated; the advantages of improved seeds, of simple ox-ploughs, and of proper methods of animal husbandry can become obvious; and the pupils can learn by practice how to use these things to the best advantage. The farm work and products should be integrated into the school life; thus the properties of fertilizers can be explained in the science classes, and their use and limitations experienced by the pupils as they see them in use.

Tanzania's success in making primary and secondary education meaningful to living and to earning a living in the community will contribute to strengthening education as a significant resource essential for modernizing agriculture.

Production Resources Summary

Since Tanzania has a natural resource base which permits expansion in the cultivated land area and increases in per-acre yields, growth in production is constrained by the lack of other crucial resources, especially trained manpower. Without this resource, the country is inevitably "locked into" traditional, primitive technology in the production of food crops. Until that technological bottleneck is broken, a shortage of human energy will constrain the growth of the traditional hoe economy.

New technology requires technically trained manpower. When implemented, such technology allows the use of other sources of energy

which, in turn, makes human energy more productive. In short, the key to initally unlocking this syndrome of difficulties lies in trained manpower.

Marketing Resources

The marketing resource base, too, is important to improve Tanzanian nutrition and exports. It has an essential role to play in improving the efficiency with which existing levels of output are marketed, and in expanding marketing volumes required if production increases. This section of the chapter focuses upon this resource base: First, the market exchange resources and then, the market facility resource.

Market Exchange Resources

Two aspects of market exchange resources are crucial in considering Tanzania's marketing resources. The first of these is the organization of the system. The second is price policy. Both will be discussed.

Market Organization. The food crops in Tanzania are marketed through a single channel of semi-autonomous, government-sponsored cooperatives. Except for bonafide producer-to-consumer sales, farmers must sell all food grains to the Primary Society. A Primary Society may operate several "buying posts" (average of four in 1969) to accommodate farmer members ranging from a few hundred to 2,000 in number. Approximately 1,800 of these cooperative societies are now in operation.

From the Primary Society, the grain is moved into the custody of the Cooperative Union, usually a regional organization, and usually one per region. In mid 1974, there were seventeen Cooperative Unions in the country.

The National Milling Corporation (NMC) is the purchasing and holding agent for all food grains marketed in the commercial market in Tanzania. (This role was assumed in late 1973 from the National Agricultural Products Board, NAPB which will be discontinued as soon as its business can be cleared out.) The general procedure is to appoint the Cooperative Union (The Regional Level Cooperative, hereafter referred to as the Union) to be the purchasing agent for NMC. Although funds to finance purchases are supplied by NMC and the purchased grain is the property of NMC, it remains in the custody of the Cooperative Union until called forth by NMC.[4] Under certain circumstances and with the approval of the Regional Commissioner, each Regional Cooperative has the privilege of reselling in the region even though the grain has been purchased and put into storage for the account of NMC.

Grain stored at the Regional Cooperative Union level may be stored in a warehouse owned by the Union and leased to NMC, or owned

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[4]In a few regions wherein the Cooperative Union is not financially viable to be sufficient to this purpose, the NMC has established its own buying agency.

by NMC and operated by the Union. The Union usually deals with all crops but generally is oriented toward cash crops. Nevertheless, an exchange system for food crops is in place.

On the side of imported products or imported inputs, the State Trading Corporation has either replaced the private importer or become party to an import-licensing system. This has in effect brought imports under explicit government control, requiring explicit priority setting, due to the limited foreign exchange available.

Price Policy. All prices are administered prices established by the Economic Committee of the Cabinet. Although some input to the Committee comes from Kilimo and from NMC, little economic analysis input is made into the price setting process. Apparently the formation of price policy has been guided more by a desire to provide inexpensive food to Tanzanian consumers than by an objective of providing a production incentive for farmers until recently.

In 1973, a policy decision was taken to make prices an effective incentive to farmers for increased production. The government designated the officially established price to be a farmer price, thereby relieving farmers of the burden of high and widely varying marketing costs. This change increased the price of food grains to the farmer in most regions. By early 1974, virtually every government agency and every

advisory group concerned with food grain prices recognized that the farm prices were too low and recommended increases. All food grain prices were lower in Tanzania than in neighboring countries, and lower than world prices by 50% or more. On April 12, 1974, a new set of prices became effective.

Market Facility Resources

Facilities for transportation, storage, and processing are the essential physical facilities for marketing the food crops. The building of facilities specifically for food grain crops is of recent origin. Some facilities used for the cash or export crops are adaptable to food crops.

Transportation

The Tanzanian Highway Maintenance and Organization Study records 16,404 kilometers of roads in Tanzania. The areas best suited for producing food crops are for the most part located considerable distances from the areas of concentrated demand. Consequently, transportation becomes very significant. Many potentially productive areas are not penetrated by roads at all. Existing roads often are not usable during the rainy season.

The study cited above estimates that 45% of the existing roads are in need of rehabilitation. Truck transport costs are high because

TABLE III

TANZANIAN OFFICIAL PRICE--1974[1]

Grain	April 12, price (Prices in Tanzania Shillings)[2]	Previous price
Maize, per kg.,		
Special regions	/50	/35
Other regions	/50	/30
Wheat, per bag, 90/kg.	70/=	39/60
Paddy, per kg.	/65	/61
Edible beans, per kg.,		
1st grade	1/50	/85
2nd grade	1/30	/65
Sugar, per kg.	3/=	2/=

[1]Source: Conference with Mr. Mushi on April 25, 1974, at the Worlds Banks Building, Washington, D.C.

[2]Read 39/60 as 39 shillings and 60 pence, /50 as 50 pence, and 3/- as 3 shillings exactly. US$1.00 = Tan. Shs. 7:15.

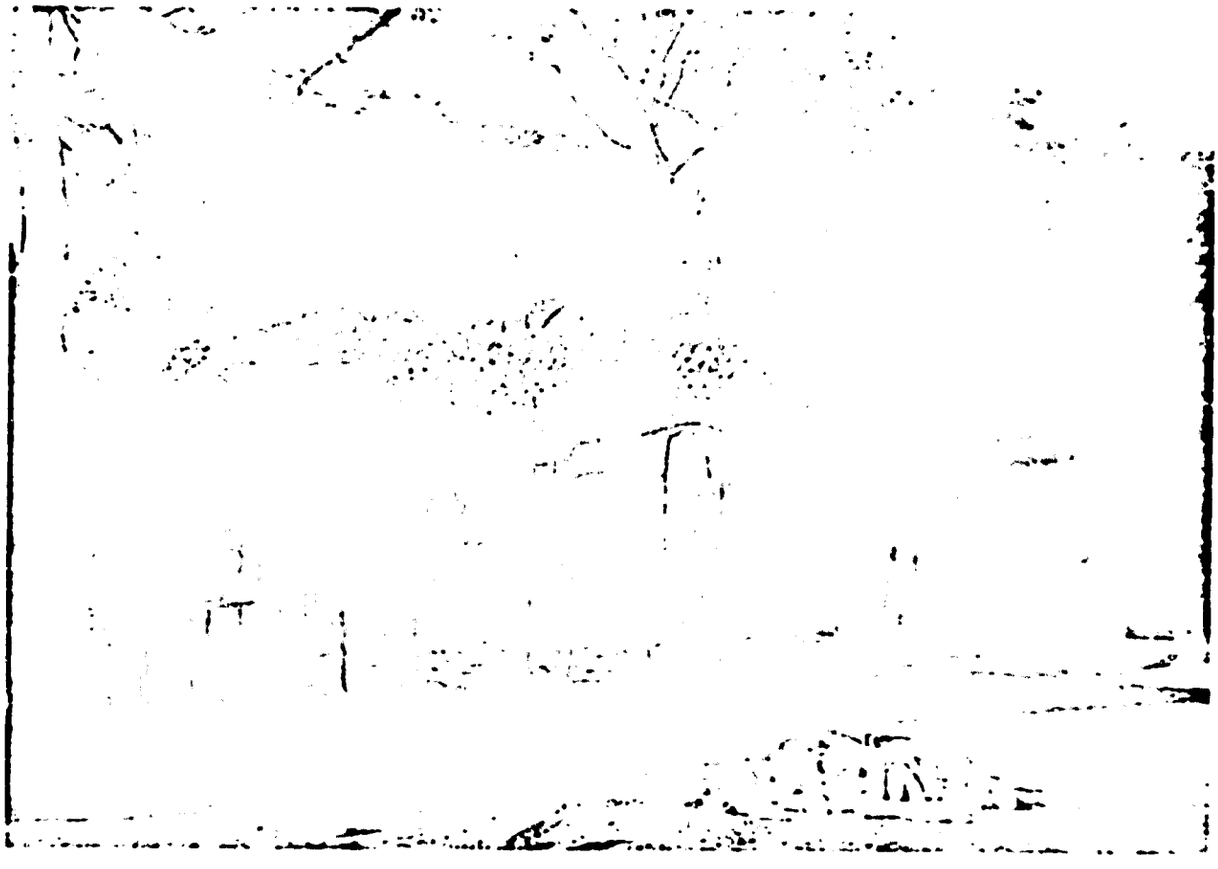
distances are great and roads are poor. The costs mount rapidly as the condition of the road deteriorates.

The rail transport facility is significant, but available only to limited areas of the country. With the completion of the new railroad from Dar es Salaam to Zambia the situation is improved for the south-western part of the country.

Trucks owned or rented by the cooperative unions are used to move grain from cooperative societies to unions and other points, both within and between regions. Interviews with cooperative union personnel in many of the regions indicated that additional trucks were regarded as a serious need if grain were to be secured from the less accessible areas on time and with minimum damage.

Costs of vehicle operation are quite high, due largely to the type of terrain and the quality of the roads. Costs of truck transport (reported by the Economic and Engineering Study of Tanzania Highway Maintenance and Organization) on good roads ranged from 81.81 Tanzanian cents per kilometer on Bitumen roads on flat terrain to 262.72 Tanzanian cents per kilometer on earth roads in hilly to mountainous terrain. Further details of this study are included in Appendix Table XVII. Costs were estimated to increase by 20 to 30% as the condition of the roads deteriorated to a poor condition and by 60 to 75% on further deterioration to a bad condition.

Picture IV



Maize storage in Dar--Family cooking facilities located below storage rack to provide smoke for drying and insect control. Smallholder family in ujamaa village, Tabora Region.

Milling Facilities

Food grains may be milled by the grower himself, by one of the small contract mills found in most villages, or by a large mill licensed to mill products that move through the commercial channel. Newhouse estimates that 20 to 30% of the total maize production, 50% of the rice production, and virtually all of the wheat production passes through commercial channels and is milled by the large mills. He also estimates that the 1972 maize milling requirement was approximately 125 tons of raw maize equivalent and projects a 1978 milling capacity requirement of 200,000 tons, with the possibility this milling capacity would be sufficient until 1984-85.[5]

The commercial maize millers listed shows a licensed capacity of over 200,000 tons. If the National Milling Corporation (NMC) operated their mills at full capacity, they could process over 100,000 tons of maize per year. Therefore, this capacity is considered adequate with no immediate need for further expansion.

Rice consumption was estimated at 50,000 tons in 1972 and, assuming an increase of 10% per year, will reach 100,000 tons by 1978-79. The country now has a licensed milling capacity of 150,000

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[5] Newhouse.

tons of rice per year, even when mills of less than 50 tons capacity are not counted. This indicates a surplus of rice milling capacity and the Newhouse Report suggests that in order to increase efficiency, mills near the producing areas might be utilized more fully than those in consumption centers.[6]

The Newhouse Report also indicates that national wheat consumption in 1972 probably will reach 67,000 tons.[7] The two NMC wheat mills have operated near normal full capacity, about 59,000 tons in 1970-71. However, if they operated six days a week, the mills could handle up to 67,000 tons per year.

A number of oil factories which utilize the expeller process are in operation. They can be used to process any reasonable expansion of soybean production, although plants using the solvent process would be cheaper to operate.

Market Resources Summary

The organization of the Tanzanian food crop marketing system was noted as was the change in price policy which determines price in a single channel system. With regard to marketing facilities, the lack of sufficient

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[6] Newhouse.

[7] Newhouse.

trucks and adequate tools was emphasized whereas milling capacity was deemed adequate.

CHAPTER IV: FOOD CROP PRODUCTION--PAST TRENDS, CURRENT PERFORMANCE AND FUTURE POTENTIAL

National trends in food crop production for recent years were summarized in Chapter I. Here they will be elaborated upon, especially in terms of regional breakdowns. In addition, the current performance of the subsector will be analyzed with regard to the production of the six food crops of interest in this analysis. Finally, attention will be turned to forces expected to have a bearing upon the future potential for expanding the output of these crops. Throughout, the focus will be upon individual crops.

Before turning attention to these items, however, a caution concerning data acquisition at the regional level is in order.

Difficulties of Obtaining Regional Production Data

Determination of production trends is difficult due to the lack of detailed data on a regional basis. Nevertheless, several efforts were made in this regard. In addition to reviewing census data and various statistical reports, conferences were held with regional officials, cooperative union managers, and other individuals who had personal knowledge of conditions in each region. The data in this section resulted from these efforts.

Initially, an attempt was made to rank major food grain crops in each region. This was done on the basis of acreage and total production, as well as the importance of the particular crop to the food supply of the region. These rankings are summarized in Table IV-1.

Maize ranked first in twelve of the eighteen regions, again indicating its position as Tanzania's dominant food crop. It ranked second in five regions

and was in third place in only the Lindi Region. It was produced for grain in all regions except the Coast where it was a fresh food crop.

Wheat was grown in only five of the eighteen regions in any significant amount. It is not considered a popular food grain in rural diets; rather it was consumed primarily in urban areas.

Rice was of considerable importance being produced in most regions. As noted in the table, it was ranked in first place--hence, above maize--in five regions and second in five others.

Sorghum and millet were most important in low rainfall regions, that is, in the central part of the country--such as Singida, Shinyanga, Kigoma, and Dodoma. In addition, sorghum was considered a major grain crop in both the West Lake and Lindi regions.

Soybeans have been produced on a very limited scale in Tanzania with most of the production in the Morogoro, Mtwara, and Lindi regions. Some production was also reported in the West Lake Region. The potential for future production seems good in these and other regions, as will be discussed later.

Various oilseed crops, such as peanuts, castor beans, sunflower, coconuts, simpson, and cotton were considered of substantial importance in many of the regions. Later observations indicated field beans also were a major crop in many of the regions, primarily for home consumption.

Current Production and Past Trends

Maize Production

As indicated earlier, maize is the most important food crop in Tanzania. It occupied 36.5% of the total area in food crops in 1971, according to Ministry of Agriculture statistics. This acreage produced about one half of the total cereal grain tonnage in Tanzania.

A summary of production data for the different regions in Tanzania is included in Table V. Large maize acreages were produced in each of the regions, except for the Coast, West Lake, Mtwara, and Mara regions. Acreage in Mtwara has apparently increased, however, in recent years. Primary maize producing areas are shown in Figure 2.

Iringa produced the greatest maize tonnage in 1971, although Tanga was reported to have the largest acreage. Other large maize producing regions were : Arusha, Mbeya, Morogoro, and Tabora. Maize production has been increasing in Ruvuma, a major producing region since 1971.

Total production in the various regions seems to have varied widely over time. According to the regional officials interviewed, this extreme variation usually was due to differences in rainfall. However, these officials said the acreage planted did not vary as widely as indicated in official statements.[1]

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[1] Total production for each region is calculated each year from some sound statistical base information while the acreage is computed from these data plus estimated yields per acre reported by Regional Agricultural Development Officers in 1965. Yield estimates per acre were requested from the Regional Agricultural Development Officers in Kilimo again in 1972. The estimates received from nine regions were 64% higher than those reported from the same regions in 1965. Yield per acre varies each year depending upon environmental conditions. Therefore, any hazard that reduces total production shows up as reduced acreage, because of the system of calculation, when actually acreage may have been stable or even higher.

Regardless of the accuracy of the secondary data available, maize is the essential food crop in Tanzania, and its production fluctuates widely.

Wheat Production

Wheat production during the 1968-71 period was reported in the Statistical Abstract in only seven of the eighteen regions in Tanzania (Table VI). Arusha averaged about 35% of the total, Iringa 31%, and Kilimanjaro 17%. A substantial amount was also produced in Morogoro and Ruvuma regions. No wheat was reported in the Tabora Region although the National Agricultural Products Board (NAPB) purchased significant quantities of wheat in that region in both 1970 and 1971.[2]

Production trends for 1968 through 1971 in the major wheat producing regions are summarized also in Table VI. Total production varied rather widely in these regions, especially in Arusha and Iringa.[3] NAPB purchases have been increasing in all wheat growing regions except Mbeya where a new disease problem has occurred. (See Figure 3.)

Wheat production has been limited to seven or eight regions, primarily because of physical conditions. Wheat varieties currently available do not yield well at altitudes below 3,000 feet elevation. For this reason, production of the crop is limited to those regions with higher altitudes and favorable rainfall.

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[2] Newhouse.

[3] This may have been due primarily to the method of calculation.

Paddy Rice Production

Rice ranks second to corn, among the cereals, accounting for about 10% of the total acreage in food grain crops by 1971. While some rice production was reported in every region in Tanzania; Tabora, Mbeya, Morogoro, Mwanza, and Shinyanga have been the major producers. These areas accounted for over two thirds of the total rice production. Rice acreage has been steadily increasing as has total production.

Trend data for production in metric tons from 1966 through 1971 are summarized in Table VII. Very little rice production was reported in the Arusha and Dodoma regions in 1971 and only limited amounts in the Ruvuma, Singida, and West Lake regions. While the quantities produced are small, rice production in the West Lake Region seems to be increasing rather steadily while it is decreasing in Arusha. (See Figure 4.)

The acreage devoted to rice production is difficult to determine and total production estimates are questionable. Like maize, these are computed by Kilimo on the basis of the yield-per-acre estimates made in 1965. Estimates of yields per acre by region again were requested in 1972. Then the yields for comparable regions were estimated to be 147% higher than in 1965.

The concentration of rice production in certain regions can be explained largely because of physical and climatic conditions. Most of the rice is grown in paddies that require substantial quantities of water not readily available in most regions. Yet, as is true with other crops, some of the large areas of production are the result of traditional farming patterns.

Sorghum Production

Sorghum ranked fourth among cereal grain crops in total production in Tanzania, according to official estimates. All regions, except Kilimanjaro, produced some although the tonnage reported was quite low for Mwanza, Tanga, Iringa, and Ruvuma. By far the leading producer of sorghum in 1971 was Mtwara Region (although this included production from both Mtwara and Lindi regions of today). (See Table VIII.) Production in Morogoro and Mwanza, and to a lesser extent in Coast, Dodoma, Iringa, Ruvuma, Shinyanga, and Tanga, appeared to be declining.

Aside from the Mtwara and Lindi regions, the major production seemed to be located in the drier regions in the central and western parts of the country. These included Kigoma, Singida, and Tabora, where production appears to have been stable or increasing. However, data sources differ concerning acreage trends and some questions remain concerning them. Primary production areas are shown in Figure 5.

In the personal interviews, sorghum was reported as the major crop in only the West Lake Region. However, it was identified as the second crop in four regions: Dodoma, Kigoma, Lindi, and Singida. Sorghum was identified as more important than millet in 13 regions.

Estimates of sorghum yields per acre were made by Regional Agricultural Development Officers in eight regions in 1972. These estimates were 20% higher than the figure of 500 kilograms per acre used since 1965 in Kilimo calculations.

Millet Production

The millets, both finger and bulrush, ranked third in tonnage among food grains and made a significant contribution to total food output in 1971. Total production in metric tons harvested by regions is summarized in Table IX. Dodoma, Mbeya, Kilimanjaro, Mara, and Singida have been the major producing regions. In contrast, no production was reported in the Tanga, Morogoro, and Coastal Regions. As with the other major cereal grain crops, total production seemed to vary rather widely from year to year in most regions. Likewise, total production trend estimates vary among data sources leaving some question about the actual trends. Primary production areas are shown in Figures 6 and 7.

Millet appears to have increased slightly from 1968 to 1971. Kilimo has used an average yield of 500 kilograms per acre since 1965 to calculate acreage from the production data. Yield estimates again were received from Regional Agricultural Development Officers in six regions in 1972 and the estimates were 37% below the 500 kilograms per acre formerly used in statistical computations. In interviews in the regions, millet was identified as a more important food crop than sorghum in only 3 regions, while 13 regions identified sorghum as the most important.

Soybean Production

Soybean production has been reported in only three of the eighteen regions and in only one, Mtwara, was production of any consequence. However, a project has been underway in Morogoro Region to increase soybean production and utilization. (See Table X.)

In spite of limited production in the past, the potential for soybean production is considered to be favorable in these three regions, as well as others. This will be discussed further in subsequent sections of this chapter.

Other Food Crops

While statistical data were not assembled for other food grain crops, including oilseeds, many of the crops have been of considerable importance in different regions, and some seem to have good potential for future production. In spite of the earlier unfavorable experience in producing ground nuts in the Mtwara Region, a considerable acreage of ground nuts is still produced there as well as in several other regions.

While not in the category of cereal grains, a few other crops are of major importance in Tanzania. Special note should be given to bananas, which are widely grown, as well as cassava, and field beans. Cassava is important because it is hardy under adverse climatic conditions. In many places, it is grown as a safeguard against famine in case other crops fail. In addition to the roots of the crop, the leaves, high in vitamin A, also form an important part of the diet in some areas.

Field beans is a crop of major importance in many of the areas and probably merits expansion in the future because of the protein that it can contribute to the diet. This is especially important in rural areas.[4]

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[4]Further insights into the production and use of the major food grain crops in Tanzania are revealed in FAO Accounting Work Sheets. Appendix Tables XVIII to XX III provide detailed information, derived from these worksheets, on the production and disposition of each of these food grain crops for 1968, 1969, 1970, and 1971. Since domestic production and consumption as well as imports and exports are included, a kind of "balance sheet" is provided for each crop. Data in these tables are self-explanatory.

Factors Influencing Production Potential

An assessment of the potential for increasing the production of food grain crops in Tanzania must recognize inherent factors that affect all types of crop production, as well as specific ones related to individual crops. Many of these factors are related to the basic resources discussed earlier. An attempt now will be made to evaluate the influence they have on food grain production potential.

Resource Base

Soil and water are the two natural resources with probably the greatest impact on the potential for food grain production. Both the quality of land and prevailing climatic conditions, especially the amount and the distribution of rainfall throughout the year, are major determinants of crop productivity. Since the kind of soils and rainfall patterns vary widely throughout Tanzania, careful study was made of available government maps. These maps show the geographic distribution of soil and water resources. Colored transparency overlays (Figure 7) were prepared from the maps to show the interrelationships between these resources in different areas of the country. Using them one can identify those areas with greatest production potential and those with severe limitations.

Variations in soil quality and annual rainfall may be observed with the colored overlays in Figure 7. The overlays reveal areas of the country with different levels of annual rainfall, based upon a 10% probability of occurrence. By combining the land potential and rainfall probability maps, areas of the country can be identified that have the natural resource potential for

various food crops.

A noteworthy fact--unproductive soil and inadequate rainfall make large areas in north-central Tanzania (much of Arusha, Dodoma, Shinyang , and Mara) very unsuitable for crop production. The low rainfall area extends throughout much of the central and western parts of the country. It includes much of the Singida, Tabora, Mwanza, Kigoma regions, and some of the Mbeya Region. Many of the soils in these areas also are relatively infertile. In addition, much of the area in the southeastern part of the country lacks rainfall and fertility. This section includes the eastern part of Ruvuma, part of Morogoro, and parts of the Mtwara and Coast regions.

Potentially, the best combination of soil and rainfall conditions for grain crop production can be found in a "7"-shaped area, starting from the western Ruvuma Region and southern Mbeya Region and moving northeastwardly through mountainous areas to Tanga and then inward again to Arusha. Significant acreages with slightly less potential border the better soils. They also are found in areas in the Mtwara and Lindi regions, around Lake Victoria and the smaller areas bordering Lake Tanganyika. Further study of these map combinations will reveal other small areas where the production potential is quite favorable.

Regional comparisons regarding potential food grain production are presented in greater detail in Table XI. This table brings together several factors that affect production potential. They include the class of land, the average annual rainfall, the percent of the land falling within areas of 750 millimeters of rainfall in 9 years out of 10, the number of consecutive months with over 100 millimeters of rainfall, and the extent of irrigation currently

available. In this table, an attempt has been made to arrange the regions in descending order with respect to most of the factors influending production potential.

From the standpoint of these combined factors, several regions rank rather high. Parts of Iringa, Morogoro, Mbeya, Ruvuma, Mara, Arusha, Tanga, and Kilimanjaro seem to have the highest potential for food grain production. In addition, as indicated by the maps and tables, certain districts, and parts of districts, within other regions also have considerable potential with respect to most of these factors. Some of these areas consist of alluvial or colluvial soils of considerable fertility, but they may need flood protection, drainage, and special management before they can contribute significantly to production.

Production Projections

Projections of the acreages needed for various food crops to meet the needs of Tanzania by 1979 have been made by the production divisions of Kilimo. (Appendix Table XXIV.) These represent the acreages considered necessary for a reasonable supply of food for Tanzania, assuming a population increase in excess of 3% per year. Several implications of these projections are noteworthy.

Achievement of the acreage goals indicated is greatly dependent upon an adequate supply of good quality seed. Although recent developments in providing a good supply of high quality seeds provide some optimism, the 1973-74 drought has slowed this process.

The seed production program is set up to expand the available seed

supply through various stages. Appendix Table XXV indicates the volumes and producers of seed available since 1970. In Appendix Table XXVI a projection is made of the production of seed for maize, soybeans, sorghum crops, millet, wheat, rice and barley from 1973 to 1980. If these projections are realized, the 1980 supply of improved seeds will expand substantially. Plans for adequate certified seeds of wheat, soybeans, and rice appear adequate. However, if a significant part of the planned foundation millet seed is planted, certified, and marketed, a millet seed surplus could soon result.

The Tanzanian Seed Company will play a major role in the seed program. has been organized to contract for the production of certified seed, then to process and to distribute this seed within the country. A modern seed plant has been set up at Njombe, together with substantial storage facilities. The facilities for the seed plant are good but are not well located geographically. At present, transportation is a problem. Consideration now is being given to a seed distribution system throughout the country and to the location of future physical facilities for processing and storing seed.

Attainment of an adequate supply of food grain crops in Tanzania by 1980 is dependent not only upon increases in acreage, but also upon improving the yields per acre from the acreage planted. Estimates of current yields were requested from regional officials throughout the country during personal interviews in the early part of 1973. Yields apparently vary considerably by regions. For example, the average yield for maize was estimated at 2 to 3 bags per acre on smallholder farms in some regions and as high as 6 to 8 bags per acre in others. (One bag is equal to approximately 3.6 bushels.) However, based upon yields achieved by some of the best producers and on

research farms, potential yields were estimated as high as 25 to 30 bags per acre. Similar estimates of current yields and potential yields were received for other food grain crops.

In Table XII a summary of some of the yield data is shown for the six major grain crops under study. A noteworthy point, regional officials said it was possible to double yields within ten years.

Improved Production Practices

Improved cultural practices seem to offer greatest promise for increasing yields, particularly on smallholders' farms. Fortunately, this kind of change involves very little cash expenditures for new inputs. In some cases, however, they do require substantial changes in cultural methods and practices. This indicates that an intensive educational program could have a substantial impact upon food crop yields during the next few years.

However, though improved cultural practices, especially plant population and weeding, offer great promise in the short run for increasing production, one must recognize these are not new innovations. Obviously, great effort, especially on the political and extension fronts, will be required to motivate farmers to do the extra work these require to improve yields.

This overview of factors affecting all six food crops suggests that substantial increases in production are possible by either increasing acreage or increasing yields. The actual achievement of this potential is dependent upon the availability of specific inputs and the knowledge of producers concerning each individual crop. Some factors that influence the possibilities for each crop will be reviewed separately.

Maize Production. Varietal trials over the past six years (East Africa and Territorial Trials conducted at 19 Tanzanian locations) showed that the top four varieties in each test yielded an average of 29% more produce than the local check variety.[5] This represents a reasonable potential for increased production from this source.

At the same time, seed quality is being emphasized which should result in higher germination and more adequate plant populations. Research at Njombe has demonstrated that yields can be increased 15 to 20% by increasing plant populations from 11,000 to 23,000 plants per acre.[6] Unfortunately, many cultivators use 5,000 or fewer plants per acre.

Breeding programs, both within Tanzania (Ukiriguru and Ilonga) and at the East Africa Community Corn Station in Kenya, have been concerned with the development of improved varieties. Breeding efforts in Kenya and in Tanzania have been directed primarily toward meeting the needs of high altitude areas. However, the need for improved varieties in low altitide areas also is recognized. A breeding and production research program has been initiated at Ilonga, through the assistance of USAID, that will cater to the needs of the lower areas.

Fertility trials have been conducted at most of the research stations in maize growing areas. Also, the Tanzania Fertilizer Company conducted

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[5] A. Bolton, "Territorial Maize Variety Trials in Tanzania, 1966-70," East African Agricultural and Forestry Journal, October, 1971. Also William Judy, "Tanzania Regional Trials 1971 and 1972," unpublished.

[6] Annual Reports, Tanzania Wattle Company, 1968-70.

82 fertilizer demonstration trials in the four major maize growing regions in 1971 and 1972.[7] On most soils in the country, maize has shown no response to potassium fertilization. It has responded to nitrogen (N) fertilization in all trials and to phosphate (P_2O_5) fertilization in most. Adequate nitrogen fertilization was associated with an average yield increase of 41% over no fertilization. An additional 14% increase was observed when adequate phosphate was used.[8] Therefore, fertilization with adequate N and P_2O_5 showed a significant potential for increasing production (55%), when other inputs were not limiting.[9]

During the 1972-73 cropping season, 284 maize demonstration packets were distributed in seven regions by the field trials officer and his staff. Results reported by extension officers from four regions showed an average of 16% higher yield for the fertilized hybrid variety over the fertilized composite variety and 45% and 46% higher yields, respectively, for the fertilized composite and hybrid varieties over the unfertilized.

Research has shown the impact of good husbandry practices such as

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[7] Promotion Service Reports 1971 and 1972, Tanzania Fertilizer Company, Annual Zonal Conference.

[8] Combined Reports of Nordic Center, Mbeya; Ukiriguru Research and Training Center, Ukiriguru; Tanzania Wattle Company, Njombe; College of Agriculture, Morogoro; Field Trials Officer, Dar es Salaam.

[9] The government should review fertilizer prices as it does food crop prices to see that fertilizer use is not discouraged. Also transportation needs of the fertilizer industry must be considered if fertilizer is to get to the farmer at the correct time and assist in maximizing production.

proper weed control (Njombe, Ukiriguru, Mbeya), proper row spacing (Ilonga), soil preparation (Mbeya), method of planting (Mbeya), and control of stalk borer (Njombe) on maize yields.[10] Adequate control of hazards such as stalk borers, birds, and wild animals is necessary if production potentials are to be attained. Their impact would appear significant since agricultural officers in some regions estimated losses from these sources to be as high as 30%.

In maize demonstration trials at three locations (near Ukiriguru, at Mbeya, and in Kenya), good agronomic practices (recommended planting date, plant population, and weed control practices) when used with local varieties and no fertilizer, produced 2.1 times the yield obtained with the poor husbandry practices normally used by smallholders.[11] When good husbandry practices, plus improved varieties and fertilizer were used, yields increased 4.7 times. Using improved varieties and fertilizer, but poor husbandry practices, resulted in only 1.5 times the unfertilized varieties. Therefore, good husbandry practices alone, which require no cash investment, can have a tremendous impact upon yield. But, for these inputs to have maximum impact, the total package of improved practices must be used.

Wheat Production. Increasing wheat yields by using better adapted varieties shows promise. In the Tanzanian Wheat Variety Trials, the top

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[10] Combined Annual and Zonal Conference Reports of Nordic Center, Mbeya; Tanzania Wattle Company, Njombe; Research Training Center, Ilonga; and Research and Training Center, Ukiriguru.

[11] Reports from Research and Training Centers at Ukiriguru and Mbeya.

four selections in each test averaged about 17% more yield than that of African Mayo, an older variety which was widely grown. Varietal trials have been conducted in the northern and southern highland areas but should be extended to lower altitudes and into the western area of the country. The Lyamungu Research and Training Institute coordinates wheat research within the country. The Tanzania Wattle Company has had an active wheat research program at Njombe, in the south, for several years and is one of the country's largest wheat producers.

Diseases and birds are major production hazards. Birds have reduced yields by 50% in some areas, according to the agricultural officers interviewed. Spraying of roosting areas has been relatively effective when done at the proper time, but research into other means of control needs maximum support.

Septoria, rust, and mildew, very serious wheat diseases, cause heavy losses. A disease, thought to be Ophiobolus (Take All), has made continuous wheat production unprofitable in some areas of the south.[12] Research into the Ophiobolus problem has been started, and selection for resistance to the continually changing rust situation is meeting with success. However, little genetic resistance to the Septoria disease is available. Varieties coming from the Njoro breeding program in Kenya have generally had satisfactory rust resistance for Tanzania but Septoria is usually not as severe in Kenya. In one experiment at Njombe, where Septoria was not as severe as normal, spraying with Belate to control Septoria and Fusaruim was

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[12]Private communications, Nordic Center, Mbeya.

associated with a 24% yield increase.[13]

Fertility research has indicated that wheat will respond to fertilizer on many of the soils in Tanzania. On some northern soils where the inherent fertility is higher, less response has been noted. In demonstration trials in the Arusha Region, conducted by the Tanzania Fertilizer Company, a 20% increase in yield occurred when 30 pounds of nitrogen were used. An increase of 21% occurred when 40 pounds of P_2O_5 were used, and a 45% increase when a 30-40-0 combination was used. At Njombe and Mbeya, nitrogen has been much less effective than phosphorus. In those studies, a 24% average increase occurred when phosphate fertilizers were used. A 7% increase occurred with nitrogen, and a combination of the two resulted in a 32% increase.[15] Lime, sulphur, and micro-nutrients have had little effect on wheat yields at Njombe.

Weed control is a major problem in many wheat growing areas. Much of the acreage is sprayed with herbicides to prevent serious competition and harvesting problems. Date of planting also affects yields significantly, although more research data are needed in order to quantify this relationship.

Rice Production. Rice production has more potential than other food grains on many of Tanzania's low-lying, poorly drained areas. Irrigation water is not available on a large part of the rice acreage, however. Even in most of the irrigated areas, it is only available for certain periods of the

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[13] Annual Report, Tanzania Wattle Company, 1971-72.

[14] Promotion Service Reports, 1972, Tanzania Fertilizer Company.

[15] Annual Reports, 1968-72, Tanzania Wattle Company, Njombe, and Nordic Center, Mbeya.

year. Since most of the rice acreage depends upon rainfall only and many of the soils have a low water-holding capacity, water availability becomes a limiting factor in rice production. Few lowland areas are properly leveled for adequate water depth control.

In variety tests at Morogoro, the best varieties under rainfed conditions produced about 70% of the yields of varieties in tests receiving at least some supplemental irrigation.[16] Even with water available, however, farmers are getting less than one-half the approximately 5,000 pounds per acre produced under relatively good conditions.

Rice yields often are reduced by a number of problems. Bird losses, often quite severe, were estimated in some regions to be as high as 20 to 30%. The rice blast disease causes severe losses in certain areas and selection for tolerance is an important part of the breeding program.[17] The white tip nematode also has caused some damage in some areas but has not become widespread.

Rice breeding work started in 1956 at Ilonga but limited work had previously been done in the Mwanza area. Currently, research is being done at Ilonga and Morogoro. Tanzanian lowland and upland variety trials are being conducted at an additional 10 to 15 different locations. Materials from the International Rice Research Institute are being used, but these lines gen-

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[16] J. H. Monyo and S. H. Mwarumka, College of Agriculture at Morogoro, and Research Training Center at Ilonga, respectively, unpublished reports.

[17] J. H. Monyo and S. H. Mwarumka.

erally are less productive and grain quality is not acceptable to Tanzanian farmers. There probably is latitude for improvement in yields through breeding of about 5% for up to 10 years.[18]

Little agronomic research information is available, but the adverse effect on yields of poor husbandry practices is evident. On farms, the land is seldom level enough to permit control of water depth; stands are erratic; weeds are not adequately controlled; and harvest losses are excessive. Fertilizer is not used on rice since most varieties do not respond with high yields, and the rice plants lodge badly under heavy nitrogen fertilization. Breeding efforts to improve lodging resistance and nitrogen responsiveness are needed. In many areas, however, production could be doubled by applying already known crop husbandry techniques.

Sorghum and Millet Production. Both sorghum and millet crops have great potential in the low rainfall areas of Tanzania. In some areas of more limited and erratic rainfall, these crops have the potential for higher production than maize. However, maize often is planted instead of these crops because birds often seriously damage them before harvest.

Sorghum and bulrush millet acreages are too scattered for governmental bird control programs to be very effective, and efforts to develop and gain acceptance of bird resistant varieties have been only partially successful. The brown seeded and corneous varieties are less acceptable and perhaps less digestible than the white seeded types, which the birds damage most severely.

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[18]Estimate of Dr. J. H. Monyo at Morogoro.

Stalk borer and shoot fly are also serious problems in sorghum production. Breeding programs are under way in East Africa that are directed toward shoot fly, stalk borer, and bird resistance. The shoot fly nursery as well as other materials from the breeding programs are being evaluated in Tanzania, and hopefully, these problems can be overcome partially through breeding. Estimates by agricultural officers of yield reduction in some areas were about 20% from shoot fly, 10% from stalk borer, and 30% from birds. Research must find a way to cope with these problems if sorghum is to fulfill its potential in grain production.

Finger millet is being grown successfully in many areas to meet the needs of the brewing industry. Bird losses, as well as storage losses, are reported to be relatively minor. Bulrush millet is better suited in the drier areas than finger millet, but bird losses are much more severe.

Tanzania has had only limited breeding work on sorghum and millet crops. However, well organized programs of the East Africa Community centered in Uganda are directed toward problems that are common in Tanzania. Some work is being started at Morogoro to develop longer duration varieties. Varieties of sorghum, bulrush millet, and finger millet from the East African program are evaluated in Tanzania in the field trials program. Nineteen bulrush and finger millet variety trials were planned for 1973-74 in addition to the sorghum variety trials.[19] The Serena sorghum variety has been increased. In four trials over a number of locations, the variety has yielded approximately twice that of the local check variety. In tests over the last three years, the

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[19] Dr. William Judy, Field Trials Officer.

top four lines in the tests have yielded about 9% more than the Serena variety, indicating the potential for still further improvements.

Engenyi has been used as a check variety in finger millet trials and the top four lines in tests have averaged 11% higher yields that Engenyi.[20] At three southern locations, a local farmer variety check was included which averaged only 61% of the Engenyi yield.

In bulrush millet tests, Serere Composite 1 has been used as a check variety and has been near the top in grain yield. Where a local farmer variety was included, it produced only 55% as much as Serere Composite 1.

The potential for improving the production of sorghums and millets through the use of improved varieties seems quite substantial. An East African test over a five-year period showed that the top four varieties averaged 17%, 7%, and 19% more grain yield, respectively, for sorghum, finger millet, and bulrush millet than the check variety.[21] Seeds of improved sorghum and millet varieties are being multiplied by the seed multiplication unit and should be adequate to meet projected needs by 1980.

Fertility tests with sorghum have been limited but most indicate a major response to phosphate and some response to nitrogen. A 28% increase in yield occurred in a series of tests when adequate phosphate fertilization was employed. Tests showed an increase of 11% occurred with nitrogen fertilization, and a 53% average higher yield occurred when a combination

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[20] Unpublished reports of Field Trials Officer William Judy.

[21] East African annual reports.

was used compared with check plot.[22] In tests in other areas of East Africa, millet has shown response to nitrogen when adequate phosphate was available. Research also has shown the importance of proper date of planting and weed control.

In the 1972-73 season, 318 sorghum demonstration boxes were distributed in eight regions by the field trials officer and his staff. Results reported by extension officers from three regions showed an average yield increase of 73% and 52%, respectively, for the fertilized white and brown seeded varieties over the unfertilized. The fertilized brown seeded varieties averaged 25% higher in yield than the fertilized white seeded varieties.

In demonstration trials at three western locations in 1971-72, yields were increased ten-fold when recommended crop husbandry practices were applied to the local varieties with no fertilization. When an improved variety and adequate fertilization were used with good husbandry, an additional seven-fold yield increase was obtained. When poor husbandry was used with the improved and fertilized varieties, yields were 60% lower.[23] As with maize, these demonstrations indicate the potential impact of improved agronomic practices (date of planting, weed control, proper plant population, etc.) on yields. However, to obtain maximum results, better varieties and fertilization also must be used.

Soybean Production. Due to marketing problems, primarily, a large

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[22] Annual Reports, Research and Training Institutes at Ukiriguru and Ilonga, 1971 and 1972.

[23] Annual Report, (Ukiriguru: Research and Training Institute, June, 1972).

reduction in soybean acreage occurred in 1964. The reduction has fluctuated between 1,000 and 4,000 acres since then. Agronomists and nutritionists agree on the importance and nutritional value of the soybean crop. However, its potential expansion in Tanzania probably will be limited by two factors: 1) the acceptance of the crop as a food, and 2) the availability of markets for non-human food uses.

A village soybean project has been initiated in Morogoro Region to teach people how to prepare soybeans so they are palatable and nutritionally acceptable. A new extracting plant is also being built in this program.

The soybean selections currently available were bred at Nachingwea and were selected at Ilonga.[24] They are very productive at the low to medium altitude areas but are very poorly adapted above 4,500 feet in elevation. Tests have shown that current varieties have the potential to produce 50 bushels of soybeans per acre at low medium altitudes but not much in excess of 20 bushels per acre at high altitudes.

The potential for improving yields of soybeans through plant breeding is quite promising. In varietal tests over the past eight years, the high four lines in each test produced 50% more than Hernon 237, an improved and commonly grown variety.[25]

Work on soybeans needs to be extended to the high altitude areas where no previous effort has been concentrated. The Tanzania Wattle Com-

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[24] R. C. Finlay, "Soybean Production" (paper presented at the National Seminar on Soybeans, Morogoro, June, 1972).

[25] Reports from Mtwara, Lyamungu, and Ilonga Research and Training Institutes, Tanzania Wattle Company, and the College of Agriculture at Morogoro.

pany has been evaluating introduced material at Njombe under high altitudes and has found materials from the southern United States, and other comparable areas, much better adapted than the varieties selected in Tanzania at low altitudes. The potential yields at the low altitude should be obtainable at the higher altitudes, if the proper crosses are made and selection is done at the high altitudes.

Only limited production research on soybeans has been done at low altitudes. This must be expanded and demonstrated in the new production areas if this relatively new crop is to approach its potential. In farm settlement schemes near Nachingwea from 1955 to 1960, an average of only 11 bushels per acre was obtained and on production farms only 13 bushels per acre. High quality seed is a problem with soybeans since the seed rapidly loses its ability to germinate under high temperatures. The soybean has a tremendous ability to compensate for variations in plant population. However, yields are low in poor stands and under wide rows that do not intercept maximum sunlight.

Diseases and insects may become greater soybean constraints as acreages increase. Termites are problems in most areas but other legume insects may be expected to increase in significance as acreages increase. In Mtwara, a treatment of Dieldren was used on fields that yielded 26% more than untreated fields.[26] Endosulphan treatments have increased economic yields at Ilonga. Diseases observed have been bacterial pustule, purple stain, Cercospora leaf spot, mosaic virus, and some root rot. Varieties

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[26]Unpublished report from Mtwara and Ilonga Research and Training Institute.

differ in reaction to most of these diseases, suggesting that resistance or tolerance may be improved through breeding.

At present, soybeans offer the lower altitude areas a high protein food crop that can be profitable to produce. Similar opportunities may be available for the high altitude areas in the future. In addition to the food potential, any excess production of soybeans should find a place in the export market.

Summary

Rather detailed data for the six major food grain crops indicate substantial potential for increasing the yields and total output of each crop. Actual increases in total quantities produced during the next several years will depend upon the additional acreages put into production as well as the increases in yields attained.

Additional land is available, as indicated earlier. The 1967 Atlas of Tanzania classifies approximately 9% of the total land area as soils with medium to high fertility and with high potential. An additional 22.9% are classified as having soils of low to medium fertility with moderate potential. According to these figures, if all the acreage estimated by Berry to be cultivated at present were on the soils categorized as having high potential, 40% more land of comparable potential could still be added.[27] The potential for expansion is greater even under the assumption that much of the land used now is of second quality because of settlement patterns and other fac-

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[27] Len Berry and Eileen Berry, A Preliminary Sub-Division of Districts into Rural Economic Zones: a Map with Key, BRALUP (Dar es Salaam: University of Dar es Salaam, 1969).

tors.

If through research and availability of fertilizers, the soils of medium to low fertility with moderate potential could be effectively used, a potential increase of several fold in cultivated area seems feasible. In view of these various factors, the acreage devoted to food crops could be greatly expanded in Tanzania if labor and capital were available to make the increase feasible. In the past, much of the production increase has been achieved this way.

In spite of these potentials, if Tanzania chose to achieve increased food crop production by encouraging a large acreage expansion, existing problems would be compounded and new ones created. Labor is an input that is in very short supply during peak labor periods. Since manpower is a crucial limiting factor, increased output of the food grains may be achieved more successfully by intensifying and increasing production on existing acreages. Achievement of higher production through increased yields has been demonstrated to be possible for each crop through better husbandry practices, better seed, the use of herbicides, and fertilization. Most of the current production, and perhaps a substantial part in the foreseeable future, will be produced on smallholder units where the ability to purchase inputs is limited. Consequently, it is fortunate that improved husbandry practices can offer the greatest promise for achieving increased yields.

Recommendations later in this report will include suggestions for programs and investments that are considered to be of greatest benefit in achieving the increased food grain production potential.

The discussion on the potential of increasing production of the six

basic food crops would be incomplete without considering this fact: The decision to apply the new technology will be made by Tanzania's two and one half million farmers. They will decide whether or not they will work toward producing for the market in addition to meeting their family needs.

The risk factor will dominate the small farmer's decision in accepting the new technology as a substitute for proven traditional practices. It will take time and consistency in educating farmers to feel secure and competent in handling the new agricultural technology.

Educating farmers to understand the new technology, to make decisions based on known alternatives, and in becoming proficient in organizing and managing the new technology must be accepted as responsibilities of continuous out-of-school education and extension.

The way farmers respond in accepting the new technology will be greatly conditioned by the confidence and trust the farmers feel in the government's competence in providing the new inputs and in the capacity of the government to make good on procurements and marketing policies.

Also a part of the farmer's decision will be his ability to trust in the institutions he will have to rely upon to service him. He must gain confidence in the new seed, both in its production promises and in its availability. If he is to use fertilizer, he must know he can get the credit he needs and that the cooperatives will stack the fertilizer near him.

In a large measure, the responsibility for the farmer's transferring his reliance upon traditional ways to scientific agriculture will lie with the effectiveness of extension as an institutionalized educational arm of government. The farmer will give up the traditional practices only when the

new are found to provide him a new sense of security. Therefore, extension must prove to be trustworthy in the same ways traditional methods have been trustworthy.

One final word about the future. Tanzania's need to increase food crop production is urgent. And the farmer's sense of security is deeply imbedded in traditional practices. Consequently, the government will be well advised to provide farmers, on a subsidy basis, the new inputs for an initial ten-year period. Providing inputs through subsidy will greatly reduce the risk factor for the farmer while eliminating the complex problem of determining credit worthiness and recovering loans.

Talk and more talk will not motivate the farmers to overnight change. They must be educated, appealed to, and persuaded to transform Tanzania's agriculture.

Experience from two decades of agricultural development in the developing countries supports the conclusion farmers will not adopt new agricultural practices without:

1) government policies that make agriculture profitable and assure the new agricultural inputs;
2) new technology that assures substantial increases in production;
3) effective institutions that serve the farmer's needs;
4) an extension service that takes to the farmers trustworthy agricultural technology and assists them in successfully applying the new to their land.

But given all the above conditions, the facts are clear enough agricultural technology is available, if applied, to meet the nutritional requirements of

the present and growing population of the world. Tanzania is no exception.

What can Tanzania do to motivate the farmers? Tanzania is fortunate in having in its political party, TANU, an institutional structure that comes face to face with each farmer at the circle level. TANU is solidly committed to increasing agricultural production as set forth in The Arusha Declaration and TANU's Policy on Socialism and Self-Reliance. Two points in The Arusha Declaration point up TANU's commitment to agriculture:

> And because the main aim of development is to get more food and more money for our other needs, our purpose must be to increase production of these agricultural crops. This is in fact the only road through which we can develop our country--in other words, only by increasing our production of these things can we get more food and more money for every Tanzanian.[28]

The Declaration continues:

> Everybody wants development; but not everybody understands and accepts the basic requirements for development. The biggest requirement is hard work. Let us go to the villages and talk to our people and see whether or not it is possible for them to work harder.[29]

For Tanzania to speed up the process of farmers improving production of the food crops, TANU must be involved in all phases of Tanzania's national educational program to motivate farmers to improve their cultural practices and accept the new technology:

> TANU's most important role should be in persuading farmers to work harder; in improving their agronomic practices, especially plant population and weeding.

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[28] The Arusha Declaration and TANU's Policy on Socialism and Self-Reliance, (Dar es Salaam: Publicity Section, TANU, 1967), p. 14.

[29] The Arusha Declaration, p. 14.

But TANU also should be informed of new improved practices extension recommends. Through its educational work at the circle level, TANU should back extension's recommendations.

Since from 50 to 200% increases in yields in maize can be achieved by getting a good stand of plants and in weeding, TANU can, by educating and persuading farmers to work harder in improving agronomic practices, make the decisive contribution in closing Tanzania's food gap.

TABLE IV

Tanzanian Food Crops Study

RANK OF MAJOR FOOD GRAIN CROPS BY REGIONS[a]

Region	Major Food Crops						Peanuts & Other Oilseeds
	Maize	Wheat	Rice	Sorghum	Millets	Soybeans	
Arusha	1	2	5	3	4	0	some
Coast	2 minor	0	1 major	3 minor	little	0	some
Dodoma	1	0	little	2	3	0	castor beans, sunflower, sesame
Iringa	1	2	4 little	3	4	0	" "
Kigoma	1	0	3	2	4 little	0	
Kilimanjaro	1	4	3	0	2	0	major
Mara	1	0	3	4	2	0	
Mbeya	1	4	2	5	3	0	major
Morogoro	1	0	2	3	0	some[b]	little
Mtwara	2	0	1	3	4	some[b]	some
Lindi	3	0	1	2	0	some[b]	coconuts, ground nuts, Simpson
Mwanza	1	0	2	little	little	0	some
Ruvuma	1	5	2	4	3	0	some
Shinyanga	2	0	1	3	4	0	some
Singida	1	0	4	2	3	0	some
Tabora	2	0	1	3 little	4 little	0	sunflower, ground nuts
Tanga	1	0	2	3	0	little	major field beans 85,000 hect.
West Lake	2	0	4	1	3	some[b]	major

[a]Rankings based upon available statistical data and personal interviews with regional officials.

[b]Potential considered good in these regions.

TABLE V

REGIONAL BREAKDOWN OF KILIMO HARVESTED PRODUCTION ESTIMATES FOR MAIZE, 1966-1971[a]

Region	1966	1967	1968	1969	1970	1971[b]	% Total National Production 1967-71
	(acres)						
Arusha	80,000	26,000	53,000	41,000	110,000	60,000	9.6
Coast	1,000	4,000	4,000	5,000	2,000	2,000	.5
Dodoma	40,000	28,000	6,000	20,000	67,000	65,000	8.0
Iringa	80,000	83,000	86,000	26,000	90,000	72,000	11.9
Kigoma	23,000	20,000	17,000	20,000	26,000	27,000	3.6
Kilimanjaro	50,000	46,000	49,000	41,000	28,000	28,000	6.3
Mara	13,000	10,000	20,000	21,000	23,000	13,000	3.2
Mbeya	67,000	52,000	56,000	53,000	67,000	62,000	9.6
Morogoro	100,000	60,000	51,000	51,000	30,000	65,000	8.5
Mtwara	4,000	3,000	4,000	5,000	12,000	19,000	1.5
Mwanza	40,000	23,000	33,000	41,000	74,000	30,000	6.8
Ruvuma	20,000	20,000	9,000	11,000	29,000	51,000	4.0
Shinyanga	65,000	39,000	23,000	20,000	36,000	5,000	4.1
Singida	30,000	20,000	25,000	14,000	27,000	19,000	3.5
Tabora	80,000	62,000	78,000	53,000	30,000	30,000	8.5
Tanga	43,000	50,000	67,000	61,000	65,000	70,000	10.4
West Lake	2,000	2,000	2,000	3,000	3,000	4,000	.5
Total (rounded)	739,000	550,000	638,000	487,000	719,000	621,000	100.0

[a]From Newhouse Report, Vol. 1, June, 1972. Quantities expressed in metric tons.

[b]Not yet revised.

TABLE VI

REGIONAL BREAKDOWN OF KILBIO HARVESTED PRODUCTION ESTIMATES FOR WHEAT, 1968-1971[a]

Region	1968	1969	1970	1971	% Total National Production 1968-71
	(metric tons)				
Arusha	13,052	10,891	30,000	5,000[b]	35.3
Coast	--	--	--	--	--
Dodoma	--	--	--	--	--
Iringa	14,502	15,370	6,625	15,980	31.4
Kigoma	--	--	--	--	--
Kilimanjaro	8,500	9,000	6,000	5,500	17.4
Mara	--	90	50	25	--
Mbeya	5,062	2,180	10,000	6,500	14.2
Morogoro	--	238	35	31	--
Mtwara	--	--	--	--	--
Mwanza	--	--	--	--	--
Ruvuma	400	405	400	450	1.0
Shinyanga	--	--	--	--	--
Singida	--	--	--	--	--
Tabora	2	--	--	--	--
Tanga	--	--	--	--	--
West Lake	--	--	--	--	--
Total	41,518	38,174	53,110	33,486	

[a]From Regional Statistical Abstract, 1968-1971. Quantities expressed in metric tons.

[b]On the basis of other data, this probably should be 40,000.

TABLE VII

REGIONAL BREAKDOWN OF KILLIO HARVESTED PRODUCTION ESTIMATES FOR PADDY, 1966-1971[a]

Region	1966	1967	1968	1969	1970	1971[b]	% Total National Production 1966-71
	(metric tons)						
Arusha	500	--	420	416	52	12	--
Coast	11,500	9,600	3,007	4,571	12,500	12,500	7
Dodoma	15	10	203	20	20	10	--
Iringa	370	1,120	1,778	650	3,610	4,487	2
Kigoma	1,025	800	711	1,224	1,425	4,000	1
Kilimanjaro	5,650	4,600	7,111	7,217	6,000	5,000	5
Mara	500	1,050	3,047	5,181	9,000	3,000	3
Mbeya	22,557	21,148	13,627	22,853	31,222	34,000	18
Morogoro	25,000	30,000	20,315	20,316	16,500	20,000	17
Mtwara	4,000	2,250	1,123	1,224	5,000	8,000	3
Mwanza	12,000	4,000	7,436	20,315	15,000	28,000	11
Ruvuma	800	800	609	660	616	910	1
Shinyanga	10,000	7,100	20,545	12,627	20,500	7,500	10
Singida	100	100	609	406	1,000	500	--
Tabora	32,000	18,000	43,000	30,779	26,000	16,000	21
Tanga	3,500	3,000	2,540	3,047	6,500	6,145	3
West Lake	--	5	9	13	20	95	--
Total (rounded)	129,500	103,600	126,100	131,500	155,000	150,000	100%

[a]From Newhouse Report, Vol. 1, June, 1972. Quantities expressed in metric tons.

[b]Not yet revised, figures for Mtwara revised on basis of subsequent information.

TABLE VIII

REGIONAL BREAKDOWN OF KILIMO HARVESTED PRODUCTION ESTIMATES FOR SORGHUM, 1968-1971[a]

Region	1968	1969	1970	1971	% Total National Production 1968-71
Arusha	6,250	4,000	22,000	7,000	6.1
Coast	4,990	4,160	1,300	1,300	1.8
Dodoma	10,000	5,000	6,000	1,000	5.4
Iringa	590	560	235	220	
Kigoma	20,000	24,250	26,000	27,950	15.3
Kilimanjaro	--	--	--	--	--
Lindi	--	--	--	--	--
Mara	4,500	5,000	5,600	3,000	2.8
Mbeya	470	570	6,000	4,000	1.7
Morogoro	15,000	12,090	8,823	2,800	6.0
Mtwara	4,9 0	20,000	19,000	90,000	20.8
Mwanza	9,100	10,000	1,500	270	3.2
Ruvuma	900	900	506	308	.1
Shinyanga	10,000	6,775	9,450	2,000	4.4
Singida	16,000	13,150	33,500	25,000	13.6
Tabora	26,000	16,000	47,100	25,190	17.7
Tanga	3,800	400	341	300	.1
West Lake	2,500	2,700	3,100	3,500	1.8
Total	135,020	125,555	190,455	193,838	100.0%

[a]From Regional Statistical Abstract, 1968-1971. Quantities expressed in metric tons.

TABLE IX

REGIONAL BREAKDOWN OF HARVESTED PRODUCTION ESTIMATES FOR MILLET, 1968-1971[a]

Region	1968	1969	1970	1971	% Total National Production 1968-71
Arusha	450	--	10,000	3,500	3.4
Coast	--	--	--	--	--
Dodoma	11,000	5,000	6,000	18,000	9.9
Iringa	1,660	908	490	640	.1
Kigoma	205	215	245	250	
Kilimanjaro	4,000	3,000	15,800	15,000	9.3
Lindi	--	--	--	--	--
Mara	16,500	17,000	17,800	8,000	14.6
Mbeya	71,500	65,700	10,000	17,500	40.7
Morogoro	--	--	--	--	--
Mtwara	410	668	1,500	1,017	.1
Mwanza	6,000	7,000	1,170	700	3.6
Ruvuma	3,200	2,500	320	170	1.5
Shinyanga	2,000	1,870	2,450	500	1.7
Singida	10,000	2,500	11,000	10,000	8.3
Tabora	3,044	1,030	12,165	845	4.2
Tanga	--	--	--	--	--
West Lake	214	700	800	900	.1
Total	130,183	108,091	89,740	77,022	100.0%

[a]From Regional Statistical Abstract, 1968-1971. Quantities expressed in metric tons.

TABLE X

REGIONAL BREAKDOWN OF KILIMO HARVESTED PRODUCTION ESTIMATES FOR SOYBEANS, 1968-1971[a]

Region	1968	1969	1970	1971	% Total National Production 1968-71
Morogoro	50	--	--	--	5.4
Mtwara	73	288	337	162	92.8
West Lake	2	2	6	7	1.8
Total	125	290	343	169	100.0%

[a]From Regional Statistical Abstract, 1968-1971. Quantities expressed in metric tons.

TABLE XI

SOME DETERMINANTS OF CROPPING POTENTIAL IN TANZANIA

Region	Land Area in Potential Land Use		Average Annual Rainfall	Land Area in Region with Adequate Rainfall[a]	No. of Consecutive Mos. with over 100mm Rainfall	% Total Land Area Irrigated	Total Land Area	% of Land Area Now in Cereals
	Class 6 %	Class 5 %	mm	%		%	mil. ac.	%
Iringa	29	21	1,205	54	5	<.1	14.0	.99
Morogoro	20	33	1,217	61	5	<.1	18.0	.48
Mbeya	16	36	1,444	24	5 to 6	<.1	20.5	1.05
Ruvuma	17	14	1,214	66	5	.24	15.1	.28
Tanga	11	34	1,112	30	2, 3	.17	6.6	4.13
Kilimanjaro	13	18	958	24	3	3.40	3.3	1.96
Kigoma	5	27	957	41	6	<.1	9.2	1.30
West Lake	--	56	1,088	44	2, 4	.23	7.1	.40
Mwanza	4	19	926	10	6	.16	4.9	2.97
Mara	4	--	1,209	19	2, 4	--	5.4	2.70
Arusha	7	10	941	3	2, 3	.24	20.3	.82
Coast	--	27	1,178	10	2, 3	<.1	8.4	.44
Mtwara	3	34	1,059	5	5	<.1	20.5	1.64
Dodoma	10	15	556	2	4	<.1	10.2	2.10
Singida	8	11	648	--	4	<.1	12.2	.86
Tabora	--	21	940	3	6	<.1	30.1	.45
Shinyanga	--	9	862	--	6	.28	12.5	.39

[a]Adequate rainfall, as computed, consists of more than 750mm of rainfall 9 years out of 10.

TABLE XII

REGIONAL OFFICIAL'S

ESTIMATES OF EXPECTED CHANGE IN CROP YIELDS IN TANZANIA OVER THE NEXT TEN YEARS[a]

	Maize	Rice	Wheat	Sorghum	Millet	Soybeans
Yield per acre:						
1. Current average, bags	5	6	6	4	4	3
2. Potential, bags	25	30	22	18	12	15
Potential yield as a percentage of current:						
3. Maximum potential, %	500	500	350	450	300	500
4. Reasonable expectation, %	200	200	200	200	200	200
Changes in yield expected from:						
5. Cultural practices, %	50	65	25	40	40	45
6. Expectations/year, %	5	5	10	5	5	5
7. Improved seed, %	30	10	15	15	20	30
8. Expectations/year, %	10	5	10	5	5	10
9. Pesticides, %[b]	10	20	25	40	40	20
10. Expectations/year, %	5	5	10	10	10	10
11. Fertilizer used, %	10[c]	5[d]	35[e]	5[c]	2[d]	5[d]
12. Expectations/year, %	1	1	5	1	1	1

[a]Data in Lines 5 through 12 show the expected relative impacts of certain factors on this change in those areas where change is sought through intensive extension efforts.

[b]If government decides to increase sorghum and millet production, birdicides must receive important government input and this as well as the use of insecticides at the farm level can have a relatively large impact. Because of the rather heavy losses of wheat and rice to birds, control can have a significant affect on production. Insect and disease control can significantly influence soybean production.

[c]The use of fertilizer on maize and sorghum has a much greater potential for increasing yield than this figure indicates but because of the relative cost of this input it is unlikely that fertilizer will make much impact at the subsistence farm level unless heavily subsidized by the government.

[d]Little work that would indicate the potential of fertilizer on rice, millet, or soybean production is available but again the cost factor would likely slow up adoption of this practice.

[e]Since acceptable cultural practices are more widely used on wheat, grown in large scale agriculture, there is relatively much less potential to improve yield here. Therefore, more must come from changes in fertilization practices.

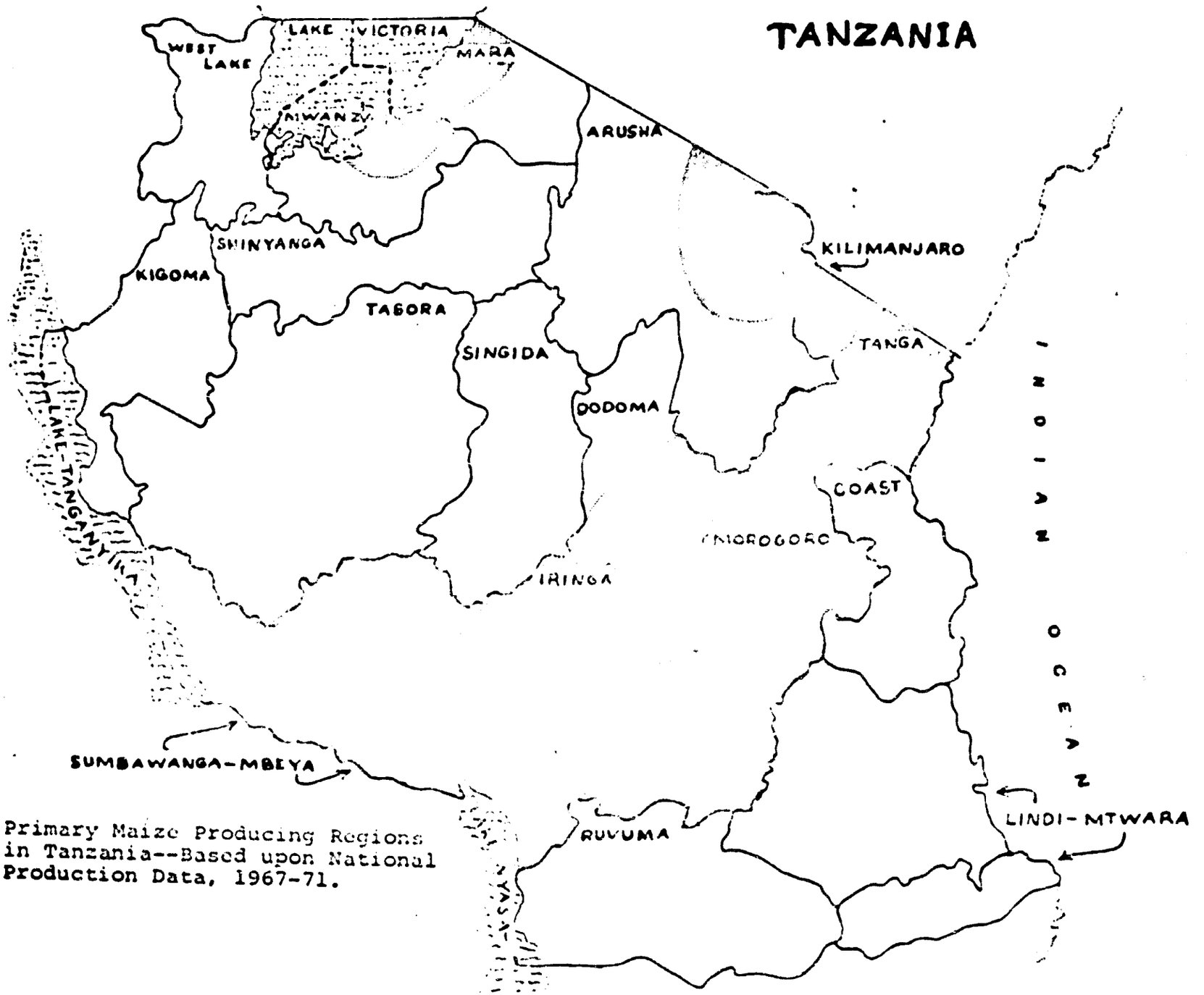

Figure 2 Primary Maize Producing Regions in Tanzania--Based upon National Production Data, 1967-71.

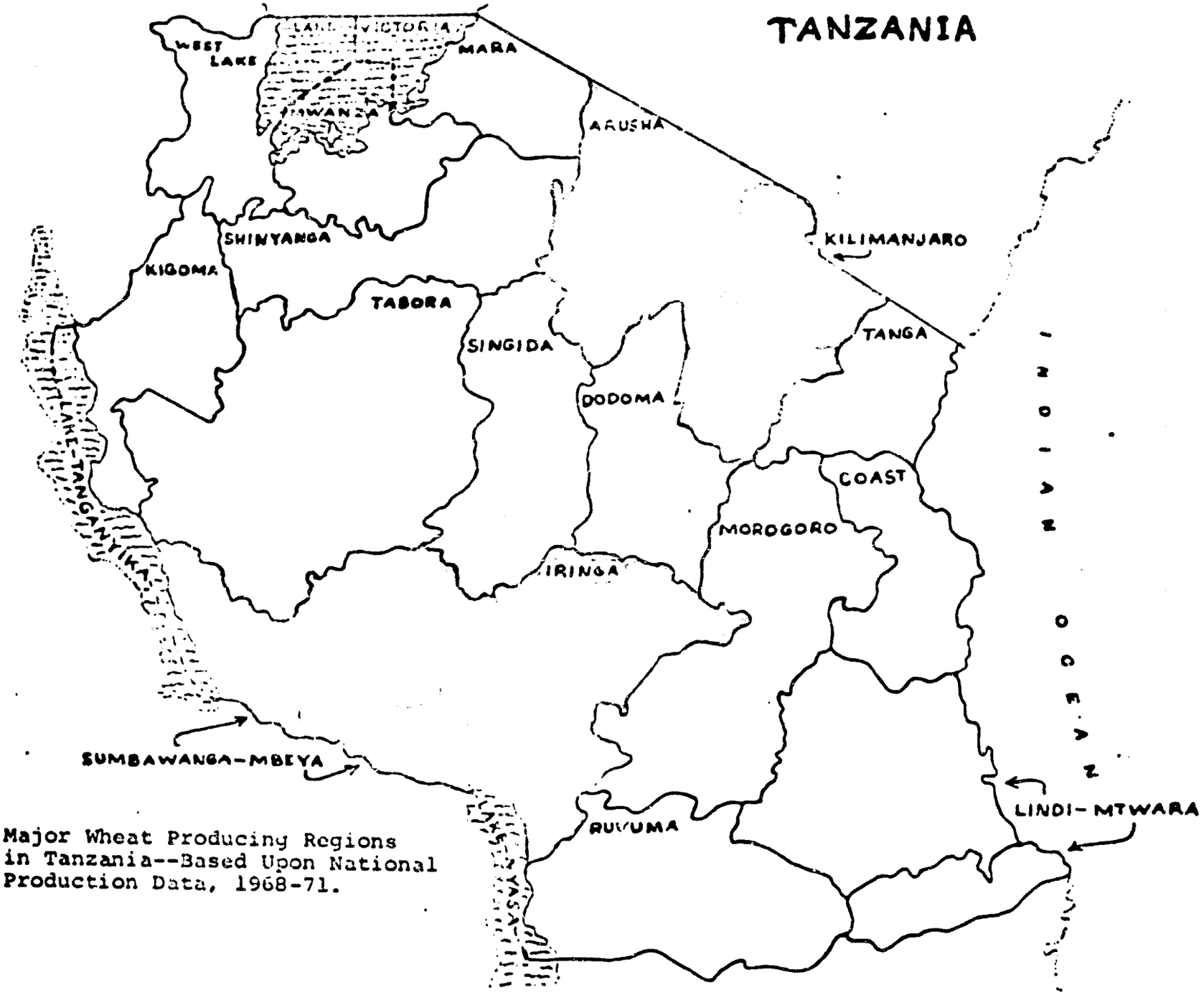

Figure 3 Major Wheat Producing Regions in Tanzania--Based Upon National Production Data, 1968-71.

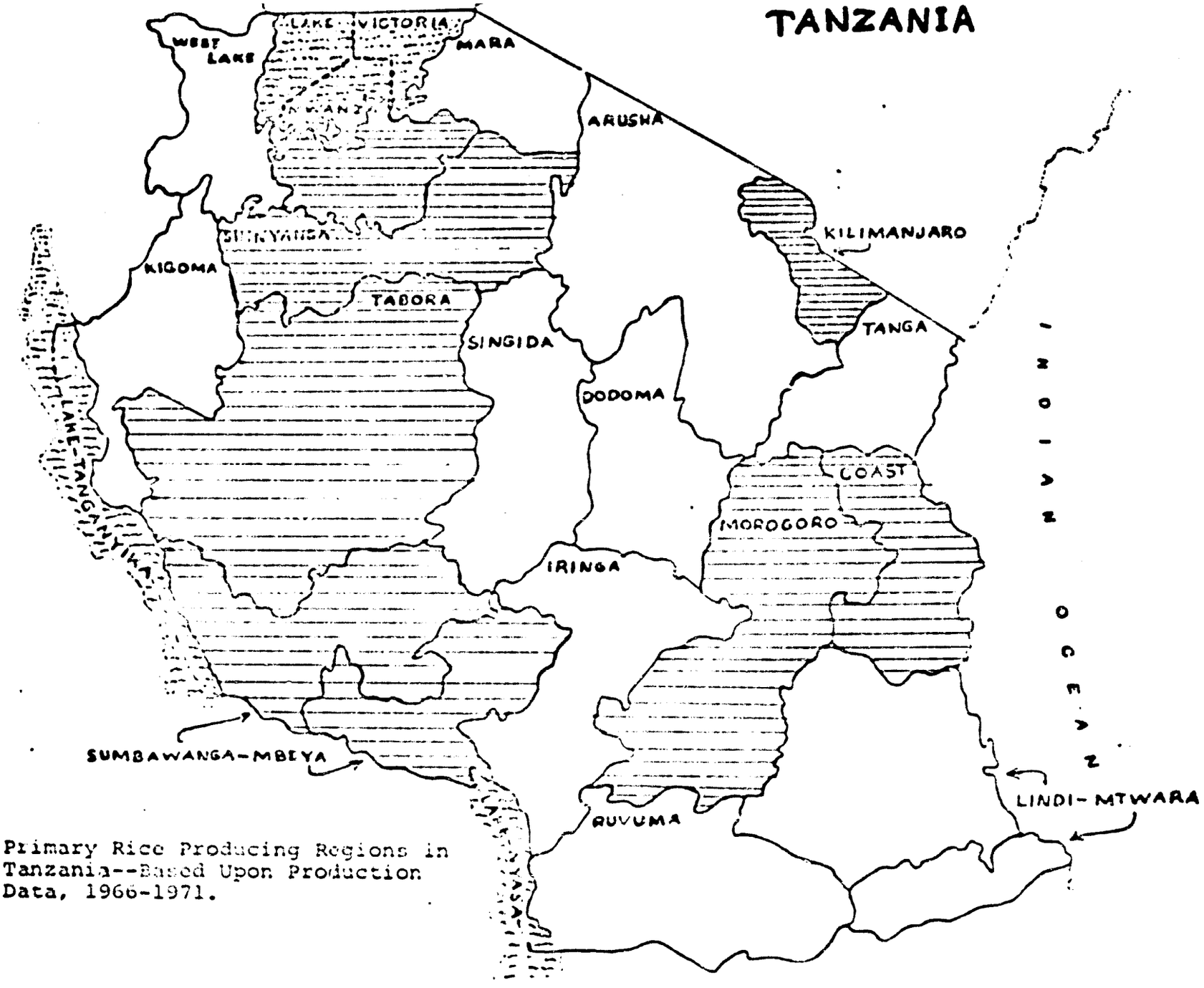

Figure 4 Primary Rice Producing Regions in Tanzania--Based Upon Production Data, 1966-1971.

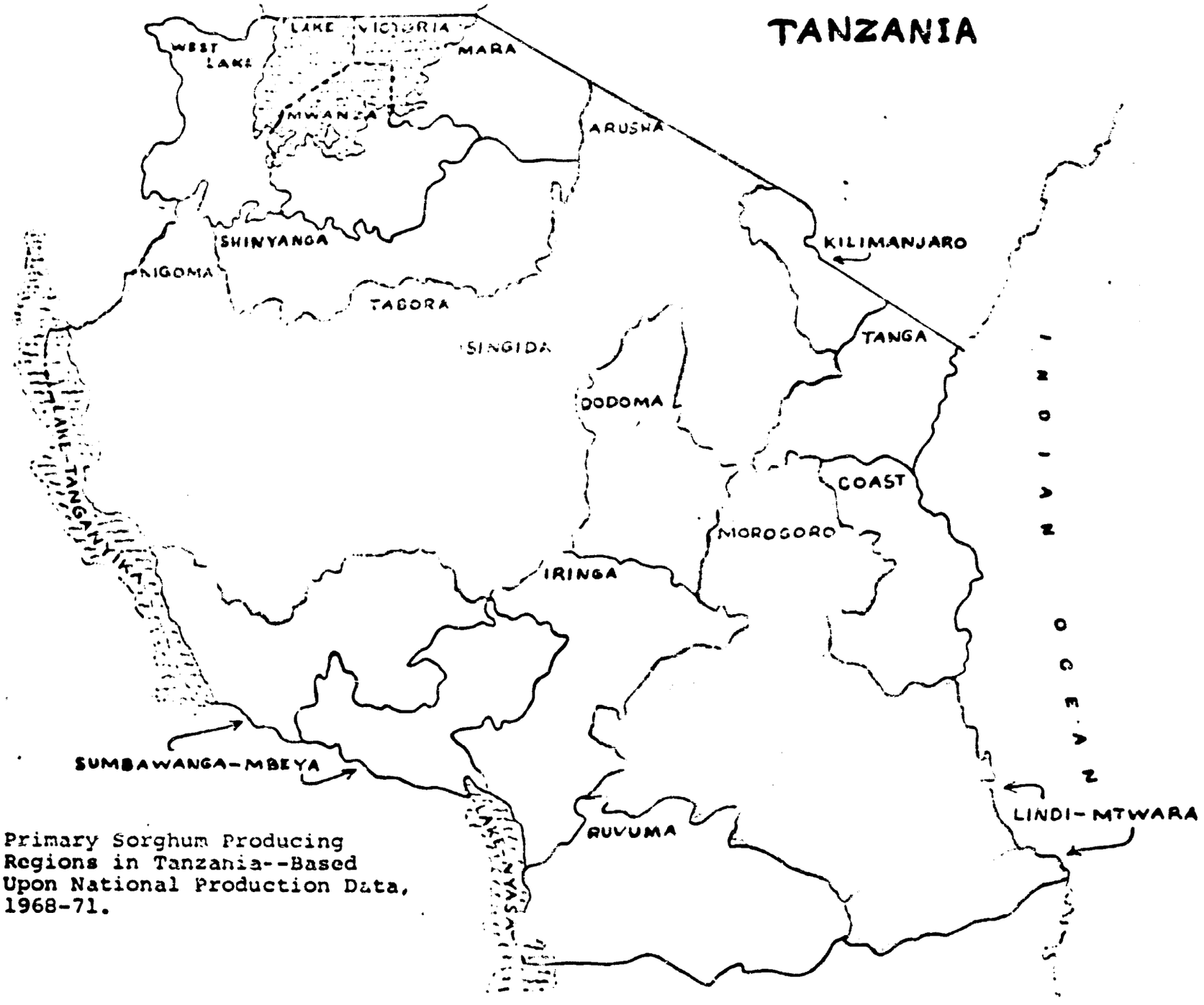

Figure 5 Primary Sorghum Producing Regions in Tanzania--Based Upon National Production Data, 1968-71.

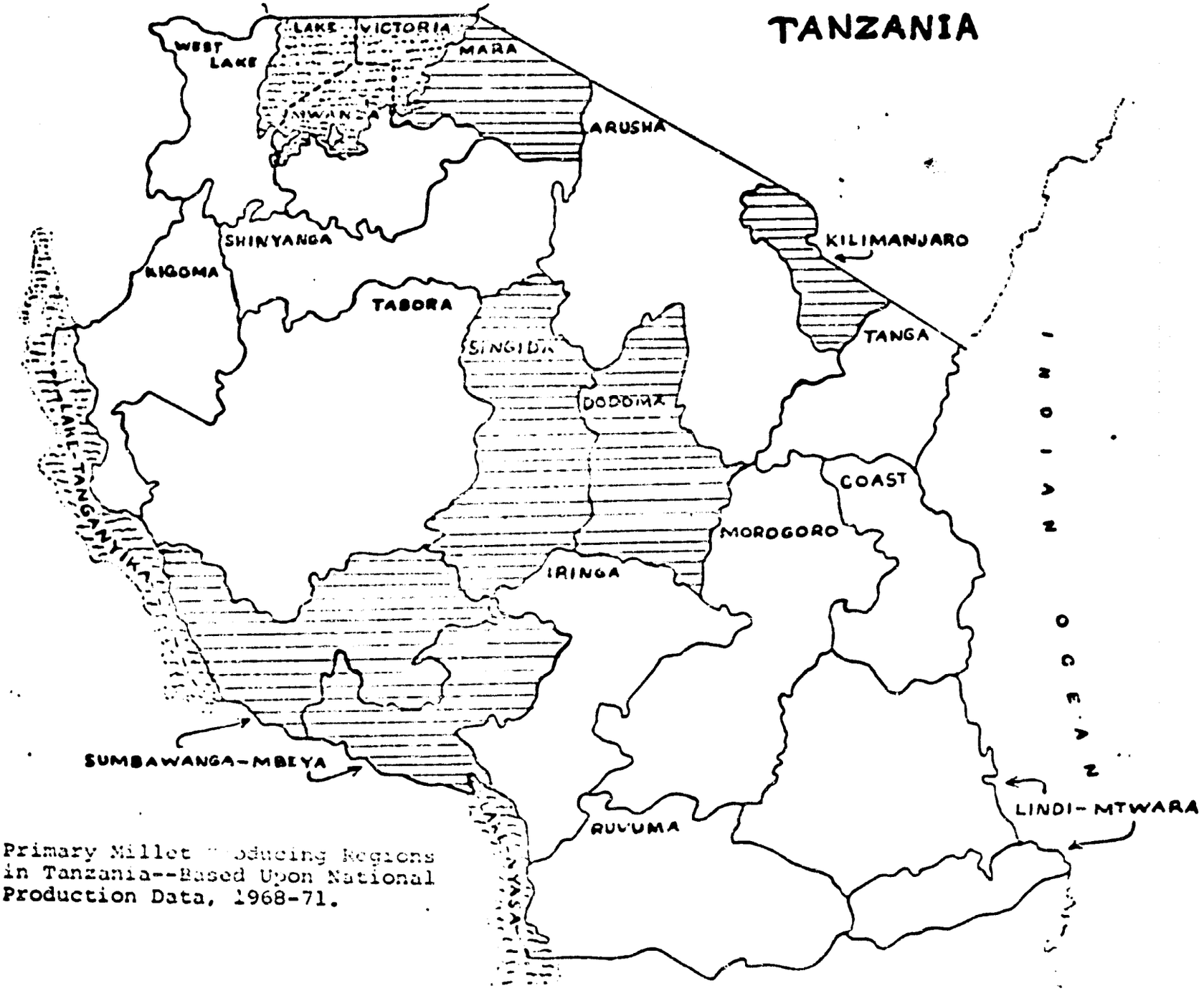

Figure 6 Primary Millet Producing Regions in Tanzania--Based Upon National Production Data, 1968-71.

CHAPTER V: MARKETING FOOD CROPS--CURRENT AND POTENTIAL

While increased food crop production is a necessary condition for improving the nutritional level of the Tanzanian consumer, without improved marketing institutions and services, it will not be sufficient. The crucial role of marketing is the performance of the functions required to move food from "the farm gate" into the hands of the final consumer. The importance of this marketing role is suggested by the estimate that one third of the food value of grain crops produced in Tanzania may be lost prior to consumption of those products. Marketing, therefore, deserves the special attention given it in this chapter.

Any marketing system, whatever the political setting within which it exists, must have the capability of performing the physical functions of collecting, storing, processing, transporting, and distributing products to users. An equally important function is the collection and transmission of economic information. In a centralized system this must, of necessity, become an explicit function. In a so-called "free-market-price" system, price is relied upon to a large degree to to transmit economic information to producers and consumers. A higher price, or a relatively high price, results from a change in the supply/demand ratio and induces producers to increase production at the same time that consumers are induced to consume more conservatively. Alternately, lower prices, or relatively low

prices, result from the opposite shift and signal producers to produce less and encourage consumers to consume more. Major reliance is placed upon the price system to allocate resources to various kinds of production and to set priorities in both production and consumption.

In the centralized system, the administratively established price, which is fixed for a specified time, does not perform this function. Yet, priorities are to be set and resources are to be allocated. These functions are generally performed at central points by decisions of responsible people faced with alternative choices.

The difference between the systems lies mostly in who makes the decisions, the diffusiveness with which decisions are made, and the explicitness of social criteria in the decision making process. In either case, the decision maker needs economic information upon which to base decisions, whether he is acting in his own self-interest or making government policy decisions. In a centrally administered price system, explicit provision must be made for the assembly and analysis of economic information to form the basis for such decision.

Thus, this analysis of the Tanzanian marketing system will focus not only on the obvious task of getting products to domestic consumers or exporters, but also on the provision of economic information to decision-makers at all levels--from Dar es Salaam to the most remote ujamaa village.

In analyzing the data on food crops in Tanzania, inconsistencies

become apparent. Fortunately, the inconsistencies of different sets of marketing data on maize, wheat, and rice have been dealt with by Newhouse.[1] In the light of the thoroughness of his efforts to resolve differences in the data, his consolidated data base has been accepted for purposes of analysis in this report.

Marketing Costs

High marketing costs or margins need continued attention. Some describe them as inordinately high. In the language of the cooperatives and related government agencies, marketing costs refer to the "costings" established to pay for the services of the cooperative unions and societies, and other agencies that provide marketing services.

The magnitude of these costs and the wide variation among regions and societies were studied by Kriesal and his associates.[2] For example, in that report the wide variation and costs among various societies in 1968-70 is detailed. Total cost ranged from 101 shillings to 196 shillings per ton. This represented a range of from 33-1/3% to 81% of the price paid to the grower. Other studies are included in that report. Newhouse treats

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[1] Newhouse.

[2] Kriesal and others, Agricultural Marketing in Tanzania--Background Research and Policy Proposals Michigan State University Research Report, June, 1970.

cost in some detail in his June, 1972, report.[3]

Prior to 1973, the method of assessing and recovering costs was a definite deterrence to increased food grain crop production. The administered price was a price set for the food grain at the time it was delivered to the account of the National Agricultural Products Board at the cooperative union level. From the price, all costs were subtracted and the price paid to the farmer was the difference between the established price and all costs. To the extent that marketing costs were inordinately high, then the price offered the farmer was inordinately low in relation to the established price. In addition it varied widely between regions and between societies. Not only was this type of costing a measure of inefficiency in the system, it was a significant deterrence to the goal of increased food grain production.

With price established at the farm level in 1973, the effect of high marketing costs as an obstacle to increased production is removed. However, the cost problem remains and likely is as significant to government. High marketing costs added onto fixed farm prices result in high food prices to consumers, which violates one of the goals of the Tanzanian Government. If food prices are maintained at somewhat lower levels, then government must find a way to pay subsidies into the marketing system to cover these high costs.

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[3] Newhouse.

Marketing costs are legitimate. Such functions as exchange, transporting, processing, and storing are necessary in a commercial food marketing system. They enhance the value of the product, and they must be paid for. Costs for performing these functions will vary in different environments. They also will vary widely between countries and considerably among regions within the same country.

Tanzania should search for a means to bring some kind of pressure upon each agency in the marketing system to promote efficiency within that system. In a private-trader marketing system, competition is relied upon to promote this kind of efficiency, which it does with varying degrees of effectiveness. Since competition is not an effective force in the Tanzanian systen, other methods or devices must be sought. Consideration might be given to improved and more detailed records and reporting systems. The establishment of representative costs from the most efficient cooperatives as goals for others to achieve might be useful. Efficiency likely will be gained primarily through the improvement of the capability of the managers of the various agencies, through a meaningful system of accountability for all responsible persons, and through a system of personal reward for efficiently accomplishing the manager's assignment.

Marketing costs and efforts to minimize them demand special attention in an effort to gain increased production of food crops in

Tanzania.

Maize Marketing

Using 1969 and 1972 production and consumption data as indicators, significant surpluses of maize were produced in only four regions of Tanzania: Dodoma, Iringa, Morogoro, and Ruvuma. Only in Morogoro Region was there a surplus in both years. (See Figure 8.) In all other regions, consumption exceeded production in those two years.

Because maize is a universally preferred food in all regions, and its production is less than demand in most, the marketing system is primarily adapted to local sales.

Newhouse[4] projects an annual production increase of 3.5% between 1969 and 1980 to maintain living standards without imports--more than that will be necessary to relieve nutritional deficiencies. To achieve a significant portion of these objectives will require concentration of efforts toward increased maize production in the regions with highest production potential. Although increased production should be a goal in every region, the selected regions with highest potential should be looked to for filling the urban demand and making up the inevitable deficit in other regions. Therefore, interregional movement of maize will

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[4]Newhouse.

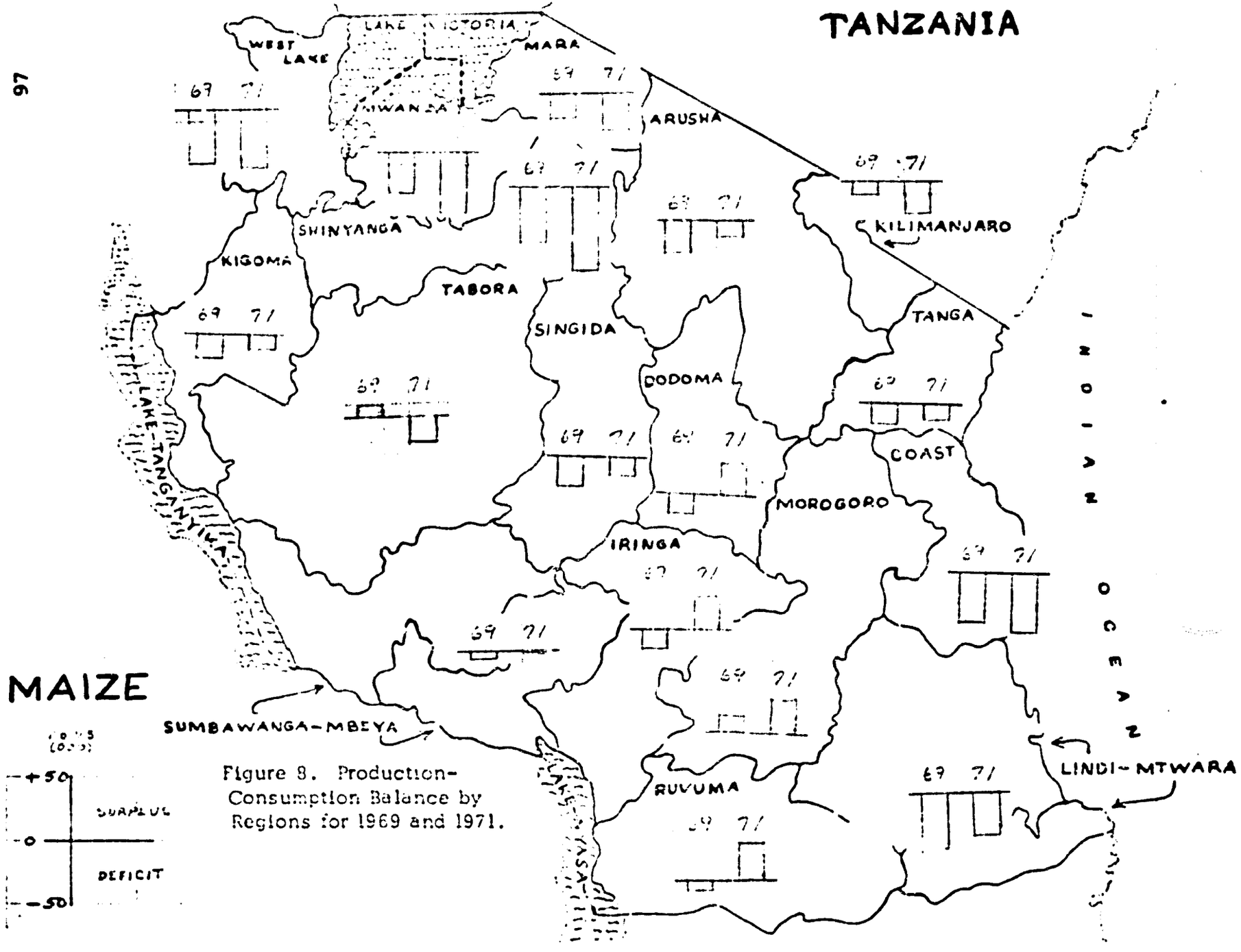

Figure 8. Production-Consumption Balance by Regions for 1969 and 1971.

need to increase if major reliance is placed upon increased maize production to provide future food needs. Likewise, significant developments in the maize marketing system will demand attention.

Wheat Marketing

Figure 9 provides a visual summation of wheat surpluses and deficits by region for 1970 and 1971. The data on wheat marketings are probably reliable because most of it is produced commercially and passes through the legal marketing system. Hence, the National Agricultural Products Board (NAPB) marketing estimates probably are good approximations of actual output.

The message in the data is unmistakable. Arusha was the surplus wheat producing region. No other one challenged it. However, other regions do have the capability to produce marketable surpluses of wheat in the future, as indicated in the last chapter.

As in the case of maize, the estimates of deficit are based not on nutritionally adequate diets but on estimates of what was actually consumed. The introduction of nutritional adequacy as an additional variable would probably have increased the deficit for these regions. Given the increases in per-capita consumption of wheat and population growth, considerable expansion of wheat production or wheat imports will likely be needed in the foreseeable future. In addition, nutritional

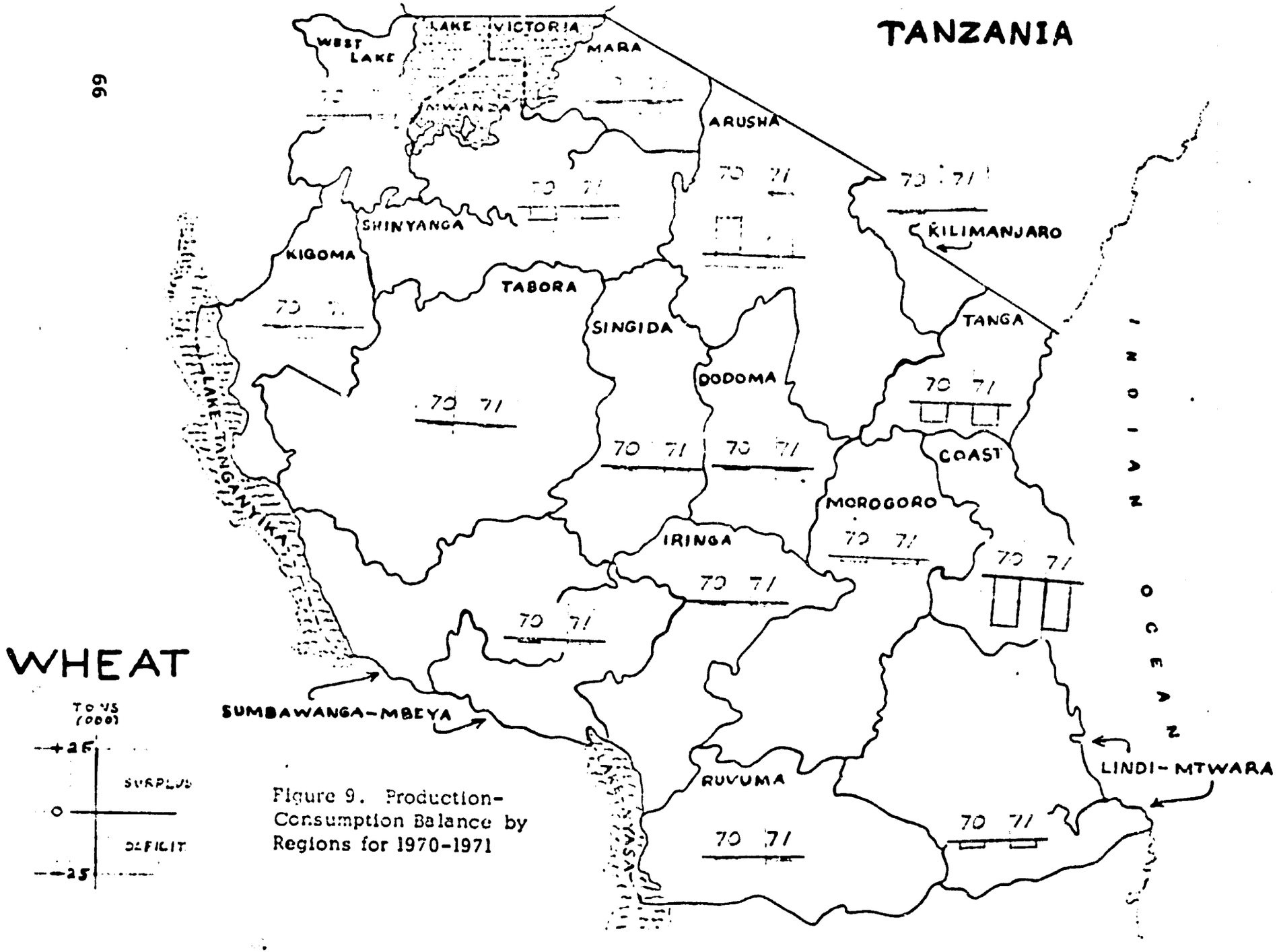

Figure 9. Production-Consumption Balance by Regions for 1970-1971

enhancement would expand these requirements further. The Market Development Bureau and NMC Officials have estimated the demand for wheat has been increasing at a rate of 7% per year for the past five years. Demand may expand even faster in the near future as a result of heavy inputs during 1974. It is expected that people who have been forced to eat wheat likely will continue to want it in their diet.

Rice (Paddy) Marketing

Figure 10 provides clues to the rice situation. The production-consumption balance for rice appears to have been better in 1969 and 1971 than it was for either maize or wheat. The most important rice marketing regions were Tabora, Mbeya, Morogoro, Mwanza, and Shinyanga; however, Shinyanga exported very little in 1971.

Improving diets in nutritional terms would have had a substantial impact on rice surpluses and deficits, as with maize and wheat mentioned above. In terms of the future, even without improvements in the diet, one author estimates that a 50% increase in output will be needed for rice during the decade of the 1970's.[5]

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[5] Newhouse.

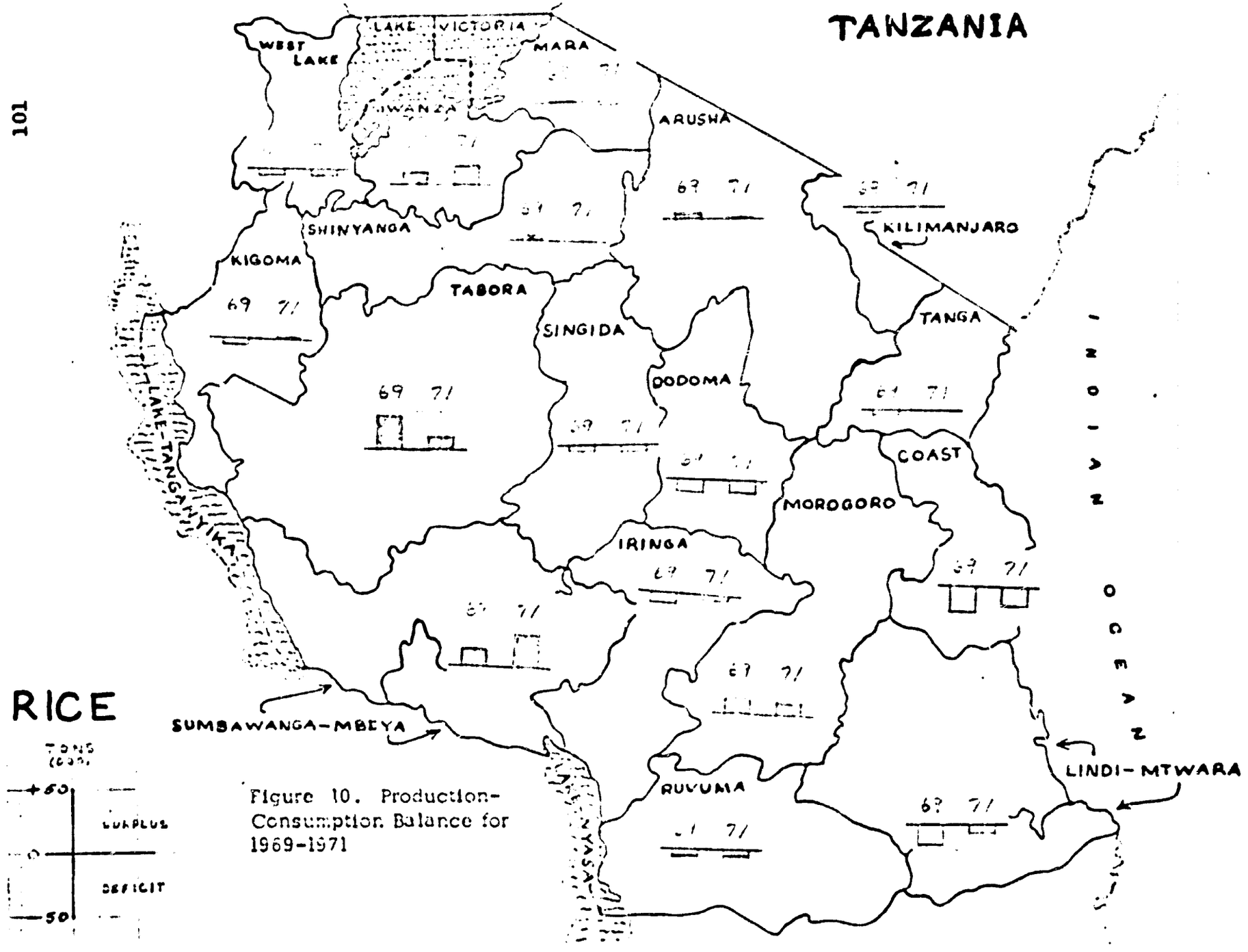

Figure 10. Production-Consumption Balance for 1969-1971

Sorghum and Millets

Sorghum and millets, especially millets, make up an important component of the food grain crop. They are generally considered to be inferior to the other three grain crops as food, hence are more significant as subsistence crops than they are as market crops. Advantages in production in many regions suggest the merit of increased production. With so little market movement, there is virtually no data, and hence no analysis of the performance of these grains in the marketing system. Millets are important in the manufacture of beer, and evidence exists of some inter-regional movement for that purpose.

Potential of the Marketing System

A substantial marketing system, both in terms of organizational structure and of physical facilities is in place. The single-channel marketing system through the apex hierarchical type cooperative is well established. Each of the food grain crops now moves through this channel. Public marketing structures have to a large extent replaced the private. Substantial Africanization of the personnel in the marketing system has taken place.

An awareness that the marketing system has a part to play in development is evident. It is positively oriented to playing the role of change agent. In general, personnel at the management level were

found to be introspective and to have a desire to help the system make its full contribution. The correct issues are being discussed and improvements are being attempted.

Even so, with present levels of production, the organizational structures, the services, and facilities throughout the system need further development and improvement. There is too little storage; there is too much loss from insects; transportation is often inadequate, and marketing margins are large.[6] Such development and improvement will be necessary to the success of an increased production program. But such development in step with the likely increases in production is well within the realm of possibility.

Grain Storage Facilities

The adequacy of grain storage throughout the country is uneven. In some regions, cooperative union staff indicated that storage facilities were adequate both at the union and cooperative society level. In other regions, storage facilities seemed inadequate at both levels. In some, the construction of additional facilities was planned or under way.

Annual purchases of wheat, maize, and paddy rice by NMC is

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[6] A partial reason for high costs is that the marketing system is required to bear some of Tanzania's social overhead capital costs. These are necessary and useful, but not a marketing function *per se*.

estimated at 375,000 metric tons. Considerable progress has been made and is in prospect in the building of new storage. Presently the NMC owns warehouses with a total capacity of 176,000 metric tons. In cooperation with SIDA (The Swedish Development Assistance Group), large silo-type storage has been or is being built in four major locations:

Kurasini (Dar es Salaam)	18,000 metric tons	Complete
Dodoma	28,000 metric tons	Structure complete
Arusha	28,000 metric tons	Construction begun
Iringa	14,000 metric tons	

Tentative approval has been given to a SIDA project to construct silo-type storage in three more locations:

Mtwara Harbor	14,000 metric tons
Tanga Harbor	14,000 metric tons
Mwanza Harbor	14,000 metric tons

NMC has proposed to Government the construction of conventional storage at nine locations:

Chimala	15,000 metric tons
Shinyanga	20,000 metric tons
Canning DSM	20,000 metric tons
Mbeya	15,000 metric tons
Mtwara	15,000 metric tons
Tabora	20,000 metric tons
Kigoma	15,000 metric tons
Arusha	25,000 metric tons
Moshi	15,000 metric tons

With the completion of the above projected storage, NMC would own storage sufficient to accommodate its yearly purchases, to store a fair amount of carryover, and to have room for considerable expansion

in its purchases.

In addition, substantial amounts of grain storage are owned by cooperative unions in some regions. In unstructured interviews with regional officers, in only three regions was storage mentioned as a major problem or bottleneck to increased production. Grain storage facilities at the regional level in Arusha, Mwanza, and Moshi were impressive. It appears regional and central storage capacity should be sufficient to meet the needs, at least through the present decade.

Even though sufficient capacity in total may be available, problems of location and of quality may persist. The need for feasible storage facilities at the farm level and at the primary society is especially acute. These facilities would of necessity be small scale. The need of the farmer is to protect the quality of his food supply from deterioration due to weather, insects, rodents, and natural processes. At the society, the need is a storage facility of the same quality sufficient to hold deliveries of farmers until a truck load is accumulated, or until road conditions allow transport.

Within the country the facility needed to build adequate storage structures appears to exist. There appears to be need for improvement in the technology of management. At all levels evidence of insect and rodent damage can be found. In a very limited contact with ujamaa

villages, creditable storage structures built of concrete blocks were in evidence, but management left much to be desired. In the development of ujamaa villages, considerable effort will need to go into improved food grain storage at the village level.

Summary

The performance of the marketing system has been mixed. On the one hand, a system is in place; on the other, its costs tend to be high. While key personnel in the system desire to make it contribute to development, methods of doing so are not always recognized. Although storage in the system is being expanded to the point of adequacy, grain storage losses due to insects and poor handling methods tend to be quite high. Regardless, in the future the system can handle larger volumes at lower costs if strategic investments are made, especially in human capital.

CHAPTER VI: INSTITUTIONAL INFRASTRUCTURE SUPPORTING FOOD CROPS SUBSECTOR

Tanzania's institutional infrastructure has a pervasive influence on both production and marketing. While these institutions do not produce foodstuffs directly, their output is essential if both production and marketing are to supply consumers with low cost, nutritious food.

Because of its evolved special importance, the ujamaa village is considered at the end of this chapter, for emphasis.

Flexibility, innovation, and transformation are all key concepts visibly present in policies and programs related to both the structures and functions of institutions in Tanzania. Consequently, it is hazardous to firmly state the current Tanzanian institutional situation and to forecast the future. Perhaps the most important characteristic about institutions in Tanzania is that they are presently in transition. All have commitments to playing their roles in contributing to Tanzania's national objective of improving the level of living of all the people. In that respect, they contrast greatly with most of the developing countries where institutions are the greatest built-in resisters to change.

An Overview

The changing nature of institutional structures and their functions are illustrated by their moving from a central administration to a decentralized one. Land tenure patterns are changing from the individual farm operator to cooperative farming and the ujamaa village. The marketing cooperatives created to serve cash (export) crops are being transformed into general pur-

pose cooperatives serving production, consumption, and marketing needs of all people. The country's political institutions have changed from a multi-party system to one party. Primary and secondary education are in the early phases of a revolution: They are being changed from institutions whose traditional function was educating children to qualify for the next level of education into educational institutions concerned about the development of people. The lending policies of the Tanzanian Rural Development Bank calls for increased lending to cooperatives and ujamaa villages as opposed to individuals. Suffice it to say, change is present in key institutions.

Basic Institutional Infrastructure

Four basic institutions relate directly to increasing the production of food crops. They are: 1) government as a policy planning and administrative institution, 2) research institutions responsible for developing, borrowing, and adapting new and superior technology, 3) extension as an educational institution responsible for aiding the farmer in applying the new agricultural technology, and 4) cooperatives for providing the needed agricultural inputs and for marketing products.

Considering the current situation and the competence of these institutions, their ability to effectively plan and carry out a nation-wide food crop program in Tanzania can be characterized this way:

1. The administrative infrastructure has to its advantage two great assets: It is strongly committed and headed by competent and dedicated leadership. However, it lacks depth in trained and experienced people at the working level which is crucial to program implementation.

2. The greatest asset of the agricultural research institutions(Fig.11)is their understanding about the importance of giving high priority to research that will have an early payoff. But honesty requires facing the fact the research institutions are thinly manned and not presently capable of providing the new agricultural technology needed to substantially increase food crop yields.

3. Extension has one major asset in that it has proven its effectiveness in working with the farmers who produce certain export crops, especially, tea, coffee, and tobacco. But its credibility is very low with the subsistence farmers.

4. The marketing cooperatives have a good record in serving the farmers who produce cash crops. In the short run, problems will surface in both providing agricultural inputs and in the marketing of food crops. But in the long run, the cooperatives should be equal to the task if steps are taken now to develop competent management to perform these functions.

5. Tanzania has a national bank whose function is to provide needed production credit through cooperatives. But the lack of borrowing experience by the farmers and of lending experience by the cooperatives for food crops is likely in the short run to place limitations on farmers borrowing to purchase needed agricultural inputs.

Conditions for Change

If the roles of institutions are to be purposively changed, at least the following conditions must be met: 1) The purpose and direction of change must be clear. 2) People must appreciate that gaining experience and developing competence to perform new functions takes time. 3) People must

be willing to openly test new strategies. 4) People must realize that new traditions and norms of operation must be developed.

The case of the Tanzanian Rural Development Bank (TRDB) is illustrative. The TRDB is now undergoing policy changes from its earlier objective of making commercial loans, largely to farmers engaged in export-oriented agriculture, to leaning to cooperatives, ujamaa villages, and groups of farmers. Difficulties will arise and time will be needed to work out loan policies for farmers lacking adequate collateral. Political leaders, administrators, institutional leaders, and farmers must be perceptive to the fact that TRDB could be destroyed and cooperatives and ujamaa villages rendered ineffective if the bank were pressured to make loans having questionable potential of being repaid. While TRDB must, through its policies and operating methods, be supportive of national policies and programs, it must be protected from pressures to be a welfare agency.

In the future the competence of the staff of the Regional Cooperative Unions will be the single most important factor in Tanzania's success in agricultural credit. That about 50% of the union cooperatives are today judged as performing well is evidence of the potential of these young institutions. Whereas in the past TRDB has primarily concerned itself with loan-making functions, in the future it must play a dynamic role in developing this leadership competence in the cooperatives. The evidence at hand supports the conclusion that the competence of union management, rather than the type of project, is the dominant factor in the success of a loan.

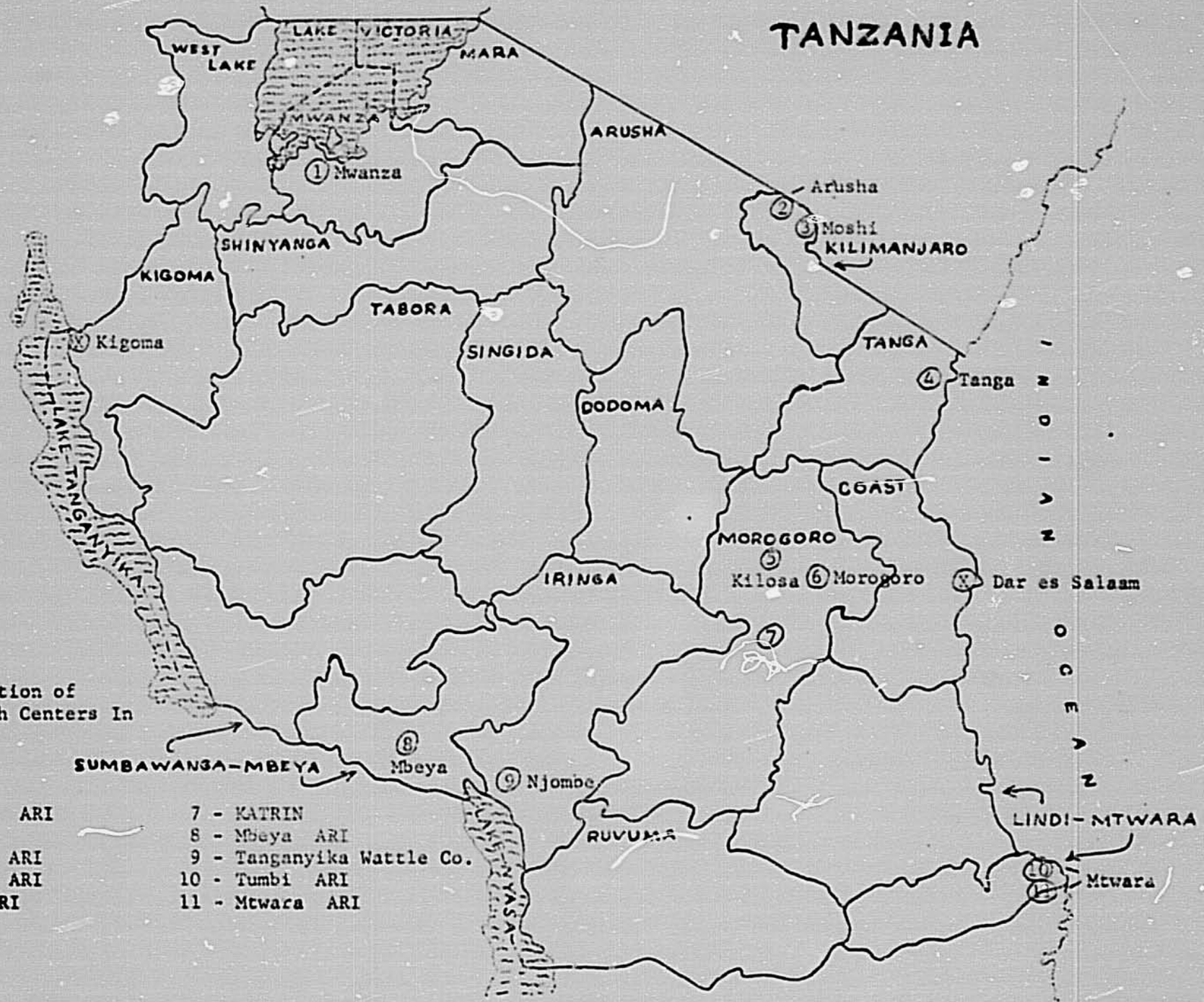

Figure 11 Location of Major Research Centers In Tanzania. (1)

1 - Ukiriguru ARI
2 - EATPRI
3 - Lyamungu ARI
4 - Mlingano ARI
5 - Ilonga ARI
6 - UNDES/FA
7 - KATRIN
8 - Mbeya ARI
9 - Tanganyika Wattle Co.
10 - Tumbi ARI
11 - Mtwara ARI

Importance of Time

Both time and timing are important concepts in characterizing Tanzania's institutional infrastructure. Presently the country possesses a good sense of timing, both in transforming existing institutions and in creating new structures. But to conclude a wide and deep understanding exists of the time required to implement programs would be wrong. Thus, a very real danger exists that political commitments will be made and plans formulated to usher in the large changes within five years. Actually, the appropriate time span would be much longer, approaching two decades.

On all levels of planning and administration, the need exists for sensitivity to the time required to transform rural Tanzania from its present tribal character and traditional subsistence society into a modern and self-sustaining economy.

Rural Development More Than Agriculture

In discussing the institutions related to food crops, one should recognize Tanzania's national commitment is toward integrated rural development. That includes, but is not limited to, agriculture. Since this is so, all institutions working in rural Tanzania are expected to serve the needs of both export and food crop agriculture. They also are expected to serve the ujamaa village, and small industries.

Training Capability in Agriculture

Since manpower--administrators, researchers, educators, and technicians--represents Tanzania's most pressing need in mounting a national

food program, it deserves attention.

Fortunately, Tanzania can reflect upon its own successful experience with selected export crops in research, organization, management, and farm education (extension). That experience should point up the absolute necessity of giving top priority to the development of manpower competence for subsistence and food crop agriculture. Through the development and implementation of a number of manpower strategies, Tanzania can move forward with a national program to increase the production of its food crops. To do so will require that crucial roles be played by four types of institutions, extension, the college of agriculture, informal institutions, and the ujamaa village. See appendix tables XXVI to XXVIII for quantative data.

Extension and Technology

While extension has established high credibility in working with selected export crops, its credibility is near zero in its relations with subsistence agriculture. In the case of cash crops, extension is backed by superior agricultural technology. In contrast, technology for subsistence agriculture is limited.

Tanzania's own evaluative studies of extension's performance in the food crop sector point up 1) the absolute necessity of extension's confining its coverage to a small enough number of subsistence farmers to establish its credibility with them; 2) the need for stronger supervision; 3) the need for strengthening the training competence of the existing training institutions before starting new ones; and 4) the necessity for extension to have agricultural technology that is proven to be superior to take to the farmers.

In brief, to fulfill its role of educating farm families, extension as an institution must apply new methods essential to increasing the production of food crops. And it must initiate far-reaching changes covering all phases of extension. It must recognize that its present low level of credibility comes from almost sole reliance upon exhortation as its primary method in working with subsistence farmers. Therefore, extension must sharply focus its objectives and its methods of selection, training, and supervision. Extension also must weed out of its field staff those who are untrainable for the new task. Finally, before talking about adding new training centers and expanding field staff, the present extension training centers must be made to turn out extension workers who know the importance of carrying to the farm production information known to be trustworthy, practical, and profitable. Imbedded in the training must be extensive field experience. The extension worker should be able to do with his own hands in the fields what he will be recommending to the farmers.

To blame all the low credibility on extension as an institution is unfair. Until there is adequate technology for all the food crops in all regions, extension will have limited new technology to take to farmers. Also until government policies can assure adequate supplies of the new agricultural inputs andthe cooperatives can deliver them to farmers, extension should resist educating farmers in applying the inputs that will not be available.

The College of Agriculture

Tanzania must--with a sense of urgency--examine the role it has as-

signed its Agricultural College at Morogoro. Since Tanzania is a rural culture and the long-range policies and projected programs are to develop Tanzania as a rural economy with agriculture as its base, a strong case must be made to first fully utilize the college's present resources by increasing the number admitted each year. Tanzania must assign to its College of Agriculture primary responsibility for producing its long-range manpower requirements for both rural development and agriculture.

The College of Agriculture at Morogoro is presently limited in its focus to scientific and technical agriculture. The future calls for changing its objectives to include 1) food science and nutrition, 2) agri-business and institutions, and 3) rural development.

Informal Institutions

A discussion of institutions in Tanzania would be incomplete without recognizing that institutions are of two types--the formal ones, such as cooperatives, and informal structures, which are imbedded in the tribal culture and the family. Though government programs for increasing production of food crops will be accomplished through the formal institutional structures, the approaches and methods employed within the formal structures must--if they are to be successful--take into account the informal ones. Cooperative work groups, whose origin is within the tribe, and the role of women in looking after food crops are illustrations of the role of the informal institutional structures.

National objectives will be important in directing all rural and agricultural development toward producing the food crops that combine to make

for a potentially balanced nutritional diet. But family values about health and well-being and the family's understanding about the importance of nutrition in physical and mental health will be decisive. These values and understandings will condition their response to the government's all-out efforts to increase food crop production and in the families' consuming more nutritious and balanced diets.

The Ujamaa Village

The most fundamental and far reaching change now under way in Tanzania is the change from individual farm operation to cooperative farming and the ujamaa village. While there is much in Tanzanian tribal culture to draw upon in moving toward cooperative farming and the development of the ujamaa village, there are also powerful traditions in individualism: A farmer is inclined to "farm my piece of land for the benefit of my family."

In President Julius K. N. Nyerere's policy statement on "Socialism and Rural Development" the ujamaa village emerges as Tanzania's most important institution. According to this policy, farmers are to move from individual farming operations to the ujamaa village and cooperative farming. Extension will work primarily with farmers in groups rather than with scattered individual farmers. Government-supported agricultural inputs--seed, fertilizer, insecticides, herbicides, and credit--will be channeled to ujamaa villages rather than to the two and one half million individual farmers.

It is difficult to find fault with the objectives of a program designed to encourage all people to participate and to benefit all from increased agricultural production.

In his many policy statements about ujamaa villages, President Nyerere has strongly emphasized time will be required for the ujamaa villages to emerge as foundation institutions. Time will be required for people to be fully and effectively integrated into cooperatives. Time will be needed for development to yield benefits sufficient to elevate the level of living of all the people.

Given the very real achievement of having created 5,600 ujamaa villages that are today in various stages of development, a persuasive case is made to "take a breather." The people need time to make the presently organized ujamaa villages economically and socially viable.

While not conclusive, largely because of limited data for analysis, strong evidence indicates the first three to five years of transfer from individual farming to ujamaa villages has resulted in a decrease in agricultural production. Accepting Tanzania's commitment to the ujamaa village, serious question should be raised about moving too rapidly in creating more of them. A pause may be needed to consolidate, to evaluate, and to find out how to assure the success of the ujamaa village as Tanzania's foundation institution. Tanzania cannot afford to disrupt agricultural production at a time when "food enough" is so essential to both the country's economy and the welfare of the people.

There is much concern about ujamaa villages becoming economically viable institutions, as indeed they must. Hard facts are needed about the working of the villages to guide policy formulations, and to develop the needed program emphasis to make them socially and economically viable. Clarity is also needed in what is meant by social and economic viability when

applied to the ujamaa village.

The need for competent managers for the ujamaa villages is gaining recognition. Also needed are clear definitions of the functions and responsibilites of managers for these villages and provisions for their training.

Since the basic economy of Tanzania is agriculture and will remain so for decades to come, a strong case is made for placing a trained farm manager in each ujamaa village, especially those with the potential of achieving economic viability. How, other than through a trained farm manager, can an ujamaa village get agricultural production on a sound and scientific basis? How else can they know what inputs to apply, how to apply them, and when?

Finally, much thought is required in defining work patterns for cooperative farms and ujamaa villages. Initially work on the ujamaa villages will be hard and demanding. It will require great discipline, will, and motivation to work for the common good of all.

CHAPTER VII: HUMAN NUTRITION IN TANZANIA: PRESENT AND PROJECTED

As suggested earlier, the primary objective of this analysis is to improve human nutrition in Tanzania. To do that, the analysis focuses upon two challenges. The first is to determine the current nutritional status. The second is to make projections of 1) the nutritional requirements in 1980 (if international nutritional standards are to be attained), 2) food crop production by that date (assuming past trends continue), 3) the extent of the difference between the projected requirements and production in 1980.

Current Nutritional Situation

The two primary indices of the current nutritional situation were mentioned in Chapter I. They are per-capita calorie and protein consumption and child and infant mortality rates. These will be explored further in this section. Then a projection of the nutritional situation expected in 1980 will be made.

Calorie and Protein Consumption Estimates

The food needs for Tanzania are dependent upon population numbers, age, and body weights. An average nutritional requirement, minimal for health in that geographic location, can be approximated, ignoring body weight data (Table XIII). Annual population estimates can be made using the 1967 Population Census as a reference and applying annual growth rates. A rate of 2.8% was used for the period 1967-1970, of 3.0% for 1971-1975, and of 3.2% for 1976-1980. These estimates are given in Table XIV.

Researchers used several procedures to determine the dietary requirements an average Tanzanian needs to attain nutritional adequacy. To achieve this state, approximately 400 grams of cereals, on the average, should be consumed per person per day. Assuming an allowance for spoilage, losses in meat preparation, and other losses, approximately 615 grams of cereals per person per day need to be produced domestically or imported. Hence, each person will require an average of approximately 225 kilograms of cereals per year. In addition, it is recommended that each Tanzanian, regardless of age or sex, consume 75 grams of peas, beans, or nuts daily.

This level of intake will assure all individuals sufficient quantity and quality of protein when their remaining energy needs are met by cereals, tubers, fruits, and other miscellaneous crops. The young child (six months to five years of age) requires a higher level of better quality protein than the adult. The 75 grams of peas, beans, or nuts will supplement the common cereal protein to produce a diet of relatively high biological value. For the adult with less critical protein quality needs, legume protein, though representing a smaller proportion (25%) of his protein requirement, will help assure good utilization of other sources of protein of poorer biological value. After allowing for normal losses (35%) from field to consumption, the daily and annual per-capita production requirements are 115 grams and 42 kilograms respectively. The nutritional requirements upon which subsequent calculations were based are summarized in Table XIII.

A base quantification of the nutritional status of those living in private households in mainland Tanzania was calculated from the 1969 House-

TABLE XIII

CALCULATION OF THE NUTRITIONAL REQUIREMENTS OF AN "AVERAGE" TANZANIAN[1]

(Calculated from recommended daily intakes of nutrients for East Africa)

Age	Population %	Kilo Calories	Protein grams
0-1[2]	5	600	25
1-5	15	1,250	45
5-10	13	1,650	55
10-15	12	2,350	60
15-20	11	2,800	65
20+male	20	2,500	65
20+female[3]	14	2,500	60
20+female[4]	10	3,000	90
Average Tanzanian requirements (adjusted)		2,170	60
Production requirements		3,340	92
(Requirement x 1.5380, or 35% waste)			

Note: 1 Data weighted by age and physiological groupings
2 Requirement in addition to that provided by mother's milk
3 Very active, not pregnant or lactating
4 Very active, is pregnant and/or lactating

Average Tanzanian requirements for most critical nutrients (daily).

	K.Cal	Prot(g)	Ca(g)	Fe(mg)	Vita.A(IV)	Thia(mg)	Ribo(mg)	Nia(mg)	Vita.C(mg)
Intake requirements	2170	60	0.60	15.0	3860	1.10	1.30	14.0	25.0
Production requirements	3340	92	0.92	23.0	5940	1.70	2.00	22.0	38.0

TABLE XIV

ESTIMATED TANZANIAN POPULATION BY YEAR

Year	Mainland Population	Zanzibar Population	Total
1967	11,946,245	353,566	12,299,811
1968	12,280,740	363,466	12,644,206
1969 (@ 2.8%	12,624,600	373,643	12,998,243
1970	12,978,089	384,105	13,362,194
1971	13,367,432	395,628	13,763,060
1972 (@ 3.0%	13,768,455	407,497	14,175,952
1973	14,181,508	419,722	14,601,230
1974	14,606,954	432,313	15,039,267
1975	15,045,162	445,283	15,490,445
1976	15,526,607	459,532	15,986,139
1977 (@ 3.2%	16,023,459	474,237	16,497,696
1978	16,536,209	489,412	17,025,621
1979	17,065,368	505,074	17,570,442
1980	17,611,460	521,236	18,132,696

Source: Bureau of Statistics, 1967 Population Census, Volume 3 (Dar es Salaam: Ministry of Economic Affairs and Development Planning, 1971)

hold Budget Survey.[1] Each diet entry was weighted by its caloric value and protein content as given in the Food Composition Table for Use in Africa.[2]

Using these data, estimates were made of the per-capita calorie and protein available for consumption in 1969. These were 2,076 kilocalories and 57.4 grams, respectively. Neither met the requirements for a nutritionally adequate diet. (See Table XV.)

It should be emphasized that these values are averages for all of Tanzania. The do not reflect how food is distributed between regions, within regions, or within families. Great inequalities exist here. Also, if the

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[1]Bureau of Statistics, 1969 Household Budget Survey (Dar es Salaam: Ministry of Economic Affairs and Development Planning, 1972).

[2]Food Composition Table for Use in Africa (Public Health Service of the United States Department of Health, Education, and Welfare, and Food Consumption and Planning Branch, Nutrition Division, of the Food and Agriculture Organization of the United Nations, 1968). Several difficulties arise in making this computation:

[a]Often an item given in the Household Budget Survey (HBS) can only be partially matched in the Food Composition Table.

[b]Reporting quantities in metric tons, 1,000 litres, and 1,000 "other units" in the HBS necessitates an approximate conversion to grams equivalent. Generally, 1,000 litres were considered a metric ton of food and, following Newhouse, 10,000 "other units" were also considered a metric ton. No adjustments were made for variations in moisture content.

[c]Calculation of the portion of the food crop consumption that came from domestic production required knowledge of imports, exports, and food removed from prior stocks. In the cases of wheat and maize, minor adjustments were made: From the HBS, figures were reduced for 1969 domestic production and removal from stocks in terms of flour equivalent. That meant maize flour was reduced 58,597 metric tons and wheat flour 22,500 metric tons non domestic.

[d]Table VI-2 gives the estimate of 1969 mainland population as 12,624,600 and HBS gives mainland population living in private households as 0.925964 of mainland population. Thus, 1969 population in private households is estimated at 11,689,925.

TABLE XV

FOOD AVAILABLE FOR CONSUMPTION BY PRIVATE HOUSEHOLDS
IN KILOCALORIES AND GRAMS PROTEIN [1]
(AVERAGE/PERSON/DAY) 1969

	K. Calories	% Requirement	Grams Protein
All food sources (includes imports)	2,076	(.9267)	57.4
Cereal grains (includes imports)	961		25.5
Domestically produced cereals and all other foods	2,011	(.8743)	55.6
Cereal grains (domestic production)	896		23.7

1. The values given may be overestimated by 20+ percent due to losses in transportation, storage, preparation and wastage.

Household Budget Survey is an estimate of food available for consumption, rather than of food actually consumed, then it could overestimate actual food eaten in 1969 by 20% or more.

These observations help account for the obvious discrepancies in infant mortality data between areas (see next section) of which over 50% probably is due to malnutrition or related causes.

In light of the sluggish to stagnant growth in food crop production between 1969 and 1973 and a population growth rate of 3% which prevailed for the bulk of the period, the per-capita consumption of calories and proteins has undoubtedly declined between 1969 and 1973. Especially in the latter part of the period when drought was beginning to affect food production, further deterioration of the nutritional situation likely occurred. In other words, the nutritional estimates for 1969 are undoubtedly overly optimistic for the current situation.

Child and Infant Mortality

As suggested in Chapter I, one of the best indicators of nutritional adequacy can be found in mortality data, especially for children from 0 to 1 and 0 to 5 years of age. For the former group, many nutritionists say that more than 40-deaths-per-1,000 live births suggests nutritional inadequacies.

Infant mortality for rural mainland Tanzania in 1967 was estimated to be 143-deaths-per-1,000 live births.[3] Several rural districts had rates in

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[3] I.D. Thomas, "Infant Mortality in Tanzania," (Geography, University of Dar es Salaam at Morogoro, Unpublished paper). The author defines rural population as the total population on the mainland except for those enumerated in the fifteen major mainland towns.

excess of 200-deaths-per-1,000 live births while at the other end of the continuum several had infant mortality rates between 60- and 70-per-1,000 live births.

Food Needs Projected to 1980

In order to be of maximum utility in the five-year planning process undertaken by the Tanzanian government, the planning horizon for this analysis coincides with theirs and culminates with the year 1980. This time frame provides the basis for making population projections which, when multiplied by per-capita nutrition requirements, yields the annual food intake required by the end of the planning period. These values must be weighted for losses between the field and actual consumption.

Cereal protein in 1980 will need to be 1.8 times the 1969 production if:

-- The non-cereal to cereal ratio in the 1969 diet continues into 1980;

-- Increased cereal production is expected to fill the gap between 1969 domestic cereal production plus 1980 non-cereal production, on the one hand, and 2,170 kilocalories per person per day, on the other. (See Table XVI.)

If increased employment opportunities boost the minimum consumption goal to 2,300 kilocalories per day by 1980, then the needed increase in production is more than 6% annually, or nearly twice the 1969 total. However, if the entire gap is made up with cereals as described above, the quality of the diet will not be improved.

TABLE XVI

PRODUCTION NEEDS RELATIVE TO 1969 DOMESTIC PRODUCTION FOR KILOCALORIE INTAKE OF 2,170 PER PERSON PER DAY [1]

Total calorie requirement by 1980 -- all foods at 2,170 kilocalories per day	$13,949.2 \times 10^9$
Total available calories needed in 1980 from non cereals (if dietary mix is in the same ratio as 1969 consumption patterns) at 2,170 kilocalories per day	$65,240.4 \times 10^9$
Ratio of cereal crop production required in 1980 to 1969 domestic cereal crop production at 2,170 kilocalories per day	1.7984

1. These figures are conservative if Household Budget Survey values included kilocalories lost prior to consumption

Increases in population require increases in the production of cereals, vegetables (for vitamins, minerals, calories, and some protein) and high protein seeds (peas, beans, and nuts) and/or animal and fish protein because increases in cereals alone would lower the nutritional status due to their low protein quality. This applies especially to the vulnerable groups: the young growing children and pregnant females. However, cereal production increases can meet the increased caloric needs mentioned, as the same number of people would require more energy. The additional food being produced must be within reach (geographically, monetarily, and culturally) of the consuming population, or it is of limited value.

In addition, target production requirements will be affected by losses in nutritive value. These occur between the point of production and that of final consumption. Reducing these losses can absorb some of the production requirements.

Growth Rates Required for Adequate Nutrition in 1980

As shown, the annual growth rate in cereal crop production must be 5.5% from 1969 through 1980 in order to close the nutritional gap and feed a growing population. Since nearly one half of the period has already passed and the food situation has deteriorated, the growth rate for the rest of the period would need to be much greater than 5.5% Quantifying this rate is impossible due to the lack of data on the rate of consumption in 1973-74. However, it will be especially challenging since the growth rate for all of Africa has been 2.6% for the period 1961 to 1972.[4]

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[4]From Table 13, The State of Food and Agriculture--1973 (Food and Agriculture Organization of the United Nations, 1974).

The computations on required increases in the production of cereal grains to help in closing the calorie gap are based on the assumption that root crops, bananas, legume seeds, vegetables, fruits, fish, and animal products will continue to be produced at a rate sufficient to maintain the 1969 cereal/non-cereal nutritional balance. As transportation and refrigeration become available, more efficient use of perishable products should become possible.

Several nutrients, not found in cereals, deserve specific attention:

1. Vitamin A: A shortage of this vitamin has caused blindness in Tanzania. Dark green vegetables, carrots, red palm oil, and liver are rich sources of vitamin A.

2. Calcium: When a diet consists of food primarily of plant origin, calcium requirements are hard to meet. Finger millet and teff are good sources but are not widely grown. Dried whole fish is an excellent source (if eaten whole). About 10 grams daily will provide enough calcium to balance a diet based on cereal protein. One glass of milk (200 grams) will also provide almost 50% of the daily requirements for calcium in addition to many of the B vitamins and vitamin A.

3. Iodine: Goiter is endemic in many areas of Tanzania. The use of iodized salt should be stressed.

4. Flouride: Flouride is beneficial up to levels of 1 to 2 parts per million. In many areas (Mount Kilamanjaro, for instance) its levels exceed 10 parts per million and evidence of toxicity is present. New supplies of water with less than 5 parts per million need to be found.

Nutrition education is also needed. Methods of food preparation,

especially for infants and young children, should be stressed. The increased use of dark green leaves and yellow vegetables should be encouraged. Legume seeds and nuts should be stressed to improve protein quality.

At issue in the short run in Tanzania is an understanding and acceptance that today a gap exists between nutritional requirements and agricultural production and that it most likely will continue for most of the next decade. But, this need not be the case in the long run if Tanzania begins now to work in earnest at formulating and implementing a comprehensive national food production program with clearly defined priorities. Food enough to meet Tanzania's nutritional requirements and perhaps enough to provide export income is achievable.

CHAPTER VIII: CONSTRAINTS TO EXPANSION OF FOOD CROP PRODUCTION AND MARKETING

Numerous obstacles mentioned in Chapters IV and V prevent food crop production and marketing from expanding as rapidly as required for nutritional adequacy. In this chapter, attention will be focused initially on the pervasive cultural considerations that underlie many of the constraints. Next attention will be given the primary constraints to increasing food crop production and then to crucial marketing bottlenecks. Finally, priority categories for all constraints in the subsector will be established both in terms of short-run bottlenecks and long-run constraints.

Cultural Considerations

If strategies designed to motivate and assist the Tanzanian subsistence farmer in increasing food crop production are to gain farmer acceptance, they should take into consideration the farmer and his family. Hence, their situation is worthy of attention as a way of gaining an understanding of the setting within which changes in Tanzanian agriculture must take place.

Historical Perspective

Throughout the years of colonial rule prior to December, 1961, the Tanzanian subsistence farmer survived with little concern about or assistance from government. Experience taught the farmer he could survive and provide a subsistence for his family only if he mastered and followed the traditions of the past. Hence, farming became a way of life. All family

activities centered around surviving and farming. Since the farmer saw the government as an exploiter rather than a helper, he developed a mistrust for it.

Operating within a traditional, subsistence agriculture, the farm was self-sufficient as an economic enterprise. The land was there for the tilling. The farmer possessed all the required agricultural inputs: He had his own seed, his own tools, his own power, and could count on his relatives and neighbors when he needed extra labor. He provided the know-how and the management. In planning his crops and carrying out production plans, the farmer had one primary concern--to produce enough for his family's needs. Occasionally he sold some to the market, but he did not produce for the market. He made no investment in agricultural inputs and, therefore, did not have to ask whether he lost money or made a profit.

Then came independence and a government of and for the people--a government with greatly increased concern for the farmer and his family as human beings.

But how does the Tanzanian Government translate this concern into programs to which the farmer will respond? How is the farmer to see the benefits he can receive by contributing toward the Government's objective of improving the quality of life for everyone? Since more than 90% of the people in Tanzania live in rural areas and are an integral part of a culture of farming, the way the farmer responds to the Government's call to modernize agriculture is crucial.

Cultural Constraints

While one could prepare an exhaustive list of restraints on transforming traditional agriculture into a modern one, the crucial question is, what are the major, determining restraints that have cultural overtones? Several restraints with strong cultural implications are dominant. The following constraints will have a compelling influence on the Government's success in motivating and assisting farmers in increasing production of food crops:

1) The cultural heritage of farm people. Tribal culture's reliance upon tradition, the narrow margins on which people survive, the dominant value of food crops oriented to family subsistence needs rather than the market, and traditional family work patterns will, in all probability, be the most persistent restraints to transforming Tanzanian agriculture. This is not to suggest the farmers will not respond to an attractive and reliable market price. But increasing the price of food crops will not be a panacea in gaining increased production. Time will be needed to show many farmers the profits new agricultural technology can produce.

2) The concept of time in the typical traditional culture coupled with the frequent underestimation of the time required for economic development by administrators and assistance agencies present a major constraint. The farmer in the traditional culture places little emphasis or urgency in time. The development project planner frequently, if not usually, sets time goals too short for accomploshment. For example, the development of trained manpower in production, marketing, governmental agencies, and cooperatives is a long-term program in any case. If established time goals are too short to be realistic, disappointment is certain. And projects fail.

3) The Government's decision to transform the marketing cooperatives into multipurpose societies at the farmer level will, in the long run, be a positive force in serving all the farmers' production and marketing needs. Again, time will be required to develop farmer trust and farmer tradition in repaying production loans. Time also will be needed to train additional co-op managers competent in developing multipurpose cooperatives into viable village institutions. These multipurpose cooperatives must perform two important roles in overcoming cultural constraints: First, they should give strong leadership to transforming traditional agriculture. Second, they must effectively serve the farmers' needs (inputs, credit, and product marketing) as they take up new agricultural practices.

4) Since most subsistence farms are operated as independent farm units by farmers steeped in their tribal culture, the early phase transition from the individual farming unit to the ujamaa village and its cooperative farming will, in the short run (three to five years), be a restraining influence on increasing production of food crops. Again, time will be required to evolve new and meaningful interpersonal relations, management competence, and new work patterns.

5) Conflict may arise between the farmers' conception of their needs (for such things as more adequate health services, education for their children, water, and seeds to plant their crops) and the Government's conception. Given this potential conflict of concerns and the different definitions of "needs," for some time farm people are likely to see their needs as subjugated to the Government's. This requires a high degree of sensitivity in government to the most pressing needs to which its limited resources should

be allocated.

6) In the short run, the effort and understanding required in transforming Tanzanian traditional agriculture may be restraining influences on the Government's commitment to motivate and assist farmers in substantially increasing the production of food crops.

7) Given primary and secondary education's orientation--which traditionally has been toward promotion to the next higher institutional level rather than toward the development of people as human resources--a major void exists. As long as it continues farm families will not be assisted in developing their understanding about scientific agriculture. Until this portion of the education system is reoriented, primary and secondary schools will make far less than their potential contribution to Tanzania's development.

Primary Production Constraints

The constraints that restrict the expansion of food grain production in Tanzania are numerous and widely varied in nature. Some are tangible, easily observed, and amenable to short run solutions. Others are much less obvious, yet they may have a more profound influence in restricting production and be more difficult to overcome than the visible ones.

Several procedures were used to identify production constraints. These included a careful study of statistical data and production trends, conferences with government officials and USAID personnel, conferences with regional officials throughout the country, and first-hand observations by team analysts in most of the regions. The latter two sources were hea-

vily relied upon.

Although the following discussion is, of necessity, negative in orientation, these constraints have been identified as a means of determining how the country can realize its tremendous agricultural potential. As indicated earlier, yield levels far in excess of those currently achieved are possible for most of the food grain crops. Yields of 100, 75, and 150 bushels per acre, respectively, for maize, sorghum, and rice crops are often attained in experimental plots when the best known production practices are used. Many factors contribute to the failure of peasant farmers to reach the yield levels achieved on experimental field plots. Some of these, such as weather conditions, are not completely under the control of the farm operator, although practices sometimes can be followed to alleviate their effects. Other constraints could be overcome, or their effects minimized, by changes in production practices at the farm level or in policies and priorities at the government level.

Overview and Discussion of Constraints

Some production constraints affect the yields of all food crops while others apply to specific crops. Some of those which limit the production of all food crops follow:

1) poor agronomic (cultural) practices;
2) little or no use of needed improved inputs;
3) energy shortage, especially at crucial times;
4) a general lack of technological information;
5) a lack of knowledge about the effects of intensive cultivation;

6) a shortage of research data applicable to Tanzanian conditions;

7) low prices and inappropriate price relationships;

8) a lack of capital and credit.

Each of these major constraints will be discussed briefly.

Agronomic Practices. A major factor contributing to the low yields of the food crops is poor agronomic production practices as suggested in Chapter IV. A considerable amount of technology is available that either is directly transferable or would require a minimum of adaptation. Techniques of hand and mechanical weed control are known. Some herbicides are used on cash crops and others would only require minimum testing if information from other areas with similar climatic conditions and soil types were used. Likewise, if available weather information is closely scrutinized and associated with what is known about crop requirements and the maturity ranges of available varieties, little field trial research is probably needed on the date of planting. Similarly, much can be predicted about the effect of plant population and distribution on yields, given the research available and what is known about soil and climatic conditions in the area. Although further research in these and other phases of agronomic practices could further define optimums, enough is presently known to make a large impact on production. The primary cost of obtaining application of this technology will be in terms of an educational program.

Production Inputs. When farmers are convinced (through demonstrations and other educational activities) of the value of improved varieties, fertilizer, herbicides, and pesticides, the unavailability of these inputs can become a serious constraint. For example, adequate quantities of

high quality seed of the improved varieties of most food crops are not available although crash programs are underway and some seed is being imported.

Fertilizer formulas needed for food crops could be produced by the Tanzania Fertilizer Company but until 1) fertilizer raw materials become readily available, 2) an effective demand develops in the various regions, and 3) transportation and storage facilities are improved, most farmers will not be able to meet their needs. Credit to purchase the fertilizer may be an equal constraint to its use.

In the case of herbicides and pesticides, imports are required in most cases, with obvious implications for the use of foreign exchange. The constraints in the use of fertilizer at the farmer level apply to the use of herbicides and pesticides also.

The Energy Constraint. To many farm families, the most obvious limit to increased production is the amount of energy needed to do it. In subsistence agriculture, virtually all energy employed in food grain production is human energy. Consequently, the first constraint identified by the persons involved in the production process often is a "labor shortage." Yet the addition of more "laborers" does not solve the problem. Instead, the productivity of human energy must be increased. Generally, more land per worker offers an opportunity for increased productivity per worker. But in Tanzania, usually the human energy per worker is already totally expended on present acreage. Therefore, increased acreage brought into production with no change in the energy component is no solution. The only opportunities for increased productivity per person are increased productivity per acre or supplemental sources of energy.

Some attempts are being made by the government to promote schemes to supplement human energy with bullock energy. There is no evidence that a significant result is being achieved.

Tractor power provides the maximum enhancement of human energy. Yet, the economic limitations of widespread use of tractor power in food grain production under present conditions raises serious questions (such as maintenance problems) about reliance on the internal combustion engine to increase production.

A rather large spectrum of production technologies is available or can be produced relatively quickly to increase production with no increase in the energy expended or to increase production in greater proportions than the energy input. For example, improved seeds, optimal planning dates, proper seeding rates, etc., can do it. These technologies increase the output of grain crops per unit of human energy. Concentration on the identification of these technologies (where known), the development of new technologies (through research), and the delivery of these technologies to farm producers (through extension) should be of first priority in plans to significantly increase food grain production in Tanzania.

Lack of Technological Information. In identifying known technologies, much has been learned and is being learned from research programs and experience in Tanzania. Applying the technologies of other countries, with appropriate adaptations to Tanzanian conditions, offers one of the most promising opportunities for outside aid.

In order to sustain increased production a continual flow of new technology is needed. This is accomplished only through organized, continuous

long-term research. The ability of such organized efforts to produce and apply new technology over a considerable period is evident in several of the export crops. As a result, production has been increasing. However, no investment of similar magnitude has been made in the production and application of new technologies in food crops. There is no magic by which food crop production can grow and be sustained. It can be accomplished only as the result of deliberate efforts and investment expended in an organized program to produce a continual flow of new technology.

Several illustrations of research needs are noteworthy. Equally high yields are not obtained in all areas of the country for all crops. Through research it should be possible to overcome some of the problems peculiar to certain situations. Consequently, high priority should be given to researching the following in maize:

1) varieties adapted to the lower elevations;
2) fertilizer response trials on a number of soil types and in microclimates not previously studied;
3) use of herbicides on food crops;
4) methods of seed bed preparation and planting as well as inter-row cultivation;
5) further pest control research on problems such as stalk borer and streak virus;
6) research on harvest and storage techniques.

Soybean research needs of high priority would be these:

1) varieties suitable to higher elevations;
2) fertilizer response studies, especially with lime and its effect on

micronutrient availability;

3) soil microbiology studies dealing with nitrogen fixation;

4) pest control research on termite problems;

5) analyses of a number of diseases.

High priority rice research needs are these:

1) the development of short-stemmed, fertilizer responsive varieties;

2) fertilizer response studies;

3) studies of water depth control, both in the area of reducing percolation losses and in better land leveling;

4) pest control research, particularly on nematodes;

5) research on grain quality.

Work is needed on sorghum and millets concerning:

1) the bird problem;

2) fertilizer response;

3) higher yielding varieties;

4) the use of herbicides as a means of increasing the productivity of human energy.

Intensive Cultivation Effects. Tanzania is moving from a pattern of shifting cultivation to a more stable agriculture. This change is being accelerated by the settling of people in ujamaa villages and the increasing pressure of the population on the available land. Almost nothing is known about the effects of such intensive cultivation as continuous maize production. Research should be initiated to find out whether crops should be rotated and how to rotate them. Research on how to manage soil in order to maintain productivity and to prevent severe erosion also is needed. Long-

time research is necessary to study this situation since indicators suggest difficulties may develop in the future.

Price Inequities. Changes in production practices will come only when the price of the output justifies the increased effort or cost of the new production inputs. The price relationships of inputs and outputs must be studied to see if this is a constraint to change. Research in this area will show what additional production is economically feasible at the farm level in key production regions as well as where prices need to be adjusted to minimize this constraint.

Lack of Capital and Credit. As indicated in Chapter III, today almost no credit and very little capital are used to produce most food crops. This must change or a deterrence to agricultural progress will persist. Modern technology requires purchased inputs. Hence, credit must be made available in conjunction with these inputs. The alternative is continuation of the stranglehold traditional agriculture now has.

Priority Short-run Bottlenecks

Some bottlenecks can be classified as short-run because some actions may be taken to alleviate them, at least to some degree, within the planning period of this project (1974 to 1980). A brief discussion of some of these, together with measures that may be taken to alleviate them, will follow. Subsequently, crucial long-run bottlenecks will be examined.

The major deterrence to overcoming the use of poor agronomic practices--practices which have little or no cash cost--is lack of awareness of what could be done and its effect on yield. The problem might be overcome

through educational programs which, through demonstration, promote the importance of improved agronomic practices and the techniques in accomplishing them. In addition, adaptive research programs will uncover other ways of increasing production before 1980.

The input requiring the least investment per acre and with the greatest payoff potential is using quality seed of adapted varieties. Government programs developing improved seed production, storage, and distribution programs can have a relatively rapid payoff once the value of this seed is demonstrated to farmers and made available to them.

The research on input-output cost relationships must also receive immediate attention and adjustments made so that lack of incentives will not be the bottleneck that stifles progress.

Pesticides and herbicides also may need to made available in areas where problems routinely occur or where emergencies arise. As production is intensified and as new varieties are brought in, pests may become important bottlenecks where previously they were unknown, unimportant, or inadequately dealt with. An example would be bird control efforts which need to be better coordinated than in the past and expanded in the future.

Priority should be given to fertilizer in those areas where yield response to fertilizer is evident, good production practices and adapted varieties are used, and pests are now controlled. In some areas, special soil deficiencies will mean the payoff in fertilizer use will be greater than in others.

Mechanization and herbicides may offer a short-run solution to the labor bottleneck. Mechanization is a solution only where production is con-

centrated in adequately sized units for it to be used economically and personnel are available who can operate and service the equipment. Herbicides may be useful on farms with and without mechanization. Herbicides not only can be used on large farms, but also small ones if farmers are educated in their use. With herbicides a single farmer can "weed" much more area.

Irrigation, it appears, should be of relatively low priority in terms of expanding irrigated acres or irrigation systems. But, in those areas where traditional irrigation systems already exist, emphasis should be placed on their optimum use in overcoming moisture deficiencies. Crops can be selected and production practices utilized that maximize the effective use of the available water. In those areas that have traditional irrigation systems available, this should be a part of the demonstration and promotional program that encourages the use of all applicable agronomic practices.

Crucial Long-run Constraints

Some constraints are classified in this category because immediate solutions--those prior to 1980--cannot be expected. This does not reduce their importance, however. One dimension of any strategy designed to deal with the food crop problem must be its time-phasing, which takes into account both the timing of the need and the time required for payoff.

Probably the most crucial long-run production constraint is represented in the traditional methods of farming. Many of these are closely related to the tribal culture and in the traditional type agriculture that have become a part of the way of life. Officials in many of the regions con-

sidered the reluctance of peasant farmers to change from traditional methods to be the major long-run constraint. The implications for a creditable food crop extension program are apparent.

Another constraint of almost equal importance from the long-run point of view is the lack of trained manpower at practically all levels in the agricultural sector of the economy. On the one hand, highly trained people are needed for conducting research and carrying on extension and other educational programs in an effective manner. On the other, trained personnel are needed in the supervising and handling of the sophisticated equipment and the new technology necessary in commercial agriculture.

Another shortage of trained manpower is evident in the rapid development of ujamaa villages, with the production of food grain and cash crops on a communal basis. Well-trained and skilled managers are essential in achieving high production in the villages. Many of the elected village leaders despite their many leadership qualities may have had no opportunity to learn about the modern techniques of agricultural management. The school at Mlingano has provided a good start in training better managers for villages, but efforts such as this will need expansion rapidly in order to take care of the needs.

Another major long-run constraint is that poor agronomic practices are used. This involves both a lack of sufficient information about technology appropriate for conditions in Tanzania and the lack of a system for effectively communicating such information to farmers. Further adaptive research must be undertaken to build upon the limited knowledge now available and to solve the problems now confronting producers, as well as those that will

appear in the future. For example, information is needed to learn how to maintain soil productivity under the intensive production practices now being encouraged in the shift toward ujamaa villages. As production in all areas is intensified and as new crops are introduced, many unforeseen problems will develop. Many of these can be solved only through careful research. This requires that a research capability be developed and maintained through time.

A long-run constraint that affects all food grain production is the lack of capital for both long-term development projects and short-term production credit. Illustrative of the first is the fact that studies tentatively indicate that in the Rufigi, and other major river basins, millions of acres could be added to the productive resources of the country. However, large amounts of development capital would be required if feasibility studies indicate such projects are practical.

An example of short-term production credit requirements is the need for capital to purchase commercial fertilizer for food crops. Many individual producers are reluctant to use credit for a crop that is produced largely for their own consumption. Likewise, cooperative unions, cooperative societies, and other lenders are reluctant to lend money to producers who do not have cash crops for sale over which vendors have some marketing control. This point of view must be altered if food crops are ever to be shifted from subsistence to commercial status. There are obvious implications for nutrition and development.

Crucial Marketing Bottlenecks

Although marketing constraints are not as numerous as those affecting production, they are significant. Clearly, marketing margins are extraordinarily high in some cases. In other situations this is not the case. Regardless, as the food crop subsector moves toward commercial status, the marketing of both purchased inputs and increased product volumes will take on added importance. The move toward commercial status is needed to develop the division of labor required in the process of development.

Overview of Constraints

Some constraints have obvious implications for the allocation of additional capital to improve the performance of the marketing system. Others imply a need to deepen the human capital available to perform the marketing function. In still other cases the implications are of an organizational nature. Since these latter ones might have relatively rapid payoffs they tend to dominate the following discussion of short-run bottlenecks.

Priority Short-run Marketing Bottlenecks

If the Tanzanian marketing system is to facilitate increased output of food crops, it must overcome several short-run bottlenecks. All of these are amenable to at least some attention without the heavy use of scarce capital.

Production Incentives. The first prerequisite to increased production is the motivation of producers to change to new methods. A price incentive that assures profit to the producer who achieves higher production is a nec-

essary part of that motivation. The determination of the price that is paid the producer, and the returns to various agencies in the marketing system, are a function of marketing. Particularly in the case of maize, regional personnel said the price has been insufficient to motivate the producer to take the steps and incur the risks necessary for increased production. The problem is complicated by the need to maintain consumer prices low enough for all the people to afford maize. Setting these prices is complicated, is of utmost importance to increased production, and requires increased and continual attention.

High Marketing Costs. Earlier studies showed that marketing costs are high and steps need to be taken to reduce them.[1]

High marketing costs are largely the result of either one or a combination of the following four things. Heavy physical loss in the harvesting, storage, and handling operations is one. Unaccountable loss in storage is another. Low operational efficiency within the marketing system is still another. And uncompensated, masked, overhead absorbed by cooperatives in providing social capital is the fourth.

Quality Standards. The problem of incentive extends not only to the producer but also to the managers within the cooperative system. The lack of quality standards for food crops results in the cooperative either not being penalized for poor quality or in being unrewarded for good quality. This lack of premium and penalty precludes proper reflection of performance either upon the wages and/or the evaluation of the marketing system managers. The lack of positive incentives for managers to reduce marketing loss and for producers to strive to bring to the market a better quality product is

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[1]See studies cited, by Kriesel and Newhouse.

a serious problem.

Limited Economic Information. The absence of adequate economic information is going to be a very great deterrence to increased output. Adequate plans cannot be made on the basis of faulty data. The marketing system plays too small a role in gathering market information. The result is a lack of information about product flows.

Getting better information may be difficult. To begin with, the marketing system creates conditions in which a black market is possible. Or, perhaps better said, the marketing system has not been able to create conditions in which a black market is no longer profitable.

Tendency to "Police" Black Market. The tendency will be to combat the black market through the use of the police approach rather than through the use of economic incentives. Recognition must be made that black marketing will dry up when and only when the official system outperforms the black market, making it no longer profitable.

The illegality of the black market makes more difficult the gathering of market information. Today officials tend to cover only what is happening in the official market system and to ignore what occurs in the very real black market which is not as easy to talk about.

Policy decisions have been made to have a single channel marketing system. Implementing efforts emphasizing police power rather than increasing the efficiency of the official system so the black market will no longer be profitable would waste scarce human capital.

Inappropriate Interpretation of Single Channel Policy.

The tendency exists to replace the middleman as a matter of political doctrine rather than as a result of alternative less costly ways to get his job done. In the Tanzanian system this replacement can be frequent and beneficial only if official market channels perform well. This concern is not intended to question the long-run policy decision made by the Tanzanian government. Rather, it raises issues as to the most expeditious path to achieve it.

Difficulty of Small Scale Technologies.

Most of the individual farm production units are quite small. The marketing system, as now constituted or as envisioned by most planners, probably cannot economically deliver all of the inputs of modernized agriculture in such small quantities as will be required by those units. To accomplish this, activities may need to be subsidized by government. If the cooperative marketing system is expected to perform this function as an income generating activity, it will be put at a further disadvantage with respect to the black market system. That would be contrary to some of the results for which policy calls. The tendency that will be a bottleneck in the short-run is to "think big." Much of what must be done initially in Tanzania will require "thinking small," for much of the initial increase in food crops output must come from the small scale subsistence producer. At least initially, he will have relatively small amounts of surplus food crops to bring to the marketing system. Everyone enjoys having large projects, but more gain may result from doing many little things just a little

better. Recognition of this, while not as exciting to political or marketing leaders, is important. For example, reducing insect damage is important.

Storage Losses. Losses due to insect and rodent damage are estimated over a range of from 5 to 35%. Regardless of the actual figure within this range, a significant increase in food supply could be attained by preventing the loss of food grain already produced. With food scarce and increased production hard to achieve, reducing storage losses becomes more important. Studies made in other developing countries indicate that the development of adequate insect preventive and control measures will pay off in economic benefits.

Protection of grain while in storage is largely a matter of applying appropriate technology. An adequate storage facility for this purpose need not be an expensive one. Problems may develop in procuring insecticides and fungicides. And a problem in safe usage may surface, but it can be solved or avoided by applying appropriate technology.

Long-run Marketing Restraints

Stocks Policy. Although Tanzania has elected in the past not to retain its own strategic reserve food supply, this policy merits re-examination. Securing food stocks in the world market is not as easy as it once was. Part of the reason is that the major exporting countries no longer have the vast surplus food stocks that for so long made it easy for many countries to forget the importance of a stocks policy.

An effective stocks policy implies careful pre-planning and programming in advance of the actions that will be taken. Developing this capa-

bility may require the use of sophisticated, advanced planning techniques. Developing such a system will not be easy.

Heterogeneous Equipment. The Tanzanian market is not large enough to support adequate spare parts and service facilities for large numbers of different trucks, tractors, combines, etc. For that reason--not precluded by donor restrictions--Tanzania should attempt to import a limited number of makes of tractors, combines, trucks, etc. This reduces the cost of maintaining adequate spare parts and service facilities. It also reduces the problem of training mechanics.

Economic Information. The inadequacy of marketing information is likely to be a long-run as well as a short-run constraint unless real efforts are made to change. Continued development of the one-channel marketing system, if successful, will make this task easier. But reporting mechanisms must be developed and monitored. Because not all production will pass through the official marketing channels, it also will be necessary to develop surveys and other estimating techniques to monitor the consumption and production habits of the subsistence sector. In the Tanzanian setting, opportunity exists for the joining of marketing and political structures to perform this task.

Whatever the approach taken, it is absolutely imperative that, in a society where there is much central decision making, the data be accurate and comprehensive. The alternative is likely to result in unwise policies due to an inadequate data base.

Transportation. The transportation system must be made more effective. Further, it must be extended to those new areas from which substantial increases in output are expected. In some parts of Tanzania this will mean the

improvement and extension of roads and in others, the extension of rail lines. Indeed, the experience of much of the industrialized world coupled with the need to import oil into Tanzania, suggests that the rail transport system should be viewed as the primary long haul carrier and that trucks be used more for shorter distance collection and distribution. The great convenience of the truck makes it easy to opt for it instead of the railroad. But, on the basis of information now at hand, this would seem a questionable choice as a national policy.

In some areas improving transportation means improving water transportation, particularly in the coastal areas to the south. Further development in Mtwara and Lindi, for instance, could well be speeded up by improved water transportation.

While transportation is indicated as a long-run restraint, there is considerable indication that this is an area in which the Tanzanian government has considerable competence and to which it is giving considerable attention. Nevertheless, it is an area in which continued attention is necessary. If such attention is not given, transportation will prove a serious constraint to the long-run development of food crop production.

New Storage. In both the long-run and the short-run, storage capacity in Tanzania must be increased in phase with the increases in the output that must be stored. Sufficient storage in the right place at the right time will be a continuing concern. At the same time scarce resources cannot be wasted on unnecessary storage. As discussed earlier, utilizing proper storage technology is important in protecting grain from insect and other damage.

In the longer run, one of the questions that must be settled is where

the storage is to be concentrated. Shall storage be at the village level, at the society level, or at the union level? Whether small scale storage at the local village level can be utilized effectively is questionable. This report will not attempt an answer but suggests careful study and decisions should be focused here.

Operating Efficiency. Keeping the cost of grain handling at a low level so that the marketing system will absorb as few resources as possible is both a long-run and a short-run problem. The long-run solutions probably involve the development of substantial training programs as well as the development and adaptation of marketing technology to the Tanzanian situation.

Increased efficiencies and subsequent reduction in operating costs occasionally come as major breakthroughs, but these are difficult both to predict and to produce. Of greater importance is continually improving the management and techniques of grain handling. This adds up to improvement in day-to-day performance, and eventually to significant reductions in costs.

Subsector Constraints by Priority Categories

The cultural, production, and marketing constraints mentioned above are integrated in this section into two categories. Consistent with the above, a short-run and a long-run category have been identified. The basis for determining whether a constraint was short run or long run was whether or not the major payoffs of an immediately initiated program to deal with it would likely be realized before or after 1980. Secondly, within each of these short-run/long-run categories, three categories of urgency are identified, namely:

Category 1: activities urgently needed;

Category 2: activities essential, but not as urgently needed as those in Category 1;

Category 3: activities that are desirable but not necessarily essential.

Table XVII summarizes these constraints by categories.

Placing activities in categories by level of urgency should not be construed to mean that all activities within one category need to be entirely completed before the activities in subsequent categories are begun. On the contrary, as with other developing nations, Tanzania's constraints appear to be layered such that the partial alleviation of one may, in turn, generate an opportunity for another constraint to become the most limiting.[2] Clearly, the implication is that each of these activities be fitted into a time-phase strategy. The question of strategies will be addressed in detail in the next chapter.

Short-run Bottlenecks by Urgency Category

Category 1--Poor Agronomic Practices. One of the most pressing immediate constraints is that of the relatively inadequate agronomic practices presently in use, especially regarding plant populations (including plant spacin and weeding. This constraint is so domina. in maize, sorghum, and millet that remedial programs designed to overcome other obstacles will be relatively ineffective until this one is addressed.

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[2]For elaboration of this concept see, Melvin G. Blase, editor, Institutions in Agricultural Development (Ames, Iowa: Iowa State University Press, 1971), Chapter 1.

TABLE XVII

FOOD CROP SUBSECTOR CONSTRAINTS BY CATEGORIES

	Constraints Amenable to Short-run Programs	Constraints Amenable to Long-run Programs.
Category 1. Remedial Program Urgently Needed	A. Inadequate agronomic practices B. Limited research data for putting together packages of practices C. Unavailability of quality seed D. Misleading price structure and insufficient price incentives E. Ineffective market organization F. Scarcity of trained manpower and frequent transfer of staff G. Inadequate and insufficient short-term training programs H. Nutritional and quality losses	A. Lack of extension credibility with subsistence farmers B. Insufficient research on food crops due to lack of policy emphasis and institutional capabilities C. Scarcity of trained personnel and frequent transfer of staff D. Unsatisfactory state of nutrition education E. Increasing population growth rate F. Shortage of administrative and management expertise
Category 2. Remedial Programs Essential	A. Inadequate credit for food crops B. Lack of experience in using fertilizer on food crops C. Insufficient research information on bananas, cassava, and field beans D. Lack of know-how in motivating farmers to change E. Limited transportation facilities	A. Inadequate national credit program B. High marketing costs C. Inadequate farm food-crop storage D. Improperly focused educational system E. Inadequate soil survey and moisture data F. Limited program and enrollment capacity of agriculture educational institutions G. Low productivity of labor which reaches a crisis during peak seasons and the lack of technology to enhance labor productivity H. Inadequate farm-to-market roads

TABLE XVII , CONTINUED

FOOD CROP SUBSECTOR CONSTRAINTS BY CATEGORIES

	Constraints Amenable to Short-run Programs	Constraints Amenable to Long-run Programs
Category 3. Remedial Program Desirable	A. Poor irrigation water management	A. Soil resource deterioration B. Heterogeneity of equipment C. Insufficient irrigation capacity D. Inadequate economics and sociology research E. Lack of information and policy guidelines for bringing the additional ten million acres into production F. Lack of a basis for determining self-sufficiency versus export-import policies in food crops

Closely related to the problem of agronomic practices is the unavailability of high quality seeds. Again, this serves as a crucial bottleneck inhibiting significant progress.

Given the production constraints within which Tanzania will be forced to operate during the immediate future, extra attention must be afforded the organizational problems in the marketing system. The black market and related problems are symptoms of constraints on more effective marketing performance. In the past, closely related to these organizational problems were those associated with a price policy, in certain regions, that apparently had not provided satisfactory incentives for food crop production.

Some of the aspects of the human capital constraints can be placed within short-run categories. The lack of effective short-term training programs both for food crop production and its marketing supports the conclusion that the technological base which characterizes the food crop subsector is inadequate. More specifically, the lack of training in certain crucial areas, such as fumigation, adds emphasis to the problem of high losses in the marketing chain from producer to consumer.

Category 2--Essential Activities. Soon after progress has begun in overcoming the constraints above, attention will have to be focused upon those that must be dealt with before solving Tanzania's basic production-nutrition problem. An example would be the constraint of the lack of adequate production credit for food crop production and marketing. As improved seeds and other purchased inputs become available, this constraint will grow as an obstacle. Another obstacle that will be encountered soon after agronomic progress is made will be the need for fertilizer for food crops.

Although not within the formal responsibility of this analysis, the importance of bananas, cassava, and field beans in the Tanzanian national diet is such that constraints to their expanded production and marketing deserve research. As sources of calories and proteins, the importance of these crops is so great in relation to the small amount of research information on them that additional on-site work in Tanzania is urgently needed.

Category 3--Important Constraints. One short-run obstacle within this category is the lack of optimal management of food crop production under irrigated conditions. The lack of more careful use of irrigation water and related input is a crucial constraint in some regions of the country.

Long-run Constraints

As indicated above, three categories of constraints are listed here which will require action that will provide primary payoff after 1980. Nevertheless, the same urgency should be applied to some of these constraints with regard to their implications for remedial action.

Category 1--Constraints Requiring Urgent Action. Of high importance is the constraint resulting from the lack of a creditable extension program in the food crop subsector. Until an effective communication link is established at the farm level, little technological change is possible. Further, the lack of readily adaptable research findings and other information, such as reliable crop reporting data, inhibits progress.

A closely related constraint is that of adequately trained personnel. This deficiency of personnel trained at the certificate, diploma, and bachelors levels acts as a pervasive bottleneck in the production and marketing

subsystems alike.

One additional constraint that requires urgent action is the consumer's lack of adequate nutrition information. This deficiency is partially if not largely responsible for the loss of essential nutrients just prior to consumption. As with the other constraints in this category, the major payoffs of remedial action designed to overcome this obstacle cannot be expected to occur before 1980. Nevertheless, action designed to overcome these constraints is urgently needed.

Category 2--Essential Constraints. The obstacle of inadequate credit for financing the nation-wide production and marketing of food crops must be included in this category. In light of the fact that food crops in Tanzania are produced on many highly decentralized production units, the breadth of this constraint is indeed nation-wide.

A number of marketing constraints must be overcome if progress is to characterize the food crop subsector. These constraints include the lack of an adequate grain reserve, the organization of a marketing system that enables marketing costs to be "taken off the top," and inadequate storage, especially at the farm level.

With regard to human capital creation, the improper focus of the primary and secondary educational system is noteworthy. Until these systems are geared to improve the quality of life of the Tanzanian people rather than to prepare students merely for the next academic level, they will be an obstacle relative to their potential role as a significant facilitator. For a positive example, one researcher saw an elementary school with a garden attended by the children as part of their educational program. The expansion of

this type of program is urged.

Category 3--Important Obstacles. Three important constraints are included in this important, but not urgent, category. Problems being generated in some parts of Tanzania lead to a deteriorization of the productivity of its soil over time. These need to be addressed but no short-run solution can be expected.

Given the size of the national market, the problems being generated by the importation of many different brands of mechanical items, such as trucks and tractors, presents a logistical problem of considerable dimension. Tanzania may not want to limit itself to one brand in each of the areas of machinery, such as farm implements. But the logistical problems that result from the multiplicity of brands currently imported represents a constraint to the long-run productivity of the capital committed to these uses.

Finally, in some areas of Tanzania, the unavailability of a potentially effective irrigation system is a major retarding factor. However, in light of the vast amounts of capital often required to overcome this obstacle, extreme care should be given to keep it in its proper perspective.

CHAPTER IX: ALTERNATIVE STRATEGIES FOR FOOD CROP SUBSECTOR DEVELOPMENT

Given the magnitude of Tanzania's food problem and the constraints to its solution identified earlier, the question must be asked: "What strategy is appropriate for the Tanzanian situation?" Before offering a recommended strategy in the next chapter, the alternative strategies open for consideration must be enumerated. Since the recommended strategy reflects a set of weights on alternative goals that emphasize nutrition, the other strategies will be discussed for those who emphasize something other than nutrition.

Four options are presented in this chapter: 1) a "Food First" strategy, 2) a long-run strategy aimed at national self-sufficiency in food production through regional specialization in growing crops, 3) an income distribution strategy minimizing regional variation, and 4) an income distribution strategy emphasizing smallholders and ujamaa villages. Each of these will be discussed. Since the first is the most comprehensive strategy and the others are variations of component parts of it, the "Food First" strategy will be discussed in greatest detail.

I. A "Food First" Strategy

This strategy implies that the nutritional problem is so dominant and its solution so urgent that it overshadows other national objectives. It implies that Tanzanian government policy be refocused during the decade of the 1970's to reallocate resources from other programs to food crops.

Further, it assumes that all external donor assistance will be programmed with this as the predominate objective.

The rationale for these drastic changes can be found in the long-term payoff to be anticipated from marked improvements in human capital. Clearly, the opportunity costs of such an approach are high in terms of foregone consumption of non-food items. But it may be justified in terms of deaths prevented and retardation averted.

Programmatically, this strategy implies the initiation of programs designed to overcome all the constraints elaborated in the preceding chapters. These will be enumerated in terms of their anticipated short and long-run payoffs.

Short-Term Payoff Programs Designed to Alleviate Urgent (Category I) Constraints

With a sense of real urgency the following types of programs would be initiated under this strategy. They would be expected to yield results before the end of the decade:

I. An Extension Education Program. The program would be designed to upgrade agronomic practices, in general, and to improve weeding of food crops, in particular. Given the shortage of qualified personnel, this program will require substantial upgrading of extension educators. In addition, transfers of personnel should be limited to no more than one per five years to provide continuity to the food crop programs.

II. An Expedited Seed Program. Not only will the recently initiated seed program need to be expedited and expanded markedly but

also improved seeds must be imported. Further, logistical problems must be dealt with and the seed promotion programs thoroughly integrated with the extension education program above. Under this strategy, seeds and other purchased inputs would be subsidized with the government paying 90 percent of the cost initially, reducing annually for ten years when terminated.

III. Reorganization of the Marketing System. Substantial reorganization of the marketing system will be required in order to improve its efficiency, both in a physical sense and an economic sense. Foremost among the physical problems is the high loss rate due to improper storage and grain handling. From an economic point of view, the marketing system will need to be reorganized in order to eliminate the economic incentive for the black market, thereby eliminating the black market itself.

IV. A Revised Pricing Policy. Ample incentives must be provided to farmers to produce food crops. In light of widely varied transportation costs this price policy re-evaluation must move from a flat price for the entire country toward a regionally established price.

V. A Nutrition Education Program. The program, beginning immediately, would be sufficiently comprehensive to focus on 1) individual meal planners, 2) meal planners in institutions, and 3) personnel in the marketing channels who can effect nutritional changes in food grains.

VI. A Production Research Program. This research would be initiated

as rapidly as possible for the entire country. Although focused on packages of production programs that increase yields, the program would not be limited in this regard.

Short-Term Payoff Programs Designed to Alleviate Essential (Category II) Constraints

A "Food First" strategy implies that programs will not only be initiated to overcome urgent constraints but also to overcome essential and important ones (categories II and III). Hence, under this strategy programs would be initiated in the following areas:

I. Expanded Fertilizer Use on Food Crops. As rapidly as farmers could be persuaded to use fertilizer in conjunction with improved seed and modern agronomic practices, subsidized fertilizer would be made available. At minimum, this will require significant expansion in fertilizer raw material import and, at maximum, the importing of substantial quantities of mixed fertilizer.

II. A Nationwide Credit Program. It would concentrate on financing any food crop activity of merit. Hence, it would deal with not only production credit but also marketing and institutional needs as well.[1]

III. Research and Promotion Programs. These would be initiated for bananas, cassava, and field beans. In light of the crucial roles these crops play as sources of calories and proteins, the present

[1]The specifics of the credit program would be influenced by the extent to which an input subsidy policy is adopted.

relative deficiency of information would be remedied under this program.

IV. Trial Programs and Other Motivational Research. Study of the methods of motivating farmers to adopt new practices would be-bin. These practice adoption studies would be designed to identify procedures to be used on a wide scale rather than to add to the literature in this area.

Short-Term Payoff Programs Designed to Alleviate Important (Category III) Constraints)

Irrigation Management. In this category one program would be iniated, if resources permit. It would be designed to improve irrigation management techniques. This would involve training programs for suited personnel from other occupations. They would have basic training in areas such as agronomy and engineering that would enable them to launch programs designed to improve irrigation management at the farm level.

Long-Term Payoff Programs Designed to Alleviate Urgent (Category I) Constraints

The following programs would be initiated under the strategy but would not be fully productive before 1980. In fact, many of them would only begin to show results by that time. Consequently, a minimum twenty-year planning horizon should be taken for the following:

I. A Nationwide Extension Education Program. A nationwide extension education program would be developed in food crop production and marketing. Not only would the in-depth nature of this

program require a relatively long planning horizon, but also many of the problems encountered will not be amenable to immediate solution. For example, the education of farmers regarding optimal combinations of plant population and quantities of commercial fertilizer is a long-term program.

II. Food Crop Information Systems. These would be of two types. The first would involve a crash program to develop an adaptive research capability. The other would create a system of crop reporting and other information flows that would enable the Tanzanian government to monitor the food crop subsector.

III. Educational Programs at Multiple Levels. Food crop production and marketing would be emphasized in primary schools. Significant expansion would occur in certificate and diploma agricultural programs. The output of bachelor's level personnel educated in the food crop area would occur as rapidly as facilities and staff could be expanded.

IV. Nutrition Education Programs. This would expand the program launched earlier. Although not limited to a female audience, this program would also concentrate on expanding the knowledge of individuals who plan and prepare meals. The program would concentrate on explaining the seriousness of the nutritional problem and upon the remedial measures possible, especially within the home.

V. A Population Control Program. Initially, a research program would deal with methods of gaining adoption of population

control practices. Subsequently, the program would make the most readily accepted birth control supplies available free of charge.

VI. A Long-Term Marketing Program. A long-term program would emphasize improved storage, the establishment of grades and standards, and the development of farm-to-market roads. Storage, especially at the farm level, would be expanded and techniques of its management emphasized. Grades and standards would be initiated so incentives could be structured into the marketing system for improving the storage and handling of food grains. Finally, a significant expansion of road building would occur at the farm-to-market level.

VII. An Institue of Public Administration. An institute of public administration and management would be created to provide compulsory short course training programs for all government employees. Several courses would be offered, one at each important career level.

Long-Term Payoff Programs Designed to Alleviate Essential (Category II) Constraints

I. Reorientation of Primary and Secondary Education. This system should be reoriented to food crop problems. Expansion of the educational system would occur only in grades one through four in order to provide functional literacy to food crop producers rather than to prepare students for the next educational level. Further, existing programs would focus upon growing, preserving,

and preparing food

II. Farm Storage Construction. A program of farm storage construction and management would be initiated. Materials would be subsidized at an initial rate of 90 percent by the government for those farmers willing to construct storage facilities. Then the subsidy would gradually phased out over a ten-year period.

III. Reorganization of the Marketing System. The reorganization would be initiated to improve marketings efficiency. After the establishment of grades and standards, a reward system can be structured to provide incentives to improve efficiency in marketing food crops. Further, the marketing system needs to be reorganized to provide penalties for inefficiencies by managers as well as incentives.

IV. Survey of Soil and Water Resources. The national program to survey soil and water resources would be accelerated. Emphasis would be placed upon the availability of underground water supplies that are rainfed as well as areas with high fertility soil.

V. Institutions Training Specialists. The size of the educational institutions training food crop specialists and the quality of their programs would be expanded to meet the manpower requirements consistent with the rest of this strategy.

VI. Alternative Energy Sources. These would be researched and tapped to enhance the productivity of human labor. Emphasis would be placed upon animal power first and tractor power second.

Long-Term Payoff Programs Designed to Alleviate Important (Category III) Constraints

Five constraints will provide the focus for the programs initiated in this category:

I. Erosion Control. Action programs on erosion control and research on fertility maintenance under stable food-production conditions would begin. Both of these problems are likely to become increasing constraints as Tanzania shifts to a less transitory type of agricultural production.

II. Standardizing Farm Equipment. The limited size of the Tanzanian national market requires that the number of brands of farm equipment, trucks, and other mechanical devices be limited to two or three so adequate spare parts and other logistical services can be provided on an economically feasible basis. However, these should not be limited to a single brand because the benefit of competition among sellers likely would be lost.

III. Irrigation Programs. These would be initiated where water availability and soil fertility make irrigation economically viable. Not only would projects within this program require substantial amounts of capital, but farmers in the program would have to be taught crop agronomic practices for irrigated agriculture.

IV. Land Expansion Programs. The target of this program would be to bring into production much of the available fertile land not now cultivated. Components of the program would include such things as road construction, tsetse fly control, and land clearing

V. Social Science Research. Social-Science research, in general,

and policy research, in particular, would be greatly expanded. Information would be developed ranging from farm management data to price analyses. The information generated would be designed for use by decision makers at the appropriate level.

E. A Long-Run National Self-Sufficiency Regional Specialization Strategy

The "Food First" strategy assumed the nutritional problems were so overwhelming as to preclude consideration of other criteria for strategy selections. This strategy recognizes that the time required for many aspects of the food crop problem limits the rate that resources can be efficiently absorbed into the food crop subsector. Further, it considers the facts that 1) the natural resource endowments of Tanzania vary widely among regions and 2) that economic development requires regional specialization in order for the gains of interregional trade to be realized. Hence, this strategy also focuses upon an objective of national self-sufficiency in the production of food crops. But the dimensión of regional specialization in production programs is added. This specialization is to generate interretional trade.

The programs designed to implement this strategy would be variations of those described in strategy I. However, they would differ in magnitude and in the regions to which development resources would apply.

Recognizing that trained manpower is in very short supply, this strategy would concentrate these and other scarce resources in selected regions. These regions would be given priority in accord with their productivity potential. However, this strategy would call for initiating

development within all regions of the country within a twenty-year period. Initially, the program would focus on those regions with highest productivity potential for increasing the output of maize. Subsequently, regions would be involved in accord with their potential for producing sorghum, millet, wheat, rice, and soybeans. Simultaneously with allocating the new development resources in accord with this priority ranking, existing food crop programs would continue in the remainder of the country emphasizing improved agronomic practices, especially weeding and plant populations

Since not as many resources could be utilized in this strategy as in the first one, an opportunity will exist for adjusting the development program to the constraints imposed by their availability. Most especially, the shortage of human capital will be the constraining resource limiting the rate at which the development program can proceed.

Programs Designed to Alleviate Constraints

The major thrust of this strategy would be the provision of a package of agronomic practices with subsidized inputs, accompanied by an education program in selected regions. Hence, priorities would need to be established for the allocation of available seed, trained manpower, fertilizer and adaptive research resources to the regions with highest productivity potential. Correlated with this program would be a series of marketing thrusts that would include establishment of price incentives for food crops, improvement in market organization, and efforts to improve the handling of food crops while in the marketing channel. Simultaneously, special efforts would be devoted to determining methods of motivating farmers to adopt new practices in the selected regions, provision of credit for food crops,

expanded short-term training for production and marketing staffs, and efforts to retain these staff members in the emphasized regions for tours of at least five years. Concurrently with the programs in selected regions, research would be undertaken in others to provide the groundwork information needed.

This strategy would provide that after a region has received a specific initial thrust designed to overcome short-run restraints, an effort would be made to dovetail these with activities designed to overcome long-run constraints. Programs in areas such as nutrition education, population, food crop storage, more complete inventorying of soil and water resources, and supplementation of human energy with other energy sources will need to be undertaken as a component part of the strategy. Likewise, in regions not directly involved initially, programs will have to be undertaken. Expanding the programs and capacities of agricultural education institutions, short-term training to improve administrative and management expertise of government and cooperative employees, and the refocusing of the educational system to more functional programs will need to be undertaken in order to backstop the specialized regional programs.

This strategy continues to emphasize food as the nations dominant problem. It differs from the "Food First" strategy in its concentration in a time-phased manner upon the developing of selected regions and particular crops. This would be designed to gain some successful experiences that would subsequently benefit regional efforts. This strategy posses flexibility with regard to the resources that might be available. If the new development capital were quite limited, the rate at which new regions were

initiated into the program could be slowed. On the other hand, if an abundance of resources were made available from external sources, the rate of progress would be determined primarily by the capacity of Tanzanian institutions to train and/or retrain personnel with expertise in food crop production and marketing.

III. An Income Distribution Strategy Minimizing Regional Variation

In sharp contrast to the above strategies, this would be designed to reduce the differences in per-capita incomes (measured in nutritional terms) among regions. Hence, the prime criteria for determining which regions would be phased into the program would be the level of nutritional adequacy in each. Nutritional adequacy would serve as a proxy for income.

Programs to Alleviate Constraints

Both short and long-run components would exist for this strategy, as in the case of the two strategies discussed above. In addition, a time-phasing would be involved similar to strategy II. The strategy's initial focus would be on low income regions, in general, and those with high infant mortality rates, in particular. Although agronomic practices would be stressed as a package, including subsidized inputs as above, the food crop to be emphasized would vary with the productivity potential for each region's resources for a particular crop. Consequently, while maize might be emphasized in some, more emphasis could be expected to be placed on sorghum or millets in other regions under this strategy. Since wheat is produced for relatively high income urban consumers, it would receive the lowest priority.

Together with the production programs, market development activities would be designed to provide price incentives and to improve the handling of food grains. Likewise, a supporting program would be initiated in the research on other locally important food crops such as bananas, cassava, and field beans.

Synchronized with the strategy's short-term payoff programs above would be a series of activities designed to bring long-run improvements in low-income regions. High on the priority list are such things as adaptive research, nutritional educational programs, population programs, farm storage activities, and determination of alternative energy sources to supplement human labor. In addition, a number of nation-wide efforts will need to be launched to improve the backstopping capability of institutions. Illustrations of these include expanding the agricultural education institutions, improving soil and water surveys, increasing research on methods of motivating farmers to adopt practices, etc.

The primary difference between this strategy and the two mentioned above is that the focus is on low income regions on a priority basis. This means that rather than attempting to cover the entire country at once, as in the case of Strategy I, and rather than attempt to focus on areas with greatest potential, as in the case of Strategy II, this strategy emphasizes those regions with the lowest nutritional status and highest infant mortality rates.

IV. An Income Distribution Strategy, Emphasizing Small Farms and Ujamaa Villages

Like Strategy III, this one concentrates on improving the distribution of income. However, rather than attempting to remedy disparaties in incomes among regions, this one focuses upon improving the production and thereby

the income of the smallholder in ujamma villages. Hence, under this strategy, resources are allocated on a priority basis to the Ujamaa villages and small farms for food crop production. To the extent that the small farms and ujamaa villages focused upon are in the low income regions, this strategy is an extension of the income distribution strategy above.

Programs Designed to Alleviate Constraints

Recognizing the crucial importance of making Ujamaa villages economically viable institutions, the initial focus of this strategy will be upon determining methods of enhancing their viability and providing the necessary managerial competence within the villages to implement these research findings. Hence, the initial focus will be upon creating the necessary human capital through short and long-term training activities designed to provide competent management in each Ujamaa village and to provide competent extension personnel to work with small farmers throughout the country. This emphasis upon human capital creation is a precondition to the acceptance and application at improved agronomic production practices by the small farmers and village members. After the management capability is in place, emphasis will be shifted to improving production through provision of subsidized inputs, provision of price incentives, and an educational package of practices clearly designed for use by small farmers and Ujamaa villages. Although the initial thrust will be upon improving the nutritional level of the farm families themselves, the expansion of marketable surpluses should be encouraged and the marketing systems improved accordingly.

Included in this strategy are: Expansion of the research program,

nutritional education program, population control activities, construction of improved farm storage facilities, and provision of supplements to the human energy constraint during peak periods.

On a national basis, a number of programs would be initiated to provide adequate backstopping for this strategy. These include improving the soil and water inventory of the country, expanding the nation's credit program, and improving the administrative and management expertise of government agencies and cooperatives.

This strategy is strongly similar to Strategy III. But it is unique in that it allocates resources made available for new development activity in the food crop area to small farmers and ujamaa villages. Initially focusing upon crops adapted to the regions with low incomes, the program would eventually have national coverage. However, approximately twenty years would be required--at minimum--to do so.

Summary Overview of Alternative Strategies

This chapter has outlined four alternative strategies for consideration in dealing with Tanzania's pressing food problem. The strategies discussed have strong implications with regard to not only the resources required but also their beneficiaries.

Strategy I is designed to provide first priority to the food crop subsector. Therefore, the strategy attempts to deal with all of the constraints identified previously in this analysis.

Strategy II, emphasizing regional specialization, is designed to provide priorities in a development program designed to cover a twenty-year

time period. Allocating new development resources in accord with the productivity potential of selected regions, emphasis initially would be placed on maize and subsequently the other food crops. Time phasing of the strategy will enable initial emphasis to be placed on the human capital constraints operating within the subsystem and thereby to alleviate future problems within the food crop subsector later in the strategy period.

Income distribution is the prime focus of the last two strategies. Strategy III focuses upon the disparaties in regional incomes and Strategy IV upon ujamaa villages and small farmers. Both strategies recognize the capital constraint and both are time-phased. Further the time phasing allows the strategies to overcome the variations in levels of external resources available.

While an infinite number of strategies might be formulated, these four represent obvious ways for Tanzania to attempt to deal with its food problem. In the chapter that follows, a recommended strategy, drawing upon components of these strategies, will be proposed for consideration.

CHAPTER X: A PRIORITY REGIONAL-CROP STRATEGY
A RECOMMENDED COMPOSITE STRATEGY FOR FOOD CROP SUBSECTOR

A recommended strategy is based on the finding of this analysis that food is Tanzania's most pressing problem. From a nutritional point of view, the problem is already extremely serious. From an analysis of past trends, it clearly is getting worse. From the perspective of projections, the future nutritional gap is likely to widen in the foreseeable future to unacceptable proportions, politically, socially, and nutritionally. Drastic action is needed.

Impending crises are not conducive to the formulation of carefully conceived strategies. Oversimplified, quick "solutions" are more attractive than a set of predetermined, time-phased actions designed to deal with both short and long-run dimensions of the problem. The latter takes time to formulate. Tanzania still has some of that time, however precious little.

A strategy to deal with the food problem must recognize several elements on the current Tanzanian scene:

1) The scarcity of manpower trained in food crops limits the subsector's absorptive capacity and potential crop focus.
2) The need for foreign exchange for purchasing food and other essentials precludes shifting significant amounts of manpower from the export (cash) crop subsector.
3) The geographical distribution of natural resources provides distinctive advantages to producing some food crops in some regions. This gives rise to major transportation and other marketing problems.

These problems plus priority bottlenecks in production, in rendering govern-

ment services, and in educating manpower rapidly enough constitute a formidable set of constraints that must be addressed by a carefully conceived strategy. (See Table XVIII.)

Highlights of Recommended Strategy

The Priority Regional-Crop Strategy provides a set of remedial actions (programs) to deal with constraints in production, in marketing, in the provision of public services and in educations. In order these are:

1) Integrated Production Program
2) Emphasis in Educational Institutions on Food Programs
3) Food Crop Support Programs of Public and Supporting Institutions
4) Coordinated Marketing Improvement Program.

Each of these will be reviewed briefly.

Integrated Production Program

This is the key program. If more food is not produced, the other programs in the strategy will be to little avail. Hence, this program is focused on farmers. While maintaining existing programs, new production programs would be started in two regions each year beginning in late 1974. For approximately the first half of the ten-year life of the strategy it would have a single focus: maize. It should be the focus of the strategy because 1) it is the staple in the diet, 2) a substantial amount of research information indicates that yield increases are possible, 3) the agroclimatic conditions in a number of parts of the country are conducive to maize production and 4) any production beyond that needed for domestic consumption could be readily absorbed in international markets at favorable prices. Hence, those regions with the highest production potential for that dominant food crop would be the first to initiate the strategy's component program.

The Integrated Production Program would concentrate on demonstrating improved agronomic practices. But it also would provide easy access to

credit, subsidized inputs, and markets for the food at prices that would provide an incentive, in addition to the incentives provided by the political party. Implementing and supporting these farm-level activities would be a staff in the office of the Regional Development Director with expertise in adult education, research, credit, and cooperatives.

Emphasis in Educational Institutions on Food Programs

The all-important constraint to closing the nutrition gap is the inadequate numbers of trained manpower. That would be addressed directly by this strategy component. This component program would focus on all levels of education. Primary and secondary education would have a food orientation. All research and training institutes would include a food program in their offerings. The Faculty of Agriculture would expand significantly with the assistance resources provided. Finally, the program would provide for refocusing some of the activities on the Dar es Salaam campus.

Food Crop Support Programs of Public and Supporting Institutions

Public services are essential at numerous points in the strategy. Assistance would be provided in upgrading and/or expanding government programs involving 1) research (agronomic, economic, and motivational), 2) seed production, 3) data acquisition, 4) nutrition, 5) credit, and 6) natural resource inventories. In addition, efforts to increase the productivity of government employees would include a policy of longer tours in positions as well as training in administration and management.

Coordinated Marketing Improvement Program

Two types of improvements are sought with this program. First, in the regions initiating the Integrated Production Programs corresponding efforts would be initiated in the cooperatives. Second, this component of the strategy would also deal with the more pervasive problems faced by cooperatives. Most of these problems extend beyond regional boundaries. Both will be highlighted.

As part of the regional Integrated Production Program, cooperatives would deliver the physical inputs when needed. This function would be closely coordinated with the government agency responsible for the subsidy program and the bank representatives responsible for credit. As production increases, provision would be made for attracting with incentive prices some of it to the market as well as for storing, processing, and transporting the marketable surplus. Expanded efforts also would be made to maintain nutritional quality at the highest possible levels.

Simultaneously with the regional focus of the Coordinated Marketing Improvement Program, the strategy would provide for remedying some of the more pervasive constraints faced by the cooperatives. The importance of incentive prices has been implied above. Assistance in formulating such policy would be provided. Likewise, a minimal grading program would be initiated. Finally, an incentive system would be started to provide rewards to encourage efficient handling of both inputs and products.

Organization for Implementation of the Strategy

To implement this strategy two levels of organization would be needed.

Consistent with the recent decentralization, as each region phases into the Integrated Production Program, the regional plan would provide the details for its initiation, implementation, and evaluation. To do this would require a regional staff who would establish regional nutritional targets and programs designed to meet them. Hence, this group would need a separate identity, a single crop focus (maize in many regions), special funding and technical assistance, and be endowed with sufficient authority to "push" the programs to successful conclusions.

At the national level a corresponding group would be needed in the Prime Minister's office where the regional plans would be reviewed. Advised by a committee of policy makers from all ministries involved, this group would issue guidelines for the preparation of regional plans, review them when submitted, and coordinate their external assistance requirements with external donors. Likewise, the needs of ministries involved would be coordinated and expedited by this group.

Implications of Strategy for External Assistance

Although specification of the exact external requirements of the strategy is impossible until 1) the extent to which it would be financed directly by the Tanzanian government is known, and 2) individual studies have been undertaken, some approximations can be estimated. These are made by program components of the strategy.

The Integrated Production Program will be basic to the success of the entire strategy. Therefore, top priority should be given to making available approximately 30 technical assistance personnel initially (expanding to 35

in three years) and $3 million annually on the average during the life of the program.

Second only in importance to the resource requirements of the Integrated Production Program will be the external resource needs of the Food Expertise Emphasis Program. High priority should be attached to providing approximately 25 technical assistance personnel and their supporting needs of $1 million annually.

The external support cost of the Coordinated Marketing Improvement Program is estimated at 14 technical assistance personnel and $2 million annually.

Implementation of the Food Crop Support Program in government and supporting institutions will require 20 technical assistance personnel and $1 million annually.

In sum, the orders of magnitude of the external assistance requirements of the strategy are approximately 90 technical assistance personnel and $7 million annually. The technical assistance will need to be built up to full strength during the initial three years and to remain there until the end of the fifth year. Then it would be phased-out over the remaining five years. The financial cost of the strategy can be expected to run at about $7 million annually until all regions have been phased into the program, whereupon external funding could be phased-out and support from domestic sources would be expected.

The Recommended Strategy for Food Crop Subsector in Detail

The Priority-Regional Crop Strategy recommended in this chapter draws upon elements of the four strategies discussed previously. It reflects a weighting of alternative goals, giving top priority to closing the growing nutritional gap. It focuses on specific target groups and regions. It is designed to relieve the first two priority categories of constraints discussed in Chapter VIII.

The food problem is so dominant that this strategy places first priority on closing Tanzania's widening nutritional gap. In this sense, the strategy is similar to the first alternative, the Food First Strategy. However, it is modified to reflect the fact that the shortage of human capital, in terms of trained manpower, limits the absorptive capacity of the subsector to the point of requiring carefully time-phased activities. Nevertheless, the strategy presupposes that top priority be given to the food crop subsector.

The strategy focuses on specific target groups. If constraints to the improvement of food crop production and marketing are to be alleviated, several sets of decision makers must modify their conventional courses of action. Foremost among these are the farmers themselves. Second, cooperatives will need to alter present programs in order to be sufficiently responsive to the needs of the subsector. Third, government agencies and supporting agencies at several levels will need to revise their programs of work. Finally, due to the critical shortage of trained manpower in the food crop area, substantial upgrading and expansion of educational institutions designed to serve this area of the economy will be required. Programs for each of these will be discussed.

Integrated Production Program at the Farm Level

The keystone element of this entire strategy is an Integrated Production Program designed to expand the production of food crops. If the constraints at this level cannot be overcome, subsequent activities will be of little avail in closing the nutritional gap. Tanzania urgently needs to produce more food.

Initially, attention will be turned to the proposed organization of the Integrated Production Program. Subsequently, constraints to be alleviated will be the basis for remedial elements in the program and, finally, the time-phasing of it will be elaborated.

Integrated Production Program: Organization. Two models were considered in proposing the organization of the Integrated Production Program. These were the Minimum Package Program in Ethiopia and the Camilla experience in Bangladesh. Elements of each are incorporated in the proposed organizational format.

The constraint imposed by the shortage of trained manpower requires that selected regions with high productivity potentials be focused upon in a time-phased manner rather than attempting a nation-wide program immediately. Hence, the program follows the minimum package approach, especially to the extent that the extension education, production credit, and input supply programs are all closely integrated.

Planning the programs at the regional level will require a regional staff be provided as each region is phased into the program. A corresponding staff will be needed in the Prime Minister's Office to issue guidelines, review regional plans, coordinate among ministries, coordinate external

requirements with donors and to expedite the total strategy.

Constraints Addressed. Initial focus is based on the constraint imposed by inadequate agronomic practices used in food crop production. Hence, an integrated effort is required, built around an extension education program. With the use of demonstration plots and model farmers, clear evidence should be provided at enough points within the target region so smallholders can see with their own eyes the consequences of using alternative practices. Initially, emphasis should be placed upon demonstrating the consequences of improved weeding, plant populations, and date of planting. After these practices, which require no purchased inputs, have been demonstrated, focus should be upon the consequences of using improved seeds and, finally, the consequences of using commercial fertilizer. While all of these can be demonstrated within one set of plots, care should be taken to be certain that the consequences of the use of the entire package of practices is clearly demonstrated. Closely coordinated with this demonstration must be input supply and credit programs. While more will be said about each of these in the discussion of other targets of the strategy, suffice it to say here that these must be tightly interwoven with the educational program to the extent that farmers are able to obtain the necessary purchased inputs as easily as possible.

Time Phasing. Maize is the dominant crop. It has the greatest production potential and the widest markets. Therefore, initial programs should be centered around it. Regions should be selected in order of their production potential for maize first, and, then for sorghum, millet, rice, wheat, and soybeans. Hence, commodities will be emphasized within each regional program.

Two regions per year would be selected annually to begin an Integrated Production Program under this strategy. The production potential of the region would be used as the criterion for determining the order in which regions are selected.

Since some regions will not be involved in the Integrated Production Program until as late as eight years after its inception, interim activities should be initiated in them not only with regard to expanding their food crop institutional base but also in terms of focusing existing efforts on food crops. Specifically, in these areas extension emphasis should be upon weeding, plant population, and date of planting during the interim period. As indicated in an earlier chapter, this would provide a significant challenge not only to the extension organization but to the political party in all regions.

Coordinated Marketing Improvement Program

This component of the strategy focuses on cooperatives. If they are to play the supportive role required by the Integrated Production Program, a series of activities would be required. These will be discussed in terms of physical inputs and economic incentives.

Physical Inputs. The Integrated Production Program can be effective only if the necessary purchased inputs are available on a timely basis. Hence, under this strategy food crops in most cooperatives would be removed from their second class status. This means that adapted seeds, fertilizers, insecticides, herbicides, fungicides, and other purchased inputs would be made physically available at the time they are needed.

In addition to the inputs that must be available in order to coordinate

the selected regions with the Integrated Production Program, facilities would be needed for efficiently handling, storing, and transporting the marketable surplus of the commodity emphasized in the region. In addition, grades would be established as soon as possible to differentiate those food grains suitable for human consumption from those that are not. In addition, use of basic practices of fumigation, drying, etc., would be encouraged by establishing a price differential for these grades.

Economic Incentives. Even if farmers know how to use improved practices with purchased inputs and even if these inputs are available, farmers cannot be expected to use them unless they are able to sell their crops for enough to regain the cost of the inputs and to receive a return for their labor comparable to other alternatives available. Although the strategy will address the price-policy question in the next section, it is worthy of note here because cooperatives have to be able to control their marketing costs and yet make inputs available at attractive prices to farmers so both they and the farmers can maintain their viability.

Food Crop Support Program

The third target group upon which this strategy focuses is selected government agencies and supporting institutions. In Tanzania's relatively centralized system, they play crucial roles. Especially in the food crop subsector a number of agencies can be instrumental in alleviating existing constraints. These will be discussed individually in terms of programs oriented both to short-term constraints and to long-term ones as well.

Research Institutions. New technology is indispensable to transfor-

ming traditional agriculture. Although some additional technology may be borrowed from other countries, such as weed control through herbicides, Tanzania faces a formidable task of generating a technological base to sustain development of the food crop subsector. In the short run, further efforts would be made to 1) thoroughly inventory the present research base and 2) emphasize varietal trials with different combinations of inputs. Subsequently, a time-phased agronomic research program would be initiated in conjunction with the Integrated Production Program schedule. In addition to agronomic research, work is needed in the social sciences. High priority would be established for farm management research, studies concerning the dissemination of information, and analyses of alternative information systems to monitor food production and marketing. Regardles of whether the emphasis is upon social science or physical science research, the narrowness of the research resource base makes imperative the initial use of technical assistance personnel while additional indigenous personnel are being educated in these specialized fields.

Seed Production. Although an impressive start has been made, considerable expansion and expediting of the seed production program is required. Again in coordination with the Integrated Production Program, this activity would be expanded. The importance of high quality, pure seed is such that this phase of the total strategy would be timed to develop well in advance of other elements. Seed made available after the planting season has little value.

Nutrition Program. If all of the nutrients were consumed that are produced, a significant improvement in Tanzania's nutritional situation would

occur. Unfortunately, however, significant losses in the quality and nutritional value of food stuffs occur before final consumption. Although part of these are conducive to remedial measures such as those suggested above for the marketing cooperatives, many of them occur due to incorrect practices used by those who plan and prepare the meals themselves. Hence, an expanded educational program regarding the composition of adequate diets and methods of preparing nutritional meals would be provided.

Credit. The constraint imposed by the lack of adequate capital being used in the food crop subsector can be overcome by the initial use of subsidies and the subsequent provision of adequate amounts of credit on attractive terms. Each will be discussed.

As suggested in Chapter IX, subsidies would be provided in order to obtain the initial acceptance of improved practices requiring purchased input. These subsidies should be provided initially at the 50% level and gradually phased out over a ten-year period. Under such a program, farmers would become accustomed both to making payments for purchased goods and to increasing them as they obtain additional experience that will indicate their profitability. One problem remains. Regardless of how carefully planned, subsidies are attractive enough to create pressure for their preservation. Clear provisions must be made, therefore, for the phase-out of the subsidies at the end of a ten-year period for each regional Integrated Production Program.

As subsidies fade out, the role of credit would have to expand. Credit would be made easily accessible on attractive terms for food crop producers. Crucial in this regard is the coordination that will be required be-

tween the credit program and the Integrated Production Program as it is initiated region by region. This will permit a ten-year projection to be made for the expansion of the development bank.

Food Crops Information System. In order to adequately monitor the performance of the production and marketing of these crops, a reporting system would be initiated as part of the strategy. A crop production reporting system and a market monitoring system would be upgraded and developed, respectively.

Natural Resource Development. In anticipation of each region's initiating its Integrated Production Program, coordinated surveys of soil quality and moisture availability as well as programs to expand the farm-to-market road system will be required. Again, because of the time-phased nature of the program, a ten-year schedule can be developed for expanding the information and transportation bases.

Personnel Policies. Pervasive throughout the entire government are problems with regard to tenure and training. Since each of these have a bearing on the effectiveness of government agencies, and, hence, on programs designed to improve the status of the subsector, they deserve attention.

A component part of this strategy addresses the problem of short tours of duty for personnel in govenment agencies. This tenure problem reduces the effectiveness of personnel because much of the learning-cost of each position is not recovered in benefits, due to insufficient tenure. A policy of position assignments of five-year duration is, therefore, a part of this recommended strategy.

Training of government personnel is required at several levels. Training programs with a dual focus would be initiated to continuously update personnel concerning food crop technology and to obtain insight into improved administrative practices and management techniques. For the latter an Institute of Public Administration is recommended and for the former a short course training program should be initiated within the Ministry of Agriculture.

Food Expertise Emphasis Program for Educational Institutions

The most limiting resource to the increase in food crop production and marketing in Tanzania is the lack of sufficiently trained manpower. This constraint acts as a "strangle hold" on virtually every segment of the subsector. Although this strategy minimizes this constraint initially by providing for remedial programs in selected regions only, in the long run, the only way to overcome this obstacle is by substantially expanding the educational institutions of the country and their output. Hence, they will be discussed at several levels.

Primary and Secondery Education Programs. Although a shift away from a promotion-oriented program to one designed to produce functional literacy for an agricultural nation has begun, it remains in its infancy. This strategy calls for expediting this refocusing to provide not only functional literacy for farmers but also to utilize the community school as a hub for demonstration programs and adult literacy activities. Clearly, improved technology with purchased inputs requires that farm people be able to read and write, at minimum.

Research and Training Institutes. This component of the strategy requires a significant strengthening of the Research and Training Institutes in general and initiation or expansion of the crop focus in all institutions over a ten-year period. Even those institutes designed primarily to train personnel for positions in the export (cash) crops subsector would require at least one year of course work in the institutes concerning food crops.

This significant expansion of the institutes will require both a substantial increase in the number of technical assistance personnel and the significant expansion in the training of Tanzanians to replace them subsequently.

College Level Training. Substantial expansion in the program of the Faculty of Agriculture at Morogoro would take place as well as some refocusing of the program offered at Dar es Salaam. Each will be discussed in that order.

The Faculty of Agriculture at Morogoro would be expanded in size and in course offerings. As the Integrated Production Program proceeds, as well as the concomitant programs in the cooperatives and government agencies, significant expansion will occur in the demand for college graduates trained in the food crop area. Consequently, the strategy calls for a ten-year plan designed for the expansion of the Faculty in accord with the expansion in the personnel requirements of agencies implementing the strategy.

While the Faculty of Agriculture at Morogoro will undoubtedly remain as the principal site for college training in the food crop area, important programs on the Dar es Salaam campus need expansion. Included in this area are the social sciences related to agriculture and training in the field

of nutrition. Both require expansion over the ten-year planning horizon assumed here.

Resource Requirements of the Strategy

Although a substantial portion of the resources required to implement this strategy can be obtained by diverting existing resources to the food cro subsector from other uses, the strategy has clear implications for majc amounts of external assistance. Although a detailed examination of the domestic resources that can be used to plug the growing nutritional gap will be needed, some indications of the general magnitude of resources likely to be needed from external sources can be provided. More precise specifications will come from the feasibility studies undertaken for projects within the programs of the strategy. These will be discussed by component programs designed to focus on specific target groups.

Integrated Production Program: External Resource Requirements

Two types of external resources are needed to support this program. Both capital and technical assistance will be required. The latter includes participant training programs comparable to the number of external technical assistance personnel.

Technical assistance to support the Integrated Production Program should be of three types. The first would be a small cadre of personnel to advise the national and regional officials responsible for initiating and implementing the production program. Five people will be needed: One in each of the two regions for which the program is initiated each year and three at

the national level to assist with the planning of the educational program, the credit program, and the marketing dimension. The second type of technical assistance needed will focus upon developing specialized training programs for personnel working in the regional Integrated Production Program. Individuals trained in agronomy, agricultural economics, and rural sociology should constitute this three-man team during the initial three years of each region's Integrated Production Program. The third type of technical assistance needed to support the Integrated Production Program requires research analysts. Although these individuals would initially predominantly come from the field of agronomy, related areas such as plant pathology and entomology should also be represented as should social scientists. Although the largest component of this team should be located at the Faculty of Agriculture at Morogoro, that ten-man team should be supplemented by a minimum of one food crop research coordinator at each of the research and training institutes.

In sum, approximately thirty technical assistance personnel are needed as soon as possible (expanding to thirty-five at the end of the first three years) in order to implement this portion of the strategy. This group should be phased out between its fifth and tenth years by the comparable number of Tanzanians returning from participant training programs abroad. However, this phase-out should not occur until after the technical assistance adviser has had an opportunity to work for a two-year period with the returned Tanzanians.

Integrated Production Program: Capital Assistance Requirements

This component of the strategy will be quite demanding with regard to capital assistance. Provision of and subsidies for purchased inputs in the initial part of the program will be required. Given the world-wide inflation in purchased inputs such as fertilizer, herbicides, etc., a minimum of one million dollars per year is likely to be required for farm inputs. In addition, the cost of the educational component of the Integrated Production Program can be expected to exceed ten million dollars per year, much of it coming from domestic rather than external sources. Finally, funds for improvement and construction of farm-to-market roads can be expected to exceed one million dollars per year and primarily to come from external sources.

In sum, the Integrated Production Program component of the strategy will require approximately three million dollars for implementation per year from external sources.

Coordinated Marketing Improvement Program: Resource Requirement

As in the case of the Integrated Production Program, the resource requirements for this component of the strategy will be discussed by categories of technical assistance and capital assistance.

Technical Assistance. Two major types of technical assistance are required to help Tanzania in implementing this component of the strategy. The first is a set of operational assistance personnel and the other are short course specialists.

Operation-type technical assistance personnel should be prepared to

help with the day-to-day problems that must be solved in reducing marketing margins and in improving the quality of food processed through the marketing system. In addition, personnel are needed to aid in developing systems for moving purchased inputs into the regions as they phase into the Integrated Production Program. To perform these functions, three technical assistance personnel should be posted in each region during the initial three years of its Integrated Production Program. In addition, a similar-sized staff should be posted in the national marketing organization to facilitate the marketing aspects of the Integrated Production Program at that level. Consequently, nine technical assistance personnel are needed to assist with these operational programs, initially. More would be needed during the second and third years as more regions phase into the program. In addition to this group, a five-man teaching team is needed to begin a set of short courses on marketing management. This team will be needed for approximately five years at which time their Tanzanian replacements will have been trained and given some experience in performing this training function.

In total, approximately fourteen technical assistance personnel are needed to strengthen the human capital component of the coordinated marketing program.

Capital Assistance. Capital assistance will be needed in making loans for improved farm food-crops storage and additional vehicles for transporting both inputs and outputs. Approximately one million dollars should be provided annually for both of these. Perhaps more important than the total sum is the timing with which these funds are made available. Clearly, the regional Integrated Production Program should not be delayed by tardy delivery

of inputs due to inadequate transportation. Similarly, the creation of marketable surpluses at the farm level should be anticipated in each of the regional production programs and the farm level storage aspect mobilized accordingly.

Food Crop Support Program: Resource Requirements

Technical assistance needed to support this component of the strategy far exceeds its capital assistance requirement. Consequently, a much larger component of it needs to be supplied by external donors. A number of technical assistance teams are needed to assist government agencies that will play a major role in closing the nutritional gap. A five-man team of analysts is needed to assist in doing background research for price policy, an area receiving increasing attention concerning the need for economic analysis. A three-man team is needed to assist in establishing policies and procedures for food crop lending in the development bank. Five nutritionists are needed to work in nutrition and family planning agencies and, finally, a seven-man team is needed to assist with the initiation of the Public Administration and Management Institute which would offer short courses to government personnel and managers of cooperatives.

Capital Requirements

The primary capital assistance requirement needed with this component of the strategy is generated out of the support necessary for the above mentioned technical assistance teams and their host institutions. Approximately one million dollars will be needed annually to provide necessary

transportation vehicles and other support needed.

Food Expertise Emphasis Program: Resource Requirements

This final component will require the largest number of technical assistance personnel of any part of the strategy. In addition to those stationed at educational institutions as part of the Integrated Production Program, approximately 25 technical assistance personnel will be needed annually to replace existing staff members selected to participate in training programs abroad. These individuals can be expected to be drawn from such institutions as the faculties of the Faculty of Agriculture at Morogoro, the faculty on the Dar es Salaam campus, and the research and training institutes. The exact disciplinary requirements will depend, of course, upon the individuals selected for further training.

Capital Requirements

As in the above program, the primary capital requirements will be used in support of the technical assistance team. Hence, about one million dollars will be needed annually.

The Strategy In Sum

This recommended strategy incorporates the urgency of the Food-First Strategy with the regional focus of the Long Run, Regional Specialization Strategy. It is built around a key component, the Integrated Production Program, designed to foster increased production as a key to unlocking Tanzania's food problem. It incorporates support programs designed to assist

cooperatives, government agencies, and educational institutions. The strategy carries an annual cost of about 90 technical assistance personnel, while the capital requirement of seven million dollars will be expected to be needed annually from external sources during the ten-year life of the strategy.

TABLE XVIII

FOOD CROP SUBSECTOR CONSTRAINTS BY CATEGORIES

	Constraints Amenable to Short-run Programs	Program Strategy Designed to Remedy	Constraints Amenable to Long-run Programs	Program Strategy Designed to Remedy
Category 1. Remedial Program Urgently Needed	A. Inadequate agronomic practices	IPP	A. Lack of extension credibility with subsistence farmers	IPP
	B. Limited research data for putting together packages of practices	FCSP	B. Insufficient research on food crops due to lack of policy emphasis and institutional capabilities	FCSP
	C. Unavailability of quality seed	FCSP	C. Scarcity of trained personnel and frequent transfer of staff	FEED/FCSP
	D. Misleading price structure and insufficient price incentives	CMIP	D. Unsatisfactory state of nutrition education	FCSP
	E. Ineffective market organization	CMIP	E. Increasing population growth rate	FCSP
	F. Scarcity of trained manpower and frequent transfer of staff	FEED/ FCSP	F. Shortage of administrative and management expertise	FCSP
	G. Inadequate and insufficient short-term training programs	IPP/ FCSP		
	H. Nutritional and quality losses	CMIP/ FEED		
Category 2. Remedial Programs Essential	A. Inadequate credit for food crops	FCSP	A. Inadequate national credit program	FCSP
	B. Lack of experience in using fertilizer on food crops	IPP	B. High marketing costs	CMIP
	C. Insufficient research information on bananas, cassava, and field beans	FCSP	C. Inadequate farm food-crop storage	IPP
	D. Lack of know-how in motivating farmers to change	FCSP	D. Improperly focused educational system	FEED
	E. Limited transportation facilities	IPP	E. Inadequate soil survey and moisture data	FCSP
			F. Limited program and enrollment capacity of agriculture educational institutions	FEED
			G. Low productivity of labor which reaches a crisis during peak seasons and the lack of technology to enhance labor productivity	FCSP
			H. Inadequate farm-to-market roads	IPP

NOTE: IPP - Integrated Production Program
FCSP - Food Crop Support Program
CMIP - Coordinated Market Improvement Program
FEED - Food Expertise Emphasis Program

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APPENDIX I

TANZANIA'S AGRICULTURAL PRODUCTION POLICIES

World wide experience supports the importance, if not necessity, for well formulated and vigorously administered national policies regarding agriculture. Consequently, Tanzania's own agricultural production policies are included as the third section of the final chapter on recommendations.

The recommendation is that every person who has a part in contributing to increasing production of food crops understand all of Tanzania's agricultural policies and know their interrelationships. All too frequently administrators, researchers, planners, and educators/extension workers assume policies are the concern of someone else.

Each specific policy is like a spoke in a wheel. Only when all the spokes are in place can the wheel function. Likewise, only when all specific policies are included and acted upon can the requisite national policies exist for a specific food crops production program.

Because these policies are not stated together elsewhere--and, therefore, are not widely understood--they are set forth in this report. Only as all who work in agriculture know and understand all the policies can they appreciate how the failure to implement one or more policies will, in turn, adversely affect other related programs.

Tanzania's agricultural production policies include the following:

a) To give major emphasis to food crop production intending that such emphasis more nearly approach the emphasis given cash crops in the past.

b) To encourage change and development measures as necessary to make the country self-sufficient in food.

c) To treat agricultural development as an integral part of integrated rural development.

d) To encourage, promote, and facilitate the development of agricultural production through ujamaa villages and cooperative "block" farming.

e) To encourage ujamaa village development. Such encouragement to include subsidy through critical inputs when such subsidy is economically justified and essential to the development of a viable ujamaa operation.

f) To enable all people to participate in development programs and benefit from them.

g) To support a one-channel marketing system for food crops through the cooperative structure.

h) To foster the development of the agricultural cooperatives into "multiservice" cooperatives, meaning they continue to assemble and market agricultural products and also become the channel for distributing agricultural inputs, consumer goods, and credit.

i) To delegate significant responsibility for planning an agricultural development of district and regional character, and for implementing those plans (within guidelines), at regional and district levels.

j) To foster geographic specialization in production as a means of maximizing production increases.

k) To utilize price incentives as a tool to encourage increased food crop production.

l) To give priority to developing local field plot demonstrations and credit programs for ujamaa villages or to cooperative efforts by individual farmers.

m) To base the credit worthiness of an individual farmer upon his intent to carry out improved practices, and subsequently, upon the extent to which the farmer has carried out or is carrying out improved practices plus his record of repayment.

n) To develop primary societies (in the cooperative structure) into socially and economically viable entities.

o) To increase food crop production and storage facilities to meet the nation's needs during the most severe periods of crop failure or other unavoidable food production crises.

p) To encourage improved storage at the primary society level and farm level to remove the necessity of incurring the

additional expense of moving food crops into Regional or NAPB storage at harvest time and back to production areas for consumption later in the year.

q) To give priority to improving feeder roads in agricultural producing areas.

r) To develop the road transport facilities and equipment to the point that the National Haulage Company will be capable of handling the long distance truck transport needs of the nation. To encourage the expansion of a Regional Union truck fleet sufficient to handle the bulk of within-Region transport needs.

s) To gain increased production through increased yields by use of improved seeds, fertilizers, and plant protection technology, rather than increased land input.

t) To provide adequate supplies of fertilizer for food crop production, primarily through internal production by allocating foreign exchange for import if it becomes necessary.

APPENDIX TABLE I

QUANTITY AND VALUE OF COTTON
PRODUCED IN TANZANIA, 1964, 1969-73/4

Crop year[3]	Seed cotton prices to growers (cts/kg)		Lint Cotton[4]				
			Production (bales of 181.4 kgs)			Average sales price (cts/kg)[5]	
	Grade A	Grade B	AR	BR	Total	AR	BR
1964	110	51	262,017	31,229	293,246	420.6	307.8
1969	110	55	331,938	50,578	382,516	381.2	284.8
1970	110	55	361,335	59,997	421,332	398.8	319.2
1971	110	55	336,109	24,007	360,116	490.7	320.9
1972/3[2]	113	60	399,813	28,220	428,033	516.5	303.7
1973/4[1]	113	60	350,000	28,220	378,220	751.4	713.3
Percentage change 1972/73	-	-	-12.5	-	-11.6	+45.5	+134.9
Annual percentage growth-rate 1964/73	+0.3		+3.3	-1.1	+2.9	+6.7	+9.9

Source: Tanzania Cotton Authority.

Note: - No change
1 Provisional
2 Revised
3 Crop year is between July of year under reference and June of subsequent year.
4 Average out-turn factor of cotton lint from seed cotton is 33 percent.
5 Tanzanian cents, 100 cents = 1 TAN Shs.

APPENDIX TABLE II

COFFEE PRODUCTION IN TANZANIA, 1964, 1969-72/3

Year	Production (tons)			Coffee Board Sales[5]			
				Mild		Hard	
	Mild[3]	Hard[4]	Total	Quantity (tons)	Ave. price (Shs per 50 kg)	Quantity (tons)	Ave. price (Shs per 50 kg)
1964	24,930[2]	8,907[2]	33,837[2]	25,945	323.5	6,179	268.3
1969	35,863	10,277	46,140	40,694	237.7	13,205	192.5
1970	32,367	17,302	49,669	28,146	354.0	15,078	288.8
1971	33,882	11,952	45,834	30,470	319.6	11,144	286.1
1971/2	38,291	15,447[2]	51,738[2]	32,438	340.2	14,711	304.9
1972/3[1]	40,470	14,108	54,578	49,893	380.9	12,952	843.3
Percentage change 1972/3	+5.7	+4.9	+5.5	+53.8	+12.0	-12.0	+12.6
Annual Percentage growth-rate 1964/73	+5.5	+5.2	+5.5	+7.5	+1.8	+8.6	+2.8

Source: Bureau of Statistics and Tanganyika Coffee Board

Note:
1 Provisional
2 Revised
3 82% of parchment delivered to Moshi mill by Coffee Board (on behalf of now defunct Tanzania Coffee and Tea Authority), Kilamanjaro Native Coffee Union and Tanzania Coffee Growers Association.
4 Amount passed for export at grading station, Bukeba.
5 Sales season is between October of previous year and September of year under reference.

APPENDIX TABLE III

SISAL PRODUCTION IN TANZANIA, 1964, 1969-73

Calendar Year	Mature area (hectares)	Production	Total export[4]	Estimated local sales[5]
		(Quantity in Metric Tons)		
1964	226,620	233,540	212,917	782
1969	227,397	209,303	172,006	18,145
1970	221,490	202,180	217,271	20,210
1971	211,478[2]	181,104	163,583	22,492[2]
1972	206,010[2]	156,849	153,917	21,820[2]
1973[1]	-	155,407	112,061	24,090
Percentage change 1972/73	-	-0.9	-27.2	+10.4
Annual percentage growth rate 1964/73	-	-4.5	-6.9	N.A.[3]

Source: Tanganyika Sisal Marketing Board and Bureau of Statistics

Note:
- \- Not available
- 1 Provisional
- 2 Revised
- 3 Not applicable
- 4 Including transfers to Kenya and Uganda
- 5 On the basis of the Survey of Industrial Production

APPENDIX TABLE IV

TEA PRODUCTION IN TANZANIA, 1964, 1969-73

Calendar Year	Area[4] (hectares)	Production (Quantity in tons) Northern Area	Southern Area	Total	small-holder Sector	local sales[5]
1964	7,594	2,027	2,785	4,812	3	1,292
1969	9,831	3,798	4,979	8,777	581	1,693
1970	10,198	3,606	4,886	8,492	725	1,900
1971	10,333	4,155	6,302	10,457	917	2,586
1972	11,138[2]	5,577[2]	7,129	12,706	1,464	2,294
1973[1]	11,084	5,527	7,131	12,658	1,648	2,895
Percentage change 1972/73	-0.5	-0.9	-	-0.4	+12.6	+26.2
Annual percentage growth-rate	+4.3	+11.8	+11.0	+11.3	N.A.[3]	+9.4

Source: Tanzania Tea Authority

Note:
- \- No change
- 1 Provisional
- 2 Revised
- 3 Not applicable
- 4 Semi-mature and mature areas, i.e. planted for a period exceeding three years. Area figures are as at middle of the year.
- 5 Sales within East Africa

APPENDIX TABLE V

TOBACCO PRODUCTION IN TANZANIA, 1964, 1968-73

Crop Year	Production (Tons)			Average prices to growers (Shs/Kg)	
	Flue-cured[3]	Fire-cured[4]	Total	Flue-cured	Fire-cured
1964	1,765	332	2,124[5]	5.29	1.30
1968/69	8,137	3,527	11,664	5.15	1.75
1969/70	8,923	2,143	11,066	5.06	1.69
1970/71	8,816	3,133	11,949	4.94	1.79
1971/72	10,580	3,601[2]	14,181[2]	5.80	2.36[2]
1972/73	10,781	1,855	12,636	5.67	2.24
Percentage change 1972/73	+1.9	-48.5	-10.9	-2.2	-5.1
Annual percentage growthrate 1964/73	+22.3	+21.1	+21.9	+0.8	+6.2

Source: Tobacco Authority of Tanzania

Note:
1 Provisional
2 Revised
3 Purchase season is normally between February of year under reference and January of subsequent year.
4 Purchase season is normally between July of year under reference and June of subsequent year.
5 Figures include aromatic tobacco which has been discontinued.

APPENDIX TABLE VI

SUGAR PRODUCTION AND CONSUMPTION IN TANZANIA, 1964,1969/73

Calendar Year	Production (Tons)	Consumption Total[3] (Tons)	Consumption Per capita[4] (Kgs)
1964	61,440	62,745	5.60
1969	92,043	88,740	6.88
1970	87,254	107,617	8.13
1971	95,787	125,349	9.20
1972	88,483	136,592[2]	9.74
1973[1]	107,139	148,239	10.28
Percentage change 1972/73	+21.1	+8.5	+5.5
Annual percentage growth-rate 1964/73	+6.4	+10.0	+7.0

Source: Bureau of Statistics

Note: 1 Provisional

2 Revised

3 Including Zanzibar.

4 Population estimates revised.

APPENDIX TABLE VII

CROP HUSBANDRY SUMMARY: MARKETED QUANTITIES OF PRINCIPAL CASH CROPS IN TANZANIA 1969/73

Principal cash crops[3]	1969	1970	1971	1972[2]	1973[1]	Percentage change 1972/73
			(1000 Tons)			
Cotton (lint)[2]	69.4	76.4	65.3	77.6	68.6	-11.6
Coffee (clean)	46.1	49.7	45.8	51.7	54.6	+ 5.5
Sisal	209.3	202.2[2]	181.1	156.8	155.4	- 0.9
Cashewnuts[2]	113.5	111.2	121.5	128.4	139.3	+ 8.5
Tea	8.8	8.5	10.5	12.7	12.7	- 0.4
Tobacco[2] (flue-cured)	8.1	8.9	8.8	10.6	10.8	+ 1.9
Tobacco (fire-cured)	3.5	2.1	3.1	3.6	1.9	-48.5
Sugar (manufactured)	92.0	87.3	95.8	88.5	107.1	+21.1
Pyrethrum (flowers)	3.8	2.3	3.7	4.3	3.5	-18.8

Source: Bureau of Statistics

Note: 1 Provisional

2 Revised

3 Quantities of cotton, cashewnuts and tobacco are based on crop years, rest based on calendar year.

APPENDIX TABLE VIII

CROP HUSBANDRY SUMMARY: VALUE OF MARKETED QUANTITIES IN TANZANIA, 1969/73

Principal cash crops	1969	1970	1971	1972[2]	1973[1]	Percentage change 1972/73
		(Shillings billion)				
Seed cotton[3]	223.3	244.6[2]	217.6[2]	257.8	226.8	-12.0
Coffee	169.8	265.8	231.3	276.5	327.0	+18.3
Sisal	184.8[2]	157.3	142.5	140.6	295.3	+110.0
Cashewnuts	105.6	102.7	113.5	111.5	124.4	+11.6
Tea[4]	52.6[2]	48.5[2]	57.7	69.4	67.4	-2.9
Tobacco (flue-cured)	41.8[2]	45.2	43.6	61.4	61.1	-0.5
Tobacco (fire-cured)	6.2	3.6	5.6	8.5	4.2	-50.6
Sugarcane[5]	39.6	37.8	41.1	34.4	42.0	+22.1
Pyrethrum	14.4	8.6	13.2	15.9	13.0	-18.2

Source: Bureau of Statistics

Note:
1 Provisional
2 Revised
3 Gross value refers to seed cotton and not cotton lint.
4 Derived at ex-estate price.
5 Gross value refers to sugarcane and not manufactured sugar. Derived at revised price.

APPENDIX TABLE IX

OIL SEEDS CROPS: VALUE OF PRODUCTION
IN TANZANIA, 1969/73

Crop	1969	1970	1971	1972[2]	1973[2]	Percentage change 1972/73
	(Shillings million)					
Cotton seed[3]	43.4	52.1	43.0	66.5	49.7	-25.3
Groundnut	28.6	24.9	19.5	30.2	36.4	+20.5
Sesame	12.0	11.2	10.0	9.8	10.6	+8.2
Castor seed	8.7	8.7	7.9	8.9	9.4	+5.6
Sunflower	4.2	2.1	2.3	5.7	6.6	+15.8
Copra[4]	11.4	5.8	7.7	6.2	6.1	-1.6

Source: Bureau of Statistics

Note: 1 Provisional

2 Revised

3 Value of seed sold by Tanzania Cotton Authority.

4 Value of marketed quantities.

APPENDIX TABLE X

MAIZE MARKETED BY NATIONAL AGRICULTURAL PRODUCTS BOARD FOR THE LAST NINE YEARS 1964/65-1973/74[2]

Details	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74[3]
					(In metric tons)					
Stock Brought Forward	77,528	28,917	19,125	64,874	75,218	45,705	22,692	37,394	12,150[1]	-
Local Purchases[4]	87,123	70,015	112,865	104,308	127,502	54,081	184,996	43,987	106,390	73,500
Imports	-	8,805	14,322	-	-	46,921	-	92,283	78,944[1]	-
Local Sales	83,771	89,483	74,752	93,077	104,455	123,374	116,551	160,050	154,020	145,000[5]
Exports	51,117	-	6,438	252	51,837	-	53,427	-	-	-
Loss in Weight	846	871	248	535	723	641	316	479	-	-
Stock Carried Forward	28,917	19,125	64,874	75,218	45,705	22,692	37,394	12,150	51,124[1]	-

- No estimates available
1 Provisional
2 From National Agricultural Products Board (NAPB)
3 Estimates only
4 Made by NAPB to 1972/73 and National Milling Corporation (NMC) thereafter
5 To March 1974. Year ends on June 30

APPENDIX TABLE XI

PADDY RICE MARKETED BY NATIONAL AGRICULTURAL PRODUCTS BOARD FOR THE LAST EIGHT YEARS 1965/66-1973/74[2]

Details[3]	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74[4]
					(In metric tons)				
Stock Brought Forward	3,635	511	5,177	988	11,450	29,162	70,076	57,442[1]	-
Local Purchases	20,581	37,402	30,191	45,711	59,789	93,069	44,580	38,543	38,600
Imports	-	-	-	-	-	-	-	-	-
Local Sales	23,594	31,697	34,379	35,228	41,779	52,145	49,302	63,600[5]	58,500
Exports	-	1,041	-	-	-	-	4,189	10,178[1]	-
Gain (Loss)	(111)	2	(1)	(21)	(298)	(10)	(376)	-	-
Stock Carried Forward	511	5,177	988	11,450	29,162	70,076	57,442	10,122[1]	-

- No estimates available
1 Provisional
2 From National Agricultural Products Board (NAPB)
3 Purchases are as Paddy but sales are as rice. All converted to a rice equivalent at an extraction rate for rice of 65%
4 Estimates only
5 This is a questionable estimate.

APPENDIX TABLE XII

WHEAT MARKETED BY NATIONAL AGRICULTURAL PRODUCTS BOARD AND NATIONAL MILLING CORPORATION FOR THE LAST SIX YEARS 1967/68-1973/74[2]

Details[3]	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74[4]
				(In metric tons)			
Stock Brought Forward	12,047	6,669	7,899	7,851	2,597	17,148[5]	-
Local Purchases	5,037	24,639	20,950	42,868	56,849	51,267	31,500
Imports	13,630	36,701	35,702	11,612	46,116[6]	-	-
Local Sales	24,039	60,107	56,684	59,655	70,587	72,000	90,000[1]
Exports	-	-	-	-	-	3,686[5]	-
Gain (Loss)	(6)	(3)	(16)	(79)	(111)	-	-
Stock Carried Forward	6,669	7,899	7,851	2,597	[illegible]	10,792[5]	-

- No estimates available
1 Provisional, probably high
2 From National Agricultural Products Board
3 Expressed as whole wheat equivalent at an extraction rate for flour of 75%
4 Estimates only
5 Provisional
6 Includes 8,066 metric tons wheat equivalent (6,050 metric tons wheat flour) imported by National Milling Corporation

APPENDIX TABLE XIII

INFANT MORTALITY AND AN ESTIMATE OF EXPECTATION OF LIFE AT BIRTH FOR THE RURAL POPULATION OF THE DISTRICTS AND REGIONS OF TANZANIA

Region and District	Infant Mortality (Deaths per 1000 livebirths)[1]	Implied Expectation of life at birth (Years)[2]
ARUSHA	81	56
Arusha	64	60
Masai	62	61
Mbulu	99	52
Hanang		
COAST	128	45
Bagamoyo	123	46
Kisarawe	119	47
Mafia	120	47
Mzizima	115	48
Rufiji	151	41
DODOMA	136	44
Dodoma	144	42
Kondoa	167	50
Mpwapwa	164	39
IRINGA	170	38
Iringa	154	40
Mufindi	156	40
Njombe	187	35
KIGOMA	131	45
Kasulu	82	56
Kibondo	193	34
Kigoma	157	40
KILIMANJARO	93	53
Kilimanjaro	95	53
Pare	90	54
MARA	168	38
Musoma	159	40
North Mara	184	36
MBEYA	193	34
Chunya	213	32
Mbeya	199	33
Mbozi	193	34

See footnotes at end of table.

TABLE XIII CONTINUED

INFANT MORTALITY AND AN ESTIMATE OF EXPECTATION OF LIFE AT BIRTH FOR THE RURAL POPULATION OF THE DISTRICTS AND REGIONS OF TANZANIA

Region and District	Infant Mortality (Deaths per 1000 livebirths)[1]	Implied Expectation of life at birth (Years)[2]
MBEYA - Con.		
Rungwe	197	34
Sumbawanga	176	37
MOROGORO	151	41
Kilosa	150	41
Morogoro	150	41
Ulanga	155	40
MTWARA	151	41
Kilwa	147	42
Lindi	154	40
Masasi	180	36
Mtwara	171	38
Nachingwea	72	58
Newala	133	44
MWANZA	141	43
Geita	146	42
Kwimba	139	43
Mwanza	136	44
Ukerewe	132	45
RUVUMA	181	36
Mbinga	131	45
Songea	178	36
Tundura	240	28[1]
SHINYANGA	124	46
Kahama	99	51
Maswa	132	45
Shinyanga	125	46
SINGIDA	169	38
Iramba	139	43
Manyoni	184	36
Singida	189	35
TABORA	109	49
Mpanda	116	48
Nzega	108	49
Tabora	110	49

See footnotes at end of table.

TABLE XIII CONTINUED

INFANT MORTALITY AND AN ESTIMATE OF EXPECTATION OF LIFE AT BIRTH FOR THE RURAL POPULATION OF THE DISTRICTS AND REGIONS OF TANZANIA

Region and District	Infant Mortality (Deaths per 1000 livebirths)[1]	Implied Expectation of life at birth (Years)[2]
TANGA	106	50
Handeni	129	45
Korogwe	124	46
Lushoto	81	56
Pangani	103	51
Tanga	97	52
WEST LAKE	146	42
Biharamulo	180	36
Bukoba	119	47
Karagwe	144	42
Ngara	235	29
ZANZIBAR	110	49
Magharib	113	48
South Region	122	46
North Region	142	43
Chake	91	54
Mkoani	92	53
Wete	104	50
TANZANIA RURAL	141	43

Source: I.D. Thomas, Infant Mortality in Tanzania, Department of Geography University of Dar es Salaam (Unpublished paper, 1972).

Note: 'Rural Population' denotes the total population except for those enumerated in the sixteen main towns.

1 Calculated from census data on children born, children surviving, and women by five-year age groups, with the use of North Regional model life tables.
Sources: Tanzania Bureau of Statistics, 1971A
(Coale and Demeny, 1966, p.42.)

2 Obtained by reference to the North Regional model life tables for females (Coale and Demeny, 1966).

APPENDIX TABLE XIV

LAND AREAS OF TANZANIA CLASSIFIED ACCORDING TO POTENTIAL LAND USE[a]

Region	Total Land Area sq.mi.	Percent of Total Land Area in Land Use Category Number[b]								Land in Cereal Grains sq.mi.	% of Total Land Area
		1	2	3	4	5	6	7	8		
Arusha	31,700	6.8	52.9	12.9		9.7	6.8		10.8	261	.82%
Kilimanjaro	5,100	14.3	24.4	6.7		17.6	12.6	6.7	17.6	100	1.96%
Tanga	10,350	3.4	21.6	8.3	8.8	33.3	11.3	6.4	6.4	428	4.13%
Coast	13,050			11.8	48.0	27.1			13.1	57	.44%
Mtwara	31,950			9.8	46.9	34.3	2.9		6.2	525	1.64%
Ruvuma	23,650				60.5	14.2	17.4	5.4	2.5	67	.28%
Morogoro	28,200			4.1	20.2	33.3	20.2	1.6	20.7	135	.48%
Dodoma	15,950		15.8	1.7	38.0	15.4	9.9		19.2	335	2.10%
Iringa	21,950				24.6	20.6	28.9	13.7	12.2	217	.99%
Mbeya	32,100	3.6			13.8	36.3	15.7	8.0	22.5	337	1.05%
Singida	19,050		2.5		60.4	10.9	8.4		17.8	164	.86%
Tabora	47,100			2.2	50.8	20.6			26.5	213	.45%
Shinyanga	19,600		20.8	15.4	27.7	8.7			27.4	77	.39%
Kigoma	14,300				33.7	26.9	5.0		34.4	186	1.30%
Mara	8,400		29.3		34.8		3.7		32.3	227	2.70%
Mwanza	7,600				55.9	19.3	4.1		20.7	226	2.97%
West Lake	11,100				14.5	55.6		11.1	18.8	44	.40%
Totals	341,150									3,599	1.05%

[a] Derived from land use potential map, 1967 Atlas of Tanzania.

[b] Key to categories:

No. 1 - Soils unsuitable for cropping.
No. 2 - Soils where little cropping possible.
No. 3 - Fertile soils where low rainfall or shallow rooting depth limits crop yields.
No. 4 - Soils of very low fertility with moderate potential.
No. 5 - Soils of low to medium fertility with moderate potential.
No. 6 - Soils of medium to high fertility with high potential.
No. 7 - Soils of low fertility in areas of high rainfall.
No. 8 - Various alluvial or colluvial soils of considerable potential but often requiring flood control, drainage, or special management.

Appendix Table XV

PROJECTED ACREAGE OF FOUNDATION SEED AND POTENTIAL MULTIPLICATION OPPORTUNITIES FOR THIS SEED[a]

	Maize		Soybeans	Sorghum	Millet	Wheat	Rice	Barley
	Composite	Isolates						
1973 FOUNDATION SEED								
Acres	500		200	140				
Production, tons	250		100	56				
Carryover, tons	50		--	11.2				
Hold for Foundation Seed planting, tons	10		13.5	2				
Available for Certified planting, tons	190		86.5	42.8				
Provides 1974 Certified:								
Acres	25,333		2,883	5,706				
Production, tons	15,200		1,730	2,853				
Provides 1975 potential Farmer acreage	1,520,000		57,660	380,000				
1974 FOUNDATION SEED								
Acres	1,700	100	600	400	100	475		300
Production, tons	850	12.5	300	160	50	237		150
Carryover, tons	170	3	--	32	10	47.4		30
Hold for Foundation Seed planting, tons	15	9.5	13.5	2	.2	45		7.5
Salvage 1973 carryover, T.	20	--	--	4.4	--	--		--
Available for Certified planting, tons	685	--	286.5	130.4	39.8	144.6		112.5
Provides 1975 Certified:								
Acres	91,330	--	9,550	17,387	15,920	2,892		2,250
Production, tons	54,798	--	5,730	8,693	9,552	1,880		1,350
Provides 1976 potential Farmer acreage	4,981,000	--	191,000	1,159,066	3,820,800	37,600		27,000

(continued)

Appendix Table XV (cont.)

PROJECTED ACREAGE OF FOUNDATION SEED AND POTENTIAL MULTIPLICATION OPPORTUNITIES FOR THIS SEED

	Maize		Soybeans	Sorghum	Millet	Wheat	Rice	Barley
	Composite	Isolates						
1975 FOUNDATION SEED								
Acres	2,550	150	600	400	100	900		200
Production, tons	1,275	19	300	160	50	450		100
Carryover, tons	255	4	--	32	10	90		20
Hold for Foundation Seed planting, tons	11	15	13.5	3	.4	45		7.5
Salvage 1974 carryover, tons	68	--	--	12.8	4	19		12
Available for Certified planting, tons	1,077	--	286.5	137.8	43.6	334		84.5
Provides 1976 Certified								
Acres	143,600	--	9,550	18,373	17,440	6,680		1,690
Production, tons	86,160	--	5,730	9,186	10,464	4,342		1,014
Provides 1977 potential Farmer acreage	7,832,000	--	191,000	1,224,800	4,185,600	86,840		20,280
1976 FOUNDATION SEED								
Acres	1,800	150	600	600	200	900		200
Production, tons	900	19	300	240	100	450		100
Carryover, tons	180	4	--	48	20	90		20
Hold for Foundation Seed planting, tons	9.5	15	18	3.6	.4	45		7.5
Salvage 1975 carryover, T.	102	--	--	12.8	8	18		8
Available for Certified planting, tons	812	--	282	201	87.6	333		80.5
Provides 1977 Certified								
Acres	108,267	--	9,400	26,800	35,040	6,660		1,610
Production	64,960	--	5,640	13,400	21,024	4,329		966
Provides 1978 potential Farmer acreage	5,905,455	--	188,000	1,786,666	8,409,600	86,580		19,320

(continued)

Appendix Table XV (cont.)

PROJECTED ACREAGE OF FOUNDATION SEED AND POTENTIAL MULTIPLICATION OPPORTUNITIES FOR THIS SEED[a]

	Maize		Soybeans	Sorghum	Millet	Wheat	Rice	Barley
	Composite	Isolates						
1977 FOUNDATION SEED								
Acres	1,600	175	800	725	200	900		200
Production, tons	800	22	400	290	100	450		100
Carryover, tons	160	4.5	--	58	20	90		20
Hold for Foundation Seed planting, tons	7.5	17.5	18	3.6	.4	45		5.6
Salvage 1976 carryover, T.	72	--	--	19.2	8	18		8
Available for Certified planting, tons	702	--	382	248	87.6	333		82.4
Provides 1978 Certified:								
Acres	93,600	--	12,733	33,067	35,040	6,660		1,648
Production, tons	56,160	--	7,640	16,533	21,024	4,329		989
Provides 1979 potential Farmer acreage	5,105,455	--	254,667	2,204,400	8,409,600	86,580		19,780
1978 FOUNDATION SEED								
Acres	1,250	200	800	725	200	900	50	150
Production, tons	625	25	400	290	100	450	17.5	75
Carryover, tons	125	5	--	58	20	90	3.5	15
Hold for Foundation Seed planting, tons	7.5	20	22.5	4.5	.4	45	5	3.8
Salvage 1977 carryover, T.	64	--	--	19.2	8	18	--	8
Available for Certified planting, tons	556	--	377.5	247	87.6	333	9	64.2
Provides 1979 Certified:								
Acres	74,133	--	12,583	32,933	35,040	6,660	180	1,284
Production, tons	44,480	--	7,550	16,466	21,024	4,329	99	770
Provides 1980 potential Farmer acreage	4,043,636	--	251,667	2,195,466	8,409,600	86,580	1,980	15,400

Footnote on next page.

Appendix Table XV

PROJECTED ACREAGE OF FOUNDATION SEED AND POTENTIAL MULTIPLICATION OPPORTUNITIES FOR THIS SEED[a]
(footnote)

[a]Figures used in computations:

	FOUNDATION		CERTIFIED		Farmers
	Seeding rate lbs./acre	Est. production lbs./acre	Seeding rate lbs./acre	Est. production lbs./acre	Seeding rate lbs./acre
Composite maize	12	1,000	15	1,200	22
Soybeans	45	1,000	60	1,200	
Sorghum	10	800	15	1,000	
Millet	4	1,000	5	1,200	
Wheat	100	1,000	100	1,300	
Rice	100	700	100	1,200	

Carryover seed stocks for emergency--20% of production for grasses, none for soybeans.
Salvage for seed purposes of carryover stocks--40% of total.

APPENDIX TABLE XVI

EMPLOYMENT IN AGRICULTURE IN TANZANIA (1971)[a]

Region	Regular Workers		Casual Workers			Total No. Workers All Sectors	
	No.	Earnings shs/mo.	No.	Man Days	Earnings shs/day	Regular	Casual
Arusha	7,700	167	3,912	72,110	3.78	19,844	6,899
Coast	2,019	222	971	22,031	5.21	16,275	2,894
Dodoma	324	356	389	7,135	7.13	8,346	2,107
Iringa	7,839	143	2,641	60,128	4.30	16,835	4,949
Kigoma	414	275	141	1,620	5.79	4,986	1,109
Kilimanjaro	7,468	233	5,453	93,543	4.59	20,904	9,190
Mara	304	481	177	3,465	4.88	6,423	749
Mbeya	4,530	189	4,087	670,321	3.59	14,381	6,212
Morogoro	11,652	239	5,421	137,031	5.17	25,026	7,963
Mtwara	1,358	252	1,733	28,017	5.26	11,634	5,381
Mwanza	721	326	437	4,611	6.13	14,661	4,382
Ruvuma	207	344	279	5,453	5.18	4,562	627
Shinyanga	191	324	30	780	5.40	7,755	1,295
Singida	231	342	25	505	6.86	4,715	1,139
Tabora	758	347	287	8,652	6.02	10,544	2,741
Tanga	22,879	195	10,274	205,295	5.69	40,230	13,247
West Lake	2,245	123	893	23,327	5.40	9,266	1,960
Dar es Salaam	788	501	193	3,314	7.74	65,684	17,587

[a]From Regional Statistical Abstract 1968-1971.

APPENDIX TABLE XVII

ESTIMATED VEHICLE OPERATING COSTS FOR DIFFERENT ROAD SURFACES AND TERRAIN 1971[a]

Surface and Terrain	Trucks Tanz. cents/km
Flat to rolling terrain:	
Bitumen	81.81
Engineered gravel	109.79
Improved earth	123.78
Earth	219.41
Rolling to hilly:	
Bitumen	82.66
Engineered gravel	115.74
Improved earth	132.28
Earth	232.91
Hilly to mountainous:	
Bitumen	90.44
Engineered gravel	128.01
Improved earth	146.80
Earth	262.72

[a]From Vol. II, Economic and Engineering Study, Tanzania Highway Maintenance and Organization.

APPENDIX TABLE XVIII
TRENDS IN PRODUCTION, PROCESSING, AND UTILIZATION OF MAIZE IN TANZANIA, 1968-1971[a]

Crop	1968	1969	1970	1971
Maize				
a) Area harvested (ha.)	1,014,000	1,014,000	1,015,000	1,015,000
b) Production (metric tons)	664,440	525,280	637,000	530,445
Imports	2,095	23,358	25,626	22,816
From stocks, net	80,000	70,000	--	--
Total supply	746,535	618,638	662,626	553,261
Exports	31,505	28,251	24,416	29,669
Direct feed, 3%	22,396	18,559	19,879	16,598
c) Processed	635,027	520,596	564,900	459,231
Waste	37,327	30,932	33,131	27,663
Flour (input)	627,027	512,596	556,900	451,231
Bran (output)	94,054	76,889	83,535	67,685
Bran (import)	2,000	--	--	--
Bran (export)	22,295	18,031	5,355	7,866
Bran (direct feed)	73,759	58,858	78,180	59,819
Flour (output)	583,135	476,714	517,917	419,645
Flour (imports)	2,820	1,642	4,137	2,340
Flour (total supply)	585,355	478,356	522,054	421,985
Flour (export)	--	--	--	--
Flour (direct food)	585,355	478,356	522,054	421,982
Beer (input)	8,000	8,000	8,000	8,000
Beer (output)	40,000	40,000	40,000	40,000
Beer (direct food)	40,000	40,000	40,000	40,000
d) Seed	20,280	20,300	20,300	20,300

[a]Data from Accounting Worksheets, FAO.

APPENDIX TABLE XIX
TRENDS IN PRODUCTION, PROCESSING AND UTILIZATION
OF WHEAT IN TANZANIA, 1968-1971[a]

Crop	1968	1969	1970	1971
Wheat				
a) Area harvested (ha.)	33,534	31,390	49,000	51,000
b) Production (metric tons)	44,298	38,706	61,000	62,000
Imports	36,013	9,765	19,530	19,018
From stocks, net	--	20,069	--	--
Total supply	80,311	68,540	80,530	81,018
To stocks, net	18,233	--	8,484	--
Exports	--	5	--	--
c) Flour (input)	57,333	62,264	65,333	74,198
Waste	1,606	1,371	1,611	1,620
Bran (direct feed)	18,187	14,090	15,027	17,066
Flour (output)	43,000	46,698	49,000	55,650
Flour (imports	8,933	5,316	9,295	3,803
Flour (total supply)	51,933	52,014	58,295	59,453
Flour (exports)	27	27	3	74
Flour (direct food)	51,906	51,987	58,292	59,379
d) Seed	3,139	4,900	5,100	5,200

[a]Data from Accounting Worksheets, FAO.

APPENDIX TABLE XX

TRENDS IN PRODUCTION, PROCESSING, AND UTILIZATION OF RICE IN TANZANIA, 1968-1971[a]

Crop	1968	1969	1970	1971
Rice				
a) Area harvested (ha.)	128,000	129,000	151,000	153,000
b) Production (metric tons)	136,000	144,000	1 2,000	185,000
Imports and exports	--	--	--	--
c) Processed for polished rice	123,030	128,970	166,410	169,200
Waste	1,360	1,440	1,820	1,850
Bran	12,303	12,897	16,641	16,920
Bran (direct feed)	110,727	116,073	149,769	152,280
Polished rice (output)	79,970	83,831	108,167	109,980
Polished rice (imports)	15,131	8,005	7,272	9,951
Polished rice (total supply)	95,101	91,837	115,439	119,931
Polished rice (to stocks, net)	4,000	22,000	50,000	50,000
Polished rice (exports)	103	--	489	4,183
Polished rice (direct food)	90,998	69,837	64,950	65,748
d) Seed	11,610	13,590	13,770	13,950

[a]Data from Accounting Worksheets, FAO.

APPENDIX TABLE XXI
TRENDS IN PRODUCTION, PROCESSING, AND UTILIZATION OF SORGHUMS IN TANZANIA, 1968-1971[a]

Crop	1968	1969	1970	1971
Sorghum				
a) Area harvested (ha.)	118,000	115,000	86,000	86,000
b) Production (metric tons)	153,000	126,000	107,000	107,000
Direct feed, 2%	3,060	2,520	2,140	2,140
c) Processed	132,915	109,590	92,870	92,870
Waste	15,300	12,600	10,700	10,700
Flour (input)	56,915	46,590	39,870	39,870
Bran (output	2,846	2,330	1,994	1,994
Bran (direct feed)	2,846	2,330	1,994	1,994
Flour (output)	54,069	44,260	37,876	37,876
Flour (direct food)	54,069	44,260	37,876	37,876
Beer (input)	76,000	63,000	53,000	53,000
Beer (output)	380,000	315,000	265,000	265,000
Beer (direct food)	380,000	315,000	265,000	265,000
d) Seed	1,725	1,290	1,290	1,290

[a]Data from Accounting Worksheets, FAO.

APPENDIX TABLE XXII
TRENDS IN PRODUCTION, PROCESSING, AND UTILIZATION OF MILLETS IN TANZANIA, 1968-1971[a]

Crop	1968	1969	1970	1971
Millets				
a) Area harvested (ha.)	122,000	127,000	129,000	129,000
b) Production (metric tons)	122,000	110,000	138,000	138,000
Imports	1,422	2,595	2,346	209
Total supply	123,422	112,595	140,346	138,209
Exports	2,760	5,969	6,690	9,178
Direct feed, 2%	2,468	2,252	2,807	2,766
c) Processed	104,022	91,179	114,879	110,496
Waste	12,342	11,260	14,035	13,821
Flour (input)	42,311	34,881	44,706	41,391
Bran (output)	2,116	1,744	2,241	2,070
Bran (direct feed)	2,116	1,744	2,241	9,070
Flour (output)	40,195	33,137	42,465	39,321
Flour (direct food)	40,195	33,137	42,465	39,321
Beer (input)	61,711	56,298	70,173	69,105
Beer (output)	308,555	281,490	350,865	345,525
Beer (direct food)	308,555	281,490	350,865	345,525
d) Seed	1,830	1,935	1,935	1,950

[a]Data from Accounting Worksheets, FAO.

Appendix Table XXIII

TRENDS IN PRODUCTION, PROCESSING, AND UTILIZATION OF SOYBEANS IN TANZANIA, 1968-1971[a]

Crop	1968	1969	1970	1971
Soybeans				
a) Area harvested (ha.)	600	2,000	870	900
b) Production (metric tons)	147	406	348	350
Imports	13	--	--	--
From stocks, net	100	--	--	300
Total supply	260	406	348	650
Exports	--	183	98	418
c) Waste	8	20	17	18
Direct food	162	164	192	173
d) Seed	90	39	41	41
e) Oil imports	266	715	1,465	815
Direct food	266	715	1,465	815

[a]Data from Accounting Worksheets, FAO.

Appendix Table XXIV

ESTIMATED ACREAGES OF SELECTED CROPS IN TANZANIA BY 1979[a]

Crop	Acreage
Maize	4,000,000
Sorghum	2,000,000
Millet	2,000,000
Soybeans	1,000,000
Rice	1,000,000
Cowpeas and eatable beans	1,000,000
Wheat	600,000
Oil crops	1,000,000
Total acres	12,600,000

[a]Projection made by Production Division, Kilimo, to produce a reasonable supply of food for Tanzania with a population increase in excess of 3% per year.

APPENDIX TABLE XXV

APPROXIMATE PRODUCTION AND SALES OF CEREAL GRAIN SEED AND PRODUCTION INTENTIONS FOR CROPPING SEASONS 1970-71 THROUGH 1973-74 IN TANZANIA

Crop	Producer	Tons of seed 1970-71	1971-72	1972-73	Intentions 1973-74
Maize	MOA farms	519.3	593.0	412.5	484.4
	Seed project	--	11.3	237.5	430.0
	T. Wattle Co.	120.0	170.0	440.0	450.0
	T. Farmers Assn 1/	312.14	209.64	394.29	750.0
Wheat	MOA farms	40.5	117.3	82.9	513.0
	Seed project	--	--	17.1	540.0
	T. Wattle Co.	400.0	260.0	220.0	250.0
	T. Farmers Assn 2/	18.0	18.0	18.0	3.0
Sorghum	MOA farms	15.2	16.1	4.4	8.2
	Seed project	--	38.6	3.3	16.0
Rice	MOA farms	600	600	600	600

1/ Estimated sales; part seed produced near Arusha and part from Kenya Seed Co., Kitale.

2/ Estimated sales from seed produced near Arusha.

NOTE: MOA farms means Ministry of Agriculture farms
T. Wattle Co. menas Tanzania Wattle Company
T. Farmers Assn. means Tanzanian Farmers Association

APPENDIX TABLE XXVI

MINISTRY OF AGRICULTURE
TRAINING INSTITUTES (MATI)

MATI	Course	Capacity
Mpwapwa	Veterinary	200
Mbeya	Agric. & Veterinary	500
Ukiriguru	Agriculture	250
Nyegezi	Agriculture	200
Tengeru	Dairy Husbandry	100
Maruku	Tea	100
Tumbi	Tobacco	100
Ilonga	Nutrition	80
Mlingano	Agriculture	200
Mtwara	Agriculture	200
Temeke	Veterinary Lab. Technology	20
Lyamungu	Horticulture (diploma)	20
Mkata	Ranch Management (diploma)	30

Source: Ministry of Agriculture
Kilimo Livestock Development Conference
February, 1974

APPENDIX TABLE XXVII

ESTIMATED REQUIREMENT FOR TRAINED AGRICULTURE PERSONNEL 1972-1980 BASED ON RATIOS

	Citizens Employed 1972	Additional Required 1973-1980	Manpower Numbers 1980	Average Annual Increase in Percentage
Graduate				
Agric.(General)[1]	99	221	320	28%
Agric.(Research)	54	104	158	24%
Vety.(General)	65	247	312	45%
Vety.(Research)	18	14	32	10%
Other	84	174	258	26%
	320	760	1080	
Diploma				
Field Officer(Agric.)Gen.[2]	383	257	640	8%
Field Officer(Agric.)Res.	147	169	316	14%
Field Officer(Vety.)Gen.	106	584	690	69%
Field Officer(Vety.)Res.	20	44	64	28%
Other	97	201	298	26%
	753	1255	2008	
Certificate				
Assistant Field Officer (Agric.)[3]	2008	4392	6400	27%
Assistant Field Officer (Veterinary)	672	2778	3450	52%
Other	446	920	1366	26%
	3126	8090	11216	

Ratios[4] Agric. Officers to families = 1 Senior Officer: 2 Agric. Assistant: 20 AFO: 10,000 Population

Veterinary Officers to livestock = 1 Senior Officer: 2 Vety. Asst.: 10 VFO: 50,000 Population

ESTIMATED REQUIREMENT OF TRAINED AGRICULTURE MANPOWER FOR 1972-1980 BASED ON 9 PERCENT FINANCIAL CONSTRAINT OF EXPENDITURE ON PERSONNEL

	1972 Employment	Additional Nos required 1973-80	Manpower Stock 1980
Graduate			
Agricultural Officer(General)[5]	99	71	170
Agricultural Officer(Research)	54	38	92
Veterinary Officer (General)	65	41	106
Veterinary Officer(Research)	18	12	30
Other	84	64	148
	320	226	546

continued

APPENDIX TABLE XXVII CONTINUED

ESTIMATED REQUIREMENT OF TRAINED AGRICULTURE MANPOWER FOR 1972-1980 BASED ON 9 PERCENT FINANCIAL CONSTRAINT OF EXPENDITURE ON PERSONNEL

	1972 Employment	Additional Nos. required 1973-80	Manpower Stock 1980
Diploma			
Field Officer(A - Gen.)[6]	383	278	661
Field Officer(A - Res.)	147	107	254
Field Officer(V - Gen.)	106	77	183
Field Officer(V - Res.)	20	14	34
Other	97	70	167
	753	546	1299

NOTE: [1]Read Agric.(General) as Agriculture General
Agric.(Res.) as Agriculture Research
Vety.(General) as Veterinary General
Vety.(Res.) as Veterinary Research

[2]Read F.O.(Agric.) Gen. as Field Officer Agriculture General
F.O.(Agric.) Res. as Field Officer Agriculture Research
F.O.(Vety.) Gen. as Field Officer Veterinary General
F.O.(Vety.) Res. as Field Officer Veterinary Research

[3]Read A.F.O.(Agric.) as Assistant Field Officer Agriculture
A.F.O.(Vety.) as Assistant Field Officer Veterinary

[4]Read The ratio presents the number of senior officers: to the number of assistants: to the number of field officers: to the number of families or the amount of livestock.

[5]Read A.O.(General) as Agriculture Officer General
A.O.(Research) as Agriculture Officer Research
V.O.(General) as Veterinary Officer General
V.O.(Research) as Veterinary Officer Research

[6]Read F.O.(A - Gen.) as Field Officer Agriculture General
F.O.(A - Res.) as Field Officer Agriculture Research
F.O.(V - Gen.) as Field Officer Veterinary General
F.O.(V - Res.) as Field Officer Veterinary Research

SOURCE: Ministry of Agriculture, Kilimo Livestock Development Conference, February, 1974.

APPENDIX TABLE XXVIII

MANPOWER REQUIREMENT BASED ON RATIOS

	Numbers 1972	Of whom Expatriate	Number required	OUT PUT REQUIREMENTS To cover net increase	To cover Expatriate	To cover Attrition	Total
Graduate							
Agric. Officer (Gen.)[1]	99	26	320	221	26	20	267
Agric. Officer (Res.)[1]	54	21	158	104	21	11	135
Vety. Officer (Gen.)[1]	65	24	312	247	24	13	284
Vety. Officer (Gen.)[1]	18	6	32	14	6	4	24
Other	84	10	258	174	10	17	201
	320	87	1080	760	87	65	911
Diplomat							
Field Officer (A) Gen.[2]	383	11	640	257	11	57	325
Field Officer (A) Res.[2]	147	--	316	169	--	22	191
Field Officer (V) Gen.[2]	106	3	690	584	3	16	603
Field Officer (V) Res.[2]	20	--	64	44	--	3	47
Other	97	--	298	201	--	15	216
	753	14	2008	1255	14	113	1382
Certificate							
Asst. F.O. (A)[3]	2008	--	6400	4392	--	101	4493
Asst. F.O. (V)[3]	672	--	3450	2778	--	34	2812
Other	446	--	1366	920	--	52	942
	3126	--	11216	8090	--	157	8247

Attrition - 5% A.F.O., 15% Diplomat , and 20% Graduate.
Increase for other - 15% Annually.

NOTE: [1]Read Agric. Officer (Gen) as Agricultural Officer General, Agric. Officer(Res)as Agricultural Officer Research; Vety. Officer (Gen) as Veterinary Officer General, Vety. Officer (Res) as Veterinary Officer Research

[2]Read Field Officer (A) Gen. as Field Officer Agriculture General, Field Officer(A)Res. as Field Officer Agriculture Research; Field Officer(V) Gen. as Field Officer Veterinary General, Field Officer (V) Res. as Field Officer Veterinary Research

[3]Read Asst. F.O.(A) as Assistant Field Officer Agriculture, Asst. F.O.(V) as Assistant Field Officer Veterinary

SOURCE: Ministry of Agriculture, Kilimo Livestock Development Conference, February, 1974.