Appendix C

Land Use and Agriculture

THE STUDY
ON
THE NATIONAL IRRIGATION MASTER PLAN
IN
THE UNITED REPUBLIC OF TANZANIA

MASTER PLAN

APPENDIX C

LAND USE AND AGRICULTURE

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LAND USE AND AGRICULTURE

CHAPTER 1 LAND USE AND FARMING SYSTEM

1.1 Land Use

1.1.1 Present Land Use

(1) Available Data on Land Use and Crop Production

The most obvious problem on land use and crop production statistics in Tanzania is multiple and conflicting statistics issued by different government agencies.

As for land use, efforts have been made to map land cover types in Tanzania but in most cases the maps are not sufficiently detailed. In 1994 the Ministry of Natural Resources and Tourism (MNRT) launched a mapping project as a part of Forest Resources Management Project covering the whole country by using Landsat satellite images. Since the result of this project provides the most up-to-date land cover of the whole country, these data were utilized as basic data on the present land use for the current study.

Statistics on cultivated area and production for major crops are produced by the Crop Monitoring and Early Warning Unit (CMEWU) of the Ministry of Agriculture and Cooperatives (MAC), the Agricultural Statistical Unit (ASU) of the MAC, and the National Accounts Section of the National Bureau of Statistics (NBS). The wide variation on the data was observed and the credibility of each source was precisely examined in the Report of "Agriculture in Tanzania Since 1986". Since the ASU production data were utilized to discuss the crop production performance in the report, the same data were also utilized for the current study on NIMP.

There is a series of sample survey on agriculture including household characteristics, cultivated area and crop production. These are National Sample Census of Agriculture (NSCA) on 1994/95, Expanded Agricultural Survey (EAS) on 1995/96 and 1996/97, Integrated Agricultural Survey (IAS) on 1997/98 and District Integrated Agricultural Survey (DIAS) on 1998/99. The data on household characteristics in this series of sample survey were utilized for the current study.

(2) General Land Use

According to the land use data obtained through the above mentioned mapping project, the present land use is categorized into eight major land types, namely; forests, woodland, bushland, grassland, cultivated land, open land, water features and others. Table 1.1.1 shows the distribution of land cover in the mainland of Tanzania. The summary table is as shown below. Total of forest and woodland occupies more than 40% of the total land area of mainland. In some regions such as Mara and Mwanza, the area covered by forest and woodland is less than 10%. The cultivated land occupies about 10% of the land area that is equivalent to 10 million ha. About 40% of the land is cultivated in DSM and Mtwara. In the regions such as Kigoma, Lindi, Rukwa and Singida, on the other hand, the cultivated land occupies less than 5% of the area. Bushland and grassland occupies around 20% of the total land area respectively.

Distribution of Land Cover in Tanzania Mainland

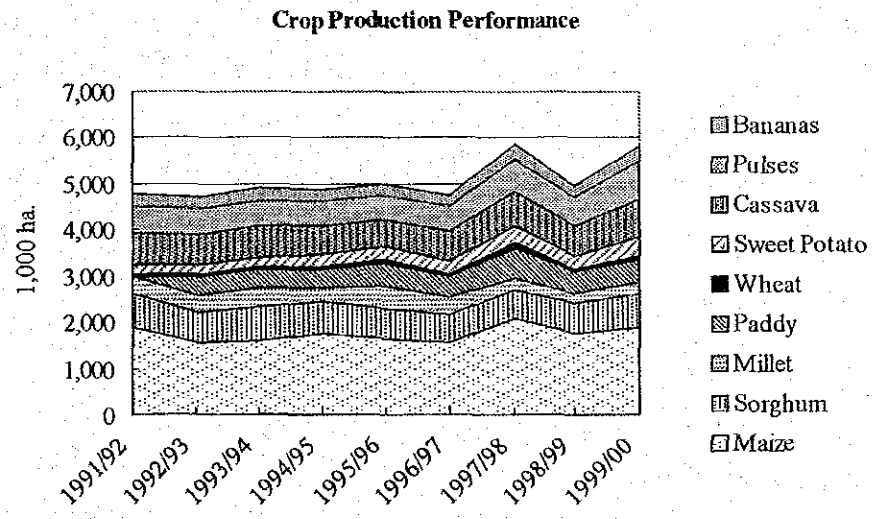
Land Cover	Area in 1,000 ha.	Percentage
Forest	2,697.5	2.8
Woodland	37,629.3	39.7
Bushland	17,390.4	18.3
Grassland	19,472.0	20.5
Cultivated Land	10,065.1	10.6
Open Land	131.6	0.1
Water Features	7,392.2	7.8
Others	67.9	0.1
Total	94,846.0	100.0

Source: National Reconnaissance Level Land Use and Natural Resources Mapping Project, Final Report 1997

Table 1.1.2 shows the distribution of so-called protected areas such as forest reserves, game reserves, national parks and conservation areas in each region and the geographical distribution is shown on Fig.2.3.1 in Appendix-E. These areas occupy nearly 30% of the whole area of the country and contribute to the promotion of the tourism industry. In regions like Rukwa, Shinyanga and Singida, these areas constitute nearly 50% of the total land. These protected areas should carefully be conserved according to the proper natural resource management policy.

(3) Crop Production

Table 1.1.3 shows the changes of planted area, production and average yield for major crops between 1991 and 2000 obtained from "Basic Data, Agriculture and Livestock Sector" prepared by ASU of the MAC. The main food crops grown in the country are maize, sorghum, millet, paddy, wheat, sweet potato, cassava, pulses and bananas. Of the food crops grown, maize is the dominant crop with the planted area of over 1.5 million ha. during recent years. Sorghum is the second largest food crop with the planted area of 0.6 to 0.7 million ha. The planted area of paddy is increasing from less than 0.4 to more than 0.5 million ha. within these several years. Wheat is grown mainly on large farms in several regions. Roots and tubers such as cassava and sweet potato and also pulses such as beans, pigeon pea and cow pea are important food crops as a part of major staples and substantial areas are utilized for these crops. The change in production area for the major food crops during the last 10 years is shown as below. The yields of these food crops are generally low due mainly to the dependence on rain-fed agriculture and therefore fluctuate because of unstable rainfall. Cash crops grown are sugarcane, coffee, tea, tobacco, sisal, cotton, cashew and pyrethrum. There is considerable variation in cultivation areas from crop to crop. The main producing areas of coffee are Kilimanjaro and Kagera. Tea is mainly grown in Iringa, Tanga and Mbeya. Tobacco is grown in areas with low rainfall and sandy soils. Shinyanga and Mwanza produce over 80%[1] of Tanzanian cotton.

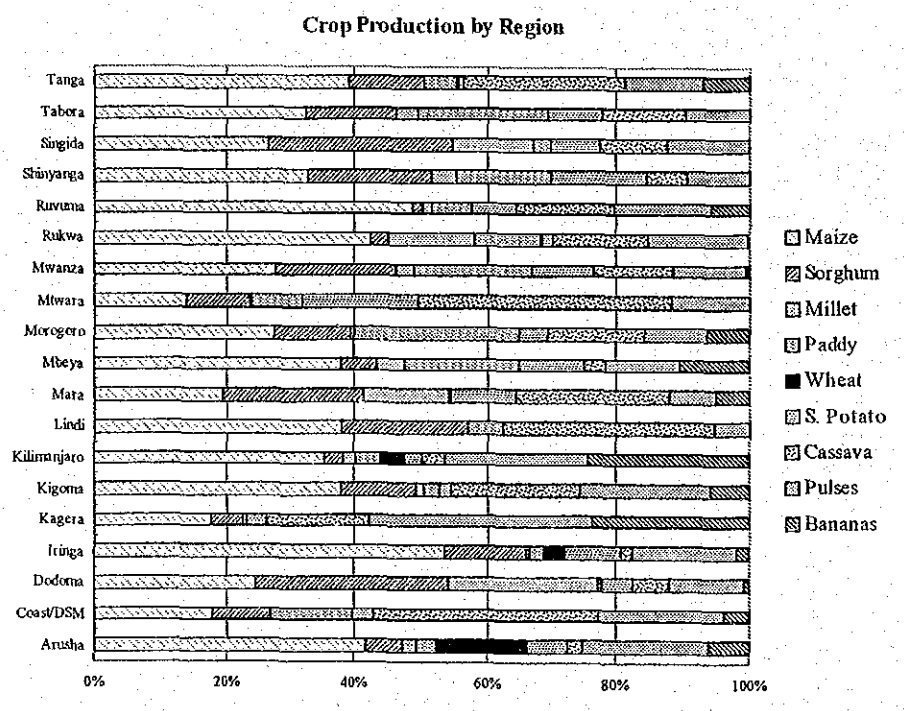


Source: Basic Data Agricultural and Livestock Sector 1992/93-1999/2000

[1] *Agriculture in Tanzania Since 1986, Follower or Leader of Growth?*

In addition to such major crops, Tanzania's climatic growing conditions are favorable for the production of a wide range of fruits, vegetables and even flowers. The most important fruits include pineapples, passion fruits, citrus fruits, mangoes, peaches, pears and bananas. While vegetables include tomatoes, spinach, cabbages and okra.

The cropping pattern varies considerably from region to region as shown in Table 1.1.4. Maize dominate the cropping in most of the regions accounting for more than 50% of the food crop area in Iringa. Sorghum, with its drought resistant characteristics, dominates in dry regions such as Dodoma and Singida. Quite considerable part of the land area is allocated for paddy in Morogoro, Tabora, Mwanza and Mbeya. Similarly, cassava is important in Mtwara, Coast and Lindi and also pulses are important in Kagera.



Source: Basic Data Agricultural and Livestock Sector 1992/93-1999/2000

(4) Livestock and Rangeland

Livestock sector plays a significant role in Tanzania and cattle, goats and sheep are the major types of livestock raised by agricultural holders. Table 1.1.5 shows the estimated number of livestock by regions in the year 1998. The total number of cattle, goats and sheep is 13, 11, and 3.5 million heads respectively. It is obvious that livestock activities are important in regions such as Arusha, Shinyanga and Mwanza. According to the results of DIAS 1998/99, an average

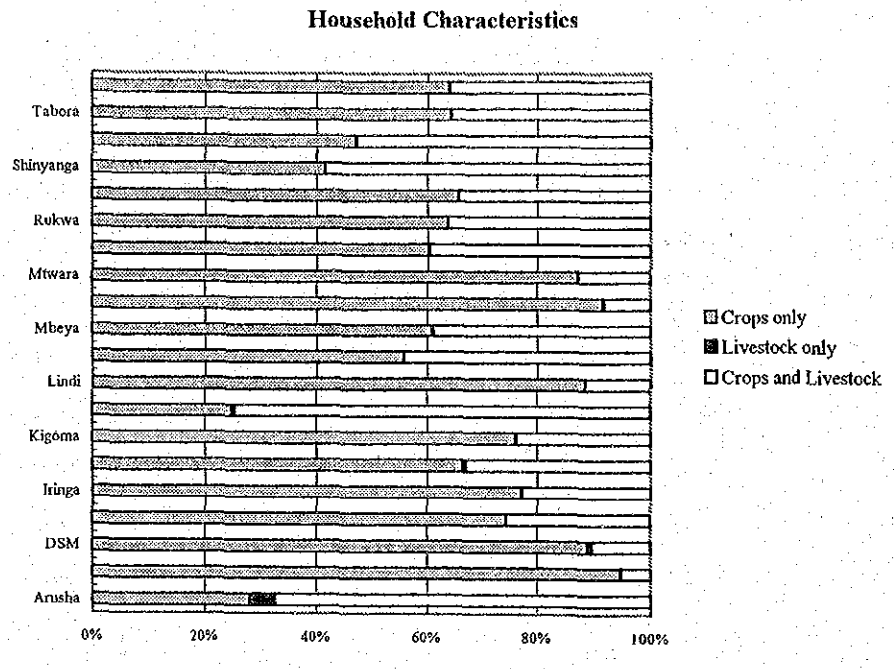
heads per one agricultural holder is 10, 7, 5.5 for cattle, goats and sheep respectively.

As for grazing land, statistics are not reliable as shown in Table 1.1.6. Because in some regions like Arusha and Mara, the land used for grazing is larger than the total land area. There are substantial areas for grazing that are unsuitable because of tsetse infestation. It is estimated that 25% of the grazing areas are affected by tsetse fly. The population increase has to some extent resulted into an expansion of agriculture into marginal lands, many of them being drier or seasonally flooded areas, which are important grazing areas for pstoralists. Particularly in drier regions such encroachments have resulted into a reduction of land available for pastoralists, who responded by moving into new areas with previously low livestock population, thus creating land use conflicts in the receiving areas.

(5) Household Characteristics

Table 1.1.7 shows agricultural households by type of holding from 1993/94 to 1998/99. The total number of households increased over the period of 1993/94-1998/99 with an annual average increase of 4.5%. Out of the total agricultural households in 1998/99, 64% were involved in growing crops only, 36% were involved in growing crops and raising livestock while only 0.4% raised livestock only. As for the sex of household head, male-headed households accounted for about 80% of the total households during the survey period constantly.

Table 1.1.8 shows the number of agricultural holdings by type of holdings and region. According to the results, the regions including Coast, Lindi, Morogoro and Mtwara depend heavily on crop production. In the regions such as Arusha, Kilimanjaro and Shinyanga, on the other hand, livestock activity plays rather important role as shown below.



Source: District Integrated Agricultural Survey 1998/99

The total planted area and number of holdings in each region are shown in Table 1.1.9. The average planted area per holding is 1.76 ha. ranging from 0.94 ha. in Kigoma to 3.00 ha. in Shinyanga. This average area per holding is distributed into 2.5 plots in average and the average area per plot is 0.7 ha.

1.1.2 Land Tenure

Uncertainty and insecurity of land tenure for many rural households causes their reluctance to invest in land improvements. Most farming systems in Tanzania still do not use adequate external inputs and fertility is mainly restored through fallows. However, such restored fertility is steadily reduced by population pressure and also by the aforementioned insecurity of land tenure. Soil erosion is consequently spreading throughout all parts of the country. The reform of land tenure system and land use legislation is urgently needed in order to minimize the land use conflict and the degradation of land resources.

Most of the cultivated area is now used for small-scale farming by land holders who cultivate the land mainly under customary tenure. The land policy became necessary due to (i) competition for plots especially in and around urban centers, (ii) demand for grazing land created serious soil erosion problem, (iii) extension of cultivation to marginal land areas and (iv) increased movement of large herds of livestock is creating land use conflicts. Furthermore, the evolution of

customary tenure towards more individualized ownership has been accompanied by the development of land markets especially in areas with high agricultural potential. The national land policy was prepared in order to (i) promote an equitable distribution of and access to land by all citizens, (ii) ensure that existing rights in land especially customary rights of small holders, (iii) promote sound land information management and (iv) protect land resources from degradation for sustainable development. Two acts of "Land Act" and "Village Land Act" were designed to provide new basic land law for the mainland of Tanzania. Since the majority of land holding falls within the class of named "village land", the Village Land Act is more important and the most important changes as to how rights in land may be owned and how tenure will be administered is set out.

1.1.3 Land Resources for Irrigation Development

(1) Area Suitable for Cropping and Grazing

As already mentioned, the percentage of cultivated area varies from region to region ranging from 38.4% in Mtwara to 2.7% in Kigoma excluding Dar es Salaam. However, when looking at land classified as suitable for cropping, it is said that there is over 7 million[2] ha. of land suitable for cropping which is unused. Such an unused cultivable land is mainly distributed in regions including Ruvuma, Iringa, Mbeya, Rukwa and Morogoro. In the regions such as Dodoma, Singida and Kilimanjaro, on the other hand, their suitable area is almost fully utilized. It is thus deemed that Tanzania has comparatively abundant land resources unlike most of its neighboring countries.

It is also mentioned previously, livestock activities are important in some of the regions and the grazing land should be managed properly in such regions. Expansion of cropping area, however, is likely to be into areas presently utilized as grazing area. This could result in conflict with pastoralists and this point should always be considered for the expansion of cropping area.

The suitable area for cropping and grazing, however, is not precisely defined based on the appropriate criteria. It will be an important task to define on regional or district basis how much suitable land for cropping and grazing is available for future agricultural development. Since the districts with lower population density have generally poorer soil and lower rainfall, any strategy to develop agriculture would need to enhance technologies for sustainable land management including irrigation technology.

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[2] *Tanzania Agriculture: Performance and Strategies for Sustainable Growth, February 2000*

(2) Irrigated Land and Area Suitable for Irrigation

There are various data on irrigated land in Tanzania. One of these data is shown in Table 1.1.10 obtained from "Basic Data Agriculture and Livestock Sector 1992/93-1998/99". According to this information, about 33% of cultivated land is actually utilized for crop production as planted land. Only 6% of the planted land which is equivalent to about 200,000 ha. is being irrigated. This figure was confirmed by the results of the inventory survey currently carried out under this study. The substantial areas were managed by small holder farmers through traditional irrigation systems of flood recession or water harvesting. When the other available information is considered, it is said that around 157,000 ha[3]. is developed or improved for irrigation up to now. The total irrigation potential is so far estimated as 1 million[4] ha. This estimation was also confirmed by the results of the inventory survey of the current study. Similar to the suitable area for cropping and grazing, the irrigation potential is not precisely defined based on the appropriate criteria. Therefore, it will be also an important task to define accurate irrigation potential on regional or district basis.

1.2 Farming System

1.2.1 Crop Based Farming Systems

The National Coordination Unit for Farming Systems Research of the Department of Research and Training of the MAC carried out the zonation of crop based farming systems based on the agro-ecological zones as shown in Table 1.2.1. A coding system was developed with the first letter representing geographical zone; next a number representing the altitude class; next a letter representing the rainfall class and lastly a number indicating whether a further subdivision was made due to crop combinations. For example, C-3B1 means: C for central zone, 3 for altitude range 1,000-1,500m, B for semi-arid (500-800mm) and 1 designating that there are several farming systems in the same condition. Zone, altitude and rainfall classes are shown in the table below.

[3] *Tanzania Agriculture: Performance and Strategies for Sustainable Growth, February 2000*
[4] *The National Irrigation Development Plan, October 1994*

Zone, Altitude and Rainfall Classes

Zone		Altitude		Rainfall	
C	Central	1	0-500m (Lowlands)	A	<500mm (Arid)
E	Eastern	2	500-1,000m (Low intermediate)	B	500-800mm (Semi-arid)
L	Lake	3	1,000-1,500m (High intermediate)	C	800-1,000mm (Moderately wet)
N	Northern	4	1,500-2,000m (Highlands)	D	1,000->1,500mm (Wet)
S	Southern	5	>2,000m (Very high)		
SH	S. Highlands				
W	Western				

Source: Variety Preference Survey Results, National Coordination Unit for Farming System Research

Variety preference survey was then carried out through on-farm testing and evaluation of varieties with farmers. The result of this survey can provide the researchers and farmers with valuable information on suitable varieties for respective zones. This result is also useful to understand the diversity of farming systems and interaction with farmer's variety choice. Furthermore, farmer strategies on variety selection according to land use type, purpose of production either home consumption or sale, implications to labor were also clarified.

1.2.2 Farm Management

Small-scale subsistence farming is dominant in Tanzania due mainly to the reliance on hand hoes as main cultivating tool. Another weakness in present cropping is heavy reliance on rain-fed agriculture. Such a conventional low-input and low-output production systems together with population increase have resulted in high rates of soil degradation due mainly to reduced fallow period. Since the most important factors affecting the productivity of crops are vegetative cover, soil organic matter contents, nutrient availability, water availability and root development, inappropriate land husbandry practices can be considered as one of the main causes of low productivity in Tanzania. Therefore, an appropriate soil and land management will play a crucial role in enabling the agricultural sector to be promoted. The government should formulate strategic plans so that farmers are encouraged to be involved in sustainable agricultural production practices including proper land management. In this context, the irrigation development can contribute to an appropriate soil and land management not only through stable supply of irrigation water to the field but also through flood control, erosion control, augmentation of underground water resources and so on.

Due to heavy reliance on rain-fed agriculture, there are 2 production systems according to the seasonal types. There are 2 seasonal types of rainfall modes. The first type is the unimodal type and the rainfall is usually from October/November to April in central, southern and southwestern highlands. The second type is bimodal type which occurs in the coast belt, northeastern highlands and Lake Victoria Basin. The bimodal type comprises 2 seasons, the short rains (Vuli) falls from October to December. The long rains (Masika) falls from March to June. The production systems depending on short and long rains are called Vuli and Masika respectively. Major production depends on Masika for most of the cereals but Vuli production is important in some regions as shown in Table 1.2.2. When irrigation is introduced, the cropping intensity can be increased through the achievement of dry season cropping. In addition to the kind of crop, therefore, the cropping pattern should carefully be designed. Since the market price fluctuates according to the season in case of vegetables specially, an appropriate cropping season should also be investigated.

It is said that the major constraints related to farm management are improved varieties, late transplanting, low plant density, poor weeding and low inputs. These constraints should be improved through strengthening of farmers supporting systems such as research, extension, input supply, marketing and access to available loans. In case of irrigation development, even more careful support might be needed for proper operation of irrigation system and maintenance practices for sustainable utilization of the facilities. The comprehensive strategy on farmers supporting system should thus be organized.

1.2.3 Irrigation Systems

The traditional irrigation crops are rice, maize, beans, onions, horticulture, bananas, sugarcane, coffee, tea and cotton. Out of these irrigated crops, rice is by far the most important crop in Tanzania. Purely rain-fed rice is not common and rice is produced twice or three times per year in some regions mainly by using water harvesting method or simple river diversions. In the report of NIDP, the typical rain-fed and irrigated paddy yields were compared and the result is shown as below.

Typical Rain-fed and Irrigated Paddy Yields in Tanzania

Irrigation System	Yield (ton/ha.)	Remarks
Rain-fed	1.0-1.8	Hand cultivation
Traditionally Irrigated	1.0-2.0	Water harvesting/River diversions
Improved Traditional	4.0	River diversion/Improved land development
New Small Holder Scheme	2.0-6.0	Mechanization/High Inputs/Modern varieties
State Farms	2.8	Mechanization/High Inputs/Modern varieties

Source: National Irrigation Development Plan, 1994

It is clear that irrigation can contribute to the increase of yield per unit area. The effect will be upheld when accompanied with mechanization, high inputs and modern varieties. Irrigation is also important to stabilize the production of perishable commodities like vegetables. Furthermore, since Tanzania has a long standing production deficit of sugar, the production of sugarcane should also be promoted through irrigation development. The irrigation development for rice and vegetables can contribute to secure food security and also to improve rural incomes. In case of cash crops such as sugarcane, however, the meaning of irrigation development is somehow different. It is therefore necessary to carefully investigate the contribution of irrigation development according to the general agriculture and livestock policy.

CHAPTER 2 BASIC PLAN FOR AGRICULTURAL DEVELOPMENT

2.1 Target Crops for Irrigation Development

The most important food crop in Tanzania is maize that accounts for about 40% of percapita calorific consumption. But, in fact, the country became self sufficient in maize production in 1985/86. Since then the production almost satisfies the demand but it depends on the rainfall availability. There is therefore some needs to invest in irrigation as a means of increasing the nation's self-sufficiency or security in maize especially in areas where there is erratic rainfall or maize is cultivated as a second crop after paddy. On the other hand, the importance of rice in the national diet in urban areas is increasing. Per capita consumption of rice increased during the past decade. The production of rice also depends fully on irrigation and the yields have increased at a greater rate due mainly to an improvement in the irrigation systems. It was thus concluded in NIDP that irrigation has a role in contributing towards food security and self-sufficiency in rice production at national level. This principle is maintained under the National Irrigation Master Plan.

The importance of rice production was further reinforced through the simulation result of future rice demand and production. As of now, the total production and demand for paddy are both slightly less than 800,000 ton per year at national level. But the estimated demand at the year 2017 will exceed 1,200,000 ton due mainly to the population increase. In order to satisfy such an increasing demand, the future production of paddy should effectively be achieved. One advantage of paddy production for farmers is that paddy can be used as subsistence food crop to supplement maize and at the same time as cash crop.

The demand on maize will similarly increase based on the future population increase. According to the projection by the study team, the total demand of maize will reach above 5 million ton per year by the year 2017. There is justification as mentioned above for small irrigated maize plots for subsistence in food deficit areas and the areas where surplus irrigation flows can be utilized. The major development on the future maize production should, however, be carried out through full utilization of the remaining potentials under rain-fed conditions. This can be achieved in the regions having a strong expectation of adequate rainfall such as Iringa, Mbeya, Rukwa and Ruvuma by expanding the cultivation area and also by increasing the yield per unit area through improvement of management in supply of hybrid seed and necessary farm input.

Even in the drier parts of the country, there is great potential for maize production under rain-fed condition through the introduction of drought resistant varieties and the improved rain-fed farming practices.

The importance of sugarcane and perishable commodities such as vegetables and other high valued crops are also emphasized as target crops for irrigation development in NIDP. The production of industrial crops including sugarcane should be considered in the course of privatization under rather large scale irrigation scheme. According to the results of the inventory survey, major irrigated crops under smallholdings other than paddy and maize are beans and vegetables including onion, tomato and leaf vegetables. Such crops can be produced in the areas with good access to the markets or with strong and durable local demand. Special attention should be paid for leguminous crops such as beans and chick peas not only from the production viewpoint but also from the soil management viewpoint.

2.2 Land Use Plan

2.2.1 Agro-ecological Zone

In order to select the suitable crops for different area, the information obtained through the Agro-Ecological Zone Map can effectively be utilized. Agro-ecological zone was defined as natural physical regions which are sufficiently large to be mapped at the scale of 1:2,000,000 and are sufficiently uniform in climate, physiography and soil patterns for generalized descriptions and evaluation of the agricultural potential and constraints. The main objective of the agro-ecological zone classification is to offer a condensed inventory of the agricultural environment with a statement on its physical potential or constraints for agricultural development.

Agro-ecological zones map provides data on climate, physiography, soils and vegetation/land use and tsetse occurrence which are the main physical factors that influence potential and constraints for crop and livestock production. The main climatic factors are the temperature regime and the growing period. The growing period was estimated through simple water balance model comparing rainfall, soil moisture storage and potential evapotranspiration. The physiography factors consist of general drainage conditions, relief and altitude. The soil factors consist of the fertility status and the moisture storing properties. The vegetation and land use factor consist of biomass available for livestock and the extent of tsetse infestation.

Agro-Ecological Zone Map was digitized under the collaboration with the Department of Research and Development, MAFS. Fig. 2.2.1 and Table 2.2.1

show the map and legend with relevant information. Agro-ecological zones were roughly categorized into 9 major physiographic types as shown in Fig. 2.2.2 and Table 2.2.2. More detailed information for each agro-ecological zone is precisely described in the condensed inventory with the format shown as below.

Format for Condensed Inventory

Agro-Ecological Zone Code			
Area in km^2			
Climate	Physiography	Soils	Vegetation/Land Use
Temperature regime: Moisture zone: Growing period:	Main land unit: Description:	Main soil unit: Other soil unit: Description:	Cultivated area (%): Main vegetation type: Estimated average LCC*: Area infested by tsetse:
Evaluation of agricultural potential and constraints			

LCC: Livestock Carrying Capacity*
Source: Soils, Physiography and Agroecological Zones of Tanzania

According to the data on major farming systems for each agro-ecological zone, map of the area suitable for paddy and maize were processed as shown in Fig. 2.2.3 and Fig. 2.2.4. Furthermore, the data on temperature regime and moisture zones can also be expressed on map as shown in Fig. 2.2.5 and Fig. 2.2.6. These information are effective for the selection of suitable crops and also for the decision of cropping intensity. Agro-ecological zones map thus provides valuable information for the selection of suitable crops under rain-fed condition, for the evaluation of the area to be proposed for irrigation scheme and also for the investigation of the suitable crop and intensity in each scheme.

2.2.2 Cropping Pattern

In order to investigate the present cropping pattern prevailing in each region, the crop production data of the year 1999/2000 obtained from "Basic Data Agriculture Sector" was utilized. Since the data on the cropped area and the production is the total of rain-fed and irrigated conditions, each figure was divided into rain-fed and irrigation by allocating the appropriate area and production in each region. The extent of irrigated area was estimated from the existing irrigated area obtained from the current inventory survey. The prevailing crop intensity was also estimated from the inventory results on the area under cultivation during dry season in each region. Since the major irrigated crops cultivated in the small holders field are paddy, maize and other crops including beans and vegetables, the analysis of the present cropping pattern was carried out by focusing on paddy, maize and others. The present cropping pattern thus

estimated is shown in the Table 2.2.3.

Based on the present cropping pattern (Table 2.2.4), the future cropping pattern was estimated according to the following criteria including the development direction and cropping intensity potential estimated from agro-ecological zone map as shown in Table 2.2.5.

- Emphasis is given to the promotion of rice production according to the principle of development concept,
- Emphasis is also given to the full utilization of remaining potential of maize production under rain-fed conditions,
- Production of other crops such as beans and vegetables will be adjusted by the climate and market conditions of each year,
- Information on crop suitability obtained from agro-ecological zone map is taken into account for the decision of development direction in each region, and
- Information on temperature regime and moisture zones obtained from agro-ecological zone map is taken into account for the decision of cropping intensity for each region.

The future cropping pattern thus planned is shown in Table 2.2.6 and the overall alteration of cropping pattern at national level is shown as below. These results on cropping pattern were served for the estimation of economic feasibility of each scheme.

Present and Future Cropping Patterns under Irrigation

Present Cropping Pattern (123.3%)					
Paddy (48.5%)		Maize (31.2%)		Others (44.0%)	
Wet (39.5%)	Dry (9.0%)	Wet (31.2%)		Wet (29.3%)	Dry (14.7%)

Developing Direction and Cropping Intensity Potential

Future Cropping Pattern (133.5%)				
Paddy (82.3%)		Maize (18.0%)	Others (33.2%)	
Wet (63.5%)	Dry (18.8%)	Wet (18.0%)	Wet (18.5%)	Dry (14.7%)

Source: Prepared by the Study Team

2.3 Farming System Improvement Plan

2.3.1 Farming System

Present farming practices prevailing in the majority of rain-fed area is likely to be of extensive cultivation, namely no application of fertilizer and agro-chemicals as well as low input of labour force are common. Proper farming practices should be adopted to take full advantage of irrigated agriculture and promote the productivity of crops cultivated based on the proper application of farm inputs. It is thus indispensable to apply certified seeds of high yielding varieties or improved varieties with proper dosage of fertilizer and agro-chemicals under sufficient supporting services such as research and extension. The detailed plan on input supply and supporting services will be described in the following clauses. The general flow of farming system improvement can be planned stage-wise as shown below.

Farming System Improvement Plan

Development Stage	Short-term (2003-2007)	Medium-term (2008-2012)	Long-term (2013-2017)
Supply of input materials such as agro-chemials, fertilizer and improved seed	-Effective utilization of materials received on grant from donors -Active promotion of agricultural input trust fund -Active promotion of community based seed production	-Creation of enabling environment for the efficient operation of the private sector -Establishment of certified seed production under the supervision by TOSCA	-Input supply through private sector -Group purchasing of input materials through farmers' organization
Supporting system such as research and extension	-Establishment of research programmes necessary for irrigation development -Completion of institutional reform on agricultural extension	-Contracting research in district level -Execution of extension services under the responsibility of each district	-Privatizing research activities to research stations, universities and NGOs -Privatizing extension activities to private sector and NGOs

Source: Prepared by the Study Team

As already mentioned in the previous chapter, the main aim of irrigation development is to increase crop production in order to contribute towards food security and self-sufficiency in rice production at national level. Important issues of proposed farming practices for paddy are as follows;-

(1) Land preparation

The land preparation is mainly carried out by hand hoe manually. It is therefore recommended to utilize draught animals in order to implement easy and effective puddling and/or leveling where such animals are available. As a next step, the joint utilization of agricultural machinery such as tractors by the farmers' organization should be encouraged.

(2) Nursery preparation

It is recommended to select vigorous seeds for sowing through the procedure of soaking. Seed amount for the nursery is estimated at around 40 to 50 kg for one ha. of the main field.

(3) Transplanting

Transplanting is recommended more than broadcasting and the planting density is 20 cm x 20 cm. In case of broadcasting, the recommended amount of seeds per one ha. is 60 kg for local variety and 80 kg for improved variety.

(4) Application of fertilizer and agro-chemicals

Fertilization is highly effective to the improved varieties and the recommended amount for one ha. is 80 kg of Nitrogen as urea and 20 kg of P_2O_5 as TSP. In case of local varieties, 30 kg of Nitrogen as urea and 20 kg of P_2O_5 as TSP is recommended. However, the utilization of organic manure should highly be encouraged.

(5) Weeding

Hand weeding is the prevailing practices and wild rice such as *Oryza longistaminata* (perennial) and *Oryza punctata* (annual) are hard to control due to high spreading habit and strong dormancy. The effective weed control can be performed by the adjustment of water level through irrigation practices and also by introducing transplanting method. It is therefore proposed to adopt transplanting method in order to carry out an effective weeding and consequently to alleviate the work load on weeding.

(6) Water management

Water management differs according to the climate and soil characteristics. In case of direct sowing, weed can be controlled through careful adjustment of water depth. Water level adjustment by band preparation is therefore recommended. Application of husk and other available organic materials to the field for increasing water retention capacity is also the recommended practice.

(7) Harvesting and post-harvesting activities

Grains are usually harvested and then threshed, winnowed and bagged immediately in the field. Effective utilization of straw, husk and bran for the better soil management should be encouraged. Since the farm gate price is lower during the harvest season, the establishment of storage facility should also be encouraged at farm level.

2.3.2 Input Supply

The main agricultural inputs employed in Tanzanian agriculture are chemical fertilizer, agro-chemicals, improved seeds and others. Such materials except improved seeds are mainly imported and it is difficult for farmers to afford such expensive input materials under rain-fed condition in which the water supply is not secured. In case of irrigated agriculture, on the other hand, the proper application of farm inputs is indispensable to take full advantage of irrigation and to promote the productivity of crops cultivated.

(1) Fertilizer and agro-chemicals

Until 1988/89 fertilizer was sold under the subsidy at the rate of 50% but this was removed gradually starting with 30% reduction in 1990/91 and full elimination of all subsidies in 1994/95. The overall impact of this was to increase the price of fertilizer to the farmer by some 150%.

The substantial amount of fertilizer is now received on grant from donors and the government distributes these fertilizers to private traders through tender. Careful price setting is needed in this process by considering the easy access of farmers.

Since the main reason restricting fertilizer use appears to be the absence of access to credit for its purchase, the government tries to alleviate this problem through the establishment of Agricultural Input Trust Fund (AGITF). AGITF provides soft loans to traders with low repayment rate for the local distribution of inputs. So far, AGITF deals only about 10% of all inputs supplied in the country and this should be strengthened.

The government's strategy on input supply should continue along the support for private channels focusing more on the creation of an enabling environment for the efficient operation of the private sector in input supply.

As for agro-chemicals, the government policy is to improve and strengthen the services in plant protection especially for the control of migratory pests and epidemic diseases. The supply of agro-chemicals has, however, suffered from the shortage in credit and distribution system. Furthermore, the enforcement of regulations of agro-chemicals under the Plant Protection Act of 1997 is inadequate.

The establishment of proper distribution systems, the provision of extension messages on the safe handling and use of agro-chemicals together with the promotion of integrated pest management measures are the key issues for the future improvement and for irrigation development.

(2) Improved Seeds

The state owned Tanzania Seed Company (TANSEED) had a monopoly on the importation and domestic production of all certified seeds until 1988/89. Along with all other aspects of the sector, the seed industry was liberalized in 1989/90. After liberalization, the quantity and quality of seed supplied by TANSEED has declined and even the sales of the private sector producers dropped.

The seed production system in Tanzania is governed by the Seed Act. Breeder seeds are mainly produced by the Department of Research and Development, more specifically in research stations such as Dakawa Research Center and KATRIN (Kilombero Agricultural Training and Research Institute at Ifakara) where breeders are stationed. Foundation seeds were formerly produced in Kilosa Farm and certified seeds were supplied through TANSEED. Since Kilosa Farm is not functioning and TANSEED was privatized, there is no clear system of improved seed production and distribution. Tanzania Official Seed Certification Agency (TOSCA) was responsible for quality control from the foundation seed farm stage up to the sale of certified seed to the farmer. TOSCA is now supervising the selected and inspected farmers to produce certified seeds by distributing breeder or foundation seeds obtained from Research Centers. Seed supply is generally not sufficient to meet the demands. Many irrigation schemes therefore produce its own seeds by obtaining breeder seeds from research centers as a part of community based seed production movement.

The characteristics of the prevailing varieties of paddy are shown below.

Characteristics of Prevailing Varieties

Variety	Line	Size	Maturity (days)	Yield (ton/ha)	Photo -sensitive	Note
Local	Super-India	Tall	150	3.5	Sensitive	Aromatic, Less fertilizer
Improved	TXD-85	Short	110-115	4-5	Non	
	TXD-88	Short	110-115	4-5	Non	Growth under water stress
	TXD-306	Short	110-115	4-5	Non	Aromatic, No growth under water stress
	TXD-220	Tall	105-110	4-5	Non	Less fertilizer, Draught resistant

(Source: Interview at Dakawa and Ifakara Research Center)

The most common local variety is Super-India and this variety is photosensitive and aromatic but not fertilizer sensitive. The yield per unit area can go up to 3.5 to 4.0 ton/ha but the national average yield is considered to be as 1.0 to 1.5 ton/ha. This average yield can be increased up to 2.0-2.5 ton/ha through proper management even without irrigation development. There are 4 improved varieties crossed in Dakawa Research Center and they are TXD-85, TXD-88, TXD-306 and TXD-220 (TXD=Tanzania Cross Dakawa). Among them, TXD-85 and TXD-88 were officially released from the Center. TXD-306 and TXD-220 are also promising varieties and these will be released officially in this or next year.

Regarding Nerica Rice, germ plasm have been collected by KATRIN mainly from WARDA (West Africa Research Development Association) of Ivory Coast in the year 1998 and 2000. Nerica rice is a cross-breed between African type and Asian type and is a composition of many types of varieties including those of upland rice, lowland rice and irrigated rice. But the majority is upland rice. KATRIN has now about 284 lines including Nerica Rice, foreign varieties and local varieties. The institute is now only maintaining the germ plasm for studying its characteristics to see if it fits the soil and weather of Tanzania and there is no fund for large-scale propagation.

Improved seed production and distribution in Tanzania is thus in an insecure circumstances. The most promising approach to improve seed production now is community based seed production. This approach builds upon pilot projects funded by bilateral donors and NGOs. These projects are all based upon continued government responsibility for the production of breeder and foundation seed and for inspection. Under such projects, selected farmers who have received specific training in seed production, are supplied with foundation seed for multiplication. If this approach proves to be viable, it can be scaled up as a major seed production system.

2.3.3 Farmers Supporting Systems

In addition to the improvement of input supply system, sufficient supporting services such as research and extension are needed for farmers to show the effect of proper application of input materials under irrigated condition and also to provide accurate knowledge on identification of pests and diseases with appropriate application of agro-chemicals. Following are the important issues for the improvement of research and extension relevant to the irrigation development.

(1) Agricultural Research

The agricultural research system in Tanzania has been the target of substantial external support over the last decade. A farming systems approach was adopted for all research works in order to focus on farmers' priority needs and to strengthen farmer-extension-research linkages. The farmers priority needs were considered by giving extension agents a role in determining research priorities, by training all scientist in PRA methodology and by elaborative examination of research proposals.

The current research programmes are classified into crop research, livestock research, special programmes and socio-economics. There is no specialized research on irrigation. The crop research on developing appropriate agronomic recommendations and the development of high yielding varieties and special programmes on soil fertility and water conservation are comparatively relevant to the development of irrigated agriculture and such researches should be promoted. Special emphasis should be given to the research on new varieties of irrigated rice including Nerica Rice.

A system for allocating funds to the district for contracting research activities has been pioneered in the lake zone. Under this approach, the district is empowered to award contracts for research and it is free to award such contracts to government research stations, universities or NGOs. Reaction to the farmers' needs would be served by strengthening the links between the research agencies and the districts within their respective area, ensuring that research topics are demand-driven with priority to solve local problems. This approach should also be applied for the research activities on irrigation development.

The department of research and development made substantial progress in privatizing research activities connected with the main export and cash crops such as tea, coffee and tobacco. A joint venture arrangement is being negotiated for the research on cotton, cashew and sugarcane. These are another direction of research in the future and the research in the field of irrigation should be incorporated into such research activities for the crops of which the productivity will be greatly increased through irrigation.

(2) Extension System

Strengthening of extension services is considered essential for the successful development of irrigated agriculture. Extension officers are required to give the guidance concerning the proper farming practices to farmers and to show the effect of proper application of farm inputs under irrigated condition. Furthermore, extension should pay a careful attention for the dissemination on

application of agro-chemicals to the farmers. Although most of the farmers are aware of the effect of agro-chemicals, they have no adequate knowledge on identification of pests and diseases and proper application of agro-chemicals. This is important from the viewpoint to minimize the detrimental effects of irrigation on the surrounding environment.

The most dramatic change to affect extension services has been the decision to decentralize all extension services to the district level. The district councils are responsible for the provision of extension services to farmers together with other services such as education, health and etc. Priority should therefore be given to the empowerment of extension staff in the field of irrigation development and the supporting system for such staff should also be established.

There has been a long tradition of NGOs operating in the agricultural sector in Tanzania. These NGOs offer an excellent opportunity to assess alternative approaches to extension work. Privatization of extension and mechanisms for cost sharing with beneficiaries are being tried under National Agricultural Extension Project II (NAEP II) with the specific objective of bringing the private sector and NGOs into the provision of extension services. This is another direction of agricultural extension in future and the activities of such private sector and NGOs should be promoted.

2.4 Agricultural Information System

As already mentioned in the previous chapter, the most obvious problem on land use and crop production statistics in Tanzania is multiple and conflicting statistics issued by different government agencies. Furthermore, the basic information including climate data, soil map, agro-ecological map and other necessary information are not well organized and are not readily available in order to utilize for various purposes. As for the data collected in the inventory survey, the accuracy of the results was not satisfactory at the present stage.

Information management system should therefore be strengthened by improving the existing management system or by establishing a documentation center. Reports and maps should efficiently be stored not only as document but also as digitized form if necessary with backup. The result of inventory survey is valuable database source to be utilized for many purposes in future. In order to utilize such database effectively together with GIS technology, the maintenance of data is needed to level up the accuracy and to keep the data up-to-date. This kind of function should be included in the information management system.

2.5 Crop Budget

In order to temporarily evaluate the economic feasibility of each proposed irrigation scheme, crop budgets of with and without project were prepared for rice, maize and beans. Beans were selected as typical irrigated crop other than rice and maize. With-project is supposed to be the condition under the proper irrigation facilities with appropriate input supply and farmers' support services. Without-project, on the other hand, is supposed to be the prevailing rain-fed condition without any input supply and support services. Information collected in the field and relevant agencies along with the data obtained from the past similar study were utilized for the preparation of crop budget. The draft proposal was carefully examined by the economist of the Department of Research and Development. The crop budget thus finalized is shown in Table 2.5.1 and the results were served for the evaluation of the economic feasibility of each proposed irrigation scheme.

Table

Table 1.1.1 Distribution of Land Cover in Tanzania Mainland

Region	Total	Forest		Woodland		Bushland		Grassland		Cultivated Land		Open Land*		Water Features**		Others	
	(1,000 ha.)	(1,000 ha.)	(%)	(1,000 ha.)	(%)	(1,000 ha.)	(%)	(1,000 ha.)	(%)	(1,000 ha.)	(%)	(1,000 ha.)	(%)	(1,000 ha.)	(%)	(1,000 ha.)	(%)
Arusha	8,415.5	287.6	3.4	1,845.4	21.9	2,478.6	29.5	2,782.2	33.1	681.9	8.1	20.9	0.2	315.1	3.7	3.8	0.0
Coast	3,185.9	123.8	3.9	1,397.4	43.9	531.9	16.7	657.0	20.6	401.9	12.6	21.4	0.7	49.9	1.6	2.6	0.1
DSM	173.5	6.5	3.7	12.0	6.9	16.1	9.3	32.0	18.4	71.8	41.4	2.0	1.2	20.8	12.0	12.3	7.1
Dodoma	4,215.0	20.0	0.5	1,231.1	29.2	1,769.5	42.0	911.9	21.6	234.3	5.6	3.3	0.1	41.1	1.0	3.8	0.1
Iringa	5,927.4	513.2	8.7	1,550.8	26.2	1,664.3	28.1	1,583.5	26.7	343.6	5.8	0.7	0.0	268.8	4.5	2.5	0.0
Kagera	3,925.4	65.5	1.7	609.7	15.5	734.8	18.7	490.1	12.5	864.8	22.0	0.1	0.0	1,158.3	29.5	2.1	0.1
Kigoma	4,602.7	26.3	0.6	2,042.8	44.4	515.2	11.2	946.1	20.6	124.4	2.7	1.0	0.0	944.4	20.5	2.5	0.1
Kilimanjaro	1,332.6	151.1	11.3	145.9	10.9	467.4	35.1	205.0	15.4	326.8	24.5	1.6	0.1	31.4	2.4	3.4	0.3
Lindi	6,717.3	105.4	1.6	3,848.7	57.3	1,245.7	18.5	1,203.5	17.9	272.1	4.1	17.3	0.3	22.9	0.3	1.7	0.0
Mara	3,050.7	11.5	0.4	289.4	9.5	707.2	23.2	869.8	28.5	270.2	8.9	1.7	0.1	899.5	29.5	1.4	0.0
Mbeya	6,319.0	107.1	1.7	3,715.7	58.8	805.1	12.7	931.4	14.7	446.2	7.1	0.7	0.0	309.8	4.9	3.0	0.0
Morogoro	6,924.0	802.4	11.6	3,109.9	44.9	606.0	8.8	1,939.8	28.0	430.0	6.2	2.4	0.0	30.4	0.4	3.1	0.0
Mtwara	1,784.3	18.1	1.0	605.2	33.9	374.3	21.0	53.3	3.0	684.5	38.4	23.8	1.3	20.7	1.2	4.4	0.2
Mwanza	3,532.4	37.4	1.1	294.9	8.3	257.1	7.3	349.9	9.9	1,013.0	28.7	0.0	0.0	1,577.7	44.7	2.4	0.1
Rukwa	7,367.4	18.5	0.3	4,170.3	56.6	622.2	8.4	1,276.0	17.3	284.0	3.9	21.5	0.3	974.1	13.2	0.8	0.0
Ruvuma	6,512.5	210.5	3.2	3,451.7	53.0	1,058.5	16.3	792.0	12.2	655.1	10.1	4.1	0.1	336.3	5.2	4.3	0.1
Shinyanga	5,008.0	2.8	0.1	1,221.5	24.4	807.3	16.1	1,465.0	29.3	1,441.5	28.8	6.2	0.1	61.9	1.2	1.8	0.0
Singida	4,886.2	1.2	0.0	2,152.9	44.1	1,476.8	30.2	922.5	18.9	218.2	4.5	1.8	0.0	112.0	2.3	0.8	0.0
Tabora	7,589.2	0.6	0.0	4,379.8	57.7	527.3	6.9	1,627.2	21.4	882.0	11.6	0.1	0.0	170.1	2.2	2.1	0.0
Tanga	2,793.2	171.4	6.1	1,322.6	47.4	618.1	22.1	313.9	11.2	356.8	12.8	0.2	0.0	1.5	0.1	8.7	0.3
Total	94,846.0	2,697.5	2.8	37,629.3	39.7	17,390.4	18.3	19,472.0	20.5	10,065.1	10.6	131.6	0.1	7,392.2	7.8	67.9	0.1

** Open Land contains Bare Soil, Salt Crusts, Rock Outcrops and Ice-cap Snow*

*** Water Feature contains Ocean, Inland Water, Swamp and Marsh*

(Source: National Reconnaissance Level Land Use and Natural Resources mapping Project, Final Report 1997)

Table 1.1.2 Distribution of Protected Area by Region

(Unit: 1,000 ha.)

Region	Total Area	Protected Area					Unprotected Area	Protected Area (%)
		Forest Reserve	Game Reserve	National Park	Conservation Area	Total		
Arusha	8,417	263	30	208	821	1,322	7,095	15.7
Coast	3,195	242	269	0	0	511	2,684	16.0
DSM	174	0	1	0	0	1	173	0.6
Dodoma	4,213	150	112	88	0	350	3,863	8.3
Iringa	5,925	485	0	161	0	646	5,279	10.9
Kagera	3,933	735	152	0	0	887	3,046	22.6
Kigoma	4,612	920	823	156	0	1,899	2,713	41.2
Kilimanjaro	1,334	143	191	56	0	390	944	29.2
Lindi	6,733	589	1,963	0	0	2,552	4,181	37.9
Mara	3,054	5	0	804	0	809	2,245	26.5
Mbeya	6,325	483	47	486	0	1,016	5,309	16.1
Morogoro	6,928	963	1,709	373	0	3,045	3,883	44.0
Mtwara	2,194	72	0	0	0	72	2,122	3.3
Mwanza	3,538	172	0	32	0	204	3,334	5.8
Rukwa	7,384	2,611	586	425	0	3,622	3,762	49.1
Ruvuma	6,587	736	306	0	0	1,042	5,545	15.8
Shinyanga	5,013	786	769	468	0	2,023	2,990	40.4
Singida	4,886	808	1,686	0	0	2,494	2,392	51.0
Tabora	7,601	3,580	445	0	0	4,025	3,576	53.0
Tanga	2,800	95	124	0	0	219	2,581	7.8
Total	94,846	13,838	9,213	3,257	821	27,129	67,717	28.6

(Source: National Reconnaissance Level Land Use and Natural Resources mapping Project, Final Report 1997)

Table 1.1.3 Crop Production Performance in Tanzania

(1,000 ha.)

Planted Area	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
Maize	1,891.4	1,565.5	1,611.8	1,763.7	1,637.4	1,564.0	2,088.0	1,764.4	1,870.4
Sorghum	728.6	641.6	728.4	689.5	665.5	622.4	596.2	659.9	736.4
Millet	366.9	391.3	410.8	303.6	473.4	353.6	268.1	195.8	251.9
Paddy	-	376.8	397.3	394.0	513.4	439.3	654.5	473.9	516.9
Wheat	45.5	60.7	34.8	54.5	59.9	56.6	99.4	57.4	71.7
Sweet Potato	214.9	215.5	220.8	293.1	290.1	287.0	371.8	284.1	416.6
Cassava	683.7	657.0	693.2	584.8	588.2	663.5	745.4	655.7	809.7
Pulses	582.5	533.7	540.6	537.4	529.1	501.6	700.5	619.4	815.3
Bananas	264.8	269.6	281.3	248.2	241.0	241.4	334.7	253.0	303.5
Sugarcane	-	-	-	-	-	-	-	-	-
Coffee	-	259.2	253.2	258.2	258.2	258.2	258.2	-	-
Tea	20.1	20.1	20.1	20.1	20.1	20.8	20.9	20.9	-
Tobacco	-	37.2	39.5	35.1	39.6	42.0	71.7	78.7	-
Sisal	48.9	38.4	42.1	43.8	40.9	40.9	40.9	40.9	42.6
Cotton	-	-	-	-	-	-	-	-	-
Cashew	-	-	-	-	-	-	-	-	-
Pyrethrum	8.2	7.2	3.1	12.1	8.1	8.1	8.1	8.2	13.5

(1,000 ton)

Production	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
Maize	2,219.7	2,267.0	2,188.1	2,874.4	2,648.2	1,831.2	2,684.6	2,451.7	2,009.3
Sorghum	587.1	719.1	473.0	838.8	872.4	498.5	563.4	561.0	598.2
Millet	451.8	424.1	435.3	342.0	585.0	347.0	235.9	194.4	219.0
Paddy	-	640.9	654.5	622.6	806.8	549.7	849.1	778.4	782.3
Wheat	65.8	83.5	59.7	75.3	83.6	78.5	111.5	82.4	32.7
Sweet Potato	256.9	258.8	283.5	448.8	418.1	477.7	637.8	569.6	798.0
Cassava	1,777.7	1,708.2	1,802.3	1,492.2	1,498.4	1,426.0	1,758.3	1,795.4	1,780.7
Pulses	311.6	397.5	279.3	374.2	467.3	368.7	462.0	528.2	673.8
Bananas	793.7	798.2	733.4	650.9	640.9	604.1	835.8	751.6	702.7
Sugarcane	1,081.0	1,371.0	1,467.0	1,284.0	1,369.0	1,298.0	983.9	1,268.9	1,255.0
Coffee	-	59.6	34.1	42.0	52.5	43.6	38.0	46.6	47.9
Tea	19.4	21.0	22.3	25.5	20.5	19.8	26.3	21.9	24.8
Tobacco	-	24.1	25.8	22.6	28.6	35.4	50.3	37.9	31.8
Sisal	32.6	21.4	26.3	25.7	22.5	20.1	20.1	20.1	-
Cotton	260.7	303.2	147.5	125.6	221.3	251.8	202.5	105.8	100.7
Cashew	41.2	39.3	46.6	63.4	81.7	65.4	93.2	103.3	121.1
Pyrethrum	1.9	2.1	0.5	0.6	0.6	0.6	0.1	0.3	0.7

(kg/ha.)

Yield	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00
Maize	1,173.6	1,448.1	1,357.6	1,629.8	1,617.3	1,170.8	1,300.0	1,400.0	1,100.0
Sorghum	807.2	1,120.8	793.1	1,216.5	1,278.7	816.5	1,115.8	900.0	800.0
Millet	1,231.4	1,083.7	1,059.7	1,126.7	1,235.7	981.3	900.0	1,000.0	900.0
Paddy	-	1,701.1	1,647.6	1,580.1	1,571.4	1,251.3	1,468.0	1,600.0	1,500.0
Wheat	1,446.7	1,375.6	1,715.5	1,381.7	1,395.7	1,386.9	1,066.7	1,400.0	500.0
Sweet Potato	1,195.4	1,200.9	1,284.0	1,531.2	1,441.2	1,664.5	1,677.7	2,000.0	1,900.0
Cassava	2,600.0	2,600.0	2,600.0	2,551.6	2,547.4	2,149.1	2,265.0	2,700.0	2,200.0
Pulses	534.9	744.8	516.6	696.3	883.2	735.0	700.0	900.0	800.0
Bananas	2,997.4	2,960.3	2,609.0	2,622.5	2,659.3	2,502.5	2,422.0	3,000.0	2,300.0
Sugarcane	-	-	-	-	-	-	-	-	-
Coffee	-	-	-	-	-	-	-	-	-
Tea	751.5	745.1	787.3	911.4	720.2	729.9	1,254.0	1,194.0	-
Tobacco	-	647.0	653.0	645.0	723.0	842.0	702.0	482.0	-
Sisal	666.7	557.3	624.7	586.8	550.1	491.4	491.4	491.4	-
Cotton	-	-	-	-	-	-	-	-	-
Cashew	-	-	-	-	-	-	-	-	-
Pyrethrum	231.7	295.8	161.0	50.0	74.0	74.0	12.0	37.0	52.0

(Source: Basic Data Agricultural and Livestock Sector 1992/93-1999/2000)

Table 1.1.4 Cultivated Area of Major Food Crops by Region

(1,000 ha.)

Area	Maize	Sorghum	Millet	Paddy	Wheat	S. Potato	Cassava	Pulses	Bananas	Total
Arusha	139.9	18.8	6.9	9.8	47.1	22.0	8.5	62.5	21.2	336.7
Coast/DSM	55.3	28.2	-	39.1	-	9.4	107.0	57.5	12.5	309.0
Dodoma	81.6	96.8	76.8	1.5	-	14.9	18.7	37.0	2.5	329.8
Iringa	203.8	48.6	2.6	8.2	13.9	31.4	6.2	59.5	8.0	382.2
Kagera	60.1	17.3	0.5	1.7	-	10.9	53.8	116.8	80.8	341.9
Kigoma	74.6	21.7	2.6	4.4	-	3.5	39.7	37.8	12.1	196.4
Kilimanjaro	88.8	7.2	4.8	9.2	9.0	6.5	8.0	56.4	60.5	250.4
Lindi	69.2	34.4	-	9.9	-	-	58.4	10.1	-	182.0
Mara	48.0	54.1	31.3	0.9	-	24.4	58.7	16.4	13.1	246.9
Mbeya	135.1	19.2	14.4	61.7	0.5	35.9	11.3	38.9	38.0	355.0
Morogoro	74.3	31.5	1.3	67.1	-	12.9	38.6	25.4	17.4	268.5
Mtwara	42.2	30.8	0.9	24.2	-	53.8	119.0	35.7	-	306.6
Mwanza	109.6	72.2	10.4	71.0	-	38.7	46.3	42.9	2.8	393.9
Rukwa	120.5	6.9	36.7	29.1	1.0	4.8	40.4	42.5	0.6	282.5
Ruvuma	110.7	3.6	3.2	13.9	-	15.7	34.7	33.0	13.6	228.4
Shinyanga	211.7	120.7	23.6	96.6	-	93.5	38.4	60.7	0.5	645.7
Singida	58.2	60.1	27.6	6.4	-	16.0	22.1	26.7	-	217.1
Tabora	78.3	33.5	8.2	48.2	-	20.0	29.9	24.0	-	242.1
Tanga	108.6	30.6	-	14.1	0.2	2.3	70.0	31.5	19.9	277.2
Total	1,870.5	736.2	251.8	517.0	71.7	416.6	809.7	815.3	303.5	5,792.3

(%)

Percentage	Maize	Sorghum	Millet	Paddy	Wheat	S. Potato	Cassava	Pulses	Bananas	Total
Arusha	41.6	5.6	2.0	2.9	14.0	6.5	2.5	18.6	6.3	100.0
Coast/DSM	17.9	9.1	-	12.7	-	3.0	34.6	18.6	4.0	100.0
Dodoma	24.7	29.4	23.3	0.5	-	4.5	5.7	11.2	0.8	100.0
Iringa	53.3	12.7	0.7	2.1	3.6	8.2	1.6	15.6	2.1	100.0
Kagera	17.6	5.1	0.1	0.5	-	3.2	15.7	34.2	23.6	100.0
Kigoma	38.0	11.0	1.3	2.2	-	1.8	20.2	19.2	6.2	100.0
Kilimanjaro	35.5	2.9	1.9	3.7	3.6	2.6	3.2	22.5	24.2	100.0
Lindi	38.0	18.9	-	5.4	-	-	32.1	5.5	-	100.0
Mara	19.4	21.9	12.7	0.4	-	9.9	23.8	6.6	5.3	100.0
Mbeya	38.1	5.4	4.1	17.4	0.1	10.1	3.2	11.0	10.7	100.0
Morogoro	27.7	11.7	0.5	25.0	-	4.8	14.4	9.5	6.5	100.0
Mtwara	13.8	10.0	0.3	7.9	-	17.5	38.8	11.6	-	100.0
Mwanza	27.8	18.3	2.6	18.0	-	9.8	11.8	10.9	0.7	100.0
Rukwa	42.7	2.4	13.0	10.3	0.4	1.7	14.3	15.0	0.2	100.0
Ruvuma	48.5	1.6	1.4	6.1	-	6.9	15.2	14.4	6.0	100.0
Shinyanga	32.8	18.7	3.7	15.0	-	14.5	5.9	9.4	0.1	100.0
Singida	26.8	27.7	12.7	2.9	-	7.4	10.2	12.3	-	100.0
Tabora	32.3	13.8	3.4	19.9	-	8.3	12.4	9.9	-	100.0
Tanga	39.2	11.0	-	5.1	0.1	0.8	25.3	11.4	7.2	100.0
Total	32.3	12.7	4.3	8.9	1.2	7.2	14.0	14.1	5.2	100.0

(Source: Basic Data Agricultural and Livestock Sector 1992/93-1998/99)

Table 1.1.5 Estimated Number of Livestock in 1998

Region	Total Cattle		Total Goats		Total Sheep	
	(1,000 heads)	(%)	(1,000 heads)	(%)	(1,000 heads)	(%)
Arusha	1,856	14.1	2,719	24.7	1,154	32.5
Coast	104	0.8	21	0.2	5	0.1
DSM	17	0.1	11	0.1	1	0.0
Dodoma	1,097	8.3	684	6.2	170	4.8
Iringa	568	4.3	239	2.2	92	2.6
Kagera	563	4.3	715	6.5	54	1.5
Kigoma	74	0.6	462	4.2	36	1.0
Kilimanjaro	473	3.6	483	4.4	221	6.2
Lindi	8	0.1	27	0.2	11	0.3
Mara	970	7.4	512	4.6	216	6.1
Mbeya	444	3.4	392	3.6	152	4.3
Morogoro	444	3.4	255	2.3	53	1.5
Mtwara	23	0.2	141	1.3	34	1.0
Mwanza	1,358	10.3	912	8.3	250	7.0
Rukwa	735	5.6	182	1.7	21	0.6
Ruvuma	52	0.4	465	4.2	30	0.8
Shinyanga	1,890	14.3	1,524	13.8	487	13.7
Singida	940	7.1	665	6.0	280	7.9
Tabora	929	7.1	363	3.3	175	4.9
Tanga	632	4.8	258	2.3	109	3.1
Total	13,177	100.0	11,030	100.0	3,551	100.0

(Source: Basic Data Agricultural and Livestock Sector 1992/93-1998/99)

Table 1.1.6 Land for Grazing Activities

(1,000 ha.)

Region	Total Land Area (A)	Land suitable for grazing (B)	Land used for grazing (C)	Tsetse fly infested area (D)	Ratio B/A (%)	Ratio D/B (%)
Arusha	8,417	12,225	11,000	1,803	145.2	14.7
Coast	3,195	567	144	302	17.7	53.3
DSM	174	-	-	-	-	-
Dodoma	4,213	3,134	1,922	934	74.4	29.8
Iringa	5,925	3,689	2,455	-	62.3	-
Kagera	3,933	628	324	177	16.0	28.2
Kigoma	4,612	1,510	305	603	32.7	39.9
Kilimanjaro	1,334	418	377	65	31.3	15.6
Lindi	6,733	2,322	82	1,009	34.5	43.5
Mara	3,054	8,636	3,455	32	282.8	0.4
Mbeya	6,325	2,095	1,271	889	33.1	42.4
Morogoro	6,928	2,644	303	2,305	38.2	87.2
Mtwara	2,194	398	370	175	18.1	44.0
Mwanza	3,538	413	380	108	11.7	26.2
Rukwa	7,384	2,622	152	337	35.5	12.9
Ruvuma	6,587	1,801	246	187	27.3	10.4
Shinyanga	5,013	3,991	1,386	1,054	79.6	26.4
Singida	4,886	2,327	1,416	1,776	47.6	76.3
Tabora	7,601	28	3	25	0.4	89.3
Tanga	2,800	1,589	488	1,184	56.8	74.5
Total	94,846	51,037	26,079	12,965	53.8	25.4

(Source: Basic Data Agricultural and Livestock Sector 1992/93-1998/99)

Table 1.1.7 Agricultural Households by Type of Holding 1993/94-1998/99

Type of Holding	NSCA* 1993/94	NSCA 1994/95	EAS** 1995/96	EAS 1996/97	IAS*** 1997/98	DIAS**** 1998/99
Total H/H (Household) (1,000 H/	3,690	3,872	4,147	4,358	4,395	4,620
Crops only (1,000 H/H)	2,396	2,432	2,711	2,896	3,043	2,947
Crops only (%)	64.9%	62.8%	65.4%	66.5%	69.2%	63.8%
Livestock only (1,000 H/H)	15	14	16	48	-	18
Livestock only (%)	0.4%	0.4%	0.4%	1.1%	-	0.4%
Crops and Livestock (1,000 H/H)	1,279	1,426	1,420	1,414	1,352	1,655
Crops and Livestock (%)	34.7%	36.8%	34.2%	32.4%	30.8%	35.8%
Male Headed (1,000 H/H)	3,044	3,210	3,351	3,533	3,568	3,728
Male Headed (%)	82.5%	82.9%	80.8%	81.1%	81.2%	80.7%
Female Headed (1,000 H/H)	646	662	795	825	828	892
Female Headed (%)	17.5%	17.1%	19.2%	18.9%	18.8%	19.3%

NCSA: National Sample Census of Agriculture*
*EAS**: Expanded Agricultural Survey*
*IAS***: Integrated Agricultural Survey*
*DIAS****: District Integrated Agricultural Survey*

Table 1.1.8 Number of Agricultural Holdings by Type of Holdings and Region

	Total	Crops only		Livestock only		Crops and Livestock	
	Households	Households	%	Households	%	Households	%
Arusha	242,349	68,257	28.2	11,019	4.5	163,073	67.3
Coast	151,724	143,884	94.8	422	0.3	7,418	4.9
DSM	25,216	22,449	89.0	212	0.8	2,555	10.1
Dodoma	305,466	227,396	74.4	-	-	78,070	25.6
Iringa	295,465	227,844	77.1	242	0.1	67,379	22.8
Kagera	343,414	228,753	66.6	1,624	0.5	113,037	32.9
Kigoma	168,871	128,350	76.0	367	0.2	40,154	23.8
Kilimanjaro	223,931	56,122	25.1	1,268	0.6	166,541	74.4
Lindi	154,318	136,493	88.4	141	0.1	17,684	11.5
Mara	191,518	106,569	55.6	26	0.0	84,923	44.3
Mbeya	325,386	198,177	60.9	512	0.2	126,697	38.9
Morogoro	262,337	240,603	91.7	758	0.3	20,976	8.0
Mtwara	212,872	185,975	87.4	20	0.0	26,877	12.6
Mwanza	347,494	209,481	60.3	38	0.0	137,975	39.7
Rukwa	142,147	90,682	63.8	20	0.0	51,445	36.2
Ruvuma	212,358	139,567	65.7	85	0.0	72,706	34.2
Shinyanga	356,170	147,777	41.5	70	0.0	208,323	58.5
Singida	195,416	91,224	46.7	346	0.2	103,846	53.1
Tabora	202,315	129,922	64.2	251	0.1	72,142	35.7
Tanga	261,125	167,154	64.0	394	0.2	93,577	35.8
Total	4,619,892	2,946,679	63.8	17,815	0.4	1,655,398	35.8

(Source: District Integrated Agricultural Survey 1998/99)

Table 1.1.9 Total Planted Area and Number of Holdings

	Planted Area (ha.)	Number of Holdings	Number of Plot	Average Area per Holding	Average Area per Plot	Average Plot per Holding
Arusha	338,728	228,197	391,385	1.48	0.87	1.7
Coast	240,886	145,457	294,174	1.66	0.82	2.0
DSM	37,788	24,142	52,853	1.57	0.71	2.2
Dodoma	642,506	305,401	534,042	2.10	1.20	1.7
Iringa	490,270	295,268	798,946	1.66	0.61	2.7
Kagera	412,049	337,801	985,299	1.22	0.42	2.9
Kigoma	151,175	161,657	374,007	0.94	0.40	2.3
Kilimanjaro	280,114	220,657	541,289	1.27	0.52	2.5
Lindi	320,058	154,177	353,255	2.08	0.91	2.3
Mara	268,106	187,751	483,842	1.43	0.55	2.6
Mbeya	534,133	321,302	1,000,323	1.66	0.53	3.1
Morogoro	316,226	245,793	491,911	1.29	0.64	2.0
Mtwara	455,173	212,852	527,200	2.14	0.86	2.5
Mwanza	287,178	287,822	504,655	1.00	0.57	1.8
Rukwa	273,396	142,125	341,844	1.92	0.80	2.4
Ruvuma	611,938	211,673	820,811	2.89	0.75	3.9
Shinyanga	1,068,047	355,614	1,096,407	3.00	0.97	3.1
Singida	358,758	195,295	504,553	1.84	0.71	2.6
Tabora	496,744	202,206	651,725	2.46	0.76	3.2
Tanga	339,224	258,852	499,064	1.31	0.68	1.9
Total	7,922,497	4,494,042	11,247,585	1.76	0.70	2.5

(Source: District Integrated Agricultural Survey 1998/99)

Table 1.1.10 Irrigated Land in Tanzania

(1,000 ha.)

	Cultivated Land (A)	Planted Land (B)	Irrigated Land				Ratio B/A (%)	Ratio C/B (%)
			Total (C)	Smallholder	State Farm	Others		
Arusha	681.9	137.1	20.0	11.7	0.3	8.0	20.1	14.6
Coast	401.9	6.5	0.8	-	-	0.8	1.6	12.3
DSM	71.8	1.2	0.2	-	-	0.2	1.7	16.7
Dodoma	234.3	332.2	1.9	-	-	1.9	141.8	0.6
Iringa	343.6	203.2	2.4	2.3	0.0	0.1	59.1	1.2
Kagera	864.8	120.5	6.6	-	-	6.6	13.9	5.5
Kigoma	124.4	49.0	0.3	-	-	0.3	39.4	0.6
Kilimanjaro	326.8	93.8	46.1	38.2	0.1	7.8	28.7	49.1
Lindi	272.1	104.9	0.2	-	-	0.2	38.6	0.2
Mara	270.2	147.6	0.0	-	-	0.0	54.6	0.0
Mbeya	446.2	178.0	47.9	46.5	1.2	0.2	39.9	26.9
Morogoro	430.0	95.9	33.1	33.1	0.0	0.0	22.3	34.5
Mtwara	684.5	99.3	0.0	-	-	0.0	14.5	0.0
Mwanza	1,013.0	156.9	3.1	-	-	3.1	15.5	2.0
Rukwa	284.0	153.7	0.5	-	-	0.5	54.1	0.3
Ruvuma	655.1	221.6	14.7	-	-	14.7	33.8	6.6
Shinyanga	1,441.5	696.1	14.2	-	-	14.2	48.3	2.0
Singida	218.2	211.7	0.3	-	-	0.3	97.0	0.1
Tabora	882.0	263.2	1.2	-	-	1.2	29.8	0.5
Tanga	356.8	75.5	5.1	5.1	0.0	0.0	21.2	6.8
Total	10,003.1	3,347.9	198.6	136.9	1.6	60.1	33.5	5.9

(Source: Basic Data Agriculture and Livestock Sector 1992/93-1998/99)

Table 1.2.1 Crop Based Farming Systems based on Agro-ecological Zones

Code	Farming System	Major Crops Grown	Agroecological Zone
C-2B	Rice-based system (irrigated)	rice, sorghum, p/millet	P11,P12
C-3B1	Maize-groundnuts based system	maize, groundnuts, sorghum, p/millet	P1,P2
C-3B2	Sorghum and millet-groundnut based system	sorghum, p/millet, grain legumes, groundnuts, grapes	P2,P10,P9,P1
C-4D	Mpwapwa high lands system	maize,beans	H7
C-2A	Eastern drylands system	pastoralist	E2
E-1B	Lowland dry: cereal-cassava system	maize, sorghum, cassava	E3
E-2B	Intermediate dry: cereal-legumes system	maize, cassava, grain legumes, sorghum, p/millet	E3,E6
E-1C1	*Coastal system*	*cassava, maize, rice, s/potato*	*C5,C1*
E-1C2	Maize-cotton-rice system	maize, cotton, rice	E9
E-2C	Maize-beans cotton system	maize, beans, cooton	E4
E-1D	Lowland wet rice based system	rice, maize	E10,C4
E-4D	Highland system	beans, round potato, maize, horticulture, coffee	E12-15
E-2D	Wet lowlands system	not available	E7,S2
E-2A	Pastoralist and park system	livestock, wildlife	E1
L-3B	Ibushi plains semi-arid system	sorghum, cotton, s/potato	P8
L-3C1	Kikunga and Nduha dominated soils system	maize, sorghum, cotton, rice, pigeon peas	P5,P13,P4
L-3C2	Lowland annual crop system	sorghum, maize, cassava, banana, legumes, beans	P4,W1,W3,W4
L-3C3	Lakeshore cassava cereal system	cassava, sorghum, cotton, s/potato, p/millet	P8,P4
L-3C4	Itogolo plains system	rice, cotton, s/potato, sorghum	P8
L-3C5	Cereal-cotton-rice system	maize, sorghum, cotton, cassava, chickpea	P4,P8
L-3C6	Cotton-cereal livestock system	maize, beans, sorghum, cotton, s/potato, groundnuts	P8
L-4D1	Cereal livestock banana system	maize, sorghum, cassava, beans, banana, coffee	N10
L-4D2	*Extensive livestock and crop production system*	*sugarcane, maize, livestock*	W4
L-4D3	Highland semi-intensive banana-coffee system	banana, coffee, potato, beans, cassava	W1
L-3D	Highland intensive banana-coffee system	banana, beans, cassava, s/potato, coffee	W4,W3
N-2B	Intermediate dry lowland maize-legume system	maize, beans	E2,N5,P2
N-3B1	*Arid lowland system*	*maize, sorghum, indigenous cattle, goat and sheep*	*E1,E2,N3,N5,N1*
N-4B1	Dry midlands maize-pegion pea system	maize, beans, pegion pea, sunflower	N1,E2
N-2C1	Intermediate lowlands maize beans tree crops	maize, beans, rice, banana	
N-3C	Intermediate highlands maize-beans system	coffee, banana, maize, beans, horticulture, intensive dairy	N4,N5,E12,N1
N-4C2	Intermediate lowlands maize-legumes system	maize, beans, pegion pea, wheat	N1
N-4B2	Large scale wheat system	wheat	N1
N-4D	Highlands coffee-banana system	coffee, banana, horticulture, intensive dairy	E12,N4,N5
N-3A	Semi-arid lowlands to intermediate system	pastoralist, bushland, park	E1,E2,N3,6,7 E8,P1,2
S-1C1	Coastal plains rice-tree crops system	rice, coconuts, cassava	C2
S-1C2	Makonde plateau cassava-tree crops system	cashew, cassava, goats and sheep	C2
S-1C3	Maize-cassava tree crops system	sesame, maize, cassava	E5,E3,C2
S-1D1	W Nachingwea system		
S-1D2	South masasi E. tunduru cassava-groundnuts	groundnuts, cassava, cashew	E5
S-1D3	Tunduru system	cashew, sesame, maize	E5
SH-2B	L.Rukwa flood plain system	maize, cassava, groundnut, s/potato	R1
SH-3B1	*Northern dry medium altitude system*	*maize, beans, sunflower*	P2
SH-3B2	Usangu plains rice-livestock system	rice, maize, cassava, s/popato, sunflower, groundnuts	R2,R3,R4
SH-2C	Ludewa depression system	maize, cassava, beans	E11
SH-3C	Chunya mbozi system	coffee, beans, maize	P3,R1
SH-1D1	Kyela rice cereal system	rice, banana, maize,	H4
SH-2D1	Wet lowlands system	cassava, rice, maize	S2
SH-2D3	Lake shore areas system	rice, cassava, groundnuts, s/potato	H3,U
SH-3D1	Wet intermediate system	maize, cassava, rice, beans, sunflower, f/millet	E7
SH-3D2	NW wet plains system	maize, cassava, s/potato	P5
SH-2D2	C.Mpanda plains and plateau system	maize, cassava, s/potato	P6
SH-4D1	Iringa E. Mountains system	maize, wheat	H7
SH-4D2	Mufindi/Iringa plateau system	maize, wheat, potato, f/millet	H1
SH-4D3	Mbinga/Ludewa highlands system	maize, wheat, potato, f/millet	H3
SH-5D1	Dissected highlands system	banana, maize, beans, tea, coffee, potato	H5,H6,H2
SH-3D3	Ufipa plateau system	maize, beans, sunflower, f/millet	U
SH-5D2	*Njombe highland plateau system*	*maioze, potato, beans, pasture*	H2
W-3B	Cotton cereal system	maize, rice, cassava, groundnuts, sorghum, s/potato	P3,P8
W-3C1	Tobacco cereal system	maize, cassava, rice, groundnuts, s/potato, tabacco, sorghum	P5
W-2D	Kigoma lake shore system	rice, cassava, maize	P6,R1
W-3D1	Tabora swamp system	*rice, s/potato, pigeon pea, groundnuts*	*P13*
W-3C2	Kigoma lowlands system		P5,W2,P13
W-3D3	Medium altitude plains Kigoma system		P13,P5,W2
W-4D	Kigoma highlands system	maize, beans, cassava, banana	W2-4

(Source: Variety Preference Survey Results, National Coordination Unit for Farming System Research)

Table 1.2.2 Planted Area of Cereals in Different Seasons

(Unit: ha.)

Region	Maize		Paddy		Sorghum		Millet		Wheat	
	Masika	Vuli	Masika	Vuli	Masika	Vuli	Masika	Vuli	Masika	Vuli
Arusha	200,617	16,799	1,385	126	4,636	0	2,384	16	3,672	0
Coast	40,149	46,782	39,677	15,440	5,286	2,056	0	13	0	0
DSM	5,194	3,086	6,670	123	161	0	4	13	0	0
Dodoma	327,386	0	4,729	0	91,703	0	86,811	0	0	0
Iringa	330,455	0	2,933	0	6,126	0	10,043	0	21,483	0
Kagera	18,510	45,458	1,690	193	22,984	6,464	4,458	870	0	0
Kigoma	1,414	47,457	784	1,759	6,673	3,943	97	629	0	0
Kilimanjaro	85,240	57,550	362	2,668	216	103	3,720	172	90	32
Lindi	73,330	0	24,288	0	54,588	0	73	0	0	0
Mara	65,896	43,565	6,009	1,177	40,758	25,475	13,115	5,193	14	0
Mbeya	211,805	20,963	48,591	72	19,753	0	12,388	614	3,520	552
Morogoro	135,414	106,372	88,505	33,788	17,994	4,129	687	198	0	0
Mtwara	90,377	0	24,898	0	23,613	0	283	0	0	0
Mwanza	43,608	123,827	35,695	42,117	28,116	22,687	14,881	7,878	0	0
Rukwa	131,491	0	6,595	0	5,702	0	19,227	0	2,454	0
Ruvuma	203,167	0	42,883	0	2,876	0	14,335	0	4,311	0
Shinyanga	430,882	0	118,473	0	98,092	0	21,885	0	0	0
Singida	141,971	0	2,125	0	87,715	0	47,847	0	0	0
Tabora	233,731	0	36,420	0	34,243	0	4,540	0	0	0
Tanga	239,994	110,107	10,822	2,238	471	398	25	19	268	171
Total	3,010,631	621,966	503,534	99,701	551,706	65,255	256,803	15,615	35,812	755

(Source: District Integrated Agricultural Survey 1998/99)

Table 2.2.1 Agro-ecological Zones (1/4)

Map Symbol	Area (km^2)	Distinguishing Features	Soils/Topography	Altitude	Growing Period	Major Farming Systems	Minor Farming Systems	Temperature Regime	Moisture Zone
Coast Plains									
C1	8,783	Coastal lowlands, mainly plains with both sandy and clayey soils; short main growing period and very short secondary growing period	Coast lowlands, mainly plain with both Sandy and Clayey soils.	<200	Short main and very short secondary growing period.	Maize, Sorghum, Cassava		T1	DM3
C2	27,900	Coastal lowlands, mainly plains with predominantly sandy soils, one short and unreliable growing period	Coast lowlands, mainly plain with predominantly sandy soils.	<500	One short and unreliable growing period.	Cashewnuts, Cassava, Rice, Coconut, Maize and Sesame.		T1	SM1
C3	6,310	Coastal Lowlands, mainly strongly dissected plains and plateaux; one short and unreliable growing period.	Mainly strongly dissected plains and plateaux with predominantly sandy soils.	<500	One short and unreliable growing period.	Coconut, Cassava		T1	SM1
C4	4,450	Coastal floodplains with flat topography and rich young alluvial; soils, growing period mainly determined by flooding regime	Riverine flood plains rich in young alluvial soils.	<200	Growing period mainly determined by flooding regime	Rice, Maize, Cassava		T1	DM3
C5	8,569	Old alluvial terraces no longer flooded from rivers with generally sandy soils; one short and unreliable growing period, severely infested by tsetse	Old alluvial terrace no longer flooded with sandy soils.	<200	One short and unreliable growing period.	Maize, Cassava, Grain legumes, Sorghum		T1	SM1
C6	1,227	Coastal lowlands, mainly plains with predominantly sandy soils; long growing period.	Coastal lowlands with predominantly sandy soils.	<100	Long growing periods	Maize, Rice, Coconut, Cloves, Cassava		T1	SC3
C7	2,132	Coastal lowlands, mainly plains with predominantly sandy soils; medium growing period.	Coastal lowlands with predominantly sandy soils.	<100	Medium growing period	Rice, Maize, Coconut, Cloves, Cassava		T1	DM2
Eastern Plateaux and Mountain Blocks									
E1	34,938	Medium altitude plains; growing period too short and unreliable for rainfed agriculture.	Semi arid plains and plateaux with mainly well drained sandy clay and clayey soils.	500 - 1200	Too short growing period and unreliable for rainfed agriculture	Sorghum, Livestock, Sisal, Pastoralism	Maize, Pigeon peas	T2	SU2
E2	39,134	Medium altitude plains with some hill ranges; mainly medium-textured soils with low to moderate fertility; growing period short and unreliable	Medium altitude flat and wide topographical depression of semi arid plains.	500 - 1200	Short and unreliable growing period.	Sorghum, Livestock, Sugarcane	Maize, Pigeon peas, Beans	T2	SU2
E3	30,332	Tropical lowlands, mainly plains with strongly weathered soils of low fertility, one short and unreliable growing period; strongly infested by tsetse	Tropical lowlands. Mainly plains with strongly weathered soils of low fertility.	200-750	One short and unreliable growing season	Maize, Sorghum, Cassava		T1	DM3
E4	8,463	Tropical lowlands, mainly plains with predominantly friable clays of low to moderate fertility, one medium but unreliable growing periond; severely infested by tsetse	Tropical lowlands. Mainly plains with predominantly friable clay soils of low to medium fertility.	200-500	One medium but unreliable growing period	Beans, Maize, Potato, Cassava		T1	SH2
E5	15,291	Tropical lowlands, mainly plains with soils of variable texture but low fertility, one medium and reliable growing period; severely infested by tsetse	Tropical lowlands, mainly plains with soils of variable texture but low fertility.	200-500	One medium and reliable growing period	Groundnuts, Cassava, Cashewnut, Maize, Sesame		T1	SM4
E6	934	Tropical lowlands, mainly plains with friable clays of low to moderate fertility; two short growing periods.	Tropical lowlands., mainly plains with friable clays of low to moderate fertility.	150-500	Two short growing periods	Maize, Cassava and Grain legumes		T1	DM1
E7	40,961	Medium altitude plains with predominantly friable clays of low to moderate fertility, one medium and reliable growing period; severely infested by tsetse.	Dissected medium altitude plains, undulating to rolling locally hilly with predominantly friable clays of low to moderate fertility.	750-1300	One medium and reliable growing period	Maize, Cassava, Rice, Beans	Coffee	T2	SH3
E8	1,777	*Floodplain severely affected by salinity.*	*Flat alluvial plains severely affected by* salinity with poorly drained clayey soils.	Wide range	One medium and reliable growing period.	Rice, Maize, Cassava		T1/T2	SU1
E9	7,701	Low altitude, flat alluvial plains with predominantly fertile clays; medium growing period strongly influenced by rainfall ponding and runoff collection; severely infested by tsetse	Low altitude , flat alluvial plains with predominantly fertile clays.	400-500	Medium growing period strongly influenced by rainfall ponding and runoff collection	Maize, Rice and Grain legumes		T1	SH2

Table 2.2.1 Agro-ecological Zones (2/4)

Map Symbol	Area (km^2)	*Distinguishing Features*	*Soils/Topography*	*Altitude*	*Growing Period*	*Major Farming Systems*	*Minor Farming Systems*	Temperature Regime	Moisture Zone
E10	6,253	Low altitude, flat alluvial plains with predominantly fertile clays; growing period mainly determined by flooding regime.	Low altitude , flat alluvial plains with predominantly fertile clays.	400-600	Growing period is determined by flooding regime.	Rice, Maize, Cassava and Grain legumes		T1	SH4/SH5
E11	3,357	Complex,medium altitude depression with mainly sandy soils of low fertility; medium, reliable growing period.	Complex, medium altitude depression with mainly sandy soils of low fertility.	500-1000	Medium reliable growing period.	Maize, Cassava and Beans		T1/T2	SH3
E12	2,752	Tropical highlands with hilly mountain plateaux, mainly clayey soils with moderate fertility, medium growing perids with unreliable onset dates.	Tropical highlands with hilly mountain plateaux, mainly clayey soils with moderate fertility.	1000-2000	Medium growing periods with unreliable onsets dates.	Coffee, Banana, Maize, Beans, Intensive dairy	Horticulture, Finger millet, Yams, Round potato, Sweet potato	T3	SC5
E13	640	Tropical highlands, mountaineous with mainly clayey soils with low to moderate ferility, long, often continuous growing periods.	Tropical highlands,mountaineous with mainly clayey soils with low to moderate fertility.	1000-2000	Often continous growing periods.	Maize, Rice and Grain legumes		T3	SC5
E14	2,976	Tropical highlands, dissected mountain plateaux with footslopes, mainly clayey soils with low to moderate fertility; medium growing periods with unreliable onset dates; severely infested by tsetse.	Tropical highlands, dissected mountain plateaux with footslopes, mainly clayey soils with moderate fertility.	1000-2000	Medium growing periods with unreliable onset dates.	Cassava, Maize		T3	SC2
E15	1,920	Tropical highlands, mountain plateau with footslopes, mainly clayey soils with low to moderate fertility; long growing periods with reliable onset dates; severely infested by tsetse.	Tropical highlands, mountain plateau with footslopes, mainly clayey soils of low to moderate fertility.	800-1700	Long growing periods with reliable onset dates.	Not covered		T2/T3	SH5
High Plains and Plateaux									
H1	13,943	High altitude plateaux with medium to heavy textured soils with low to moderate fertility; medium growing periods with reliable onsets.	High rainfall intermediate Lowlands Chromic cambisols (Fluventic Ustropept).	1500-2000	Medium growing periods with reliable onsets.	Maize, Beans, Tobacco, Fingermillet, Livestock, Sorghum, Sunflower, Groundnuts and Cassava		T3	SM4
H2	6,989	High altitude plateaux with medium to heavy textured soils with low to moderate fertility; medium to long growing periods with reliable onsets.	High rainfall intermediate Lowlands Chromic cambisol Xanthic Ferralsols (Fluventic Ustroopept, Eutrustox).	1500-2100	Medium to long growing periods with reliable onsets.	Maize, Beans, Sunflower, Groundnuts, Livestock		T3	SH5
H3	13,137	Tropical mountains with clayey soils of low to moderate fertility; long growing periods with reliable onsets.	Tropical mountains, with clayey soils of low to moderate fertility.	1500-2300	Long growing periods with reliable onsets.	Maize, Beans, Sunflower, Fingermillet, Groundnuts and Rice		T3	SH5
H4	658	Low altitude lacustrine alluvial plains with fertile, medium to heavy textured soils; long, often continuous growing periods.	Low altitude lacustrine alluvial plains with fertile, medium to heavy textured soils.	500	Long, often continous growing periods.	Rice, Cocoa, Banana, Fruits, Cassava, Maize, Beans and Sweetpotato		T1	SC8
H5	9,300	Volcanic highlands with plateaux and strongly dissected landforms covered by volcanic ash soils; long, often continuous growing periods.	Volcanic highlands with plateaux and strongly dissected landforms covered by volcanic ash soils.	1200-2400	Long, often continous growing periods.	Rice, Groundnuts, Sorghum, Onions, Livestock	Sunflower, Maize, Cassava, Sweet potato and beans	T3	SH5
H6	790	Very high altitude plateau covered by volcanic ash soils; long, often continuous growing periods.	Very high altitude plateau covered by volcanic ash soils.	2300-2700	Long, often continous growing periods.	Natural forest, Miombo Woodlands and Grasslands		T4	SC8
H7	18,438	Tropical, often strongly dissected, mountain plateaux covered by clays with low to moderate fertility; medium growing periods with reliable onsets.	Tropical, often strongly dissected, mountain plateaux covered by clays with low to moderate fertility.	1500-2300	Medium growing periods with reliable onsets.	Coffee, Tea, Banan, Beans	Maize, Fruits, Sweetpotato, Cassava	T3	SH3
Volcanoes and Rift Depressions									
N1	6,114	High altitude plateaux covered by clays with low to moderate fertility and volcanic ash soils of high fertility; short to medium growing periods with unreliable onsets.	High altitude plateaux covered by clays with low to moderate fertility and volcanic ash soils of high fertility.	1500-2500	Short to Medium growing periods with unreliable onsets.	Wheat/Barley, Pigeon peas, Coffee, Banana, Maize, Fingermillet, Sorghum, Fruit trees, Cassava		T3	SM2
N2	1,060	Very high altitude volcanic plateau and slopes; growing period limited by low temperature.	Very high altitude volcanic plateau and slopes.	2000-2500	Growing period limited by low temperature.	Good grazing, Non agricultural		T4	SH1
N3	3,686	Medium altitude lake flats with saline soils; very short to short growing periods.	Medium altitude lake flats with saline soils.	900-1100	Very short to short growing periods.	Pastoralist, Bushland parks		T2	SU1/SU2/SU3

Table 2.2.1 Agro-ecological Zones (3/4)

Map Symbol	Area (km^2)	Distinguishing Features	Soils/Topography	Altitude	Growing Period	Major Farming Systems	Minor Farming Systems	Temperature Regime	Moisture Zone
N4	3,159	Volcanic mountain with predominantly fertile clays derived from volcanic sediments and lavas; growing periods governed by altitude and onsets by exposure to rainbearing winds and rainshadow effects.	Volcanic mountain with predominantly fertile clays derived from volcanic sediments and lavas.	900-1600	Growing periods governed by altitude and onsets by exposure to rainbearing winds and rainshadow effects.	Coffee, Banana, Intensive dairy, Maize, Fingermillet, Beans, Yams, Round and Sweetpotatoes		T2/T4	SH1/SC4
N5	4,544	Medium altitude volcanic plateau with fertile volcanic ash soils; short to medium growing period with unreliable onsets.	Medium altitude volcanic plateau with fertile volcanic ash soils.	1300-1700	Short to medium growing period with unreliable onsets.	Coffee, Banana, Intensive dairy, Maize, Fingermillet, Beans, Yams, Round and Sweetpotatoes		T2	SH2/SM2
N6	6,127	Medium altitude volcanic plateau with fertile volcanic ash soils; short or very short growing periods with unreliable onsets.	Medium altitude volcanic plateau with fertile volcanic ash soils.	1300-1700	Short to very short growing periods with unreliable onsets.	Pastoralist, Bushland parks		T2	SU1/SU2
N7	10,926	Medium altitude volcanic plateau with fertile volcanic ash soils; short growing periods with unreliable onsets.	Medium altitude volcanic plateau with fertile volcanic ash soils.	1300-1800	Short growing periods with unreliable onsets.	Pastoralist, Bushland parks		T2	SU2/SU3
N8	9,610	High altitude, dissected to hilly volcanic plateau with fertile volcanic ash soils; short growing periods with unreliable onsets.	High altitude, dissected to hilly volcanic plateau with fertile volcanic ash soils.	1300-2300	Short growing periods with unreliable onsets.	Pastoralist, Bushland parks		T3	SU3
N9	2,675	Medium altitude volcanic plateau covered by sodic volcanic ash soils; short growing periods with unreliable onsets; severely infested by tsetse.	Medium altitude volcanic plateau covered by sodic volcanic ash soils.	1100-1800	Short growing periods with unreliable onsets.	Maize, Beans, Cassava, Cotton, Bushland parks		T2	SU3
N10	724	High altitude plateau with predominantly clayey soils of low to *moderate fertility; long, often continous growing periods with* unreliable onsets.	High altitude plateau with predominantly *clayey* soils of low to moderate fertility.	1500-1800	Long, often continous growing periods with unreliable onsets.	Extensive livestock, Maize, Sugarcane		T3	SC6
Central Plateau (Plains)									
P1	7,995	Medium altitude plains with mainly sandy soils; short and unreliable growing periods.	Medium altitude plains with mainly sandy soils.	1100-1300	Short and unreliable growing periods.	Not covered		T2	SU2
P2	50,093	Medium altitude plains with mainly sandy soils; short growing periods with reliable onsets; severely infested by tsetse.	Medium altitude plains with mainly sandy soils.	1100-1300	Short growing periods with reliable onsets.	Bush parks, Sorghum, Maize, Groundnuts, Pastoralist		T2	SU3
P3	42,662	Medium altitude plains with mainly sandy soils; medium growing periods with reliable onsets; severely infested by tsetse.	Medium altitude plains with mainly sandy soils.	1100-1300	Medium growing periods with reliable onsets.	Maize, Cassava, Rice, Groundnuts, Bush parks		T2	SU4
P4	27,545	Medium altitude plains with heterogeneous soils; medium growing periods with unreliable onsets.	Medium altitude plains with heterogeneous soils.	1200-1300	Medium growing periods with unreliable onsets.	Maize, Sorghum, Cotton, Rice, Beans, Cassava.		T2	SU4/SM3
P5	67,855	Medium altitude plains with mainly sandy upland soils and *clayey bottomland soils; medium growing periods with reliable* onsets; severely infested by tsetse.	Medium altitude plains with mainly sandy upland soils and clayey bottomland soils.	1100-1300	Medium growing periods with reliable onsets.	Bush park, Maize, Cassava, Rice, Groundnuts		T2	SU5
P6	30,079	Medium altitude plains and plateaux with mainly sandy and loamy soils of low fertility; medium growing periods with reliable onsets; severely infested by tsetse.	Medium altitude plains and plateaux with mainly sandy and loamy soils of low fertility.	800-1800	Medium growing periods with reliable onsets.	Maize, Oilpalm, Groundnuts, Beans, Banana, Cassava		T2	SM5
P7	6,253	Medium altitude plains with mainly clays of high fertility, short growing periods with unreliable onsets.	Medium altitude plains with mainly clays of high fertility.	1000-1100	Short growing periods with *unreliable onsets.*	Sorghum, Cotton, Sweetpotatoes		T2	SU3
P8	38,496	Medium altitude plains with mainly hardpan soils and clays of moderate fertility; short growing periods with unreliable onsets.	Medium altitude plains with mainly hardpan soils and clays of moderate fertility.	1000-1200	Short growing periods with unreliable onsets.	Sorghum, Cotton, Sweetpotatoes, Cassava, Maize		T2	SU3
P9	6,180	Medium altitude plains with mainly sandy and loamy soils of low fertility severely affected by erosion; short growing periods with reliable onsets.	*Medium altitude plains with mainly sandy* and loam of low fertility.	*1000-1400*	*Short growing periods with reliable* onsets.	*Sorghum, Cotton, Sweetpotatoes*		T2	SU3

Table 2.2.1 Agro-ecological Zones (4/4)

Map Symbol	Area (km^2)	Distinguishing Features	Soils/Topography	Altitude	Growing Period	Major Farming Systems	Minor Farming Systems	Temperature Regime	Moisture Zone
P10	10,114	Medium altitude plains with mainly sandy or loamy soils of low fertility, covered by dense thicket; short growing periods with reliable onsets.	Medium altitude plains with mainly sandy or loamy soils of low fertility.	1100-1400	Short growing periods with reliable onsets.	Sorghum, Maize, Groundnuts		T2	SU3
P11	4,146	Medium altitude flat depression with mainly hardpan and saline soils; short growing period strongly altered by flooding; runoff, salinity.	Medium altitude flat depression with mainly hardpan and saline soils.	900	Short growing period strongly altered by flooding, ruoff, salinity.	Rice, Sorghum		T2	SU3
P12	4,568	Medium altitude, flat lowland plains with seasonally waterlogged or flooded clays; short growing period strongly altered by flooding.	Medium altitude, flat lowland plain with seasonally waterlogged or flooded clays.	900-1200	Short growing period strongly altered by flooding.	Sorghum, Cotton, Sweetpotatoes		T2	SU3
P13	17,216	Medium altitude, flat lowland plains with seasonally or permanently waterlogged clays; medium growing period strongly altered by flooding, severely infested by tsetse.	Medium altitude, flat lowland plains with seasonally or permanently waterlogged clays.	900-1200	Medium growing period strongly altered by flooding.	Not covered		T2	SU5
Rukwa - Ruaha Rift Zone - Alluvial Flats									
R1	17,461	Medium altitude, flat rift depression with mainly sodic soils; medium growing periods with reliable onsets.	Medium altitude, flat rift depression with many sodic soils.	800-1000	Medium growing period with reliable onsets.	Maize, Wheat, Potato, Beans, Cassava, Rice, Groundnuts, Cotton, Tobacco.		T2	SM4/SH5
R2	4,619	Medium altitude flat lacustrine plains with mainly alluvial clays, saline and hardpan soils; medium growing periods with reliable onsets.	Medium altitude flat lacustrine plains with mainly alluvial clays, saline and hardpan soils.	Variable	Medium growing period with reliable onsets.	Rice, Sorghum, Maize, Cassava, Livestock, Fingermillet	Round potatoes, Sweetpotato, Wheat	T2	SU4
R3	2,688	Comparable to zone R2 but shorter growing periods and severely infested by tsetse.	Medium altitude flat lacustrine plains with mainly alluvial clays, saline and hardpan soils.	900-1400	Short growing period with reliable onsets.	Bush park		T2	SU3
R4	1,514	Medium altitude riverine floodplain with young, fertile alluvial soils; short growing period with reliable onset, strongly modified by flooding regime.	Medium altitude riverine floodplain with young, fertile alluvial soils.	1000	Short growing period with reliable onsets.	Rice, Cocoa, Banana		T2	SU3
Inland Sedimentary Sediments									
S1	11,136	Low altitude plains and plateaux, covered by sandy soils of low fertility, short and unreliable growing periods; severely infested by tsetse.	Low altitude plains and plateaux covered by sandy soils of low fertility.	200-500	Short and unreliable growing periods.	Bush park	Cassava, Maize, Rice	T	SM1
S2	51,592	As above, but with longer and more reliable growing periods.	Low altitude plains and plateaux covered by sandy soils of low fertility.	200-1000	Longer and more reliable growing periods.	Maize, Cassava, Tobacco, Rice	Sorghum, Cashew, Groundnuts, Cowpeas, Simsim.	T1/T2	SM4
Inland Sedimentary Sediments									
U	16,654	High altitude, plains and plateaux covered by sandy and loamy soils of low fertility; medium growing periods with reliable onsets.	High altitude plains and plateaux covered by sandy and loamy soils of low fertility.	1400-2300	Medium growing periods with reliable growing onsets.	Maize, Beans, Round potato, Coffee		T3	SH3
Western Highlands									
W1	8,688	High altitude, strongly dissected to hilly plateaux with mainly clays of low to medium fertility;long often continuous growing periods.	High altitude, strongly dissected to hilly plateaux with mainly clays of low fertility.	1500-1800	Long often continous growing periods.	Banana, Coffee, Beans, Cassava, Maize, Livestock, , Sugar, Bush park	Sweet potato, Groundnuts, Bamba	T3	SC7
W2	13,427	High altitude, strongly dissected to hilly plateaux with mainly clays of low to medium fertility; long growing periods with reliable onsets.	High altitude, strongly dissected to hilly plateaux with mainly clays of low to medium fertility.	1500-1700	Long growing periods with reliable onsets.	Maize, Cassava, Oilpalm, Beans, Banana, Bush park	Cowpeas, Bamba, Yam	T3	SM5
W3	6,690	Medium altitude plains and plateaux, often dissected, covered by sands and loams with low fertility; medium growing periods with unreliable onsets.	Medium altitude plains and plateaux, often dissected, covered by sands and loams with low fertility.	1200-1600	Medium growing periods with unreliable onsets.	Livestock, Maize, Sugarcane, Banana, Coffee, Beans, Cassava, Bush park	Cowpeas, Bamba, Yam	T2	SM3
W4	10,622	Medium altitude plains and plateaux covered by clays with low fertility, long, often continuous growing periods.	Medium altitude plains and plateaux covered by clays with low fertility.	1400-1500	Long, often continous growing periods.	Banana, Coffee, Beans, Cassava	Cowpeas, Bamba, Yam	T2	SC7

(Source: Soils, Physiology and Agro-ecological Zones of Tanzania, Crop Monitoring and Early Warning System Project)

Table 2.2.2 Major Physiographic Types of Agro-ecological Zones

Type	Agro-ecological Zones	Characteristics
		Rocky terrain unuitable for Agriculture
Type-1	C4, E10, P4	Agroecological zones of predominance of flood plains
Type-2	E9, P12, P13, (R1), R2	Agroecological zones of p[redominance of seasonal waterlogging or flooding
Type-3	E8, N3, N9, P11, (R3)	Agroecological zones of predominance of salinity or sodicity
Type-4	E12, E13, E14, E15, H3, H7, N4	Agroecological zones with mountaineous character
Type-5	H1, H2, H5, H6, N1, N2, N8, N10, U, W1	Agroecological zones at high and very high altitude, excluding mountaineous areas
Type-6	E1, E2, N6, N7, P1	Other agroecological zones with very short growing periods (less than three months)
Type-7	C2, C3, C5, E3, N5, P2, P7, P8, P9, P10, R3, S1	Other agroecological zones with short growing periods (3-4 months).
Type-8	C1, C7, E4, E5, E6, E7, E11, P3, P4, P5, S2, W3	Other agroecological zones with medium growing periods (4-7 months)
Type-9	C6, P6, (R1), W2, W4	Other agroecological zones with long to very long growing periods (more than 7 months)

(Source: Soils, Physiology and Agro-ecological Zones of Tanzania, Crop Monitoring and Early Warning System Project)

Table 2.2.3 Present Cropping Pattern for Paddy and Maize

PADDY	Total			Rainfed			Irrigated		
	Yield (ton/ha)	Area (ha)	Production (ton)	Yield (ton/ha)	Area (ha)	Production (ton)	Yield (ton/ha)	Area (ha)	Production (ton)
ARUSHA	1.2	9,800	12,200	0.9	6,420	5,778	1.9	3,380	6,422
COAST/DSM	1.5	39,100	60,200	1.5	38,214	57,321	3.3	886	2,879
DODOMA	0.3	1,500	500	0.2	1,100	220	0.7	400	280
IRINGA	1.5	8,200	12,600	1.2	6,475	7,770	2.8	1,725	4,830
KAGERA	1.5	1,700	2,600	1.5	1,692	2,572	3.5	8	28
KIGOMA	1.9	4,400	8,200	1.5	2,857	4,343	2.5	1,543	3,857
KILIMANJARO	2.3	9,200	21,400	1.3	2,457	3,194	2.7	6,743	18,206
LINDI	1.5	9,900	15,200	1.4	9,047	12,213	3.5	853	2,987
MARA	1.9	900	1,700	1.5	732	1,113	3.5	168	587
MBEYA	3.0	61,700	189,800	1.8	22,330	40,194	3.8	39,370	149,606
MOROGORO	1.5	67,100	103,200	1.2	54,500	65,400	3.0	12,600	37,800
MTWARA	1.0	24,200	26,000	1.1	23,897	25,092	3.0	303	908
MWANZA	1.5	71,000	109,200	1.5	70,190	106,689	3.1	810	2,511
RUKWA	2.3	29,100	67,200	2.1	25,518	53,587	3.8	3,582	13,613
RUVUMA	2.1	13,900	29,800	2.1	13,837	29,612	3.0	63	188
SHINYANGA	0.5	96,600	44,600	0.5	95,731	43,079	1.8	869	1,521
SINGIDA	0.5	6,400	2,900	0.4	5,988	2,096	2.0	413	804
TABORA	0.9	48,200	44,500	0.9	46,707	42,036	1.7	1,493	2,464
TANGA	2.2	14,100	30,500	1.5	7,867	11,800	3.0	6,233	18,700
TOTAL	1.5	517,000	782,300	1.2	435,558	514,108	3.3	81,442	268,192

MAIZE	Total			Rainfed			Irrigated		
	Yield (ton/ha)	Area (ha)	Production (ton)	Yield (ton/ha)	Area (ha)	Production (ton)	Yield (ton/ha)	Area (ha)	Production (ton)
ARUSHA	1.7	129,500	213,800	1.6	100,444	155,689	2.0	29,056	58,111
COAST/DSM	0.9	34,500	30,800	0.9	34,450	30,661	2.8	50	139
DODOMA	0.5	61,700	28,900	0.4	59,320	25,329	1.5	2,380	3,571
IRINGA	2.0	187,200	373,700	2.0	186,594	371,882	3.0	606	1,818
KAGERA	1.1	58,800	65,300	1.1	58,799	65,296	3.8	1	4
KIGOMA	1.7	69,800	119,900	1.7	67,320	114,444	2.2	2,480	5,456
KILIMANJARO	2.0	90,000	181,300	1.9	67,632	129,853	2.3	22,368	51,447
LINDI	1.0	69,200	66,200	1.0	69,115	66,005	2.3	85	195
MARA	1.4	49,000	68,100	1.4	48,949	67,941	3.1	51	159
MBEYA	1.9	124,200	235,000	1.9	123,630	233,289	3.0	570	1,711
MOROGORO	1.3	76,000	96,600	1.2	70,600	84,720	2.2	5,400	11,880
MTWARA	0.9	42,200	39,800	0.9	41,903	38,760	3.5	297	1,040
MWANZA	1.2	109,100	129,400	1.2	109,050	129,224	3.5	50	176
RUKWA	1.7	118,500	203,700	1.7	118,235	202,774	3.5	265	926
RUVUMA	1.8	110,700	199,800	1.8	110,619	199,556	3.0	81	244
SHINYANGA	0.5	211,700	103,800	0.5	211,634	103,700	1.5	66	100
SINGIDA	0.6	57,300	32,900	0.6	57,289	32,884	1.5	11	16
TABORA	1.3	78,300	103,800	1.3	78,262	103,697	2.7	38	103
TANGA	1.8	86,600	158,900	1.8	86,347	158,016	3.5	253	884
TOTAL	1.4	1,764,300	2,451,700	1.4	1,700,191	2,313,720	2.2	64,109	137,980

IRRIGATED AREA	Inventorized Existing Irrigated Area		Paddy		Maize		Others	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
ARUSHA	49,797	100.0	3,380	6.8	29,056	58.3	17,361	34.9
COAST/DSM	1,134	100.0	886	78.1	50	4.4	199	17.5
DODOMA	3,557	100.0	400	11.2	2,380	66.9	777	21.8
IRINGA	3,535	100.0	1,725	48.8	606	17.1	1,204	34.1
KAGERA	15	100.0	8	53.9	1	6.4	6	39.7
KIGOMA	6,769	100.0	1,543	22.8	2,480	36.6	2,746	40.6
KILIMANJARO	45,678	100.0	6,743	14.8	22,368	49.0	16,567	36.3
LINDI	1,231	100.0	853	69.3	85	6.9	293	23.8
MARA	341	100.0	168	49.2	51	15.1	122	35.8
MBEYA	49,112	100.0	39,370	80.2	570	1.2	9,172	18.7
MOROGORO	25,144	100.0	12,600	50.1	5,400	21.5	7,144	28.4
MTWARA	730	100.0	303	41.4	297	40.7	130	17.9
MWANZA	1,008	100.0	810	80.4	50	5.0	148	14.6
RUKWA	4,736	100.0	3,582	75.6	265	5.6	889	18.8
RUVUMA	198	100.0	63	31.7	81	41.0	54	27.2
SHINYANGA	1,210	100.0	869	71.8	66	5.5	274	22.7
SINGIDA	525	100.0	413	78.6	11	2.0	102	19.4
TABORA	1,923	100.0	1,493	77.7	38	2.0	391	20.4
TANGA	8,626	100.0	6,233	72.3	253	2.9	2,140	24.8
TOTAL	205,269	100.0	81,442	39.7	64,109	31.2	59,718	29.1

(Source: Estimation based on Basic data Agricultural Sector and Inventory Survey)

Table 2.2.4 Present Cropping Pattern (Unit : %)

Region	Rainfed				Irrigation Rainy Season				Irrigation Dry Season				Irrigation Total			
	Paddy	Maize	Others	Total	Paddy	Maize	Others	Total	Paddy	Maize	Others	Total	Paddy	Maize	Others	Total
ARUSHA	2.9	41.6	55.5	100.0	6.8	58.3	34.9	100.0	2.7	0	19.7	22.4	9.5	58.3	54.6	122.4
COAST	12.7	17.9	69.4	100.0	78.1	4.4	17.5	100.0	39.1	0	20.0	59.1	117.2	4.4	37.5	159.1
DAR-ES-SALAAM	12.7	17.9	69.4	100.0	78.1	4.4	17.5	100.0	39.1	0	20.0	59.1	117.2	4.4	37.5	159.1
DODOMA	0.5	24.7	74.8	100.0	0.0	66.9	33.1	100.0	0.0	0	8.1	8.1	0.0	66.9	41.2	108.1
IRINGA	2.1	53.4	44.5	100.0	48.8	17.1	34.1	100.0	9.8	0	12.1	21.8	58.6	17.1	46.1	121.8
KAGERA	0.5	17.6	81.9	100.0	53.9	6.4	39.7	100.0	0.0	0	0.0	0.0	53.9	6.4	39.7	100.0
KIGOMA	2.2	38.0	59.8	100.0	22.8	36.6	40.6	100.0	0.0	0	9.5	9.5	22.8	36.6	50.0	109.5
KILIMANJARO	3.7	35.5	60.8	100.0	14.8	49.0	36.3	100.0	2.0	0	13.2	15.2	16.8	49.0	49.5	115.2
LINDI	5.4	38.0	56.6	100.0	69.3	6.9	23.8	100.0	0.0	0	0.0	0.0	69.3	6.9	23.8	100.0
MARA	0.4	19.4	80.2	100.0	49.2	15.1	35.8	100.0	0.0	0	2.7	2.7	49.2	15.1	38.5	102.7
MBEYA	17.4	38.1	44.5	100.0	80.2	1.2	18.7	100.0	17.6	0	12.8	30.4	97.8	1.2	31.4	130.4
MOROGORO	25.0	27.7	47.3	100.0	50.1	21.5	28.4	100.0	12.5	0	18.7	31.2	62.6	21.5	47.1	131.2
MTWARA	7.9	13.8	78.3	100.0	41.4	40.7	17.9	100.0	8.3	0	2.2	10.5	49.7	40.7	20.0	110.5
MWANZA	18.0	27.8	54.2	100.0	80.4	5.0	14.6	100.0	24.1	0	6.2	30.3	104.5	5.0	20.8	130.3
RUKWA	10.3	42.7	47	100.0	75.6	5.6	18.8	100.0	26.5	0	12.6	39.1	102.1	5.6	31.4	139.1
RUVUMA	6.1	48.5	45.4	100.0	31.7	41.0	27.2	100.0	9.5	0	10.0	19.5	41.2	41.0	37.2	119.5
SHINYANGA	15.0	32.8	52.2	100.0	71.8	5.5	22.7	100.0	7.2	0	2.5	9.7	79.0	5.5	25.2	109.7
SINGIDA	2.9	26.8	70.3	100.0	78.6	2.0	19.4	100.0	0.0	0	0.0	0.0	78.6	2.0	19.4	100.0
TABORA	19.9	32.3	47.8	100.0	77.7	2.0	20.4	100.0	7.8	0	3.7	11.4	85.4	2.0	24.0	111.4
TANGA	5.1	39.2	55.7	100.0	72.3	2.9	24.8	100.0	21.7	0	12.2	33.9	93.9	2.9	37.0	133.9
Average	8.9	32.3	58.8	100.0	39.5	31.2	29.3	100.0	9.0	0	14.7	23.3	48.5	31.2	44.0	123.3

(Estimation based on Basic Data Agricultural Sector 1993/94-1999/2000 and the Inventory survey)

Table 2.2.5 Development Direction and Crop Intensity Potential for Regions

Region	Present Condition	Suitability for Paddy	Suitability for Maize	Development Direction	Present Crop Intensity	Temperature Regime	Moisture Zones	Crop Intensity Potential
ARUSHA	Maize	-	-	Others	Low	T2	SU	Low
COAST	Paddy	+	+	Paddy	High	T1	DM/SM	High
DAR-ES-SALAAM	Paddy	+	+-	Paddy	High	T1	SM	High
DODOMA	Maize	-	-	Others	Low	T2	SU	Low
IRINGA	Paddy	+-	+-	Paddy/Maize	Medium	T3	SH/SM	Medium
KAGERA	Paddy	+-	+-	Paddy	Low	T2/T3	SC/SM	Low
KIGOMA	Others	+-	+	Paddy	Low	T2/T3	SM/SU	Medium
KILIMANJARO	Maize	+-	+-	Others	Low	T2/T4	SH/SU	Medium
LINDI	Paddy	+-	+-	Paddy	Low	T1/T2	DM/SM	High
MARA	Paddy	-	+-	Paddy/Maize	Low	T2/T3	SU	Low
MBEYA	Paddy	+	+-	Paddy	Medium	T2/T3	SH/SU	High
MOROGORO	Paddy	+	+	Paddy	Medium	T3	SH/SM	High
MTWARA	Paddy/Maize	+-	+-	Paddy/Maize	Medium	T1	SM	Medium
MWANZA	Paddy	+	+	Paddy	High	T2	SU	High
RUKWA	Paddy	+-	+	Paddy	High	T2/T3	SH/SM	High
RUVUMA	Maize	+	+	Paddy/Maize	Medium	T2	SH/SM	Medium
SHINYANGA	Paddy	+-	+	Paddy	Medium	T2	SU	Medium
SINGIDA	Paddy	-	+	Paddy	Low	T2	SU	Low
TABORA	Paddy	+	+	Paddy	Medium	T2	SU	Medium
TANGA	Paddy	-	+-	Paddy	High	T1	DM/SU	High

Note: + = Suitable area is widely distributed, +- = Suitable area is limited, - = Suitable area is not distributed
Note: *T1(Max/Min)=29-31/19-23, T2(Max/Min)=27-30/15-18, T3(Max/Min)=22-25/10-15, T4(Max/Min)=16-19/5-10*
Note: DM=double cropping, SC=single (often continuous), SH=single (highly responsive to moisture storage capacity)
SM=single (moderately responsive to moisture storage capacity), SU=single (unresponsive to moisture storage capacity)
(Estimation based on Agro-ecological Zone map)

Table 2.2.6 Future Cropping Pattern (Unit : %)

Region	Rainfed				Irrigation Rainy Season				Irrigation Dry Season				Irrigation Total			
	Paddy	Maize	Others	Total	Paddy	Maize	Others	Total	Paddy	Maize	Others	Total	Paddy	Maize	Others	Total
ARUSHA	2.9	41.6	55.5	100.0	20.0	50.0	30.0	100.0	5.0	0	19.7	24.7	25.0	50.0	49.7	124.7
COAST	12.7	17.9	69.4	100.0	80.0	5.0	15.0	100.0	50.0	0	20.0	70.0	130.0	5.0	35.0	170.0
DAR-ES-SALAAM	12.7	17.9	69.4	100.0	80.0	5.0	15.0	100.0	50.0	0	20.0	70.0	130.0	5.0	35.0	170.0
DODOMA	0.5	24.7	74.8	100.0	20.0	50.0	30.0	100.0	0.0	0	8.1	8.1	20.0	50.0	38.1	108.1
IRINGA	2.1	53.4	44.5	100.0	50.0	30.0	20.0	100.0	10.0	0	12.1	22.1	60.0	30.0	32.1	122.1
KAGERA	0.5	17.6	81.9	100.0	80.0	5.0	15.0	100.0	0.0	0	0.0	0.0	80.0	5.0	15.0	100.0
KIGOMA	2.2	38.0	59.8	100.0	50.0	30.0	20.0	100.0	5.0	0	9.5	14.5	55.0	30.0	29.5	114.5
KILIMANJARO	3.7	35.5	60.8	100.0	20.0	50.0	30.0	100.0	5.0	0	13.2	18.2	25.0	50.0	43.2	118.2
LINDI	5.4	38.0	56.6	100.0	80.0	5.0	15.0	100.0	10.0	0	0.0	10.0	90.0	5.0	15.0	110.0
MARA	0.4	19.4	80.2	100.0	50.0	30.0	20.0	100.0	0.0	0	2.7	2.7	50.0	30.0	22.7	102.7
MBEYA	17.4	38.1	44.5	100.0	80.0	5.0	15.0	100.0	25.0	0	12.8	37.8	105.0	5.0	27.8	137.8
MOROGORO	25.0	27.7	47.3	100.0	80.0	5.0	15.0	100.0	25.0	0	18.7	43.7	105.0	5.0	33.7	143.7
MTWARA	7.9	13.8	78.3	100.0	50.0	30.0	20.0	100.0	10.0	0	2.2	12.2	60.0	30.0	22.2	112.2
MWANZA	18.0	27.8	54.2	100.0	80.0	5.0	15.0	100.0	50.0	0	6.2	56.2	130.0	5.0	21.2	156.2
RUKWA	10.3	42.7	47	100.0	80.0	5.0	15.0	100.0	50.0	0	12.6	62.6	130.0	5.0	27.6	162.6
RUVUMA	6.1	48.5	45.4	100.0	50.0	30.0	20.0	100.0	10.0	0	10.0	20.0	60.0	30.0	30.0	120.0
SHINYANGA	15.0	32.8	52.2	100.0	80.0	5.0	15.0	100.0	10.0	0	2.5	12.5	90.0	5.0	17.5	112.5
SINGIDA	2.9	26.8	70.3	100.0	80.0	5.0	15.0	100.0	0.0	0	0.0	0.0	80.0	5.0	15.0	100.0
TABORA	19.9	32.3	47.8	100.0	80.0	5.0	15.0	100.0	10.0	0	3.7	13.7	90.0	5.0	18.7	113.7
TANGA	5.1	39.2	55.7	100.0	80.0	5.0	15.0	100.0	50.0	0	12.2	62.2	130.0	5.0	27.2	162.2
Average	8.9	32.3	58.8	100.0	63.5	18.0	18.5	100.0	18.8	0	14.7	33.5	82.3	18.0	33.2	133.5

(Estimation by the Study Team)

Table 2.5.1 Crop Budget of Major Crops With and Without Project Conditions (1/3)

Crop Budget of Paddy under Rainfed Present Condition (Without)		Unit	Unit Price (Tsh)	Q'ty	Value (Tsh)	Remark
I	Gross Return					
	Yield	kg/ha		1,000		
	Farmgate Price	Tsh/kg	190.00			
	Gross Return	Tsh/ha			190,000	
II	Production Cost					
	1. Farm Inputs					
	1.1 Seed	kg/ha	145	60	8,700	
	1.2 Fertilizer					
	Urea (46% N)	kg/ha	250	0	0	
	SA (21% N)	kg/ha	200	0	0	
	TSP (46% P2O5)	kg/ha	200	0	0	
	NPK	kg/ha	300	0	0	
	Manure	ton/ha		0	0	
	1.3 Agro-chemical					
	Pesticide	lit/ha	10,000	0	0	
	Herbicide	lit/ha	5,000	0	0	
	Fungicide	lit/ha	5,000	0	0	
	1.4 Packing Material					
	Bags (60 kg)	nos/ha	500	17	8,500	
	Sub-total				17,200	
	2. Labour Requirement					
	Land prep., Puddle and Bund	man/day		30		
	Nursery	man/day		0		
	Plant/Transplanting	man/day		5		
	Weeding and Fertilizer	man/day		25		
	Bird Scaring	man/day		30		
	Harvesting	man/day		13		
	Transport Marketing	man/day		5		
	Irrigation, etc	man/day		0		
	Threshing/Winnowing	man/day		6		
	Sub-total		300	114	34,200	
	3. Machinery of Draught Animal					
	Tractor	LS		0		
	Hand Tractor	LS		0		
	Draught Animal	LS		0		
	Sub-total				0	
	4. Miscellaneous Cost					
	5% of Cost				2,570	
	Total Cost				53,970	
III	Net Return					
	Value				136,030	

Crop Budget of Paddy under Irrigation Proposed Condition (With)		Unit	Unit Price (Tsh)	Q'ty	Value (Tsh)	Remark
I	Gross Return					
	Yield	kg/ha		3,500		
	Farmgate Price	Tsh/kg	190.00			
	Gross Return	Tsh/ha			665,000	
II	Production Cost					
	1. Farm Inputs					
	1.1 Seed	kg/ha	400	80	32,000	
	1.2 Fertilizer					
	Urea (46% N)	kg/ha	250	174	43,500	
	SA (21% N)	kg/ha	200	0	0	
	TSP (46% P2O5)	kg/ha	200	43	8,600	
	NPK	kg/ha	300	0	0	
	Manure	ton/ha		0	0	
	1.3 Agro-chemical					
	Pesticide	lit/ha	10,000	4	40,000	
	Herbicide	lit/ha	5,000	4	20,000	
	Fungicide	lit/ha	5,000	0	0	
	1.4 Packing Material					
	Bags (60 kg)	nos/ha	500	59	29,500	
	Sub-total				173,600	
	2. Labour Requirement					
	Land prep., Puddle and Bund	man/day		30		
	Nursery	man/day		10		
	Plant/Transplanting	man/day		20		
	Weeding and Fertilizer	man/day		30		
	Bird Scaring	man/day		35		
	Harvesting	man/day		25		
	Transport Marketing	man/day		10		
	Irrigation, etc	man/day		4		
	Threshing/Winnowing	man/day		12		
	Sub-total		300	176	52,800	
	3. Machinery of Draught Animal					
	Tractor	LS		0		
	Hand Tractor	LS		0		
	Draught Animal	LS		0		
	Sub-total			0	0	
	4. Miscellaneous Cost					
	5% of Cost				11,320	
	Total Cost				237,720	
III	Net Return					
	Value				427,280	

(Source: Prepared by the tudy Team)

Table 2.5.1 Crop Budget of Major Crops With and Without Project Conditions (2/3)

	Crop Budget of Maize under Rainfed Present Condition (Without)	Unit	Unit Price (Tsh)	Q'ty	Value (Tsh)	Remark
I	Gross Return					
	Yield	kg/ha		1,000		
	Farmgate Price	Tsh/kg	120.00			
	Gross Return	Tsh/ha			120,000	
II	Production Cost					
	1. Farm Inputs					
	1.1 Seed	kg/ha	97	15	1,455	
	1.2 Fertilizer					
	Urea (46% N)	kg/ha	250	0	0	
	SA (21% N)	kg/ha	200	0	0	
	TSP (46% P2O5)	kg/ha	200	0	0	
	NPK	kg/ha	300	0	0	
	Manure	ton/ha		0	0	
	1.3 Agro-chemical					
	Pesticide	lit/ha	10,000	0	0	
	Herbicide	lit/ha	5,000	0	0	
	Fungicide	lit/ha	5,000	0	0	
	1.4 Packing Material					
	Bags	nos/ha	500	17	8,500	
	Sub-total				9,955	
	2. Labour Requirement					
	Land Preparation	man/day		25		
	Planting	man/day		5		
	Manure Application	man/day		0		
	Fertilizer Apploication	man/day		0		
	Weeding	man/day		25		
	Harvest	man/day		20		
	Shell, Pack, Market	man/day		6		
	Irrigation	man/day		0		
	Sub-total		300	81	24,300	
	3. Machinery of Draught Animal					
	Tractor	LS		0		
	Hand Tractor	LS		0		
	Draught Animal	LS		0		
	Sub-total			0	0	
	4. Miscellaneous Cost					
	5% of Cost				1,713	
	Total Cost				35,968	
III	Net Return					
	Value				84,032	

	Crop Budget of Maize under Irrigation Proposed Condition (With)	Unit	Unit Price (Tsh)	Q'ty	Value (Tsh)	Remark
I	Gross Return					
	Yield	kg/ha		3,000		
	Farmgate Price	Tsh/kg	120.00			
	Gross Return	Tsh/ha			360,000	
II	Production Cost					
	1. Farm Inputs					
	1.1 Seed	kg/ha	590	15	8,850	
	1.2 Fertilizer					
	Urea (46% N)	kg/ha	250	100	25,000	
	SA (21% N)	kg/ha	200	0	0	
	TSP (46% P2O5)	kg/ha	200	0	0	
	NPK	kg/ha	300	100	30,000	
	Manure	ton/ha		0	0	
	1.3 Agro-chemical					
	Pesticide	lit/ha	10,000	4	40,000	
	Herbicide	lit/ha	5,000	0	0	
	Fungicide	lit/ha	5,000	0	0	
	1.4 Packing Material					
	Bags	nos/ha	500	50	25,000	
	Sub-total				128,850	
	2. Labour Requirement					
	Land Preparation	man/day		25		
	Planting	man/day		5		
	Manure Application	man/day				
	Fertilizer Apploication	man/day		3		
	Weeding	man/day		40		
	Harvest	man/day		42		
	Shell, Pack, Market	man/day		13		
	Irrigation	man/day		4		
	Sub-total		300	132	39,480	
	3. Machinery of Draught Animal					
	Tractor	LS		0		
	Hand Tractor	LS		0		
	Draught Animal	LS		0		
	Sub-total			0	0	
	4. Miscellaneous Cost					
	5% of Cost				8,417	
	Total Cost				176,747	
III	Net Return					
	Value				183,254	

(Source: Prepared by the tudy Team)

Table 2.5.1 Crop Budget of Major Crops With and Without Project Conditions (3/3)

	Crop Budget of Beans under Rainfed *Present Condition (Without)*	Unit	Unit Price (Tsh)	Q'ty	Value (Tsh)	Remark
I	Gross Return					
	Yield	kg/ha		500		
	Farmgate Price	Tsh/kg	250.00			
	Gross Return	Tsh/ha			125,000	
II	Production Cost					
	1. Farm Inputs					
	1.1 Seed	kg/ha	292	40	11,680	
	1.2 Fertilizer					
	Urea (46% N)	kg/ha	250	0	0	
	SA (21% N)	kg/ha	200	0	0	
	TSP (46% P2O5)	kg/ha	200	0	0	
	NPK	kg/ha	300	0	0	
	Manure	ton/ha		0	0	
	1.3 Agro-chemical					
	Pesticide	lit/ha	10,000	0	0	
	Herbicide	lit/ha	5,000	0	0	
	Fungicide	lit/ha	5,000	0	0	
	1.4 Packing Material					
	Bags	nos/ha	500	9	4,500	
	Sub-total				16,180	
	2. Labour Requirement					
	Land Preparation	man/day		25		
	Planting	man/day		5		
	Manure Application	man/day				
	Fertilizer Apploication	man/day				
	Weeding	man/day		25		
	Harvest	man/day		15		
	Shell, Pack, Market	man/day		6		
	Irrigation	man/day				
	Sub-total		300	76	22,800	
	3. Machinery of Draught Animal					
	Tractor	LS		0		
	Hand Tractor	LS		0		
	Draught Animal	LS		0		
	Sub-total			0	0	
	4. Miscellaneous Cost					
	5% of Cost				1,949	
	Total Cost				40,929	
III	Net Return					
	Value				84,071	

(Source: Prepared by the tudy Team)

	Crop Budget of Beans under Irrigation Proposed Condition (With)	Unit	Unit Price (Tsh)	Q'ty	Value (Tsh)	Remark
I	Gross Return					
	Yield	kg/ha		1,500		
	Farmgate Price	Tsh/kg	250.00			
	Gross Return	Tsh/ha			375,000	
II	Production Cost					
	1. Farm Inputs					
	1.1 Seed	kg/ha	800	40	32,000	
	1.2 Fertilizer					
	Urea (46% N)	kg/ha	250	0	0	
	SA (21% N)	kg/ha	200	0	0	
	TSP (46% P2O5)	kg/ha	200	0	0	
	NPK	kg/ha	300	124	37,200	
	Manure	ton/ha		0	0	
	1.3 Agro-chemical					
	Pesticide	lit/ha	10,000	4	40,000	
	Herbicide	lit/ha	5,000	0	0	
	Fungicide	lit/ha	5,000	0	0	
	1.4 Packing Material					
	Bags	nos/ha	500	25	12,500	
	Sub-total				121,700	
	2. Labour Requirement					
	Land Preparation	man/day		25		
	Planting	man/day		5		
	Manure Application	man/day				
	Fertilizer Apploication	man/day		2		
	Weeding	man/day		30		
	Harvest	man/day		45		
	Shell, Pack, Market	man/day		18		
	Irrigation	man/day		4		
	Sub-total		300	125	37,500	
	3. Machinery of Draught Animal					
	Tractor	LS		0		
	Hand Tractor	LS		0		
	Draught Animal	LS		0		
	Sub-total			0	0	
	4. Miscellaneous Cost					
	5% of Cost				7,960	
	Total Cost				167,160	
III	Net Return					
	Value				207,840	