

**MINISTRY OF AGRICULTURE AND FOOD SECURITY**  
**IRRIGATION AND TECHNICAL SERVICES DIVISION**

**AGRICULTURAL MECHANIZATION IN TANZANIA**

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**ABSTRACT**

*Agriculture is the leading sector of the economy in Tanzania, accounting for over half of both the GDP and merchandize exports. Over 80% of its population of 34.5 million people live and earn their living in the rural areas with agriculture as the mainstay of their living (ASDS, 2001).*

*Tanzania agriculture is mainly subsistence farming and is characterized by low level of technology use and poor management leading to low crop yields. Small scale farming which is dominant in the country has failed to utilise fully the large land resource available.*

*Improvement of the agricultural sector is paramount in poverty reduction. Commercialising smallholder agriculture and accelerating its growth rate is essential in increasing agricultural production as a means of pulling the majority of the rural poor out of abject poverty. Given the generally abundant land resource, efforts to increase agricultural production should include both technologies to expand utilized land area and intensification of the existing cultivated area. This may be achieved through mechanization and adoption of other improved technologies such as improved seed, use of fertilizers, agro processing and accessibility to markets.*

*Agricultural mechanisation includes three main power sources, that is human, animal and mechanical. Under the tropical heat, a health adult using a hand hoe can work about 0.5 ha per season thus limiting the area under cultivation to 2 ha only for an average family of four adults. On the other hand a family owning a pair of draught animals can manage 5 - 8 ha per season while a 60-70 Hp tractor can manage more than 80 ha in a season.*

*Mechanization enhances the human capacity, leading to intensification and increased productivity as a result of timely planting, weeding, harvesting, post harvesting handling and accessibility to markets. Also it reduces drudgery making agriculture an attractive enterprise. It therefore has the potential to turn idle land into productive land for national economic growth, food self-sufficiency, industrial growth and employment, leading to poverty reduction. Tanzania needs to mount a long-term effort to develop a modern agriculture, mechanization playing a leading role.*

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## AGRICULTURAL MECHANIZATION IN TANZANIA

### 1. INTRODUCTION

Agriculture is the leading sector of the economy in Tanzania, accounting for over half of both the GDP and merchandise exports. Over 80% of its population of 34.5 million people live and earn their living in the rural areas with agriculture as the mainstay of their living (ASDS, 2001). The main food crops grown in the country are maize, paddy, sorghum, millet, cassava, potatoes, pulses, sunflower, simsim, groundnuts, palm oil and coconut while the main cash crops are cashew nuts, coffee, cotton, sugar, tea, tobacco, sisal and pyrethrum. The annual average production of food and cash crops is 8 million tons and 600,000 tons respectively.

Tanzania agriculture is mainly subsistence farming and is characterized by low level of technology use and poor management leading to low crop yields. Among the major identified factors contributing to low yields are, low adoption of improved crop production techniques including mechanization, low and unstable commodity prices, highly variable rainfall and low level of utilization of available land. Increased food production is also partly constrained by the unreliable supplies of key inputs such as improved seed, fertilizer, chemicals, agricultural tools and machinery.

Small scale farming which is dominant in the country has failed to utilise fully the large land resource available as out of the 44 million ha classified as suitable for agriculture, only 10.1 million ha or 23 % is under cultivation. Smallholder farmers cultivate 85% of the total arable land working between 0.2 and 2.0 ha with an average per capita holding of only 0.2 ha per household (ASDS, 2001). The major limitation on the size of land holdings and utilization is the heavy reliance on the hand hoe, which is used as the main tool for cultivation. The low field capacity of the hand hoe sets obvious limitations on the area of crops that can be grown using family labour. This leads to low crop production, household food insecurity and low incomes in the rural communities as they depend mainly on agriculture to sustain their livelihoods.

Therefore despite its importance, agriculture has failed to improve the livelihood of the rural population hence perpetuating the existing pervasive poverty among the farming communities. In the last decade the growth of the agricultural sector has been only 3%. Although this is greater than both the rate of total population growth and the rate of growth of the agricultural labour force, it is considered to be unsatisfactory as it has not been able to bring a sufficient number of the rural poor above the poverty line. About 50% of the rural population still live below the poverty line (ASDS, 2001).

As agriculture remains to be the engine of economic growth in the country and bearing in mind that over 80% of the population live and eke a living in the rural areas, then improvement of the agricultural sector is paramount in poverty reduction (Figure 1). Actions that will increase agricultural production will ensure availability and access to food and improve farm incomes and hence reduce poverty. Furthermore, as agriculture has been the single largest contributor to GDP and foreign exchange earnings and that its growth linkages (multipliers) are felt in both the rural and urban areas then improvements in the sector will contribute highly to the country's overall economic development now and in the near future.

### 2. TANZANIA DEVELOPMENT VISION AND AGRICULTURE

Despite some impressive macroeconomic achievements resulting from the reform programmes, agricultural growth and rural poverty reduction continue to present daunting challenges. In response to these and other pertinent development issues, the Government adopted the Tanzania Development Vision 2025 (TDV).

The Tanzania Development Vision envisages raising the general standard of living of Tanzanians by ensuring food security, improving income levels and increasing export earnings. Agriculture has been identified as one of the priority sectors for achieving these goals. However, Tanzania agriculture has numerous weaknesses including low productivity, underdeveloped supporting facilities, use of inappropriate technology, dependency on rainfed agriculture and impediments to food market access only to mention a few.

Therefore, commercialising smallholder agriculture and accelerating its growth rate is essential in increasing agricultural production as a means of pulling the majority of the rural poor out of abject poverty. Given the generally abundant land resource, efforts to increase agricultural production should include both technologies to expand utilized land area and intensification of the existing cultivated area. This may be achieved through mechanization and adoption of other improved technologies such as improved seed, use of fertilizers, agro processing and accessibility to markets.

In order to fulfil this, The Ministry of Agriculture and Food Security (MAFS) has developed the Agricultural Sector Development Strategy (ASDS) as a paramount instrument for alleviating poverty. The primary objective of the ASDS is to create an enabling and conducive environment for improving profitability of the agricultural sector as the basis for improved farm incomes and rural poverty reduction in the medium and long term. ASDS provides a basis for action by both the public and private sector to support Tanzania's efforts to stimulate agricultural growth and reduction of poverty.

### **3. MECHANIZATION AND POVERTY REDUCTION**

Agricultural mechanisation can be defined as the manufacture, distribution and operation of all types of tools, implements, machines and equipment for agricultural land development, farm production, crop harvesting, storage structures and primary processing. It includes three main power sources that, is human, animal and mechanical.

Human power is the simplest and most basic level of mechanization. Humans have a low capacity and efficiency as a source of power and the output is further limited by health, diet and environmental conditions. Under the tropical heat, a health adult using a hand hoe can work about 0.5 ha per season thus limiting the area under cultivation to 2 ha only for an average family of four adults. On the other hand a family owning a pair of draught animals can manage 5 - 8 ha per season while a 60-70 Hp tractor can manage more than 80 ha in a season. Therefore the adoption of higher levels of mechanisation is essential in increasing the cropped area and incomes of the rural population and hence alleviating poverty.

Mechanization enhances the human capacity, leading to extensification and increased productivity as a result of timely planting, weeding, harvesting, post harvesting handling and accessibility to markets. Also it reduces drudgery making agriculture an attractive enterprise.

Mechanization is becoming increasingly important in addressing the shortage of farm power in rural areas. This is because the agricultural labour force is declining as a result of rural-urban migration, non-farm employment opportunities and the HIV/AIDS and malaria pandemics. The agricultural labour force is growing at only 2.8% compared to the overall growth rate of the total labour force of 3.1%.

#### **3.1 Current Status of Mechanization**

Despite its importance, the level of mechanization has remained low in the country with the hand hoe dominating in the farming systems. The use of animal traction and mechanical power

is limited. While there are over 14 million hand hoes in use, the number of oxen and animal drawn ploughs is approximately 1.2 million and 570,000 respectively. There are also about 9,500 tractors that are operational and another 6,000 are broken down although repairable. On the average the number of ploughs has been increasing at an average of 20,000 units per year while 200 to 300 tractors are imported annually. The country needs more than 30000 animal drawn ploughs and 1800 tractors annually in order to cater for farm power needs for agricultural growth.

Over the past 20 years, tractor sales in the country have drastically dropped from 1,143 tractors in 1985 to 274 in 2002 mainly because of their high prices that render them out of reach to the majority of farmers (Table 1). Lack of credits, stringent borrowing conditions from commercial banks and low crop prices make tractors unaffordable. While the price of a 70 Hp tractor with a plough, harrow and trailer was sold at Tshs. 460,000/= in 1984, it is over Tshs. 35,000,000/= now with its mentioned accessories. On the other hand the price of many crops has not changed much over the years and in many cases the prices have declined in real terms taking into consideration the massive devaluation of the T shilling and inflation, which was rampant in the 70s to mid 90 when it escalated to above 30%. For example in 1985, a kilogramme of maize was Tshs. 5.41 equivalent to 0.318 US\$ and it is Tshs. 120.00 per kilogramme now which is equivalent to 0.113 US\$. While in 1985, a farmer could purchase a 70Hp tractor with implements by selling 870 bags (of 100 kg) of maize, now he has to part with 3,000 bags to acquire the same tractor and implements.

The decline in tractor sales in the country is reflected in the annual cultivated area. Whereas in a period of five years, that is from 1983/85 to 1987/88, the area under cultivation increased by 37%, from 3,437,480 ha to 4,74,780 ha, in the period of 15 years, that is from 1988/89 to 2000/2001, the area under cultivation increased by 250,220 ha only, which is 5.3%, that is from 4,714,780 ha cultivated in 1987/88 to 4,965,000 ha in 2000/2001 (Table 2). The area expansion of the cultivated land in the former case is mainly attributed to direct Government efforts in promoting tractorisation, which lead to the doubling in the number of tractors in the country between 1975 and 1985 from 9,000 to 18,533.

### **3.2 Availability and Supply of Agricultural Machinery, Tools and Implements**

Tractors and associated implements are imported from various countries in Europe, America, Asia and some African countries. The main dealers include Incar Tanzania Limited (New Holland), Tanzania Farmers Service Centre Limited (Valmet), General Motor Investment (New Holland), Mpomabiva Investments Ltd (Case Tractors and Heavy Equipment), Noble Motors Limited (Escort and Farmtrac –Ex India), FARMCON International Limited (MF), Helia Company Limited (ITMCO – Ex Iran), FMD East Africa Limited (MF), TTD Ltd (MF), AFRICATIC Limited (DFH – Ex China), Quality Group Ltd (ITMCO), Gaher Intertrade Company, Mining Agriculture and Construction Limited (MF –Ex Pakistan, Renault – Ex France), Farm Parts Ltd (MF, Ford, Swaraj) and Tractors Ltd (MF).

The market for used and reconditioned tractors is increasing in the country, as it seems they are generally affordable to many farmers because of their low prices. Several companies are involved in selling these tractors and the notable ones are TAMASCO, FARMCON, Tractors Ltd (MF), Gaher Intertrade Company, Trans Arusha, Tanzania Farmer Service Centre, Shio Engineering Works, Tractor Repair Company of Arusha, Tractors limited, KIVESCO and Tanzania Farmers Service Centre.

*The bulk of hand tools and animal drawn implements are met by imports from China, India, South Africa and England. A number of dealers are involved in this business, the main ones are*

*Mohammed Enterprises, K. Agency International Ltd, Shinyanga Emporium (1978 Ltd), Alfa Cycles, Kishan Enterprises and Afritool Ltd.*

Generally the availability of agricultural machinery and implements is good in the country as dealers are meeting the demand. The main limitation to the smallholder farmers is the affordability as many machines are expensive.

### **3.3 Manufacturing of Agricultural Tools, Implements and Machinery**

Manufacturing of tools, implements and machinery in Tanzania is very low compared to other neighbouring countries like Kenya, Zimbabwe, Mozambique and South Africa. In 1970, the Ubungo Farm Implements (UFI) was established and in 1984 the Zana Za Kilimo, Mbeya (ZZK factory) started operation. The two factories were involved with manufacture of hand tools such as hand hoes, machetes, axes, sickles, rakes and forked hoes. They were also producing animal drawn ploughs.

*UFI had a production capacity of 2.5 million pieces of hand tools and 30,000 ploughs annually while ZZK had a capacity of 1.5 million pieces of hand tools and 10,000 ploughs annually. Economic difficulties forced the two companies to stop production and were listed for privatization. UFI has been sold to Tanzania Steel Pipes Ltd and the factory is currently under rehabilitation. ZZK has been sold to Simba Steel Pipes who are also rehabilitating the factory.*

*There are also small manufacturers who produce small quantities of implements. The most prominent are SEAZ Agricultural Implements in Mbeya, Nandra Engineering Works in Moshi and Capital Farmers Development Co Ltd in Dodoma who fabricate mouldboard ploughs, harrows, rippers, chisel ploughs, cultivators and planters.*

*The informal sector comprised of blacksmiths, artisans and rural craft workshops, produce small quantities of hand tools, which include sickles, knives, billhooks and a few hand hoes mainly to cater for the needs of farmers in their villages. In areas where animal traction is important like Shinyanga, Singida, Rukwa, Mbeya, Tabora and Dodoma regions, these artisans are prominent in the production of animal drawn carts to meet the needs of rural transportation. The Small Industries Development Organization (SIDO) is developing a programme to support this sector.*

Processing machines such as maize hulling and milling, shelling, paddy threshing and hulling, coffee pulping, cassava grating, chipping and oil expelling machines are produced locally by private sector entrepreneurs in big towns such as Dar es Salaam, Arusha, Morogoro etc. The more prominent ones are Mang'ula, Machine Tools and INTERMECH in Morogoro, Jandu Plumbers in Arusha, Tanzania Engineering Manufacturing and Design Organization (TEMDO) in Arusha, Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) in Arusha, Tanzania Automotive Technology Centre (TATC) Factory in Kibaha and FARMCON International of Dar es Salaam just to mention a few.

### **3.4 Potentials in Mechanization**

Mechanisation of agriculture as experience tells us, has the potential to turn idle land into productive land for national economic growth, food self-sufficiency, industrial growth and

employment. The use of hand tools does not permit acceptable increase in areas under cultivation and meet timeliness requirements for various field operations. Therefore the adoption of higher levels of mechanization such as animal traction and mechanical power is a matter of great importance in the economic development in Tanzania.

### **3.4.1 Animal Traction**

Animal traction is one of the major sources of power in smallholder agriculture and its increased use in the past two decades indicates that it is an acceptable, affordable and sustainable technology. It is a smallholder technology where non-owners also benefit substantially through direct hire or other social arrangements, thus spreading the benefits over a wider cross-section of the farming community including the poor. Work animals intensify agricultural production, reduce drudgery and provide smallholder farmers with vital power for crop cultivation and transportation with minimum maintenance costs.

However, the utilization of draught animals in the country is mainly confined to conventional tillage using mouldboard ploughs and to limited extent transportation. This limits their utilization efficiency making them idle for most of their productive time in a year. Work animals can be utilized in other field operations like harrowing, planting, weeding, puddling and harvesting.

Weed control using the hand hoe is labour intensive and has been identified as a constraint to increased crop production. Weeding alone accounts for 40-55% of the total labour input in smallholder farming. Also crop losses of 50-80% have been recorded because of poor or late weeding (Shetto and Kwiligwa, 1990). The advantages of animal traction in expanding the cropped area is usually limited by weeding where the hand hoe is used as timely weeding is not usually achieved because of the high labour demand. Animal drawn weeders reduce the labour in manual weeding from 60-100 hours per acre to 3-8 hours only hence ensuring timely weeding with less drudgery. An ordinary family of 6 people owning a plough and depending on the hand hoe for weeding can comfortably manage 6 to 8 acres in a season, whereas the same family could manage 15-20 acres by adopting an animal drawn weeder while maintaining the same pair of animals.

Employment of draught animals in weeding will enable farmers to increase their cropped area and yields because of better and timely weeding. This will increase agricultural production and incomes of the smallholder farmers hence reducing poverty. It will also increase the utilization efficiency of the animals thereby spreading the ownership costs over a longer period of time making animal traction less costly especially when they are hired out.

Despite Tanzania having a big cattle herd of more than 16 million, only 1.2 million are employed for draught purposes implying that more animals may be used in agricultural production. It is estimated that there are approximately 2 million mature steers that can be trained for draught purposes. The employment of these animals for draught purposes may put more than 2 million hectares under crop production. This will highly improve the household food security, increase incomes of the rural population, reduce poverty and contribute to the economic development of the country. Traditional livestock keeping regions may be given priority. These include Shinyanga, Mwanza, Mara, Tabora, Singida, Dodoma, Manyara, Arusha, Iringa, Mbeya and Rukwa.

### **3.4.2 Mechanical Power**

Mechanical power enhances the human capacity leading to extensification and increased productivity as a result of timely planting, weeding, harvesting and post harvesting handling. Mechanical power is economically sustainable if farmers can purchase or hire equipment and

have the technical and managerial skills to keep it in good condition and replace it when it reaches the end of its economic life.

Accessibility to tractors may be improved through the provision of affordable loans with low interest rates. The priority areas for mechanical power will be areas where they are viable technically and economically e.g. in the fertile alluvial and vertisol soils, maize legume, cotton/maize - rice, paddy-sugar cane farming systems and the cash cropping based systems of wheat, sisal and tea.

Conditions that favour motorized mechanization include large farms, reliable rainfall or presence of irrigation and the potential to market crops profitably. It is risky where the climate is variable and unpredictable with limited infrastructure and institutional support. An increase of 1,000 tractors of medium size (60-90 Hp) yearly, will put more than 100,000 ha of cropped land annually.

### **3.4.3 Conservation Agriculture**

Conventional tillage by using mouldboard ploughs continuously leads to soil degradation and formation of hard pans, which reduce infiltration and increase run off leading to decreased yields and increased soil erosion. During tillage, the soils are inverted and exposed to the hazards of the weather. With fine dust on the surface and compaction below a lot of soil is washed away with the first rains.

Further more the costs of land preparation are increasing every year due to high costs of machinery, fuel and tractor spares. Weed management is also becoming a serious problem as the inversion of the topsoil by tractor or ox ploughs brings up weed seeds to the ground surface which, apart from competing with crops for the limited moisture and nutrients they increase the labour demand in management.

Therefore better farming practices such as conservation agriculture should be promoted as they improve the productivity of the soil leading to increased crop yields. Also they save farm power and labour requirements due to the elimination of ploughing and reduction of weeding efforts guaranteeing more sustainable crop production.

Conservation agriculture, involves some land management practices that allow for the restoration of soil nutrients, increased infiltration of rain and surface water enhanced retention of soil moisture, the regeneration and maintenance of a good surface vegetative cover and rooting depth. It includes direct sowing/no tillage, reduced/minimum tillage, non-surface incorporation of crop residues, maintenance of complete soil cover consisting of cover crops or crop residues and crop rotation judiciously selected to enhance the crop environment and to avoid build-up of pests and diseases.

An increase in maize yields has been observed in Karatu and Hanang districts from 0.5t/acre in conventional ploughed plots to 1.8t/acre in plots with cover crops and direct seeding. The labour requirement was reduced from 67 days per season to 37 days respectively while the soil moisture was improved by 30% (Mariki, 2004).

Results from Uyole Agricultural Research Institute indicate a labour saving of 57% with jab planters, 60% when animal drawn rippers are used and 72% with the animal drawn direct seeder compared to conventional flat cultivation using the ox-drawn mouldboard plough (ARI Uyole, 2003).

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#### 4. CURRENT INTERVENTIONS TO IMPROVE MECHANIZATION

In the late 1980s, the Government started to move from a centrally planned economy to a more market oriented economy as a result of structural economic adjustment programmes. The government disengaged itself from direct commercial and production activities allowing for more participation of the private sector. However, there has been a wide gap between the expectations and the real situation as the response has not been encouraging from the private sector in terms of provision of agricultural mechanization services. Investment in agricultural machinery is high, needing a high capital outlay. The profitability is low compared to domestic consumables and it is highly seasonal making the business unattractive. Commercial banks are reluctant to finance the sector, as agriculture is generally vulnerable to weather hazards. Dependence on trade financing makes investment in agricultural machinery difficult. This has made the Government to make several interventions aimed at promoting agricultural mechanization in the country.

##### 4.1 Provision of Loans for the purchase of new tractors

The Government initiated a loan scheme for the purchase of new tractors and rehabilitation of old tractors through the Agricultural Inputs Trust Fund in the year 2003/2004. Loans of up to Tshs.35,000,000/= are provided for the purchase of new tractors and implements at an interest rate of 12% over 3 years. A total of Tshs. 444,000,000/= was loaned out in the 1<sup>st</sup> year of operation. However, many farmers lack the needed collateral as many of their immovable assets do not have title deeds. Also, funds available from the Agricultural Inputs Trust Fund are limited making it difficult to meet the farmers' requirements. Therefore, the Government has been encouraging the private sector, which includes machinery dealers and financial institutions to provide such services to farmers at a reasonable cost.

##### 4.2 Rehabilitation of tractors

More than 6,000 tractors are not working but can be rehabilitated to good working condition at a fraction of the cost of a new tractor. However many of the tractor owners do not have the resources to carry the rehabilitation. In the year 2003/2004, a loan scheme under the Agricultural Inputs Trust Fund was initiated to assist farmers to rehabilitation their tractors. Loans of up to Tshs. 3,500,000 are provided for rehabilitation of tractors at an interest rate of 8% payable over 18 months. The Agricultural Inputs Trust Fund has signed an agreement with the main tractor and spare parts dealers in the country to undertaking the rehabilitation work in a more orderly manner. A total of 153 loans worthy Tshs. 516,430,000/= have been issued.

##### 4.3 Promotion of tractor hiring services

Tractors are expensive and unaffordable to the majority of smallholder farmers, as they do not have the capital to purchase them. Even where credits may be available, they fail to meet the collateral arrangements needed. However, such farmers are able to pay for tractor ploughing services once offered by contractors. The Government is encouraging the private sector to establish and manage tractor-hiring services centres to increase the accessibility of farm power to the majority of farmers by providing loans for the purchase of tractors and implements. The Tanzania Cotton Association imported 100 tractors that were distributed to 22 ginneries to enable them to provide tractor hire services to farmers in their areas.

#### **4.4 Promotion of alternate technologies such as power tillers**

The use of power tillers may be an alternative to alleviating the power shortage in farming. In the year 2000-2002, the government introduced 230 power tillers. Several demonstrations were conducted in the country in order to expose the technology to farmers. The performance of these power tillers has been satisfactory and the demand is increasing especially in paddy growing areas. The private sector has taken up the initiative and in the past two years about 150 power tillers have been sold. The private sector is encouraged to provide after sale services such as supply of spares, repair and maintenance.

#### **4.5 Training of farmers on a wide range of animal drawn implements**

Training of farmers is conducted to improve their hands on skills in handling animals and a wide range of implements particularly weeders, ridgers, rippers and planters. A total of 590 Village Extension Officers and 425 farmer trainers from 102 districts have been trained. These have formed core teams for training farmers at village level. Farmer groups have been organised in the villages and 330 sets of implements worthy Tshs. 269,397,500/= have been provided. The implements include ploughs, weeders, rippers, ridgers and ripper planters. The private sector is encouraged to participate in these activities to expose farmers to a wider range of implements available and device credit schemes for customers

#### **4.6 Rehabilitation Oxen Training Centres**

Fifty three Ox training centres are currently at various stages of rehabilitation. These centres have been provided with a wide range of implements which include ploughs, weeders, ridgers, rippers, ripper planters and ox carts to enable them to conduct demonstrations and training to farmers. Demonstration farms in these OTCs are instrumental in training farmers modern farming techniques for increased production per unit area using recommended agronomic practices for the particular location.

In increasing the accessibility and affordability of animal drawn implements, a loan scheme has been initiated under the Agricultural Inputs Trust Fund. Loans are provided at an interest rate of 8% repayable in two years. Farmers are encouraged to form Savings and Credit Societies in order to access these loans as these societies may guarantee their members for the requested loans without the need of immovable assets as collateral.

#### **4.7 Conservation Agriculture**

Land degradation is increasing because of continuous manipulation of the soil by disc ploughs and harrows. Conservation agriculture is promoted to enable more sustainable crop production.

The Land Management Programme (LAMP) conducted extensive demonstrations using tractor drawn tined implements and subsoilers and animal drawn rippers and subsoilers in Babati, Kiteto, Simanjiro, Arumeru, Kondoa and Singida districts in the 1990s. Since 1992 more than 5,000 ha of land in the LAMP project area (Babati, Kiteto and Simanjiro districts) have been treated with some kind of soil conservation measures. It is estimated that the average land with some conservation treatments can produce 50% higher crop yields compared to just ploughed land without these treatments.

The Selian Agricultural Research Institute (SARI) has been undertaking some activities especially in conservation agriculture in the past five years in collaboration with the Tanzania Farmers' Service Centre. Cover crops such as *Mucuna* spp. and *Dolichos* lab lab and no-till direct seeding technologies have been introduced in Karatu and Hanang districts. An increase

in maize yields has been observed from 0.5t/acre in conventional ploughed plots to 1.8t/acre in plots with cover crops. The labour requirement was reduced from 67 days per season to 37 days respectively while the soil moisture was improved by 30% (Mariki, 2004).

ARI Ilonga and ARI Mlingano initiated some cover crops variety screening trials in the year 2002. The cover crops under evaluation include *Dolichus spp.*, *Centrosema pubescens*, *Stylothenes spp.*, *Mucuna spp.*, *Tropical kudzu*, *Clitoria ternatea*, *Siratro spp.*, *Cannavalia spp.*, *Clitoraria spp.*, *Calopogonia spp.*, *Cowpeas and pigeonpeas*. Some cover crops that have established themselves well vegetatively developing high biomass and withstanding moisture stress include *Centrosema spp.*, *Dolichus lab lab*, *Clitoria spp.* and *pigeon peas*. Some of these have maintained their vegetative growth for two years now and a lot of mulch has been generated.

In the Southern Highlands, ARI Uyole initiated some activities on conservation tillage based on animal drawn traction in the 1999/2000 season. Both on-station and on-farm trials are conducted. Improved animal drawn conservation tillage implements such as rippers, ripper planters, sub-soilers and tie ridgers are tested in conjunction with the conventional mould board plough and a no till herbicide treatment. Both implements performance variables such as draught, labour requirement, field capacity, durability and soil related characteristics such as moisture content, bulk density penetration resistance and infiltration are observed. Emphasis is also put on farmer assessment that includes parameters such as ease of operation, affordability, and sustainability in the farming systems and labour requirement. (ARI Uyole, 2003)

The Ministry of Agriculture and Food Security in collaboration with FAO and GTZ has initiated a pilot project on conservation agriculture and appropriate mechanization in six districts of Kilosa, Mvomero, Mbeya, Arumeru, Kaaratu and Bukoba rural. The main outputs of the project include harmonization of conservation agriculture data, introduction and validation of tools and equipment suitable for conservation agriculture and review of mechanization policy and formulation of strategies conducive to conservation agriculture. The project started in September 2004 with duration of 18 months.

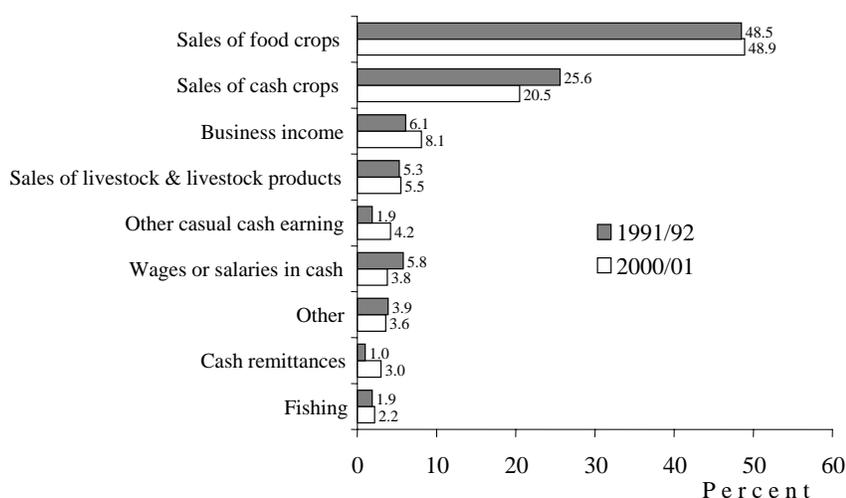
## 7.0 Concluding Remarks

In order to increase agricultural production and returns from agricultural produce, there is a need to expand the area under cultivation by increasing the number of agricultural machines on the farm that is both animal and tractor drawn implements. Therefore, a more consolidated programme is needed. In preparing the programme a detailed assessment of the country's capabilities and potentials for agricultural mechanization should be done. An analysis on the participation of the private sector should be done and modalities of implementation worked out based on the current liberalization process and economic transformations that the country is undergoing. Short and long term plans should be drawn indicating specific actions and outputs to raise the level of mechanization in the country.

**The Ministry of Agriculture and Food Security (MAFS) envisages “ an agricultural sector that by the year 2025 is modernized, commercial, highly productive and profitable, utilizes natural resources in an overall sustainable manner and acts as a basis for inter-sectoral linkages. It is aimed that the existing subsistence dominated agriculture will be gradually transformed into a commercially profitable production system”.**

## ANNEXES:

Figure 1: Rural Household Income Sources

Table 1: Sales / Importation of tractors 1982 – 2002  
Source: Household Budget Survey 2001/2002

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
No. of tractors	210	263	495	1,143	407	289	536	338	241	369

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
273	180	73	58	49	309	665	440	431	375	274

Source: MAFS – Mechanization Section

Table 2: Area cultivated (ha) of major crops, production (tonnes) and population in selected years.

CROP	Year 1983/84			Year 1987/88			Year 1994/95		
	Area 000 hectare	Production 000 metric tonnes	Yield per ha kgs	Area 000 hectare	Production 000 metric tonnes	Yield per ha kgs	Area 000 hectare	Production 000 metric tonnes	Yield per ha kgs
Maize	1226.62	1711.71	1390	1671.7	2423.33	1447	1763.7	2874.4	1629.8
Sorghum	476.22	301.18	630	492.23	423.51	860	689.5	838.8	1216.5
Millet	228.09	168.44	740	311.9	199.02	638	303.6	342.0	1126.7
Paddy	271.21	328.28	1210	409.12	782.3	1912	394.0	622.6	1580.1
Wheat	47.62	72.42	1520	60.83	75.24	1237	54.5	75.3	1395.7
Cassava	619.81	1385.92	2220	756.44	1399.2	1850	584.8	1492.2	2551.6
S/Patatoes	116.84	209.3	1790	180.65	319.18	1767	293.1	448.8	1531.2
Pulses	448.07	339.51	760	561.02	379.2	676	537.4	374.2	696.3
Bananas	-	-	-	270.85	792.3	2925	248.2	650.9	1622.5
<b>Total</b>	<b>3437.48</b>	<b>4516.76</b>	<b>10260</b>	<b>4714.74</b>	<b>6763.28</b>	<b>13312</b>	<b>4868.8</b>	<b>7719.2</b>	<b>14350.4</b>

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...continued

CROP	Year 2000/01		
	Area 000 hectare	Production 000 metric tonnes	Yield per ha kgs
Maize	1581.5	2698.0	1706
Sorghum	691.7	691.7	1200.5
Millet	201.1	206.5	1000
Paddy	323.7	323.7	1958.1
Wheat	52.1	72.03	1381.9
Cassava	660.9	1721.7	2604.9
S/Patotoes	522.3	950.1	1819.1
Pulses	641.8	682.951	1064.0
Bananas	289.9	752.1	2594.0
<b>Total</b>	<b>4965.0</b>	<b>8098.781</b>	<b>15328.5</b>

**REFERENCES**

- ARI Uyole, 2003. Annual Progress Report 2002/2003 – Agricultural Engineering Research Section.
- ASDS, URT, 2001. Agricultural Sector Development Strategy.
- Mariki, W. L. 2004. The Impact of Conservation Tillage and Cover Crops on Soil Fertility and Crop Production in Karatu and Hanang Districts in Northern Tanzania. TFSC/GTZ Technical Report, Arusha, Tanzania 1999-2003.
- Shetto, R.M and Kwiligwa, E.M. 1990. Weed Control Systems in Maize based on Animal Drawn Cultivators. In Lawrence et al (eds) Research for Development of Animal Traction in West Africa. ILCA.306pp.
- URT, 1997. Ministry of Agriculture and Livestock Policy, 1997.
- URT, 2000. Vision 2025, Tanzania Development Vision.
- URT, 2001. Rural Development Strategy, United Republic of Tanzania, Prime Minister's Office.
- URT, 2002. Basic data. Ministry of Agriculture and Food Security.
- URT,2002. Tanzania Agriculture: Performance and Strategies for Sustainable Growth, February 2000.