MINISTRY OF AGRICULTURE FOOD SECURITY AND COOPERATIVES

SOYA BEAN PRODUCTION AND UTILIZATION IN TANZANIA

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SOYA BEAN PRODUCTION AND UTILIZATION IN TANZANIA

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EXECUTIVE SUMMARY

The study on status of soya bean production and utilization in Tanzania was done in order to assist in planning for its development. The study involved stakeholders from research, extension, soya bean and poultry farmers, food and animal feed processors. The study areas were potential soya bean growing regions of Ruvuma, Mbeya, Rukwa and Iringa; others were Arusha and Kilimanjaro. Food and feed processors were mainly from Dar es Salaam region. Research information was obtained from Zonal Research in ARI Ilonga, ARI Selian, ARI Uyole, SUA and AVDRC. University of Dar es Salaam Processing and Chemical Engineering Faculty gave information on possibility of fabricating soya bean processing equipments and TRA informed on import and export of soya bean products. Questionnaires, discussion questions and secondary data were used.

This study was conducted following the increase of stakeholders who were requesting data and information on the soya bean for food and feed. These include the Ministry of Water and Livestock Development and the Italian traders association (Convivium, 2000), which wanted to buy 150,000 tonnes of soya beans from Tanzania. Other were medium to large scale feed and food processors, traders and small-scale soya bean food formulators. Following these demands, FAO was requested to support the study in order to outline potentials and constraints pertaining to the crop.

The Terms of References (ToR) to carry out the study were collection and review of information on formal and informal experience, knowledge and information on past soya bean production in Tanzania, adaptability of soya bean varieties and production based in the country's agro-ecological conditions. They also included soya bean requirements for rhizobium inoculation, research on the past research achievements and ongoing research activities carried out by MAFC, SUA and other bodies and seed production and potentials for increased multiplications. Other ToR was on current status of production (smallholder and commercial farmers) and available production statistics; information on local markets and prices, and imports of soya bean and soya bean products (seeds, oil and cake). Information on regional (EAC

and SADC) and world market to determine potential demand for local and export markets and current potential use of soya bean at smallholder level and processing industries for human and animal feeds. In addition, ToR was on government policy on promoting soya bean, seed multiplication and policy for promoting non-GMO and organic food export markets. The output was to prepare a report outlining constraints and potential for future soya bean development in Tanzania.

The findings are that soya bean has been in the country for nearly 100 years since it was introduced in 1907. However, its production and utilization is negligible compared to other countries where soya bean is used as protein source in human food and animal feeds instead of sardines and fishmeal, especially in poultry industry. The use of sardines in poultry feeding has been found to transmit fowl typhoid, a vertical transmission disease that implies extra costs for chemical control and have negative effects on end users of poultry products. This also bring taints to poultry products that lead to lack of market for local poultry products to international hotels, supermarkets and expatriate communities. The study has also found that the country has annual potential of producing more than two million tonnes of soya bean, a potential that has not been exploited. According to available data, current production is 1,140 tonnes per year. However, the estimated annual production is more than 5,000 tonnes. The major limitations that have been found are lack of knowledge on its use in animal feed and food formulations and lack of reliable market which have undermined increased production. This is because soya bean has to be processed to remove anti-nutritional factors before any use. Lack of large-scale extruder is a limitation to livestock sector because this industry needs large amounts of processed soya beans that is free from anti-nutritional factors. In addition, it was found that lack of adequate soya bean and lack of extruders has led to many poultry farms to be reluctant to change their feed formulations because they are not sure of regular and constant supply of the material throughout the year. At the moment, there is only one large-scale soya bean extruder for animal feeds, which is also underutilized. There are a number of small-scale soya bean processors who produce soya bean products like soya bean flour and soya drink that have emerged recently. Another finding is that when feed processors claim that the amount of soya bean that is produced is very little, farmers say they do not know where to sell their soya bean. From this situation

it is vivid that there is potential for increased production. This implies that lack of coordination between production and consumer is a bottleneck requiring immediate intervention. Despite the farmers' arguments it was found that, the high farm gate prices discourage investment in food and feed processing. Farmers require farm gate price of more than 300 shillings per kilo while their cost of production is less than 180 shillings per kilogram. Due to high farm gate price resulting from low production, at the moment Tanzania cannot compete in selling soya bean at world market where soya bean is sold between 200 and 323 TShs CIF Rotterdam. Therefore, Tanzania should promote soya bean for more local utilization in human food, animal feeds and for soil fertility management. The level of 30% of under-fives who are malnourished is a challenge to increase production and use of soya bean at household level to curb the problem.

The study recommendations are to initiate formation of Tanzania Soya bean Association that will involve all stakeholders, promote small to large scale soya bean processing to create demand for soya bean production, encourage private sector to invest in soya bean processing as per ASDS and ASDP policy framework. Farmers training on the economics of soya bean production to give realistic prices to encourage investment and contract farming as long term solution were proposed. Farmers should also be trained on the use of soya bean at household level to improve their health and income and technical institutions need to come up and introduce the appropriate home and commercial use soya bean food and feed processing equipment. Others recommendations are for the government to declare soya bean production and utilization a national priority to treat malnutrition and improve income and create employment to people. Hospitals and health institutions need to be encouraged to use soya bean-based products and promote establishment of specialized soya bean products shops. Promotion of blending soya bean with new and traditional foods together with information dissemination and publication seemed of importance for community. Also exploitation of soya bean as cheap source of protein in animal feeds and human food was stressed. The study also recommended establishment of soya bean seed production and distribution system for farmers for sustainable seed supply. Last but not least is the need for the government to waive some taxes on importing soya bean processing machines and remove VAT on soya bean food and feed to promote production and utilization.

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LIST OF ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ARI	Agricultural Research Institute
ASPS	Agricultural Sector Programme Support
AVDRC	Asian Vegetable Development Research Centre
CIF	Cost Insurance and Freight
COSTECH	Commission for Science and Technology
DADP	District Agricultural Development Plans
DALDO	District Agriculture and Livestock Development Officer
DAS	District Administrative Secretary
DC	District Commissioner
DCDO	District Community Development Officer
FAO	Food and Agriculture Organization of the United Nations
FDP	Focal Development Programme
FOB	Freight on Board
GAPEX	General Agricultural Production for Export
GM	Genetic Modified
HIV	Human Immune Virus
IHFA	International Health Food Association
IITA	International Institute of Tropical Agriculture
KIWASOKA	Kikundi cha Wakulima wa Soya Kaengesa
LAC	Laela Agricultural Centre
MAFC	Ministry of Agriculture and Food Security
MWLD	Ministry of Water and Livestock Development
MCM	Ministry of Cooperatives and Marketing
NGO	Non-Government Organization
NMC	National Milling Corporation
OFC	Overseas Food Corporation
PADEP	Participatory Agricultural Development and Em powerment Project
PO RALG	Presidents Offices, Regional Authorities and Local Government
RAA	Regional Agricultural Advisor
RLA	Regional Livestock Advisor

SADC	Southern Africa Development Cooperation
SDA	Seventh-Day Adventists
SIDO	Small Industrial Development Organization
STC	State Trading Cooperation
SUA	Sokoine University of Agriculture
TAFMA	Tanzania Animal Feed Manufacturers Association
TARP	Tanzania Agricultural Research Programme
TBS	Tanzania Bureau of Standards
TFCO	Tanzania Animal Feed Company
TFDA	Tanzania Food and Drug Authority
ToR	Terms of Reference
TFNC	Tanzania Food and Nutrition Centre
TRA	Tanzania Revenue Authority
TSh	Tanzania shillings
TV	Television
USA	United States of America
USDA	United States Department of Agriculture
USD	United States Dollar
UDSM	University of Dar es Salaam
VAT	Value Added Tax
VETA	Vocational Education and Training Authority

1 INTRODUCTION

1.1 History of soya bean in Tanzania

The origin of soya bean (Glycine max L. Merrill) is China; 2800 to 2300 B.C. Publications in China have been found to contain reference to medicinal value of soya beans (Hymowitz and Newell, 1981 in Myaka 1993). Soya bean reached Eastern Coast of Africa in late 1800 during the regions' trading with Chinese. Soya bean was introduced in Tanzania in 1907 by German agriculturalists Whigham (1975) in Myaka (1990) and Ngeze, 1993). Further introductions in the country were made in 1909 and 1939. In 1938 and 1939 a collection of 64 cultivars of soya bean from India, South Africa and Far East was established at Amani. The Overseas Food Co-operation (OFC) made further introduction in 1950s in Nachingwea.

Soya bean breeding programme in Tanzania started in 1955 and by early 1960s the programme showed good results. The acreage on soya bean expanded during the 1970s and production became 3,000 tonnes per year. This led to expansion on the use of soya beans for human foods. During this period, GAPEX and later National Milling Corporation bought soya beans for export. In 1973 tests were run in villages for making whole soya flour and by 1974 maize flour were being fortified with soy flour (3:1) for porridges and wheat flour was fortified with soy flour (9:1) for breads. By 1978 production of lisha, a corn-soy-milk product was 572 tonnes which was distributed through institutional channels to malnourished children in health clinics. In Nachingwea, village soya bean projects were established and future prospects for soya bean were considered very bright. In 1979 Tanzania hosted the Second International Workshop on Low-Cost Extrusion Cookers, where much attention was given to cereal-soy blends. The failures of NMC prior to emergence of strong private sector to take over the tasks it was serving, led to decline in soya bean production and development in Tanzania.

1.2 Importance of soya bean and potential in Tanzania

Soya bean is an important crop due to its nutritional value and its wide utilization at household as well as industrial level. It contains 20% non-

cholesterol oil and 45% protein compared to 20 and 13% protein content in meat and egg, respectively (Table 1). Soya bean-fortified products are considerably cheaper than other sources of high quality protein, such as fish, meat, milk and other protein-rich legumes. The cost of protein, when purchased as soya bean, is only about 10-20% of the cost of protein from fish, meat, eggs or milk. Therefore, soya bean is suitable to areas where other protein sources are unavailable or too expensive. Essential amino acids in soya bean are isoleucine, leucine, lysine, methionine and cystine, phenylalanine and tyrosine, threonine, tryptohan and valine. The defatted soya bean cake

Table 1:- Nutrient content (%) in soya bean compared to other food stuffs per 100gm

Food type	Water	Energy	Protein	Oil	Calcium	Iron
Common beans	10	334	25.0	1.7	110	8.0
Peas	10	337	25.0	1.0	70	5.0
Pigeon peas	10	328	26.0	2.0	100	5.0
SOYA BEANS	8	382	40.0	20.0	200	7.0
Meat	66	202	20.0	14.0	10	3.0
Milk	74	140	7.0	8.0	260	0.2
Egg	74	158	13.0	11.5	55	2.0
Ground nuts	6	579	27.0	45.0	50	2.5
Wheat flour	13	346	11.0	1.6	20	2.5
Finger millet flour	12	332	5.5	0.8	350	5.0
Maize flour	12	362	9.5	4.0	12	2.5
Cassava flour	12	342	1.5	0.0	55	2.0
Plantain (banana)	67	128	1.5	0.2	7	0.5
Round potatoes	80	75	2.0	0.0	10	0.7
Sweet potatoes	70	114	1.5	0.0	25	1.0

Source: Marealle, 1974 (Tanzania food Tables) in Madata (2005)

and full fat cake are important source of protein in animal feeds. Soya beans is important in adding value to sick people and for treatment of malnutrition, particularly for the minor children who are estimated at 30% (Laswai et al., 2005) of minor children in Tanzanians. This high level of malnutrition is because of rapid population growth and crippling economic problems in many African countries have reduced living standards and affected eating habits, causing widespread malnutrition.

Tanzania has good potential for increased soya bean production. The crop can be grown almost everywhere particularly where common beans and maize are grown. The crop does well from sea level to 2,000 m.a.s.l. Ngeze, (1993) and Myaka, (1993) provided right varieties are used. Soya bean requires at least 500 mm of well distributed rainfall in three to four months and soil pH above 5. Despite this importance and potential, utilization in food and feed formulation has not been adequately exploited compared to other countries. The crop is unpopular because most of the people are ignorant, since the high protein content of soya bean is not readily digested if cooked as ordinary beans. Unlike other legumes, soya bean has to be processed through light heat treatment to deactivate anti-nutritional (trypsin, hemagglutinins and phytic acid) and remove bean flavour before any use in food or feed formulation. The importance of soya bean as a source of high quality protein in feed formulation is not well known when compared to Brazil and USA, where large portion of soya bean is used in feed formulation. This implies that in the short-term, efforts to promote soya bean should focus on local utilization in food and animal feed formulations, since at the moment we cannot compete with world largest producers.

1.3 Study Justifications

Justification to carry out the study was based among others on the increase of stakeholders who were requesting information and data on soya bean production. Other reasons were failure of past soya bean development initiatives, the request by livestock sector to remove some importation taxes on soya bean products and VAT on manufacturing animal feed to promote the sector, low level of production and utilization of soya bean, little response by farmers despite the efforts which is done by MAFC and other stakeholders

to promote the crop. Also, more reasons included the importance of soya bean as cheap source of protein in curbing malnutrition, which is currently at 30% for minor children and high costs of animal sources of protein (meat, eggs and fish) while alternative and cheap protein source (Ngeze, 1993) could be obtained from soya bean. Other reasons were the wide ecological requirements of the crop including areas where there is malnutrition but soya bean is not grown and utilized, the advantage that the crop has on adding nitrogen to the soil through nitrogen fixation and therefore improving soil fertility, particularly nitrogen, which is normally required compared to others elements. Through nitrogen fixation, the crop can reduce high costs of industrial fertilizers that may also have some effects on the environment. It was also important to make analysis on the costs of production in relation to other crops so as to determine the estimated farm gate prices. The country's good potential for increased soya bean production, the opportunity that has not been exploited to contribute to poverty eradication and create employment like in other countries and the demand for raw soya bean by companies like Convivium 2000 from Italy and individuals who wanted soya bean seeds, was also important to carry out this study. Last reason but not least was the support from FAO to carry out the study.

1.4 Objectives

1.4.1 Main Objective

The main objective of the study was to establish the current status of soya bean in the country so as to assist in planning for its future development. The out put of the study was to outline constraints and potentials for future soya bean development in Tanzania.

1.4.2 Specific objectives

i. To collect and review information on current and potential for increased production;
ii. To collect information on soya bean production with regard to adaptability of soya bean varieties to day-length and toleration and rhizobium requirements;
iii. To review MAFC, SUA and other bodies on soya bean research – past,

ongoing activities and on GM soya bean varieties;

iv. To review soya bean seed production and supply activities;

v. To review information on local markets and prices, imports of soya bean and soya bean products (seeds, oil, cake) and explore world market situation to determine potential demand for local and export markets, particularly on non-GMO and organic export markets; and

vi. To review the current and potential use of soya bean at smallholder level and processing at industrial level for human food and animal feeds.

2. LITERATURE REVIEW

The literature reviewed in this study was on research, production, processing, marketing, seed production and use of soya bean in human foods and animal feeds.

2.1 Soya bean research and development in Tanzania

Soya bean breeding in Tanzania started in 1950s with the main focus on breeding and developing improved varieties and agronomic practices suitable to Tanzanian conditions. According to Myaka (1990), achievements on soya bean research had been on variety setting that was first done at Ilonga and KATRIN from 1960/61 to 1968/69 and from 1966 to 1972/73, respectively. This breeding contributed to the release of Hermon (237H/1, 7H/101 and IH/192) selections (Auckland, 1982). The second breeding programme began in 1973 at ARI Ilonga where parental stock consisted of 1H/192, 7H/101, Bossier, Hokkaido 48 and improved Pelican. The lines selected were tested from 1976 to 1978 and ended by recommending Bossier and 3H/1 as superior varieties. The new varieties are ex-Laela in 2002 and Uyole Soya 1 in 2004.

2.2 Soya bean production in Tanzania

The leading regions for soya bean production are Ruvuma, Mbeya, Rukwa, Iringa and Morogoro (Figure 1). Potential for the country is shown in Table 2. Despite the good potential for increased production this opportunity has not been exploited compared to other countries (Figure 3). Reverend Father Gerald Rupper introduced soya bean in Ruvuma region at Peramiho Roman Catholic Mission in 1960 for adding nutritive value to children food stuffs (Mhagama, 2005). The crop was also introduced for soil fertility management purposes. Soya bean was further introduced and promoted in 1947 to 1970 in Mtwara, Lindi and Morogoro regions by Overseas Food Corporation, State Trading Corporation (STC), General Agricultural Production for Export (GAPEX) and National Milling Corporation who bought the crop for export to Japan and Singapore. The collapse of these projects led to decline on soya bean production as farmers did not know where to sell or how to use it.

Due to little attention to the crop, data on production are also not readily available and when available accuracy is questionable. Notably there is lack of data on production of soya bean at MAFC from 2001/2002 backward. Categorization of data on soya bean production from general pulses (all legumes) started in 2001/2002; data indicates that total production in 2001/2002 was 390 tonnes and in 2002/2003 was 1,700 tonnes. In 2003 the Ministry of Agriculture and Food Security requested regions to present their potentials on soya bean production following the Italian Traders Association (Convivium, 2000) which wanted to buy 150,000 tonnes of soya beans from Tanzania; the indicative price was 228 TSh per kilogram CIF Ravenna, Italy. According to regions, the total annual soya bean production is estimated at 2,166,000 tonnes (Table 2).

FIG 1: MAJOR SOYA BEAN PRODUCTION REGIONS

KEY

High Potential Areas

Mediam Potential Areas

Low Potential Areas

Table 2: Potential of soya bean production in Tanzania

S/n.	Region	Production (T)
1	Tanga	120,000
2	Kilimanjaro	115,000
3	Rukwa	225,000
5	Mbeya	300,000
6	Ruvuma	225,000
7	Iringa	200,000
8	Kagera	100,000
9	Tabora	50,000
10	Morogoro	120,000
11	Dar es Salaam	500
12	Mara	100,000
13	Singida	30,000
14	Kigoma	120,000
15	Arusha	120,000
16	Shinyanga	45,000
17	Mwanza	65,000
18	Coast	500
19	Manyara	100,000
20	Dodoma	15,000
21	Lindi	25,000
22	Mtwara	30,000
	TOTAL	2,166,000

Source: Region Administrative Secretaries (2005)

2.3 Soya bean utilization

Unlike other legumes, soya bean has to be processed to remove anti-nutritional factors before being utilized in food and feed formulations for human and animal use, respectively. Myaka

(1990) explained that for a long time since its introduction Tanzania, soya bean was produced for export; therefore farmers did not know the existing simple ways of processing soya bean at household level. Also, early research on varieties and production practices did not go hand in hand with education to farmers on home and industrial soya bean preparations for food and animal feed. This has been one of the limitations and challenge to research and extension since the crop was introduced. The procedure to process soya bean has been summarized in Myaka, (1993) (Appendix 2).

2.3.1 Anti-nutritional factors

Soya bean like most legumes contains some biologically active substances in their raw state. These substances are anti-nutritional factors. The first anti-nutritional factor is trypsin inhibitors which blocks the enzyme that is responsible for breaking down protein in digestion. According to Weingartner (1987) in Myaka (1993), there are about three major anti-nutritional factors in soya beans. Trypsin inhibitor accounts for about 6% of the total soya bean protein. The mechanism involved is that, the trypsin inhibitors irreversibly bind trypsin making the enzyme unavailable for its role in the breakdown of protein (Liener, 1981). The second anti-nutritional factor is the hemagglutinins. These make up 1-3% of the total protein. Their mechanism of action is by agglutinating the red blood cells. Third anti-nutritional factor is the phytic acid. Whole soya bean contain 1-2% phytic acid. Phytic acid may decrease the availability of divalent cations such as calcium, zinc and iron by the formation of an insoluble protein-phytic acid mineral complex. Almost all three anti-nutritional factors are thermo-labile, that is they can easily be inactivated by a light heat treatment. For example, boiling soya bean for up to 45 minutes destroys trypsin inhibitors and hemagglutinins. Apart from anti-nutritional factor deactivation, heat treatment improves soya bean protein digestibility.

2.3.2 Bean off-flavours

The soya bean contains an enzyme called lipoxygenase. This enzyme produces the off-flavor only when it comes in contact with fats in the soya bean cells in the presence of cold water (Javaheri, 1990). Damaging of cell tissue by pounding or grinding exposes the sites of the enzyme and fats. Thus, addition of cold water to the damaged tissue causes a reaction between enzyme and fats which results in strong bean-off flavour. Once the flavour has been developed it cannot be eliminated; however, when cell tissues are damaged, the off- flavours will never develop as long as the tissues remain dry (Javaheri, 1990). Lipoxygenenase enzyme can also be inactivated by heat treatment. To avoid the bean-flavours the following things should be observed: (i) soya beans must always be dropped gradually into boiling water; (ii) wet raw soya beans should not be pounded before cooking; and (iii) broken soya beans should not be brought in contact with cold water (Javaheri, 1990).

2.4 Soya bean processing

The basic principle of soya bean preparation is based on solving the problem of anti-nutritional factors and removal of bean off-flavours problems. For preparation at small-scale utilization level, soya bean must be dropped gradually into boiling water and for large scale soya bean has to pass through heat treatment equipment – when extracting oil or extruding. At small-scale level, basic soya bean preparations are those that have been outlined by Schempp (1989) and Jovaheri (1990) in Myaka 1993. They include boiling soya bean to remove anti-nutritional factors, de-hulling and preparation of soya bean flour and recipes. Soya bean hulls contain about 10% protein and are good roughage removing them is optional and is in most cases desirable where there is a need for food products with lower fibre content. The common recipes at household level are soya porridge, soya ugali (stiff porridge), soya bean biscuits, soya bean/cassava cakes, soya bean vegetables relish (similar to groundnut vegetable relish), soya bean milk and soyee (soya bean coffee). Their preparations are described in Appendix 3.

2.5 Animal feed industry in Tanzania and protein sources in animal feeds

2.5.1 History of animal feed industry in Tanzania

According to unpublished information by Tanzania Animal Feeds Manufacturing Association (TAFMA) in 2002 titled "Soya bean as an Alternative to Sardines in Compounding Livestock Feeds", serious feed compounding in Tanzania started in 1971 by the National Milling Corporation and then Tanzania Animal Feeds Company (TAFCO) which took over from NMC. Both of these parastatals are now defunct. TAFCO used to produce 80% of the countries feed requirement; at that time private sector played minimal role in the industry. When TAFCO collapsed in 1992, the feed industry also collapsed as private sector was not ready to take over feed manufacturing. From 1992 numerous small feed manufacturers emerged to fill the gap. They were poorly equipped, lacked technology and rarely observed the required quality standards. However, they easily sold their products because there was a shortage of such products. Lack of large-scale feed manufacturers made feed more expensive. As a result, backyard home mixing of poor quality feeds mushroomed. Home mixing generated suspicion in the quality and safety of poultry products produced and was instrumental in creating the market for imported poultry products that have internationally accepted standards.

TAFMA further, points out that, animal feed industry in Tanzania has the problem of poor feed milling equipment and technology since almost all feed mills use conventional maize hammer mills and mixer to make feeds. Taxation of livestock inputs on the other side has made the sector to lag behind in terms of feed quality compared to other East African feed millers. Competition between human and animal feed millers on the same raw materials (maize, fish-meal and sardine) has made raw materials to become very expensive thus making feeds and poultry products even more expensive compared to other countries which use specific raw materials like yellow maize, soya bean, by-products from meat processing industries and oil pressing industries for feed manufacturing.

2.5.2 Tanzania Feed Manufacturers Association (TAFMA)

The problems of the animal feeds industry prompted 19 commercial feed manufacturers to form an association namely Tanzania Animal Feeds Manufacturers Association (TAFMA) in order to monitor feed quality. TAFMA has the following objectives;

(i) To provide common forum for all animal feed manufacturers in Tanzania;
(ii) To liaise with the established government machinery on all issues pertaining to the manufacturing of animal feeds in the country e.g. provision of raw materials and marketing of association products;
(iii) To provide a link between the association and livestock keepers;
(iv) To ensure that all members of the associations' products conform to the standards set by TBS;
(v) To enter into any arrangement with any co-operations and companies that may seem conducive to the attainment of the association objectives;
(vi) To act as guarantors to its members whenever need arises, particularly in procurement of necessary ingredients for the production of animal feed; and
(vii) To advise, inform or guide its members of new developments in the animal feed industry so as to keep them abreast of the changes in other countries.

2.5.3 Protein source of raw materials in animal feeds formulations

The two major sources of protein for livestock feeds is plant and animal origin. The major plant protein sources are soya bean, cotton seed cake, sunflower and groundnut cakes. Animal protein sources are fishmeal, sardine and blood meal.

2.5.3.1 Plant protein sources

In countries where poultry industry is developed, soya beans meals are widely used as source of protein because it has the highest protein content among the vegetables while in Tanzania, cotton cake is the commonest plant protein source. Soya bean cake is mostly used protein source in animal feeds due to

high protein content. Full fat soya bean that contains up to 20% oil provides an excellent means of increasing oil levels in the feed without having the problem of physically oily feed. One of the reasons for not using soya bean in animal feeds in Tanzania is low capacity to de-activate anti-nutritional factors in soya bean that interfere with the birds' ability to digest soya bean protein before deactivation of the inhibitors.

With regard to sunflower cake which is also widely used in Tanzania, the cake lacks lysine. Also, the protein levels in sunflower cake can be as low as 30% or as high as 44%. This implies that sunflower cake should be bought from one supplier and frequently checked for quality. Groundnuts have very low lysine and methionine contents and they are prone to aflatoxin contamination that cannot be inactivated by normal cooking procedure. Cotton seed cake is another material, which must be decorticated in order to be used in poultry diets. It also contains gossypol, which can cause a green/black discoloration of egg yolks. These limitations on protein sources to other plants makes soya bean as the only quality source of protein that can readily be available at required quality. However, despite these advantages, soya bean feeds are not used in the country for the reasons that have been mentioned.

2.5.3.2 Animal proteins sources

The two major sources of animal protein widely used in Tanzania are sardine and fishmeal mainly from Lake Victoria. The problems of using sardine in poultry are that sardine can easily be contaminated by salmonella which causes fowl typhoid (salmonellosis), a vertically transmitted disease. In the mid 1990s, fowls typhoid caused up to 60% mortality and led to the collapse of parent stock and layers operations in Tanzania. As a result today all major hatcheries in Tanzania import over 80% of their hatching egg requirements (TAFMA, 2002). Over the years the price of sardine has increased from Tshs 250 per kg to Tshs 400 (Table 8 and Figure 5) making poultry feeds very expensive because it has low and variable protein content compared with soya bean. Consequently poultry products become very expensive and cannot easily compete with better quality imported poultry products. Fishmeal is the by-product of the fishing industry. The industrial processed fishmeal is of high value from nutritional point of view but it has to be processed at high levels of precision in order to kill all the bacteria (salmonella) at the same

time maintaining the quality of protein. It has a very high quality protein and also contains adequate levels of energy, calcium, and phosphorus.

According to TAFMA (2002), the use of sardines and fishmeal has been associated with fish taint (taste and smell) in poultry products especially table eggs and chicken meat. As a result, locally produced poultry products do not meet international standards and are not internationally accepted either in tourist hotel and/or by the expatriate community who have to import poultry products from countries like South Africa and Brazil.

2.5.4 Feed formulation and critical raw materials in compounding poultry feeds

In formulating a diet for animals the objective is to use a combination of the available raw material to meet the desired specifications. The common methods that are used are linear programming and the computerized feed formulation. The computerized least cost feed formulation programmes give the best quality feed at least cost. This method of feed formulation is used to make comparison on the quality of feed and its cost when soya bean and fishmeal are used as protein sources. It has been found that the feeds formulated using sardine sources are more expensive than those using soya bean meals. TAFMA (2002) reported that total saving when soya bean is used in formulating 399,695 tonnes of poultry feeds was 6.366 billion shillings (Appendix 4).

Despite this saving soya bean meal is not used because is not available to the required amount. This is because soya bean processing requires huge investments and continuous supply of soya beans. The small quantity of soya bean production in Tanzania is a limitation to utilization of local soya bean in poultry industry. Therefore, in order to develop poultry industry in Tanzania, TAFMA has the opinion to the government to remove all taxes; custom duty and VAT on manufactured animal feeds for at least a period of five (5) years. This measure will result in the short-term importation of soya bean meal and later developments of an international competitive poultry industry which will have substantive multiplier effect and therefore stimulate local soya bean production. TAFMA expects that this will motivate development of soya bean processing industry in the country and after five years the government can re-institutes taxes on imported soya bean meal.

2.6 Soya bean seed production and distribution

There are five seed farms under MAFC responsible for seed production mainly maize, sunflower, wheat, rice, sorghum and common bean seeds. These farms are Dabaga, Msimba, Arusha, Kilangali and Mwere Seed Farms. These farms produce foundation and certified seed. In late 1970s to early 1990s Msimba seed farm was producing soya bean seeds but the farm stopped following the collapse of the crop due to problems on its marketing that could stimulate seeds production. Emphasis has been put to cereals (maize, paddy and wheat) and legumes certified seed production by the government as well as private sectors. In efforts to revive soya bean production, in 2003/2004 Crop Promotion Services (CPS) section under MAFC started promotion of on-farm soya bean seed production. A total of 200kg were distributed in Iringa, Mbeya, and Sumbawanga Rural districts and the harvest was 900 kilograms out of 81 kilograms of soya bean seeds, which were planted. In 2004/2005 a total of 800 kilogram were distributed in Singida region, 750 kilogram in Sumbawanga district, and 100 kilogram in Mbeya district for on-farm seed production, 15 tonnes were harvested. As such there had been no seed farm which is producing soya bean as a seed until 2004/2005 when the Ministry of Agriculture and Food Security instructed Dabaga Seed Farm to produce certified soya bean seeds due to increasing demand.

2.7 Soya bean marketing

There is no information on soya bean marketing as compared to traditional cereal and other legume crops. Small-scale and unorganized traders mainly do soya bean trading. Some literature report that in the past soya beans were mainly grown for export market (Myaka, 1990; 1993). Information from ARI Naliendele reported that in 1970s, GAPEX was exporting soya bean to Singapore and Japan. According to TAFMA (2000), NMC used to buy soya bean but its collapse contributed to the decline of its production and development.

2.8 Government policies related to soya bean

One of the government policies that address development of soya bean is Agricultural Sector Development Strategy (ASDS). ASDS focus on creating

enabling environment for involving private sector in production, processing and marketing of agricultural produce so as to increase productivity, improve farm income, reduce rural poverty and to ensure household food security. The Agricultural Sector Development Programme (ASDP) under ASDS guides on how District Agricultural Development Plans (DADPs) should be implemented in addressing production and marketing of crops like soya bean so as to contribute to increased income and poverty reduction. The major concern on soya bean is processing and marketing for utilization activities that private sector is encouraged to invest-in in line with ASDS and ASDP framework. So far genetic modification (GM) in agricultural sector is still under research and GM products are nationally discouraged.

3. STUDY METHODOLOGY AND LIMITATIONS

3.1 Methodology

A set of seven types of questionnaires (Appendix 1) for each of the stakeholders was used to obtain the required information. Informal and open discussion was also used to get additional information. Primary and secondary data on soya bean production was collected from Regional and District Agricultural Extension Officers in Ruvuma, Mbeya, Rukwa, Iringa, Arusha and Kilimanjaro regions. Research information was from Zonal Agricultural Research Centre and Sokoine University of Agriculture (SUA). The Research centres were Eastern Zone Agricultural Research Institute (ARI Ilonga), Northern Zone Agricultural Research Institute (ARI Selian), Southern Highland Zone Agricultural Research Institute (ARI Uyole), and Southern Research Zone. Other institutions were Asian Vegetable Development Research Centre (AVDRC) a World Vegetable Regional Centre for Africa and University of Dar es Salaam Department of Processing and Chemical Engineering on technologies for processing soya bean. Information on food and feed processing were mainly drawn from Dar es Salaam region. Poultry farmers in Dar es Salaam were also consulted to get the information on use of soya bean animal feeds. Other information came from seed farms, traders and TRA. The study area and respondents were purposely selected so as to have comprehensive and triangulation on production, marketing, processing and utilization of soya bean in Tanzania.

3.2 Limitations of study

Due to limited time and resources, only few areas were visited and met few respondents in field. The study could have also covered Lake, Southern and Western Zones and other potential areas for soya bean. It was also not possible to identify and meet all small-scale food and feed processors in each region, machine fabricators, and institutions like TFNC, TBS, SIDO, VETA, health centres and others who deal with soya bean for the same reasons. It was also not possible to identify small-scale soya bean traders and the few who were met at that moment were dealing with other easily marketable staples like sesame, maize, sunflower and common beans.

4. STUDY FINDINGS

4.1 Research findings

Researchers who were met (Appendix 9) were from Sokoine University of Agriculture (SUA), University of Dar es Salaam Chemical and Processing Engineering Department, Eastern Zone Agricultural Research Institute (ARI Ilonga), Northern Zone Agricultural Research Institute (ARI Selian), Southern Highland Zone Agricultural Research Institute (ARI Uyole) and Asian Vegetable Development Research Centre (AVDRC) a World Vegetable Regional Centre for Africa based in Arusha.

4.1.1 Soya bean varieties and yield

It was found that, there are no local varieties in Tanzania since all soya bean varieties were imported. However, varieties like Bossier had been in the country for long time and might have been mixed with others. All researchers reported that Bossier was a variety which can be found in all areas where soya bean can be grown. It was found that in Northern zone, the varieties that were under research are Kaleya (from Kenya), Duicker (from Zimbabwe), Sable (ex-Arusha), Delma, Hood, Wilson black, Hill, Cooper Hampton and line EA I 3715 all from Canada. Suitable varieties were Kaleya and Duicker. It was found that in Southern Highland zone the famous soya bean in Ruvuma region is Hermon (3H/1), which is also locally known as Songea soya bean variety. In Mbeya, Rukwa and Iringa regions the recommended varieties are Uyole soya 1 (SH 1), Duicker, Kaleya, ex-Laela and Uyole soya 1. The later two were released at ARI Uyole under TARP II in 2002 and 2004, respectively. Others are IITA TGX series (2E, 8E). In Eastern and Southern zones the common variety is Bossier. It was also found that AVDRC is researching on AGS 292 and 329 lines from Japan and line number 338 and 339 from Taiwan.

Under ideal conditions soya bean varieties have different yields. At AVRDC soya bean variety trials were reported to yield up to 5.7 tonnes per hectare. At SUA yield was reported to be 2 tonnes per hectare under research and 0.4 under farmer's conditions. The reasons for low yield were reported to be poor production and management techniques and use of small plots that leads to

negligence in management. Selian reported a soya bean yield of 2.4 tonnes per hectare under research and 1.2 tonnes/hectare under farmers' condition. The reasons for the differences were use of low yielding (Bossier), poor production techniques, non-adherence to dates of planting, intercropping with maize and non-use of Bradyrhizobium japonica bacteria inoculation as in research. At ARI Uyole, soya bean yield is between 2 and 3.6 tonnes per hectare for Uyole soya 1 and ex-Laela and Bossier is between 2 and 2.5 tonnes/hectare while under farmers' condition Uyole Soya 1 and Ex-Laela produces 1.5 to 1.8 and Bossier produces 1.2 to 1.5 tonnes/hectare.

4.1.2 Adaptability and effect of day length for soya bean in Tanzania

As literature has documented, soya bean is widely adapted to different ecological conditions. The study found that in Tanzania, there is no significant effect of day length on soya bean production because the country is closer to the equator, where the difference on longest and shortest day (day and night hours) is not very significant. The most important thing in soya bean is the appropriate soil and moisture conditions for normal plant growth. Also, temperature determines the quality of soya bean produced; at low altitude and high temperature areas where soya bean flowers early but their dry matter and biomass accumulation is low as compared to high altitude areas where crop gets enough moisture. For example, Bossier is short maturing variety which needs four months to mature unlike Uyole soya 1 and 3H/1 (Songea variety) which needs up to five months to mature.

4.1.3 On-going research on soya bean

It was found that each research stations had either similar or different on-going activities on soya bean research. The similar activities are on processing and utilization of soya bean at household level. At ARI Uyole, the ongoing activities are seed multiplication (breeder and foundation seed), processing for utilization at household level and control of soya bean leaf rust diseases which are common in Zimbabwe. At present there is no serious insect pest in soya bean as compared to soya bean bean fly in Asian countries. At AVDRC ongoing activities are on evaluation for adaptability, production practices, soya bean palatability and promotion for acceptability and use of soya bean for soil fertility management. On part of promotion the centre reported that

there has not been much success in Tanzania on the vegetable soya bean because of lack of awareness and low level of utilization of soya bean in Tanzania.

The ongoing soya bean research activities at SUA are on improvement of soya bean varieties under TARP II-SUA and Focal Projects and research on production and processing preparation of foodstuffs and utilization at farmer's level. The on-going research on soya bean at ARI Ilonga is a project on evaluation of soya bean IITA genotypes, the on-farm and outstation which is funded by ASPS II. On-farm farmer research groups are in Korogwe and Kilosa districts; the plan in 2005/2006 season is to include Kibaha and Kilombero districts in the programme. On-station activities are on multi-location varieties trials at Ilonga, Kibaha, KATRIN and Selian.

None of the research stations reported to do research on genetic modified (GM) soya bean but researchers had a reservation that if soya bean products are imported from world soya bean producers like Brazil, USA, India, Argentina and other developed countries, it will most likely include GM soya bean products which up to now the government has not entertained.

4.1.4 East Africa and SADC regional collaboration research on soya bean

The regional soya bean research is at IITA in Uganda. It was reported that researchers do collaborate by sharing information related to soya bean, particularly on suitable varieties, diseases resistance, production, processing and utilization of soya bean. For example, there is an on-going evaluation of 15 TGX series soya bean lines from IITA against Bossier and Uyole soya 1 at ARI Ilonga. Other activities are on nitrogen fixation and release of new varieties.

4.1.5 Soya bean research achievements

There have been achievements in soya bean research since it was introduced in 1907. The study found that the achievements in Southern Highlands include the release of variety Uyole soy 1 in 2004, recommendation of Ezumu tumu, Ex-Laela, Duicker, Kaleya in 2002. Others are on research

and promotion of soya-based food preparations at household level, on-farm work for variety introduction and seed production, food processing and development of promotional materials in collaboration with other institutions such as COSTECH and FARMESA. Achievements of soya bean research at SUA are on multiplication and distribution of Kaleya, Bossier and Duicker soya bean varieties to farmers in project areas, release of NITROSUA nitrogen inoculation in early 1990s, publicizing and awareness creation on the importance of soya bean in Morogoro region through SUA TV. In July 2003, SUA started a FOCAL Project titled "Promotion of Soya bean Production, Processing, Utilization and Marketing for Poverty Alleviation and Improvement of Health in Morogoro" (Laswai et al., 2005). The goal of the project is to have a regional level adoption of soya bean for income generation and improvement of health. This is one of the strategies that will lead to increased production. In Eastern zone there are 16 tests of soya bean varieties which are planned to be released in 2007.

The overall impacts on the achievement on soya bean research in the study area are on the dissemination of the improved methods of processing and utilization at household level which started in early 1990s. The impact can be seen on the emerging number of processors who are using soya bean in weaning foods, soy drink and other soya bean-fortified stuffs that did not exist at that time.

4.1.6 Research on requirements of Rhizobium and nitrogen fixation in soya bean

According to literature, rhizobia bacteria have the natural capacity of invading the roots of leguminous plants and cause swellings in the root cortex to form nodules. In nodules bacteria reduce gaseous nitrogen to ammonium which later combines with sugars and other organic compounds to produce proteins and nucleic acids for both plant and bacteria. Nitrogen fixing capacity differs with variety; for example, Magoye soya bean variety in Malawi has high capacity of fixing nitrogen but not for Bossier in Tanzania.

The study found that in Tanzania some varieties require Bradyrhizobium japonica inoculation because the strains of bacteria to colonize atmospheric nitrogen do not exist in soils, especially in the Northern Zone. These

varieties therefore have to be inoculated with exotic Rhizobium or addition of nitrogen fertilizers in order to have optimal soya bean yield. Example, variety like Bossier does not have nodules to fix nitrogen. Therefore if the area where it is being planted is not rich in soil fertility, particularly nitrogen (N), it will need additional fertilizer through inoculation of Rhizobium or normal application of nitrogen fertilizers. The applied exotic Rhizobium will compete with the indigenous Rhizobium naturally found in the soil and hence increase the level of symbiotic utilization of nitrogen by the plant and bacteria. On the other hand, 3H/1 (Songea) variety in Ruvuma has the capacity of fixing nitrogen therefore it does not need additional fertilizer.

Temperature also affects nodulation and nitrogen fixation. According to Montez et al. (1995), growth of soya bean is lowest at 150C and best at 250C. Higher temperature (350C) reduces nitrogen fixation; also nodules occur deeper in soils that are between 250C and 350C than at 150C. Based on these facts it was reported that in order to have optimal soya bean yield at Dabaga Seed Farm the seed has to be inoculated. Dabaga has temperature between 100C and 280C and therefore microbial activities are slow.

4.1.7 Challenges on soya bean research in Tanzania

The challenges on research facing each station were moreless the same although they differ slightly. In general challenges are on low level of utilization and marketing of local soya bean, inadequate funding in soya bean research compared to other countries. Also, there is challenge on promotion of local soya bean in relation to competition with imported soya bean meals that are sold at low prices, limited knowledge on production and processing and challenge to obtain higher yielding varieties compared to other countries. Other challenges are limitations on release of varieties due to high costs that are involved, lack of government priority on soya bean as an important crop and research on nutrition content between soya beans from different altitudes due to differences on biomass accumulation. The challenge on the lack of a well-organized production and market are for both research and extension. This is because while farmers claim that there is no market for soya bean; processors claim that they do not have enough soya beans. This is because; animal feed entrepreneurs need large quantities of soya bean which at present cannot be supplied by smallscale farmers. This is the limitation of

using soya bean as it was pointed out by TAFMA. For example, one poultry farm reported that the farm has more than 100,000 birds that would require up to two (2) tonnes of soya bean feeds per day (750 tonnes per year) the amount that cannot be supplied throughout the year by farmers. The study also found that it is uneconomical for large entrepreneurs to collect little amount of soya bean from farmers. Such a situation discourages investment in soya bean processing and use.

4.2 Soya bean production

Just as it was mentioned in literature, the study found that there is very little soya bean production in Tanzania despite that there is good potential for increased production. According to RAAs and District Agricultural Extension Officers in the study areas, the major limitations of soya bean production are marketing, processing, utilization and knowledge on the crop. Estimated soya bean production from the available data in Southern Highland regions from 2000/2001 to 2000/2005 shows an increase in soya bean production from 425 in 2000/01 to 1,059 tonnes in 2003/04; highest production was 2,063 tonnes in 2002/03 (Table 3 and Figure 2).

The low and fluctuation on production was found to be due to the influence of un-reliable and unstable market for the crop, production is likely to increase if there is market. Potential for these four regions is 750,000 tonnes per year. Data shows that soya bean production is negligible compared to world soya bean production (Table 4 and Figure 3).

Table 3: Soya Bean Production in Southern Highland Regions

Region	2000 /01		2001 /02		2002 /2003		2003 /2004		2004 /05		Potential	
	H	T	H	T	H	T	H	T	H	T	H	T
Ruvuma	342	276	364	225	446	267	797	455	707	499	150,000	225,000
Rukwa	51	37	24	17	24	12	31	13	25	11	150,000	225,000
Mbeya	-	-	72	72	1,250	1,250	536	536	525	533	200,000	300,000
Iringa	149	112	233	956	117	534	39	55	75	105	130,000	200,000
Total	542		693	1,270	1,837	2,063	1,403	1,059	1,332	1,148	650,000	750,000

Source: Regional and District offices

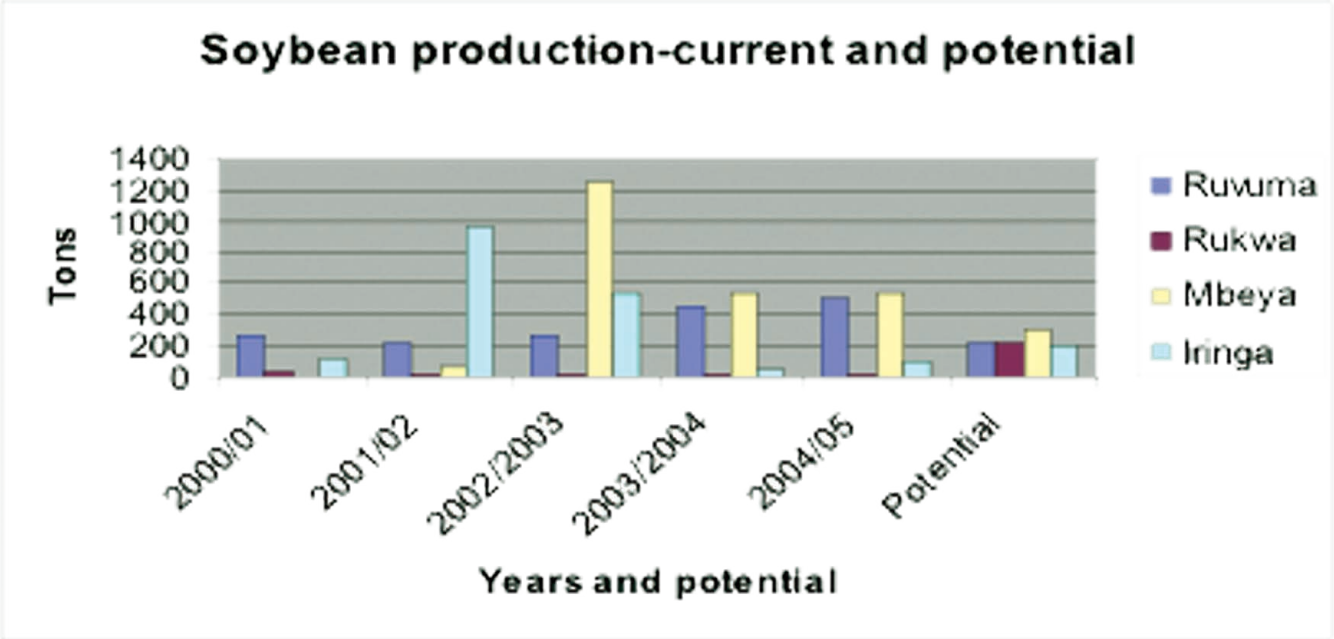

Figure 2: Soya bean production in Southern Highland - current and potential. Potential '000'

Table 4: World soya bean production '000,000'Tonnes

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
USA	59.17	64.78	73.19	74.61	72.22	75.07	78.68	75.01	66.79	85.49
Brazil	24.15	27.30	32.50	31.30	34.20	39.00	43.50	52.00	52.60	53.00
Argentina	12.44	11.20	19.50	19.90	21.00	27.80	30.00	35.50	33.00	39.00
*Tanzania	-	-	-	-	-	0. 43	1.27	2.06	1.06	1.15

*Source: USDA (United States department of Agriculture); * Tanzania: '000'*

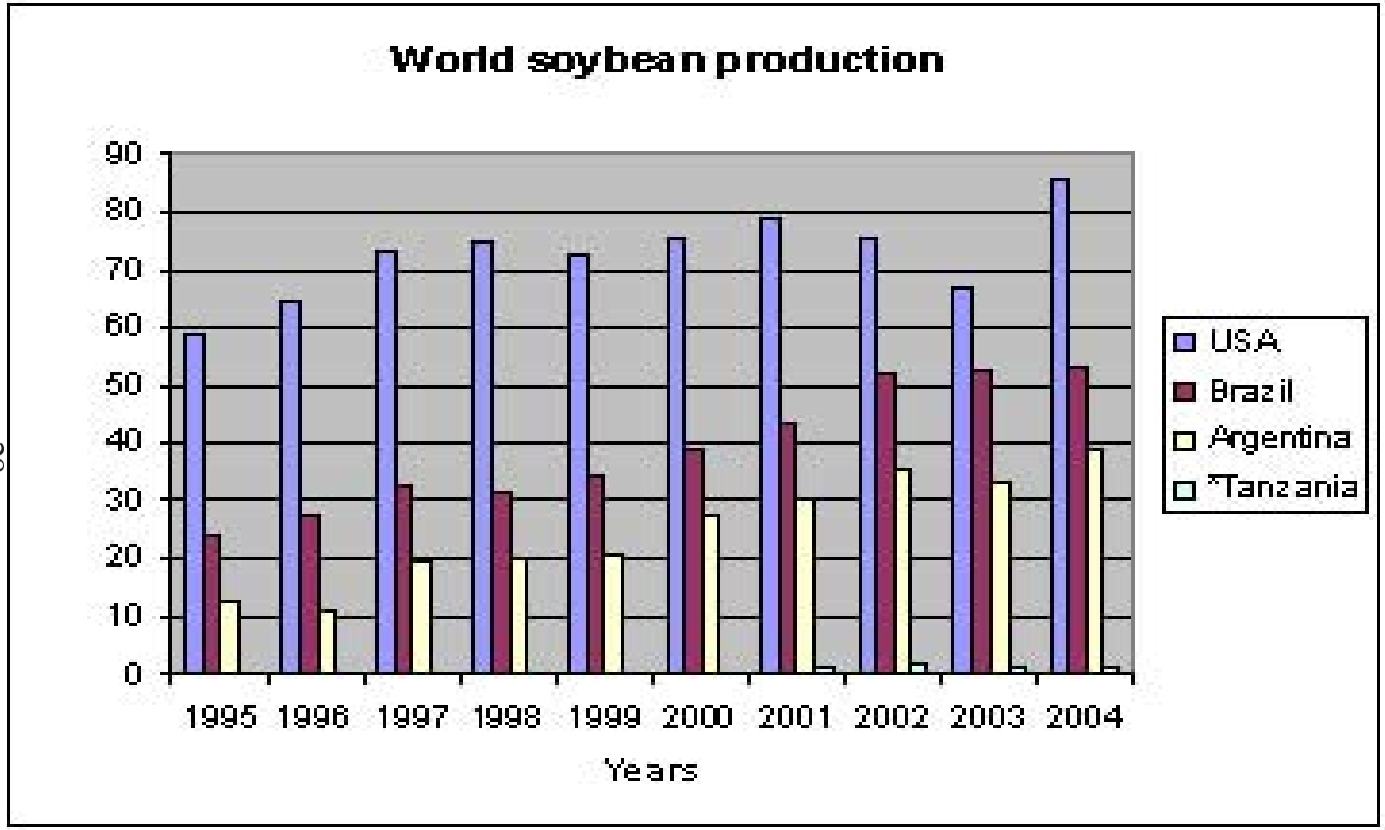

Figure 3: World Soya bean production '000',000'; Tanzania '000'

4.2.1 Ruvuma region

Soya bean promotion and production in Ruvuma region started in 1960s at MRUMA Centre at Peramiho Roman Catholic Mission. The crop was introduced along with Crotalaria (sunnhemp) for soil fertility management and adding value to local foodstuffs in villages surrounding the mission. Farmers were sensitized to grow it and MRUMA Centre bought it at a price of 50Tsh per kilogram and sold it to Songea Co-operative Society and GAPEX. Farmers could not use it because they did not know how to process it. In 1987, MRUMA started soya bean promotion for local utilization as well as for sale. Due to increased promotion, more people became aware on the importance of the crop and production increased. Marketing remained to be a major limitation for more production that prompted MRUMA to train farmers on processing and utilization. Between late 1990s and early 2000s, more farmers and traders emerged in soya bean production and trading.

The crop is produced in all four districts of Songea Rural, Namtumbo, Mbinga and lastly Tunduru district (Figure 1). The region has the potential of producing 225,000 tonnes per year (Table 3 and Figure 2). Soya bean production in Ruvuma region just in many parts of Tanzania neither needs fertilizer nor does it require field and storage chemicals. This could be the reason for the lowest costs of production compared to other crops. The common variety grown in the region is Songea variety (3H/1) which is long maturing taking up to six months to harvest. This is an ideal and favourite variety to the region as it dries when the rains have stopped.

The study found that with the reliable market, soya bean production could replace the tedious and un-environmentally friendly tobacco production in the region. In order to utilize the potential, the Regional authority and Peramiho Centre are looking for the reliable market for soya bean. A South African Company showed interest of buying soya bean from the region. The company required an average of 20 tonnes each quarter (consignment), while at the moment it is difficult to meet this amount due to seasonality and low level of production for supply to each quarter.

Farmers at Amani Makolo village in Mbinga district reported that, the early maturing Bossier variety which takes a maximum of four months to mature is

not ideal in their place unless is late planted to mature when the rains stop; it will be laborious in drying. The lowest yield of Songea variety is 0.4 tonnes/ha (160kg/acre) although under good management the yield is 2 tonnes/ha. Bossier produce up to 2.5 tonnes per hectare under good management. The Oyster Bay Street in Amani Makolo village with large population of Seventh-Day Adventists has relatively organized farmer/religious groups who are producing soya bean. Their average production is up to 2 tonnes per hectare. Farmers reported that in 2004/2005 the village produced more than 70 tonnes of soya beans. They sold it to middlemen at 200 Tsh per kilogram. The advantage of soya bean in improving soil fertility was vivid in Amani Makolo village in that if farmer lend a plot to grow soya bean in the first season, the following season the farmer will not be allowed to grow any crop because the plot has already accumulated substantial amount of soil fertility particularly nitrogenous and the owner of the plot would like to get it back. Second crop after soya bean do not need any type of fertilizers (industrial or farmyard manure).

4.2.2 Mbeya region

Potential districts for soya bean production in Mbeya region are Ileje, Mbozi, Mbarali, Chunya and Mbeya Rural (Figure 1). The limitation of soya bean production in Kyela and Rungwe districts is land scarcity. Farmers give priority on production of crops with ready market than soya bean. The estimated annual potential for soya bean production is 300,000 tonnes (Table 3 and Figure 2). The common variety grown in Mbeya is Bossier. Other varieties are Kaleya, Duicker, ex-Laela and Uyole Soya 1.

4.2.3 Rukwa region

All four districts in Rukwa region have the potential to produce soya bean. The districts are Sumbawanga Rural and Urban, Nkasi and Mpanda (Figure 1). Table 3 and Figure 2 shows that up to 225,000 tonnes of soya bean can be produced in Rukwa region. It was reported that the crop became popular in Rukwa region in 1994/1995 when Laela Agricultural Centre (LAC) under Roman Catholic Sumbawanga produced soya bean for use in animal feed (pigs and cattle) and for soil fertility management. Seeds were brought from Zambia. It was also reported that collaboration between LAC and ARI Uyole

started in 1996. This collaboration led to the release of ex-Laela variety. From 1996/1997 to 2000 collaboration between ARI Uyole and Laela Centre focused on production and utilization of soya bean. A series of trainings to neighbouring villages were done on production and utilization. The varieties grown in Rukwa region are Bossier, ex-Laela and Uyole soya 1. For ex-Laela the farmer get 1.625tonnes/ha and research is 3.6 tonnes/ha.

Just as in other areas where there is potential for soya bean production, marketing of the produce have been a limitation on expanding soya bean production in the region. To address the marketing problems, Sumbawanga district, the NGOs FarmCom Tanzania Limited based in Dar es Salaam had a plan to contract thirty (30) members of KIWASOKA (Kikundi cha Wakulima wa Soya Kaengesa) in Kaengesa village, for soya bean production starting from 2005/2006. In the contract, the NGO planned to supply the required inputs to facilitate soya bean production. Five neighbouring villages showed interest of joining into such contract in order to make soya bean as an additional cash crop after maize and sunflower. The two parties had not yet signed the contract; the NGO proposed a farm gate price between 250 and 300 Tsh per kilogram as compared to average price for maize is 85 Tsh per kilogram, common beans is 300 and 160 for sunflower. In addition to what NGOs are planning, Sumbawanga District Council has proposed soya bean production and utilization as one of their priorities in the District Agricultural Development Programme (DADP). The district submitted to MAFC a proposal worth 14 million shillings for soya bean development.

In Sumbawanga Municipal Council, the DALDO reported the increases in a number of local small-scale soya bean food processors in Sumbawanga Township. CARITAS under Roman Catholic in Sumbawanga district is behind the promotion of processing and formulation of soya bean foodstuffs. It has been sponsoring training on processing and utilization of soya bean as weaning food. Some homemade soya bean animal feed processors in Sumbawanga started emerging, e.g. Ms Bigabo (a poultry farmer who use soya bean from his farm).

4.2.4 Iringa region

All districts in Iringa region have the potential to produce soya bean. The districts are Iringa Rural, Kilolo, Njombe, Makete, Mufindi and Ludewa

(Figure 1). Large production is in Njombe, Iringa Rural and Mufindi districts. Just as in other regions, the RAA for Iringa region associated fluctuation of soya bean production (Table 3and Figure 2) with lack of market and low level of utilization. The region has a potential of producing 200,000 tonnes per year.

4.2.5 Arusha region

The potential districts for soya bean production in Arusha region are Arumeru, Karatu and Babati. The region has the annual potential of producing 120,000 tonnes (Table 2). RAA for Arusha reported that despite this potential, there is negligible soya bean production because land pressure requires farmers to grow other crops and not soya bean alone due to its unreliable market compared to other crops. The more profitable and the easy to sell crop such as pigeon peas, lablab and common beans are given priority. For example, the RAA gave the example of 900Tsh per kilogram for lablab, which has high demand in Kenya, compared to soya bean that has no reliable market. Also, the RAA reported that in Arusha, most of animal feed processors use under-grade common bean and sardines in formulating animal feeds; none of them use soya bean because of its availability. It was reported that people are increasingly becoming aware on use of soya bean especially for preparing weaning foods notably is Afri-Youth Association which process soya bean into soy drink and soya bean flour mixed with other cereal flours.

The Ms Dodoma Transport Company was also interviewed, formally the company was doing large commercial soya bean production, but due to high costs of production and unreliable market, the company stopped. Ms Dodoma Transport Company proposed a price of 500 Tsh per kilogram in Arusha to meet production costs.

4.2.6 Kilimanjaro region

Production and utilization of soya bean in Kilimanjaro does not differ much to that of Arusha. According to RAA for Kilimanjaro, soya bean can be produced in Kilimanjaro region but the limitation is land scarcity; farmers fail to grow soya bean when they are not sure about its market as compared to crops like maize, coffee, beans, lablab, sunflower etc. that have readily

market. The annual potential of soya bean production is 115,000 tonnes Table 2). The RAA and Regional Livestock Advisor (RLA) reported that there are no animal feed processors who use soya bean as source of protein in poultry feeds because there are no enough soya beans. RLA mentioned the complaint of one poultry farmer, that during tourists peak period in Moshi the company does not sell poultry products to tourists hotels because of fishy taints in eggs and poultry meat since the company uses sardines and fish meals as source of protein in the poultry feeds due to lack of soya bean.

4.3 The challenges to agricultural extension services

The study found that there is little production of soya bean compared to the good potential which is available. The regional and district extensions in the study reported that the most challenge they faced in promoting soya bean was to increase production and use because there is good potential and opportunities. The major limitations they pointed out were marketing and use of the crop. They recommended that in order to increase production and use the important aspects to look at should be:

(i) To promote use of soya bean in food and animal feeds formulation so as to stimulate production. This is because people are not aware that soya bean is an excellent source of protein for both human and animal;
(ii) There should be frequent and regular training to livestock keepers and feed processors and extension workers on production and use of soya bean;
(iii) Soya bean economics to ensure reliable market and fair pricing;
(iv) Improve agro-processing at village/ward and district level;
(v) To improve communication network and information sharing to bridge the gap between production and marketing;
(vi) Promotion of contract farming for reliability on production and marketing: and
(vii) Increase on-farm seed production for increased availability and accessibility to suitable varieties.

4.4 Soya bean seed production and its availability

In general, there is no clear mechanism of soya bean seed production and

distribution, as compared to crops like cereals and common beans in the country. The study found that it is only Dabaga seed farm that in 2001/2002 started soya bean seed production where 2.6 tonnes of Bossier soya beans certified seeds were produced but there was no customer hence the seeds were stored and planted in 2004/2005. A total seed production for Uyole soy 1 and Bossier varieties at the farm was 12.4 tonnes; tentative price was 1,500 Tsh per kilogram due to cost of production which was estimated at 1,209 Tsh per kilogram. Other soya bean seeds are produced at research centres like ARI Uyole and ARI Ilonga mainly for research work and for few organizations and individuals who may need. Research also produces seeds through on-farm seed production. During the study, farmers reported to use previous harvest as seeds for the next season, some also bought from market where they did not know when the crop was harvested. This has lead to poor germination and low production of soya bean.

4.5 Soya bean processing for human food and in animal feeds

This section describes briefly the findings on processing of soya bean for use in food and animal feed formulations. The study found that numerous small-scale soya bean foods processors have emerged in recent years due to promotion on use of soya bean.

4.5.1 Soya bean food processing

There are several small-scale soya bean food processors almost in all regions where this study was conducted. Their number has been increasing due to awareness on its importance following the work of different stakeholders, government, NGOs and individuals unlike the past when the crop was not known. The current and relatively the only large-scale soya bean food processor is Ms Power Foods based in Dar es Salaam. The company process soy drink, soya bean milk, soya beans flour mixed with cereals like finger millet, maize, cassava and sorghum. The company has the machine with capacity of processing up to 3,000 tonnes per year. At the moment the company processes a maximum of 1,000 tonnes per year to meet its requirements. The company does contract farming with farmers in Ruvuma region. For example, in 2004/2005 the target was to buy 500 tonnes of soya beans under contract, actual was 200 tonnes at 250Tshs per kilogram in Songea.

The company suggests the government to promote soya bean production and utilization through advertisement in TV, radio and newspapers. In a TV for example, the advertisement should show all the processes on how soya bean is produced in field, processed and different types of soya bean recipes. This will lead to the understanding of the crop by the community and hence more production and utilization.

4.5.2 Soya bean animal feed processing

Soya bean has to be processed through extrusion method or when extracting oil in order to remove anti-nutritional factor that it contain before is used in animal feeds. The study found that apart from low volume of soya bean production to the farmers' side, the processing capacity for animal feeds operates below 50% of its capacity while soya beans for animal feeds could take up to 75% of the total production in the country. One feed processor reported that if poultry industry would decide to use local soya bean in animal feeds, the amount of soya bean that is produced would be inadequate.

4.5.2.1 Soya bean in animal feed processing in Mbeya

Out of nine animal feed processors (Appendix 6) who were visited in Mbeya Municipal Council only, two companies (Ms Simex Animal Feed Company and Ms Songo Sala na Kazi) are using soya bean in poultry feeds formulation, Simex was using more soya bean than the other company. Ms Simex Animal Feeds started feed formulation in 2000 using 4 tonnes of soya beans per year. At the time of visit, the company was using up to 14 tonnes of soya beans per year. The retail price for the processed soya bean was 700 Tsh per kilogram at the factory. The main source of raw soya bean is Mbeya and Rukwa at factory price of 400 Tsh per kilogram. It was reported that the farm gate price in Mbozi and Ileje district was between 200 and 300 Tsh per kilogram. In January to April the price of raw soya bean at the factory goes up to 700 shillings per kilogram especially during rain season when sardines are scarce and hence soya bean has to be used much but worse enough it is out of season. At this period, the retail price goes up to 1,500 shillings per kilogram. Simex sell its feeds in Mbeya, Sumbawanga, Iringa and in Malawi and Zambia. Sala na Kazi sell within Mbeya.

Both processors Simex and Songo Sala na Kazi fry soya bean to remove anti-nutritional factors. The two companies complained on the use of such low and poor technology as they end up with poor quality feeds because sometimes they over-fry soya beans that denature some of the important nutrients, there is also no uniformity to the fried soya bean. Due to weather conditions in Mbeya, the two companies reported not to process soya bean by boiling or steaming in water as the method is mainly for small-scale processors where drying in small quantities is possible especially during rain season. Due to variability on supply of raw soya bean sometimes Simex company import soya bean from Malawi at factory price of 350 Tsh per kilogram; the average is 5 tonnes/year.

4.5.2.2 Soya bean processing for animal feeds in Dar es Salaam

The study revealed that Riyami Miller based in Dar es Salaam is the only large-scale soya bean feed processor who owns soya bean extruder (other processors are shown in Appendix 7). Riyami Millers is an old plant which it is operating under-capacity. It has the capacity milling up to ten tonnes per day equivalent to 3,650 tonnes per year. Despite the plant capacity, the company process an average of 1,000 tonnes per year as it depends on the supply which is estimated at five tonnes per day from May to October. The level of utilization of the extruder is below 50% of its capacity because of inadequate and irregular supply of soya bean (raw materials). During the study, the price of raw soya bean at the mill was between 300 and 355 Tsh per kilogram, sometimes the price goes up to 400 Tsh. There is no contract on supplying of the material. The average cost of extruding one kilogram of soya bean is 100 shillings. At the mill, the extruded soya bean is sold between 450 to 600 shillings per kilogram same as that of sardines that are sold at 450 to 500 shillings per kilogram (Table 7 and Figure 5).
The management reported that there was an increase in demand of extruded soya bean for poultry indicating that poultry farms which are using soya bean have increased. The company requires farmers to produce more soya beans in order to utilize the processing capacity of the plant. The company get soya bean mainly from Ruvuma, Mbeya, Rukwa, Iringa and Morogoro regions. Other regions are Tanga and Mtwara. The possibility of producing soya bean in these regions indicates that more soya beans can be produced if such millers are in place.

4.6 Use of soya bean feeds in animal

Although the importance of soya bean in livestock feed formulation is well known, very little is used for the purpose. The main reason for this situation is non-availability of raw soya bean throughout the year to replace the sardines. It is estimated that in Dar es Salaam alone, there are more than 100 poultry farms that could use soya bean based feeds if it could be available regularly. Among nine poultry farmers who were visited (Appendix 7), only Kiluvya Poultry Farm and Riyami Millers use soya bean based feeds. At Kiluvya Poultry Farm there is drop of about 7% in egg production that might have been caused by inadequate processing or type of soya bean seed varieties. However, the use of soya bean based feed at the farm is much better than sardines because use of sardines lead up to 30% loss of hatchery. The farm is planning to invest on extruding machine that cost between 20,000 and 30,000 USD in South Africa. The target is to have 60,000 chicken parent stocks that will be raised using soya bean. The management at the farm complained on the inadequate supply of soya bean meal from millers who own extruders. They have to book for it for at least four days because the material is not sufficient. The company buys extruded soya bean at 600 Tsh per kilogram and sardines at 1,100 shillings per kilogram.

Other animal feed processors in Dar es Salaam who were visited have poultry farms but none of them to use soya bean based feeds because of short supply of raw soya bean. For example, one poultry farm annual requirements of soya bean meal is 750 tonnes for making of 7,500 tonnes of soya bean animal feeds but the constraint is the availability of raw soya bean. Another limitation on use of soya bean for animal feeds is its cost. Poultry farmers propose the price of raw soya bean to be sold at 300 and 400 Tsh per kilogram at their factories in Dar es Salaam. So if the cost of extruding is 100 Tanzanian shillings then the extruded soya bean should be sold at maximum of 500 Tanzanian shillings per kilogram. This is relatively same price as that of sardine and fish meal. Such price will attract poultry industry to utilize local soya bean.

It was found that some animal feed processors are planning to replace sardines/fishmeal with soya bean. This is because sardines/fishmeal is becoming expensive and there is competition to it with human. The use of

sardines might result to infection of salmonellosis and other bacteria and fungi diseases. This requires poultry farmers to spend more on chemicals against these diseases which is an extra cost to the final product. Unlike sardine and fishmeal which cannot be stored for longer time before it is attacked by fungi and bacteria, a well-dried raw soya bean can be stored for a longer time without being destroyed and loosing its quality.

Due to scarcity of soya bean meals and diseases risks on sardines and fish meal, animal feed processors and poultry farmers proposes exemption of import custom taxes and VAT on processed soya bean animal feeds for at least first five years (just like in fertilizers and agricultural chemicals). This is on the thinking that it will promote poultry industry in the country and at the same time create demand for soya bean to livestock keepers. A custom duty for soya bean is 17% and VAT is 20%. Poultry farmers also request research, extension and farmers to insure that soya bean is produced at low cost by using improved and high yielding varieties in order to sell it at low prices. This will attract large investment as long term strategy to develop the crop and livestock sector.

4.7 The estimated cost of production and local price for soya bean

It was found that in Southern Highland regions the average cost of production of soya bean was 147 (Appendixes 5) and the retail price was between 250 and 700 shilling per kilogram while in Arusha and Moshi it was 800 to 1,000 shillings. In Ruvuma region, the regional authority propose an indicative farm get price of 300 to 400 Tsh per kilogram instead of the current 200 Tsh to 400 which is offered by middlemen at Songea Township. The lowest price at time of harvest - May to July and highest when the crop is scarce, January and April. It was also reported that sometimes middlemen collect soya bean at 150 TSh per kilogram; the retail price at Songea Central Market was 250 shillings per kilogram. However, according to estimated costs of production (Appendix 5 - 1) the lowest farm gate price for soya bean in Songea district could be 252 and 293 shillings per kilogram at 50% and 75% profit margin respectively. The indicative farm gate price for Ileje district in Mbeya was 252 and 294 shillings per kilogram at 50% and 75% profit margin respectively (Appendix 5-2). Retail price for raw soya bean at Mbeya Central Market was between 600 and 700 TSh per kilogram. Traders reported that the farm get price in villages is between 300 and 400 Tsh per kilogram.

The estimated farm gate price for Sumbawanga district in Rukwa region was 138 and 161 shillings per kilogram at 50% and 75% profit margin respectively (Appendix 5-3). The retail price for raw soya bean during the study was 600 shillings per kilogram at Sumbawanga central market. The estimated farm gate price for Iringa rural district was 133 and 156 shillings per kilogram at 50% and 75% profit margin respectively (Appendix 5 - 4). During the study, the market price for raw soya bean at Iringa Central Market was 650 Tsh per kilogram and Makambako town in Njombe district was 500 TSh per kilogram.

It was found out that the price of soya bean in Arusha and Kilimanjaro was between 800 and 1000 TSh per kilogram. Traders reported a price of up to 2,000 shillings per kilogram for the soya bean they buy from Mbeya, Ruvuma and Rukwa during the months of December to April before the new harvest. The retailers' customers are small-scale soya bean food processors that have emerged in recent years. They also reported soya bean from these regions do cross boarder to Kenya. Traders in Moshi sometimes do sell soya bean from countries in southern part of Africa. They also reported that people are increasingly becoming aware on use of soya bean products. This is reflected the number of people who are buying the products. For example a packet of 200 gram of the processed soy-drink made and packet by Afri-Youth Association Arusha was being sold at retail price of 1,000 Tsh. The retailers reported that they give advisory services to their customers on processing soya bean.

Based on cost of production of 147 Tsh per kilogram, assuming the 50% or 75% profit margin, therefore farm gate price could be between 221 and 257 Tsh per kilogram respectively. If cost of transport to Dar es Salaam is 70 Tsh per kilogram, the farmer could sell raw soya bean between 290 and 350 Tsh per kilogram with profit margin of 20%. However, due to little production and high demand the retail price of soya bean is between 300 and 700 Tsh at harvest and 700 to 2,000 Tsh from December to April in Arusha and Moshi Municipals. These prices are higher as compared to imported and already extruded soya bean which is sold at 258 Tsh per kilogram (CIF – DSM) (Appendix 8) while the extruded local soya bean is sold at 600 Tsh per kilogram.

4.8 Export and import of soya beans

During this study it was found out that potential crop exporters do not export soya bean because of high prices offered by farmers that are greater than export price; they said that at present the FGP of 300 Tsh per kilogram which is offered by farmers cannot compete with price of large producers i.e. USA, Brazil, Argentina, China and India. The costs involved for soya bean export are freight, grading, packaging and insurance. They proposed a price of 300Tsh per kilogram in Dar es Salaam for an exporter to sell it at average CIF price of 530 Tsh per kilogram (Table 5) possibly to a specific market which need organic soya bean. This is because at world market soya bean is sold between USD 200 and 323 CIF Rotterdam per tonne. The farm gate price for USA is between 167 and 291 USD per ton (Table 6 and Figure 4).

Table 5: Estimated costs of exporting soya bean

Activity	Cost (Tsh/kg)
FOB Dar es Salaam	300
Freight and insurance to the market	80
Grading (3%) of FOB price	9
Empty bags	12
Bagging costs	7
Cleaning	5
Interest	48
Profit 15%	70
TOTAL	**530**

In December 2004, Convivium 2000 from Italy wanted to buy 150,000 tonnes of soya beans at 228 USD per ton CIF Ravenna in Italy. These prices are very low for Tanzania producers. Therefore, should concentrate on promoting the local market through encouraging local utilization by feeding animals like what large producers are doing where almost 75% is fed to animals and 25% for food and other use. Promotion of soya bean production

Table 6: World soya bean prices 1993 -2004 CIF Rotterdam

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
$/Ton	264	259	248	304	307	259	225	208	200	203	267	323
$/Kg	0.264	0.259	0.248	0.304	0.307	0.259	0.225	0.208	0.200	0.203	0.267	0.323
US FGP/Ton	213	233	205	263	274	230	176	173	167	170	209	291

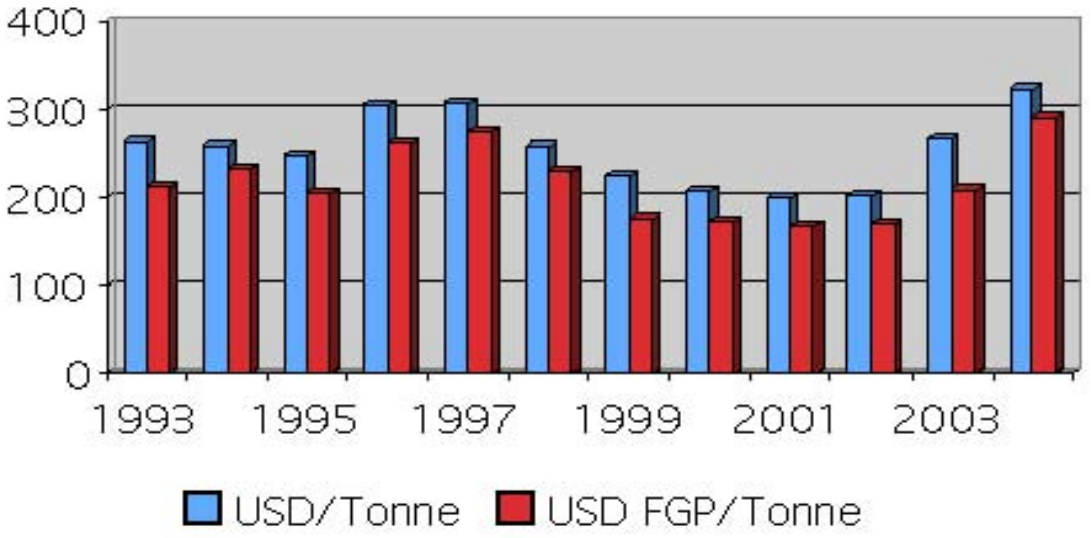

Figure 4: World soya bean prices. Source: USDA

for local consumption will also sensitize local investment on milling of soya bean because investment depends on level of production and consistence supply.

Tanzania Revenue Authority (TRA) import and export section were consulted for the information on the volume of import and export of soya bean products (Appendix 8). Data shows that there is large volume of imports compared to export; this is possibly because the imported products have already been processed i.e. ready to use deffated soya bean meals that are sold at low prices. The imports are from Brazil, Argentina, India and USA who are world producers. The average price of the imported products costs between 2000 and 2004 was 258 Tsh per kilogram CIF Dar es Salaam. As it has been pointed out by research, there is also a possibility that much of the imported products being genetic modified soya bean (GM) which have not been allowed in Tanzania. Low costs of imported soya bean could be due to low costs of production in these countries because of high technology and large scale farming as compared to Tanzania farming where soya bean producers are mainly small-scale farmers with inadequate processing capacity.

4.9 Fabrication of soya bean processing equipments at University of Dar es Salaam

The Department of Processing and Chemical Engineering of the University of Dar es Salaam was contacted to find out if there is a possibility of fabricating a medium soya bean extruding machine to de-activate anti-nutritional factors. It was found that the university can fabricate such machine(s) with capacity of toasting one to two tonnes of soya bean per day. The system works by employing hot steam from the boiler to raw soya bean to deactivate the anti-nutrition factors. This is followed by drying the steamed soya bean for further use. Peramiho Mission use similar method; however, at Peramiho firewood is used to boil water covered by perforated 200-kilogram capacity drum with raw soya bean (Figure 5). These perforations allow the steam from boiling water to pass into raw soya bean. One animal feed processor in Dar es Salaam is interested on investing on processing using the UDSM technology and the company is in the process of installing it.

Figure: 5 Local soya bean steaming at Peramiho to remove anti-nutritional factors

5. DISCUSSION

Tanzania has a good potential of producing more than two million tonnes of soya bean per year but the potential has not yet been exploited although the crop has been in a country for nearly 100 years. National production is negligible compared to world producers. Its wide ecological adaptation implies that all regions in Tanzania can produce it provided right varieties are used.

The reasons for unutilized potential of soya bean are lack of reliable market and knowledge of farmers on processing and utilization at household level. The history of the crop in the country shows that lack of market caused failure to the past initiatives to promote it. The prevailing high price of raw soya bean is because of high demand compared to availability. These prices have demoralized processing investments that could stimulate more production.

Lack of improved and large-scale technology for oil extraction and animal feeds processing which would consume up to 75% of soya bean is cause for limited use of soya bean in animal feeds. Livestock sector need incorporate soya bean in their animal feed so as to capture local and international market of their livestock products. This will be a solution to the present situation where some international hotels, super market and expatriate communities prefer imported poultry products because local poultry products are produced using sardine and fish meal as a main source of protein instead of soya bean. This implies that farmers could benefit by selling raw soya bean to the processors. Similarly processors and livestock farmers could benefit through capturing local and international market of their products. This will create employment and contribute to increased income and poverty reduction to farmers and community at large.

In the present study it has been found that there are only two large-scale processors in Tanzania. One is for food and the other is for animal feed processing. This is the limitation because if there could be more of such processors they would compete for soya bean raw material. This could stimulate more production and therefore exploit fully the importance of the crop. Apparently, the larger feed processor is operating under capacity. Private sector is urged to invest on large scale processing of soya bean as long-term

solution. The high costs of the machines is a limitation for investment, at the moment we should concentrate on using locally made extruders that can be fabricated at the UDSM and institutions like SIDO and VETA. Once such simple machines are in place, they will create demand for raw materials and therefore promote more production and use.

About 80% of Tanzanians live in rural areas where 30% of the under-five are malnourished. This indicates the lack of awareness on soya bean potentials because soya bean could produce cheap protein source with minimum cost. The crop can do well almost in all parts of country including the areas where there is frequent occurrence of malnutrition. There is a need of promoting more soya bean processing techniques and use at household level to ensure that each family get access to use of soya bean products. Use of processed soya bean at household level can also be facilitated by blending cereal/soya bean flours at required ratio for preparing recipes that have been mentioned in the study.

Given large rural population, the amount of produced soya bean could all be used, the same as it is for common beans. It is also emphasized that, at the moment the community should use soya bean products not for minors and vulnerable groups like HIV/AIDS victims and others, but for all groups of people just like in China and Eastern Asia where the crop originated. The possibilities of having more than nine recipes that can be made shows the wide range of choice one could opt in preparing soya bean recipes especially in hotels and restaurants.

The present study has also revealed that the main cause for soya bean processors and livestock sector to complaining on the lack of soya bean materials while farmers complain on lack of market is the existing price. Farmers need farm gate price of up to 400 shillings per kilogram while processors need price of 300 to 350 in Dar es Salaam. The two sides need coordination in order to link soya bean production, marketing, processing and utilization. This study has found that in Southern Highlands, the average cost of production is 147 shillings per kilogram; therefore farm gate price could be between 221 and 257 shillings per kilogram. Assuming that the cost of transport from Sumbawanga to Dar es Salaam is 75 TSh per kilogram and insurance is five shillings per kilogram, then one kilogram of soya

bean could be sold at 337 in Dar es Salaam. This price will attract more investment on processing soya bean and create market and employment for increased production. In addition, if 100 shillings is charged for extruding one kilogram, the extruded soya bean will be sold at 437 similar to sardines and fishmeal which is mostly used in animal feeds (Table 7 and Figure 6). At this level, soya bean will be given priority in animal feed since it has no salmonella and taints to poultry products.

Importation of soya bean has negative impact to our country. It gives advantage to soya bean producers and processors from outside the country rather than Tanzanians. Eventually this demoralize our farmers who depend on agriculture for their living. In addition imported soya bean will lead us to the use of GM which has not been allowed in Tanzania. Local soya bean is one of the best crops which is currently being advocated for organic agriculture because it does not need fertilizers and can be stored without storage chemicals.

The export of soya bean is very challenging because at world market for example soya bean is sold at USD 228 per ton CIF Ravenna; (price which given in December 2004 by Italian company, Convivium 2000). Apparently large world producers sell soya beans between 200 and 323 USD per ton CIF Rotterdam (Table 6) which implies that Tanzania cannot compete on exporting soya bean. Therefore at the moment, we should focus on the local market. Exporters of crops, claim that in order to export soya bean the price in Dar es Salaam should be 300 shillings per kilogram, this will make the exporter sell at 530 at world market (Table 5). This is not competitive because the world market prices is at maximum of 323 shillings (CIF) and Convivium needed it at CIF price of 228 shillings per kilogram. However this price of 300 shillings per kilogram which is demanded by exporters is similar to the one which is offered by large scale processors at their mills. It is also similar to the price if a farmer would like to sell in Dar es Salaam. This price will eventually lead to the price of the processed soya bean be equal to that of sardines and fish-meal (Table 7 and Figure 5) and will enhance more use of soya bean in animal feeds sardines will therefore be left to maintain water ecosystem.

Table 7: Price of protein source raw materials for animal feeds in DSM 2004/2005 (Tsh/kg)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Sardine	425	425	465	470	545	550	550	550	550	550	500	475
Soya bean	500	600	550	500	400	300	340	350	370	400	450	450
Fish meal	350	350	360	370	380	400	400	400	400	400	390	360
Cotton cake	195	200	200	200	195	110	110	120	130	150	170	180
Sunflower	140	145	150	150	130	110	100	100	110	110	120	130

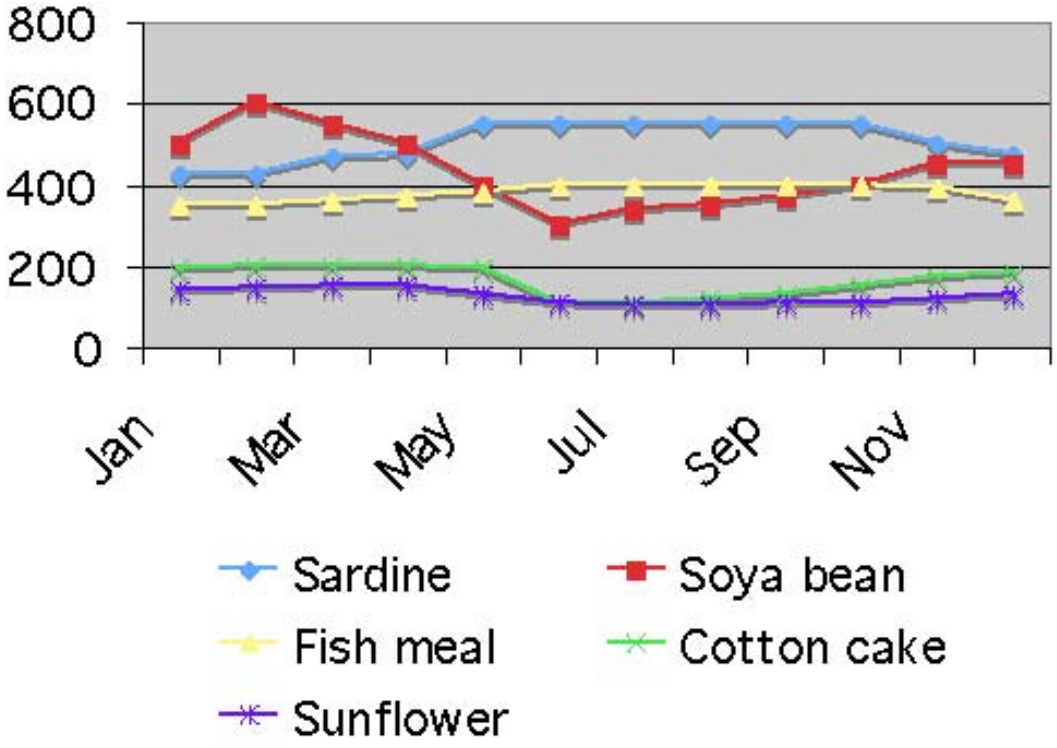

Figure 6: Protein source raw materials for animal feeds in DSM (2004/2005) (TSh/Kg)

Soya bean in Tanzania is produced under rain fed. Therefore in order to ensure constant supply farmers, traders and processors should all be committed and give realistic prices that are related to actual costs i.e. a farmer should give a realistic price and processor ensure that all soya beans that will be produced will be bought (contract farming). The prices could be maintained according to contract to ensure its availability throughout the year.

The challenge to research is to have high yielding varieties so that raw soya bean is sold at competitive but profitable price. The challenge to extension is to promote increased production to utilize the good potential and existing market opportunities. At present, researchers have done a recommendable job, what is required is promotion for more production and utilization. Promotion could be through use of media like TV, radio magazines and newspapers, leaflets, posters, brochures that cater for food and animal feed to promote production, processing, marketing and utilization.

There should be deliberate efforts by all stakeholders to popularize the use of soya bean by playing their role.

6. CONCLUSION

Finding from this study indicates that there is good potential to increase production and use of soya bean for our health and development of livestock sector. This in turn will create employment, raise income to farmers and community at large. The local high price of soya bean observed in this study is because of low production that also discourages more investment in production and processing. This price however is the opportunity for farmers to increase production. The major issue to consider when planning soya bean production and development in Tanzania is to create awareness and knowledge of Tanzanians on utilization of soya bean in food and feed formulation and encourage more production to attract more private investment in processing. There is a need to use multi –ministerial/ institutional approach where Ministries of Agriculture, Cooperative and Marketing, Water and Livestock Development, Industry and Trade, Local Government and Regional Authorities, private sector, framers and technical institutions with joint efforts to promote production and use of the crop. The under fives malnutrition stands at 30% mostly in rural where there is good potential for soya bean; this should be taken as an opportunity for increased production and use of soya bean. The continued use of sardines in the formulation of feeds is a threat to the future of the environment and ecosystem in lakes and rivers where sardines and fish are found. On the other side, the use of soya bean instead of sardines is an environmentally friendly alternative as it can be grown each year and every where. Also, the role of soya bean in nitrogen fixation improves soil fertility.

It should be noted that several opportunities for the production of soya bean do exist. These include high prices during shortage, malnutrition level, possibility of using soya bean instead of sardines and fish meals in poultry feeds. Others are the low costs of production of soya bean compared to other crops, the role of soya bean in fixing nitrogen and the situation that we cannot compete into exporting soya bean. These should not be viewed as obstacles but rather they should be viewed as opportunities. Other opportunities are the presence of MAFC, ASDS and ASDP policies and guidelines to enhance more crop production.

7. RECOMMENDATIONS

From the finding of the study the following strategies for development soya bean in Tanzania are recommended:

i. Initiate Tanzania soya bean association with members from all stakeholders;
ii. Promote small to large scale soya bean processing industries in order to satisfy for the demand of soya bean raw materials hence more production and use;
iii. Form farmers' associations to facilitate increased production and marketing;
iv. Encourage private investment in production and processing;
v. Promote contract farming and training on entrepreneurship of soya bean production for fare pricing to encourage private investment;
vi. Technical institutions such as SUA, VETA, UDSM, SIDO, private fabricators to fabricate and introduce the appropriate home and commercial use soya bean processing equipments for food and feed processors;
vii. Subsidise on the imported soya bean processing equipments and VAT on human and animal feeds manufacturing;
viii. The government should formulate policy to enforce millers to fortify soya bean in traditional food stuffs national priority for improved health;
ix. Facilitate the initiation of soya bean based specialized shops and nutritionists to develop more soya bean based foods mixed with new and traditional foods;
x. Strengthen information dissemination and publication on soya bean;
xi. Exposure the public to relevant policies on promotion of non-traditional crops;
xii. Establish mechanism for soya bean seed production and distribution; and
xiii. Strengthen research to develop suitable and high yielding soya bean varieties.

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APPENDIX 1:
QUESTIONNAIRES FOR STUDY OF SOYA BEAN PRODUCTION AND UTILIZATION IN TANZANIA

1.1: Questionnaire for feed and food processors

Date of interview ---------- Respondents' Serial No. ----------

Dear Sir/Madam,

The MAFC is undertaking a study to establish the current state of soya bean production, processing, marketing and utilization in Tanzania. To that effect, it has prepared this questionnaire with the intention of collecting current data, information on production, processing, marketing and utilization. The questionnaire findings will assist in planning and development of soya bean production in the country. All information obtained from you will be kept confidential.

SECTION A

Identification Questions
Name of the organization/industry----------
Address ----------
Telephone Number ----------
E-mail ----------
Location of the industry:- Town ---------- Street ----------
History: Year the organisation/industry started ----------

SECTION B

General information

1. What is the major role of your industry ----------?
2. If major role is feed/food processing mention types of feeds/ food you process
   i. ----------
   ii.----------

3. Mention the year you started feed/food processing in Tanzania -------
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4. Are the feeds you process for market or for your own use ----------
----------?

5. If for selling who are your major customers
   i. ----------
   ii.----------

6. Do you meet market requirements? Explain
   i. ----------
   ii.----------

7. Do you use soya bean in feed/food you process? Yes ----------
   No ----------

SECTION C

8. Which feed/food types require soya bean as an ingredient

No	Type	% Soya bean	% Other ingredient (mention)		

9. What is the average price of soya bean feeds and other by-products you produce?

No	Type	Tsh/kg

10. Explain the demand of soya bean feeds and other by-products that you produce
    ---

11. How do you meet the demand? Explain
    ---

12. What is the quantity of soya bean feed produced in tonnes and by type?

No	Type	2000	2001	2002	2003	2004	2005

13. Explain the annual potential of your industry to process soya bean feed ----------
14. What are your soya bean requirements as raw material per year (Tonnes) ----------?
15. What is a source of soya bean raw material? Local [ ] External [ ]
16. If external source from where is it imported and the average amount

No	Form of material	Amount (kg)					
		2000	2001	2002	2003	2004	2005

17. What is the average price (Tsh/kg) of soya bean material you import ----------?

No	Country	Type of soya bean material	FOB	CIF

FOB: Free on Board; CIF: Cost Insurance Freight

18. How much tax or levies do you pay for importing soya bean products?

Import duty ----------, VAT ---------- and levies----------

19. Comment(s) on taxes for the imported soya bean products? ----------

20. If it is a local raw soya bean, from which regions do you source?

Regions	Amount (kg)					
	2000	2001	2002	2003	2004	2005

21. What is the average price (Tsh/kg) at your industry for the raw soya bean you source from regions ----------?
22. Does local soya bean source meet your requirements? Yes [ ] No [ ]
23. If No Q 20, how do you meet the requirements, explain ----------
24. If Yes Q 20, how reliable are the supply of raw soya bean. Explain ----------
25. How do you source soya bean from regions?
    Using middlemen [ ], traders [ ] or farmers [ ]
26. Do you have contract arrangements for soya bean supply to your industry?
    If yes, what is the average price (Tsh/kg) for the contract ----------?
27. Have you tried to contract farmer(s) to produce and supply soya bean for your industry?
    Yes [ ] No [ ]
28. If No to Q27, explain the reasons for not using contract farming on production and supply of soya bean for your industry
    i. ----------
    ii.----------
29. What is your future plan on using local soya bean as major protein source for feed production?
    i. ----------
    ii.----------

1.2: Questionnaire for livestock farmers

Date of interview --------- Respondents' Serial No. --------

Dear Sir/Madam,

The MAFC is undertaking a study to establish the current state of soya bean production, processing, marketing and utilization in Tanzania. To that effect, it has prepared this questionnaire with the intention of collecting current data, information on production, processing, marketing and utilization. The questionnaire findings will assist in planning and development of soya bean production in the country. All information obtained from you will be kept confidential.

SECTION A

Identification Questions
Name of the organization/farm ----------
Telephone Number ----------
Location of the industry:- Town ---------- Street ----------
History: Year the organization/industry started ----------

UTILIZATION OF SOYA BEAN IN ANIMAL FEEDS

1. Where do you get soya bean feed for your farm ----------?
2. What is the average requirement of soya bean raw material for production of animal feeds for poultry and/or pig production in your farm?
   i. ----------
   ii.----------
3. What are the potential requirements of soya bean feeds in your farm?
   i. ----------
   ii.----------
4. Do you meet the requirement of soya bean feeds in your farm? Explain
   i. ----------
   ii.----------

5. If you import soya bean products to meet the requirements of your farm, What are the quality differences on use of local soya bean and the imported in terms of final livestock production and productivity, explain
   i. ----------
   ii.----------
6. What do you think could be the reason for livestock performance in Q35? Explain
   i. ----------
   ii.----------
7. If you use imported soya bean, what is the reason for not using Tanzanian soya bean for your livestock production?
   i. ----------
   ii.----------

1.3: Questionnaire to soya bean traders

Date of interview ---------- Respondents' Serial No. ----------

Dear Sir/Madam,

The MAFC is undertaking a study to establish the current state of soya bean production, processing, marketing and utilization in Tanzania. To that effect, it has prepared this questionnaire with the intention of collecting current data, information on production, processing, marketing and utilization. The questionnaire findings will assist in planning and development of soya bean production in the country. All information obtained from you will be kept confidential.

1. What is the average amount and price (Tsh/kg) of soya bean you buy from regions?

	Amount (kg)							
Regions	2001	Tsh/ kg	2002	Tsh/ kg	2003	Tsh/ kg	2004	Tsh/ kg

2. Does local soya bean source meet your trading requirements? Yes [ ] No [ ]
3. If No Q 20, how do you meet the requirements, explain
   ---
4. If Yes Q 20, how reliable are the supply of raw soya bean. Explain
   ---
5. How do you source soya bean from regions?
   Using middlemen [ ], traders [ ] or farmers [ ]
6. Do you have contract arrangements for soya bean supply to your industry?
   If yes, what is the average price (Tsh/kg) for the contract ----------?
7. Have you tried to contract farmer(s) to produce and supply soya bean for your trading? Yes [ ] No [ ]

8. If No to Q7, explain the reasons for not using contract farming on production and supply of soya bean for your industry
   i. ----------
   ii ----------

9. If you export soya bean what is the average amount (Tonnes) and country of destination?

Country	2001	Tonne	2002	Tonne	2003	Tonne	2004	Tonne

10. What are the limitations of soya bean trading in the country?
---

11. Suggest the way forward against these limitations----------

1.4: Questionnaire for zonal legume/soya bean research

Date of interview ---------- Respondents' Serial No. ----------

Dear Sir/Madam,

The MAFC is undertaking a study to establish the current state of soya bean production, processing, marketing and utilization in Tanzania. To that effect, it has prepared this questionnaire with the intention of collecting current data, information on production, processing, marketing and utilization. The questionnaire findings will assist in planning and development of soya bean production in the country. All information obtained from you will be kept confidential.

1. What are potential areas regions/districts for soya bean production in your zone?
   i.----------
   ii.----------
2. What local soya bean varieties that is grown in your zone? (Tanzania)?
   i.----------
   ii.----------
3. What are the improved soya bean varieties that are grown in Tanzania?
   i. ----------
   ii.----------
4. Have you been contacted/ consulted by private sector to produce/ research on soya bean varieties? Mention the company ad type of soya bean variety you were required to produce
   i. ----------
   ii.----------
5. What are the imported and the country of origin for the improved soya bean varieties that are grown in Tanzania?
   i. Variety ---------- Country ----------
   ii. Variety ---------- Country ----------
6. Among these varieties (Q4) mention the GMO soya bean varieties
   i. Variety ---------- Country ----------

ii. Variety ---------- Country --------

7. What are research activities on GMO soya bean in your area (SUA?)
   i. ----------
   ii.----------
8. Explain the on-going research activities on soya bean at Sokoine University of Agriculture
   i.----------
   ii.----------
9. What are the achievements of soya bean research at Sokoine University of Agriculture/ Zone Research Centre? (released varieties and other packages)
   i. ----------
   ii.----------
10. Explain the on-going research activities on soya bean in your zone and Tanzania at large?
    i. ----------
    ii.----------
11. Explain types of research activities on soya bean in East Africa and SADC region
    i. ----------
    ii.----------
12. Explain the challenges and problems facing soya bean research in your zone and in Tanzania
    i. ----------
    ii.----------
13. Explain the challenges of soya bean research in Tanzania with reference to other countries
    i. ----------
    ii.----------
14. What is the average soya bean productivity (tonnes per hectare) under farmers' conditions ---------- and under research ----------?
15. What are the reason(s) for difference in yield between farmer fields and research?
    i. ----------
    ii.----------
16. Explain the adaptability of soya bean varieties based on agro-ecological conditions in your zone

i. ----------
ii.----------

17. Explain the effect of day-length to soya bean varieties that are grown in the country and your zone
    i. ----------
    ii.----------
18. Mention any suitable varieties that are day-length tolerant in your zone
    i. ----------
    ii.----------
19. What are the advantages of day length tolerant varieties?
    i. ----------
    ii.----------
20. What are the disadvantages of day length tolerant varieties?
    i. ----------
    ii.----------
21. As far as country's (zone's) agro-ecological conditions are concerned, does day-length affect soya bean production in the country or your zone?
    i. ----------
    ii.----------
22. Varieties like magoye in Malawi and Zambia, and some IITA varieties does not require rhizobium inoculation for production; are varieties grown in the country particularly in your zone require rhizobium inoculation for their production, explain
    i. ----------
    ii.----------

1.5: Questionnaire for region & district extensionists

Date of interview ---------- Respondents' Serial No. ----------

Dear Sir/Madam,

The MAFC is undertaking a study to establish the current state of soya bean production, processing, marketing and utilization in Tanzania. To that effect, it has prepared this questionnaire with the intention of collecting current data, information on production, processing, marketing and utilization. The questionnaire findings will assist in planning and development of soya bean production in the country. All information obtained from you will be kept confidential.

Region ---------- District ----------

1. Mention the potential districts for soya bean production in the region
   i. ----------
   ii.----------
2. Who are potential producers?
   i. Smallholder (approximate number) ---------- Yield kg/acre ------
   ii.Large commercial (approximate number) -------- Yield kg/acre
   ----
3. Soya bean production in the regio

District	1999/00		2000/01		2001/02		2002/03		2003/04		2004/05		Poten-tiaal	
	H	T	H	T	H	T	H	T	H	T	H	T	H	T

4. What are constraints of soya bean production in the region?
   i. ----------
   ii.----------

DISTRICT AGRICULTURE OFFICER

5. When did soya bean production started in the district, explain briefly
---

6. Mention the potential divisions for soya bean production in the district
   i. ---
   ii.---

7. Soya bean production in the district (ha and tonnes)

District	1999/00		2000/01		2001/02		2002/03		2003/04		2004/05		Poten-tiaal	
	H	T	H	T	H	T	H	T	H	T	H	T	H	T

8. Source and type of soya bean seed varieties

Variety	Source	Price (Tsh/kg)	Remarks

9. What is the purpose of soya bean production? Market [ ]
   own use [ ]
10. If for market, where do you sell ---------- Tsh/kg ----------?
11. Determine gross margin (per ha) for soya bean compared to other crops

Crop	Total costs	Production	Revenue	Remarks
Soya bean				
Maize				
Sunflower				
Common beans				

12. If for own use do you use as food or feed? Explain.....

13. What is the average annual use (kg) of soya bean as food at smallholder level.....

14. What is the potential use of soya bean at smallholder level?

---

15. Explain the popularity of soya bean production and utilization in the district

---

16. What are the constraints of soya bean production and utilization in the district?

1.6: Questionnaire to seed farms

Date of interview ---------- Respondents' Serial No. ----------

Dear Sir/Madam,

The MAFC is undertaking a study to establish the current state of soya bean production, processing, marketing and utilization in Tanzania. To that effect, it has prepared this questionnaire with the intention of collecting current data, information on production, processing, marketing and utilization. The questionnaire findings will assist in planning and development of soya bean production in the country. All information obtained from you will be kept confidential.

1. Name of farm
   ----
2. Mention types of seeds and annual average quantity of production
   i.----------
   ii.----------

3. Quantity (tonnes) of soya bean seed production in your farm?

No	Variety	2000	2001	2002	2003	2004	2005

4. Who are potential customers and average quantity (kg) of seeds you sell?

No	Customer	2000	2001	2002	2003	2004	2005

5. What are the average number of small-scale farmers ----------, large-scale farmers----------, stockist ---------- and others ---------- (mention) who buy soya bean seeds from your farm?

6. What is the annual potential (tonnes) of soya bean seed production in the farm ----?

7. Explain the reasons for not achieving this potential
i.----------
ii.----------

1.7: Questionnaire for soya bean farmers

Date of interview ---------- Respondents' Serial No. ----------

Dear Sir/Madam,

The MAFC is undertaking a study to establish the current state of soya bean production, processing, marketing and utilization in Tanzania. To that effect, it has prepared this questionnaire with the intention of collecting current data, information on production, processing, marketing and utilization. The questionnaire findings will assist in planning and development of soya bean production in the country. All information obtained from you will be kept confidential.

1. When did you start soya bean production, explain briefly
   ---
2. Do you have an association for soya bean production in your village
   Yes [ ] No [ ]? Are you a member of this association?
   Yes [ ] No [ ]
3. What is the name of this association?
   ---
4. What is the purpose of soya bean production? Market [ ]
   own use [ ]
5. If for market, where do you sell ---------- Tsh/kg ----------?
   i.---
   ii.---
6. What is the average price of soya bean you produce? ---------Tsh/kg
7. If for own use do you use as food or feed? Explain
   ---
8. Do you have contract arrangements with your customers?
   Yes [ ] No [ ]. If yes, which companies have sign contract for soya bean production?
   ---
9. Comment on soya bean contract farming
   ---

10. What is the average soya bean production since 1999/2000 to date?

Village	1999/00		2000/01		2001/02		2002/03		2003/04		2004/05		Poten-tiaal	
	H	T	H	T	H	T	H	T	H	T	H	T	H	T

11. Where do you get soya bean seeds?

Variety	Source	Price (Tsh/kg)	Remarks

12. Determine gross margin (per ha) for soya bean compared to other crops

Crop	Total costs	Production	Revenue	Remarks
Soya bean				
Maize				
Sunflower				
Common beans				

13. What is the average annual use (kg) of soya bean as food at smallholder level? ----------

14 How popular is soya bean production and utilization in the village, explain ----------

15. What are your constraints on soya bean production and utilization in the district? ----------
---

APPENDIX 2:

PROCESSING OF SOYA BEAN TO REMOVE ANTI-NUTRITIONAL FACTORS

1. Cooking

- Separate the dirt from soya bean (never wash or soak the uncooked soya bean to avoid risk of developing the beany off-flavours)
- Drop the unwashed soya bean into boiling water gradually so the boiling does not stop. The water to soya bean ratio should be 1:4 by volume. Boil for 30 minutes, ND Remove the beans from fire throw away the water and then wash with cold water.

2. De-hulling for small quantities

- Cook the dry whole soya bean as in 1 above,
- Place the cooked beans in a basin of fresh water and agitate the beans between fingers to remove the hulls, and
- Pour off the water, the hulls will be removed with water

3. De-hulling for large quantities

- Cook the dry whole soya bean as in 1 above;
- Dry the cooked soya bean in the sun, and
- De-hull using de-hulling machines

4. Preparation of soya bean flour

- Cook the soya bean as in 1 above
- De-hull the beans before or after drying as above (optional),
- Grind the dry cooked soya beans in a ponder or in a grinding (hammer) mill,
- Sieve the ground beans to produce a finer flour, and
- Store the soya bean in an air-tight container

APPENDIX 3:

SOYA BEAN RECIPES

1.1 SOYA BEAN FLOUR RECIPES

(i) Soya porridge with cooked soya flour

Ingredients:
- 1 part of cooked soya flour
- 9 parts of maize flour/6 parts of cassava flour
- Water
- Salt or sugar to taste

Procedure:
1. Mix the maize/cassava flour and soya flour; add water to make a paste.
2. Add the paste to the boiling water stirring all the time to prevent lumps forming and avoiding the porridge sticking on the bottom of the pot.
3. Let me porridge cook for 20 minutes.
4. Add salt or sugar to taste.

(ii) Soya porridge with uncooked soya flour

Ingredients:
As described in cooked soya flour

Procedure:
1. Drop the uncooked soya flour into the boiling water, stir it (don't make a paste, soya flour does not lump in boiling water nor does it stick to the pot).
2. Let it boil for 10 minutes.
3. Add water to the maize flour/cassava flour to make a paste.
4. Add the paste to the boiling soya flour, stirring all the time to avoid sticking.
5. Let the porridge boil for 20 minutes.
6. Add salt and sugar to taste.

(iii) Soya ugali (stiff porridge)

Ugali is traditional and staple food for most Tanzanians. Because it is prepared from cereal flour its protein content is usually low. Addition of soya gives a balanced ugali diet.

Ingredients:
- 9 parts of cereal flour (maize)
- 1 part of cooked soya bean flour

Procedure:
1. Mix cereal and soya bean flour.
2. Add water to the mixed flour to make pastes.
3. Bring the paste to boil while stirring.
4. After boiling add some more flour mixture to make it stiff.

(iv) Soya bean biscuits

Ingredients: -
- 1 part of cooked soya flour
- 1 part of maize flour
- 4 tablespoons of sugar to 2 tea cups of flour mixture
- a bit of salt and little oil for frying.

Procedure:
1. Mix all the dry ingredients together.
2. Add water to make dough.
3. Make the dough in small round balls.
4. Fry the balls in heated oil until brown on both sides.

(v) Soya bean/cassava cakes

Ingredients: -
- 9 eggs
- 1 cup soya bean flour
- 2 cups cassava flour
- 3 tablespoons sugar
- 9 tablespoons sugar
- Butter or cooking oil

Procedure: 1. Sift the dry ingredients. 2. Cream the sugar, fat and egg together. 3. Fold in the flour. 4. Add hot water bit by bit to make the dough lights. 5. Oil the baking tin. 6. Pour in the dough and put in a hot oven to bake.

(vi) Soya bean vegetables relish (Similar to groundnut vegetable relish)

Ingredients:
- 1 cup of cooked soya flour
- Vegetables (any green)
- Salt, tomatoes, onions

Procedure: 1. Wash and cut the vegetables. 2 Cook the vegetables for at least 10 minutes then add salt. 3. Add water to cooked soya flour to make paste. 4. Add the paste to the vegetables. 5 Let it boil for about t minutes, then serve with rice or ugali.

(vii) Soya bean milk

Ingredients:
- One par of cooked soya bean flour and six parts of water.

Procedure:
1. Soya bean flour is prinked into boiling water.
2. The mixture is simmered for 45 minutes.
3. The mixture is poured into a Jersy or cheese cloth and the liquid squeezed out. (The residues obtained after squeezing out the milk are very nutritious; it can be used to make pancakes after adding slat, sugar and egg).
4. Add a little bit of slat and sugar to taste (flavour with mashed fruits; then this is good for children).

1.2 RECIPES FROM WHOLE SOYA BEANS

(i) Soya bean snack
Ingredients:
- Soya beans
- Cooking oil and salt

Procedure:
1. Cook the soya beans as explained in the basic preparations above.
2. Fry the cooked soya bean in oil until golden brown.
3. Drain out the fat and sprinkle with salt or sugar to taste.

(ii) Soyee (Soya bean Coffee)

Ingredients:
- Soya beans

Procedure:
1. Cook the soya beans as explained in the basic preparations above.
2. Dry the cooked soya beans in the sun.
3. Roast the dried soya beans until dark brown (without any oil).
4. Pound the roasted soya beans to a fine powder; sieve and pound again until the soya beans are all crashed.
5. Place it in air tight container and store in a cool place.
6. Use the soyee (soy coffee) as you use any other type of coffee.

(iii) Soya bean pancakes

Ingredients:
- 1 cup of soya beans
- 1 egg
- 3 tablespoons of cassava flour or maize floor
- 2 tablespoons of sugar
- oil for frying
- salt to taste

Procedure:
1. Cook the soya bean as explained in the basic preparations.
2. Pound the cooked soya beans until they are completely mashed.
3. Add egg, sugar and a bit of salt to the mash and mix well.
4. Use cassava lour or maize flour for molding so that they do not break.
5. Fry the cakes in heated oil until they are golden brown on both sides.

APPENDIX 4-1:

COST BETWEEN SARDINES AND SOYA BEAN IN ANIMAL FEEDS

Type of feed	Raw materials Tsh/bag			% difference
	Sardines	Soya bean	Compari-son	
Chick Mash	6,389.00	6,117.00	Less by 272.00	- 4.3
Growers Mash	5,455.00	5,226.50	Less by 228.50	- 4.1
Layers Mash	7,326.50	6,309.50	Less by 1,017.00	- 13.8
Broiler Starter	10,058.50	8,875.00	Less by 1,283.50	- 12.7
Broiler Finisher	8,287.50	7,796.50	Less by 491.00	- 5.9
Pre-Breeder Starter	8,193.50	8,303.00	More by 109.50	+ 1.3
Breed Starter	7,415.00	7,527.00	More by 112.00	+ 1.5
Breeder Grower	6,195.00	6,248.00	More than 53.00	+ 0.8
Pre-Breeder	6,202.00	6,281.00	More by 79.00	+ 1.2
Breeder	6,446.50	6,380.50	Less by 66.00	- 1.0

Source:- TAFMA, unpublished information

APPENDIX 4-2:

ANNUAL SAVING FROM USE OF SOYA BEAN MEAL IN MANUFACTURING FEEDS

Type	Annual feed in tonnes	Saving per ton	Total saving
Chick Mash	20,000	5,440.00	48,800,000.00
Growers Mash	45,000	4,570.00	205,650,000.00
Layers Mash	250,000	20,340.00	5,085,000,000.00
Broiler Starter	24,000	25,670.00	616,080,000.00
Broiler Finisher	40,000	9,820.00	392,800,000.00
Pre-Breeder Starter	560	(2,190.00)	(1,226,400.00)
Breed Starter	735	(2,240.00)	1,646,400.00)
Breeder Grower	1,500	(1,060.00)	(1,590,000.00)
Pre-Breeder	1,500	(1,540.00)	(2,310,000.00)
Breeder	16,400	1,320.00	21,648,000.00
Total	**399,695**	**0**	**6,363,205,200.00**

Source:- TAFMA, unpublished information

APPENDIXES 5:
GROSS MARGIN ANALYSIS FOR MAIZE, COMMON BEANS, SUNFLOWER AND SOYA BEAN IN SELECTED DISTRICTS IN SOUTHERN HIGHLAND FOR 2004/2005 SEASON

Appendix 5-1: Songea Rural District - Ruvuma Region

	PRACTICE LEVEL	TRADITIONAL				IMPROVED			
	Crop	Maize	C/beans	S/flower	Soya bean	Maize	C/beans	S/flower	Soya bean
1	Land clearing	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
2	Ploughing	18,500	15,000	15,000	15,000	18,500	15,000	15,000	15,000
3	Harrowing	-	1,000	-	-	-	1,000	-	-
4	Planting	5,000	10,000	5,000	5,000	7,500	10,000	5,000	5,000
5	1st weeding	10,000	10,000	8,000	8,000	10,000	10,000	8,000	8,000
6	Fertilizer appl	5,000	-	-	-	5,000	2,000	5,000	-
7	Pesticide appl	3,000	3,000	-	-	3,000	3,000	-	-
8	2nd Weeding	5,000	5,000	-	-	5,000	5,000	-	5,000
9	Harvesting	5,000	5,000	5,000	5,000	8,000	5,000	5,000	5,000
10	Transportation	25,000	5,000	10,000	5,000	30,000	80,000	10,000	8,000
11	Threashing	5,000	3,000	3,000	3,000	10,000	3,000	2,000	2,000
12	Cleaning	3,000	2,000	2,000	2,000	5,000	2,000	3,000	3,000
13	Bagging costs	2,000	1,000	1,000	1,000	3,000	2,000	2,000	2,000
14	Seed (kg)	15	40	18	40	10	45	20	40
15	Seed (TShs)	1,500	10,000	3,000	12,000	15,000	18,000	5,000	20,000

16	Fertilizer (kg)	-	-	-	-	100	35	100	-
17	Fertilizer (TShs)	36,000	-	-	-	72,000	22,000	22,000	-
18	Pesticides (kg)	1.50	1.00	-	-	2.50	1.00	-	-
19	Pesticides (TShs)	12,000	5,000	-	-	37,500	5,000	-	-
20	Bags and ropes	8,000	3,000	3,500	3,000	13,000	6,000	5,500	4,500
21	Transport to DSM	60	60	60	60	60	60	60	60
22	Other costs	-	-	-	-	-	-	-	-
	Total Costs (TC)	**152,060**	**86,060**	**63,560**	**67,060**	**250,560**	**197,060**	**95,560**	**85,560**
23	Produce (kg/acre)	1500	500	360	400	2500	800	600	800
24	Cost/Kg (Break even price)	101.37	172.12	176.56	167.65	100.22	246.33	159.27	106.95
25	FGP – 50% profit	177.40	301.21	308.97	251	175.39	431.07	278.72	187.16
26	Retail (TSh/Kg)	120	250	250	300	120	250	250	300
27	Total Revenue (TR) - 50%	266,105	150,605	111,230	117,355	438,480	344,855	167,230	149,730
28	Gross profit (TR-TC)	114,045	64,545	47,670	50,295	187,920	147,795	71,670	64,170
29	Net Profit TSh/Kg	76	129	132	126	75	185	119	80
30	NP- At retail price Tsh/kg	19	78	73	132	20	4	91	193

NB: 1. Price of soya bean traditional practices 251TSh/Kg at 50% profit margin; currently no improved practices in soya bean production; 2. FGP- Farm gate price

APPENDIX 5-2: ILEJE DISTRICT - MBEYA REGION

	PRACTICE LEVEL	TRADITIONAL				IMPROVED			
	CROP	MAIZE	C/ BEANS	S/ FLOW-ER	S/ BEANS	MAIZE	C/ BEANS	S/ FLOW-ER	S/ BEANS
1	Land clearing	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
2	Ploughing	8,000	8,000	8,000	8,000	10,000	10,000	10,000	10,000
3	Harrowing	-	-	-	-	5,000	5,000	-	5,000
4	Planting	4,000	4,000	4,000	4,000	6,000	6,000	6,000	6,000
5	1st weeding	6,000	5,000	6,000	5,000	7,000	6,000	6,000	6,000
6	Fertilizer application.	3,200	-	-	-	8,000	-	8,000	-
7	Pesticide application	-	-	-	-	8,000	2,500	3,000	-
8	2nd Weeding	3,000	-	1,000	-	3,500	-	3,000	-
9	Harvesting	4,000	3,000	3,000	3,000	6,000	4,000	4,000	4,000
10	Transportation	4,000	2,000	2,000	2,000	10,000	5,000	4,000	5,000
11	Threashing	3,000	1,500	1,000	1,500	4,000	2,000	1,200	2,000
12	Cleaning	1,500	1,000	1,000	1,000	3,000	2,000	1,800	2,000
13	Bagging costs	1,000	1,000	500	1,000	3,000	1,200	3,200	3,000
14	Seed (kg)	8	10	3	8	10	26	6	15
15	Seed (TShs)	5,600	4,000	600	4,000	13,000	52,000	6,000	15,000
16	Fertilizer (kg)	10	-	-	-	150	-	25	-
17	Fertilizer (TShs)	3,200	-	-	-	48,000	-	8,000	-

18	Pesticides (kg)	-	-	-	-	4	0	-	-
19	Pesticides (TShs)	-	-	-	-	8,000	2,500	-	-
20	Bags and ropes	-	-	-	-	6,000	2,000	2,000	2,000
21	Transportation to DSM	70	70	70	70	70	70	70	70
22	Other costs	-	-	-	-	-	-	-	-
	Total Costs (TC)	50,570	33,570	31,170	33,570	152,570	104,270	70,270	64,070
23	Produce (Kg/Acre)	600	200	350	200	1,800	800	1,000	1,200
24	Cost/Kg (Break even price)	84	168	89	168	85	130	70	53
25	FGP – 50% OR 75% profit	147.50	293.74	155.85	252 / 293.74	148.33	228.09	122.97	93.44
26	Current retail price TSh/ Kg	100	400	130	500	100	400	130	500
27	Total Revenue (TR) - 75%	88,498	58,748	54,548	58,748	266,998	182,473	122,973	112,123
28	Gross Profit (TR-TC)	37,928	25,178	23,378	25,178	114,428	78,203	52,703	48,053
29	Net Profit TSh/Kg (75%)	63	126	67	126	64	98	53	40
30	NP- At retail price Tsh/kg	16	232	41	332	15	270	60	447

NB: 1. Average price of soya bean traditional practices 252/293TSh/Kg at 50 or 75% profit margin respectively; cur rently no improved practices in soya bean production

2. FGP- Farm gate price

APPENDIX 5-3: SUMBAWANGA RURAL DISTRICT - RUKWA REGION

	PRACTICE LEVEL	TRADITIONAL				IMPROVED			
	CROP	MAIZE	C/BEANS	S/FLOW-ER	S/BEANS	MAIZE	C/BEANS	S/FLOW-ER	S/BEANS
1	Land clearing	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
2	Ploughing	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
3	Harrowing	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
4	Planting	1,000	500	1,000	500	3,000	6,000	3,000	7,000
5	1st weeding	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
6	Fertilizer application	-	-	-	-	4,000	6,000	4,000	-
7	Pesticide application	-	-	-	-	1,000	2,000	-	-
8	2nd Weeding	2,000	-	-	6,000	6,000	-	-	6,000
9	Harvesting	3,000	6,000	1,400	6,000	5,000	6,000	2,500	6,000
10	Transportation	4,500	,500	3,000	2,500	8,500	2,500	5,000	4,500
11	Threashing	2,700	1,500	1,000	2,500	5,000	2,500	1,500	4,500
12	Cleaning	2,000	1,000	2,000	2,000	3,000	2,000	3,000	3,000
13	Bagging costs	1,000	1,000	1,000	1,000	5,000	2,000	5,000	2,000
14	Seed (kg)	20	40	10	10	10	20	3	10
15	Seed (TShs)	2,000	8,000	3,000	5,000	20,000	10,000	1,250	5,000
16	Fertilizer (kg)	-	-	-	-	150	100	50	-

17	Fertilizer (TShs)	-	-	-	-	60,000	40,000	20,000	-
18	Pesticides (kg)	-	-	-	-	0	1	-	-
19	Pesticides (TShs)	-	-	-	-	1,000	10,000	-	-
20	Bags and ropes	3,600	1,200	2,400	2,000	8,500	2,500	5,000	4,500
21	Transport to DSM	50	50	50	50	50	50	50	-
22	Other costs	500	200	300	300	850	300	500	500
	Total Costs (TC)	40,350	38,950	33,150	45,850	148,900	109,850	68,800	61,000
23	Produce (Kg/Acre)	900	300	240	500	1700	500	600	900
24	Cost/Kg	44.83	129.83	138.13	91.70	87.59	219.70	114.67	67.78
25	FGP – 50%	78.46	227.21	241.72	138	153.28	384.48	200.67	118.61
26	Retail price TSh/Kg	85	250	100	500	85	250	100	500
27	Total revenue (TR) - 50%	70,613	68,163	58,013	80,238	260,575	192,238	120,400	106,750
28	Gross profit (TR-TC)	30,263	29,213	24,863	34,388	111,675	82,388	51,600	45,750
29	Net Profit TSh/Kg (50%)	34	97	104	69	66	165	86	51
30	NP- retail Tsh/kg	40	120	(38)	408	(3)	30	(15)	432

NB: 1. Price of soya bean traditional practices 138 Sh/Kg at 50 % profit margin; currently no improved practices in soya bean production

2. FGP- Farm gate price

APPENDIX 5-4: IRINGA RURAL DISTRICT - IRINGA REGION

	PRACTICE LEVEL	TRADITIONAL				IMPROVED			
	CROP	MAIZE	C/ BEANS	S/FLOW-ER	S/BEANS	MAIZE	C/ BEANS	S/FLOW-ER	S/BEANS
1	Land clearing	2,000	3,000	2,000	2,000	2,000	2,000	2,000	2,000
2	Ploughing	5,000	5,000	5,000	5,000	13,500	13,500	13,500	13,500
3	Harrowing	5,000	5,000	5,000	5,000	6,750	6,750	6,750	6,750
4	Planting	3,000	3,000	3,500	3,000	3,000	3,000	3,000	3,000
5	1st weeding	3,000	3,000	3,000	3,000	12,000	12,000	3,000	12,000
6	Fertilizer appl	-	-	-	-	3,000	3,000	3,000	3,000
7	Pesticide appl	-	-	-	-	3,000	3,000	3,000	-
8	2nd Weeding	3,000	3,000	3,000	3,000	6,000	6,000	6,000	6,000
9	Harvesting	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
10	Transportation	3,500	3,500	3,500	3,500	10,000	4,000	10,000	4,000
11	Threashing	5,000	5,000	5,000	5,000	10,000	4,000	10,000	4,000
12	Cleaning	500	500	500	500	5,000	6,000	5,000	6,000
13	Bagging costs	1,000	1,000	1,000	1,000	5,000	2,000	5,000	2,000
14	Seed (kg)	10	35	3	12	12	25	3	12
15	Seed (TShs)	-	-	-	-	20,000	42,000	3,600	12,000
16	Fertilizer (kg)	-	-	-	-	100	35	100	50

17	Fertilizer (TShs)	-	-	-	-	30,000	15,000	30,000	15,000
18	Pesticides (kg)	-	-	-	-	10	1	1	-
19	Pesticides (TShs)	-	-	-	-	15,000	20,000	8,500	-
20	Bags and ropes	1,500	1,500	1,500	1,500	10,000	3,500	10,000	10,000
21	Transport to DSM	50	50	50	50	50	50	50	-
22	Other costs	-	-	-	-	-	-	-	-
	Total Costs TC)	35,550	36,550	36,050	35,550	157,300	148,800	125,400	102,250
23	Produce (Kg/ Acre)	500	300	400	400	2000	700	700	700
24	Cost/Kg	71.10	121.83	90.13	88.88	78.65	212.57	179.14	146.07
25	FGP – 50% profit	124.43	213.21	157.72	133.3 / 155.5	137.64	372.00	313.50	255.63
26	Current retail price TSh/Kg	100	400	130	500	100	400	130	500
27	Total Revenue (TR) - 50%	62,213	63,963	63,088	62,213	275,275	260,400	219,450	178,938
28	Gross Profit (TR-TC)	26,663	27,413	27,038	26,663	117,975	111,600	94,050	76,688
29	Net Profit TSh/Kg (50%)	53	91	68	67	59	159	134	110
30	NP retail Tsh/kg	29	278	40	411	21	187	(49)	354

NB: 1. Price of soya bean traditional practices 133.3TSh/Kg at 50% profit margin respectively; currently no improved practices in soya bean production 2.FGP- Farm gate price

APPENDIX 6: FEED PROCESSORS IN MBEYA MUNICIPAL

S/N	All processors	Processors using soya bean
1	Simex animal feeds	Simex Animal feeds
2	Songo Sala na Kazi	Songo Sala na Kazi
3	OTI animal feeds	
4	Juhudi animal feeds	
5	Uyole animal feeds	
6	Daniel Mlungu	
7	Tekka Shabani	
8	Gabriel Sarinjo	
9	Jonathan Nkoma	

APPENDIX 7: FEED PROCESSORS IN DAR ES SALAAM

S/N	All processors	Processors with poultry farm using soya bean
1	*Tausi Animal Feeds Ltd	
2	Falcon Animal Feeds Ltd	
3	Faida Animal Feeds Ltd	
4	*Jadide Animal Feeds Ltd	
5	*Riyami Millers Ltd	**Riyami Millers Ltd
6	Igo Animal Feeds Ltd	
7	*A to Z Animal Feeds	
8	*Twiga Animal Feeds Ltd	
9	*Kiluvya Poulrty Farm	**Kiluvya Poulrty Farm
10	Msangi Animal Feeds Ltd	

11	*Mkuza Chicks Ltd	
12	Kiboko Animal Feeds Ltd	
13	Interfarm Animal Feeds Ltd	
14	Kimara Animal Feeds	
15	Hillary Animal Feeds Ltd	
16	Singasinga Animal Feeds Ltd	
17	Rafiki Animal Feeds	
18	*Farmers Centre	
19	Suma JKT	
20	Gema Animal Feeds	
21	*Fide Animal Feeds	
22	Twins Temeke Animal Feeds	
23	Bafia Animal Feeds	
24	Buguruni Feed Mills	
25	K. M. Animal Feeds	
26	Vita Animal Feeds Ltd	
27	Munanka Animal Feeds Ltd	
28	*Interchick Company Ltd	

*Source: TAFMA Unpublished information; * visited but not using soya bean ** visited and use it*

APPENDIX 8:

IMPORT AND EXPORT OF SOYA BEAN PRODUCTS FROM 2000 TO 2004

DESTINATION	FOB Value (TSHS.)	Net Weight (Kg)	TSHS/Kg
UNITED ARA	1,187,005.00	10,500.00	113.05
BRAZIL	4,950,000.00	22,000.00	225.00
SWITZERLAND	36,044,434.00	33,600.00	1,072.75
UNITED KIN	2,276,232.00	1,412.00	1,612.06
NETHERLANDS	133,964,523.00	210,000.00	637.93
ST. HELENA	185,680,874.00	227,520.00	816.11
UGANDA	1,160,000.00	21,750.00	53.33
UNITED STAT.	43,515,385.00	60,000.00	725.26
TOTAL	408,778,453.00	586,782.00	696.64
EXPORT 2001			
UNITED ARA	387,648.00	2,000.00	193.82
BELGIUM	56,249,472.00	60,000.00	937.49
BOTWSANA	676,716.00	6,000.00	112.79
GERMANY	26,733,798.00	29,100.00	918.69
UNITED KIN	3,483,960.00	5,700.00	611.22
ITALY	1,823,637.00	25,800.00	70.68
KENYA	1,360,045.00	8,500.00	160.01
KOREA	31,323,105.00	9,072.00	3,452.72
NETHERLAND	2,000,250.00	3,000.00	666.75

OMAN	2,100,058.00	11,900.00	176.48
RWANDA	1,716,000.00	11,800.00	145.42
UGANDA	10,000,000.00	100,000.00	100.00
SOUTH AFRICA	3,055,438.00	15,000.00	203.70
ZAMBIA	500,000.00	5,000.00	100.00
DR CONGO	2,100,000.00	30,000.00	70.00
TOTAL	143,510,127.00	322,872.00	444.48
EXPORT 2002			
JAPAN	112,035,825.00	395,000.00	283.64
NETHERLAND	14,680,722.00	18,769.00	782.18
OMAN	432,002.00	2,400.00	180.00
RWANDA	420,236.00	2,500.00	168.09
DR CONGO	50,304,804.00	220,000.00	228.66
TOTAL	177,873,589.00	638,669.00	278.51
EXPORT 2003			
UNITED ARA	40,000.00	100.00	400.00
BURUNDI	62,462,078.00	273,000.00	228.80
COMOROS	690,000.00	900.00	766.67
OMAN	635,000.00	2,500.00	254.00
RWANDA	420,000.00	9,900.00	42.42
SOUTH AFRI	2,212,801.00	4,550.00	486.33
ZAMBIA	203,111,660.00	868,200.00	233.95
TOTAL	269,571,539.00	1,159,150.00	232.56

EXPORT 2004

UNITED ARA	10,900,000	5,600	1,946.43
OMAN	2,160,000	5,400	400.00
RWANDA	4,250,000	34,000	125.00
SAUDI ARAB	5,333,624	10,450	510.39
UGANDA	50,000	1,500	33.33
DR CONGO	7,994,869	60,000	133.25
TOTAL	**30,688,493**	**116,950**	**262.41**

SUMMARY OF EXPORT

YEAR	FOB Value	Net Weight	
	(TSHS.)	(Kg)	TSHS/Kg
2000	408,778,453.00	586,782.00	696.64
2001	143,510,127.00	322,872.00	444.48
2002	177,873,589.00	638,669.00	278.51
2003	269,571,539.00	1,159,150.00	232.56
2004	30,688,493.00	116,950.00	262.41

IMPORT 2000

DESTINATION	CIF Value	Net Weight	TSHS/Kg
	(TSHS.)	(Kg)	
BRAZIL	26,793,778.00	110,000.00	243.58
EQUOADOR	83,807,999.00	504,000.00	166.29
UNITED KIN	638,193.00	3,000.00	212.73
INDIA	30,337,968.00	145,736.00	208.17
ITALY	156,670,753.00	938,250.00	166.98
MALAWI	860,000.00	10,750.00	80.00
UNITED STAT	484,709,257.00	3,336,900.00	145.26
SOUTH AFRIC	57,832,030.00	735,130.00	78.67
TOTAL	**841,649,978.00**	**5 ,783,766.00**	**145.52**

IMPORT 2001			
UNITED ARA	7,926.00	203.00	39.04
BELGIUM	165,455,013.00	990,000.00	167.13
CHINA	201,486.00	60.00	3,358.10
EQUADOR	464,918,126.00	1,812,777.00	256.47
INDIA	12,957,654.00	50,565.00	256.26
ITALY	122,770,041.00	237,675.00	516.55
KENYA	250,180.00	100.00	2,501.80
UNITED STAT	431,472,054.00	1,634,302.00	264.01
SOUTH AFRIC	482,875,851.00	1,554,000.00	310.73
TOTAL	**1,680,908,331.00**	**6,279,682.00**	**267.67**

DESTINATION	CIF value (TSHS)	Net Weight (Kg)	TSHS/Kg
UNITED ARA	206,732,725.00	742,500.00	278.43
EQUADOR	468,257,087.00	1,710,000.00	273.83
INDIA	18,000,208.00	69,733.00	258.13
JAPAN	5,025,158.00	17,080.00	294.21
UNITED STAT	496,937,804.00	2,580,117.00	192.60
SOUTH AFRIC	206,112,882.00	798,682.00	258.07
TOTAL	**1,401,065,864.00**	**5,918,112.00**	**236.74**

IMPORT 2003			
BELGIUM	377,166,836.00	1,805,500.00	208.90
EQUADOR	151,074,766.00	517,500.00	291.93
INDIA	4,514,501.00	16,628.00	271.50
ITALY	1,018,771,079.00	3,508,574.00	290.37
KENYA	388,984.00	300.00	1,296.61
MALAWI	3,545,661.00	25,000.00	141.83
UNITED STA	875,385,018.00	2,848,300.00	307.34
TOTAL	**2,430,846,845.00**	**8,721,802.00**	**278.71**
IMPORT 2004			
UNITED ARA	910,078.00	5,040.00	180.57
CHINA	15,000.00	50.00	300.00
DENMARK	46,973,984.00	109,000.00	430.95
KENYA	4,326,417.00	7,395.00	585.05
UNITED STA	404,916,637.00	1,383,977.00	292.57
SOUTH AFRI	414,908,790.00	1,000,868.00	414.55
ZIMBABWE	82,633,242.00	122,447.00	674.85
TOTAL	**954,684,148.00**	**2,628,777.00**	**363.17**

SUMMARY: IMPORT OF SOYA BEAN PRODUCTS

YEAR	CIF Value	Net Weight	
	(TSHS.)	(Kg)	TSHS/Kg
2000	841,649,978.00	5,783,766.00	145.52
2001	1,680,908,331.00	6,279,682.00	267.67
2002	1,401,065,864.00	5,918,112.00	236.74
2003	2,430,846,845.00	8,721,802.00	278.71
2004	954,684,148.00	2,628,777.00	363.17

APPENDIX 9:
SOYA BEAN STAKEHOLDERS WHO WERE MET DURING THE STUDY

S/N	NAME	ORGANIZATION	PLACE
1	Dr. H. S. Laswai	Food Science and Technology Dept.	SUA. Morogoro
2	Dr. C. L. Rweyemamu	Crop Science Department	SUA. Morogoro
3	Dr. F. A. Myaka	Zonal Research Coordinator ARI Ilonga	Kilosa
4	Dr. Mushi	Zonal Director ARI Ilonga	Kilosa
5	Dr. M. O. Oluoch	Training specialist. AVRDC	Arusha
6	Dr. Mbwana	Zonal Director ARI Selian	Arusha
7	Dr. Mughendi	Senior research officer ARI Selian	Arusha
8	L. R. Chalamila	Regional Agricultural Advisor	Arusha
9	P. Mazeru	Senior Agricultural Officer RAS Arusha	Arusha
10	D. S. Mand	Director. Dodoma Transport Agency Ltd.	Arusha
11	Mkamba (Mrs).	Regional Agricultural Advisor Kilimanjaro	Moshi
12	Dr. Kimario	Regional Livestock Advisor Kilimanjaro	Moshi
13	Nyoni	Senior Agricultural Officer. RAS Iringa	Iringa
14	P. Lyimo	Principal Agricultural Officer. DED Iringa	Iringa
15	M. Mpwehwe	DALDO Iringa	Iringa
16	L. M. Horombo	Farm Manager. Dabaga Seed Farm	Iringa

17	Dr. M. Msabaha	Zonal Director ARI Uyole	Mbeya
18	Dr. C. Madata	Senior research Officer ARI Uyole	Mbeya
19	E. D. Y. Kiranga.	ZRELO ARI Uyole	Mbeya
20	Msanga (Mrs)	Regional Agricultural Advisor Ruvuma	Songea
21	Dr. A. H. S. Tarimo	Regional Livestock Advisor Ruvuma	Songea
22	Mwalongo	Ag. District Executive Director Rural District	Songea
23	A. S. K. Maswaga	DALDO Songea District	Songea
24	G. M. Ndunguru	DALDO Namtumbo District	Songea
25	Waziri	Agricultural Officer DED Songea District	Songea
26	Peter Ngonyani	Farmer Peramiho	Songea
27	G. Mhagama	In-charge MRUMA Centre Peramiho	Songea
28	W. Ngailo	Farmer Peramiho	Songea
29	Suzan Komba	Farmer Peramiho	Songea
30	G. Mhina	DALDO Mbinga District	Ruvuma region
31	M. Khamkoma	Senior Agricultural Officer DED	Mbinga
32	Joseph Nyoni	Farmer Amani Makolo	Mbinga
33	Solanus Chaula	Farmer Amani Makolo	Mbinga
34	Kitangalala	Regional Agricultural Advisor	Mbeya
35	P. S. Mwaisobwa	Regional Livestock Advisor	Mbeya
36	Kessy	Senior Agricultural Officer	RAS Mbeya
37	Mhando	Municipal Agric. & Livestock Officer	Mbeya

38	E. Lameck	Principal Livestock Officer Mbeya Municipal	Mbeya
39	Samki Africanus	Director. Simex Animal Feeds	Mbeya
40	Songo	Ms Songo Sala na Kazi Animal Feeds	Mbeya
41	Ms. OTI animal feeds	OTI animal feeds	Mbeya
42	Juhudi animal feeds	Juhudi animal feeds	Mbeya
43	Uyole animal feeds	Uyole animal feeds	Mbeya
44	D. Mlungu	Manager. Mlungu Animal Feeds	Mbeya
45	Tekka Shabani	Tekka Animal Feeds	Mbeya
46	Gabriel Sarinjo	Sarinjo Animal Feeds	Mbeya
47	Jonathan Nkoma	Nkoma Animal Feeds	Mbeya
48	O. M. Mhile	DALDO Sumbawanga Rural District	Sum-bawanga
49	G. Masebe	Laela Agricultural Centre	Rukwa
50	J. Mwangono	Senior Agricultural Officer	DED S'wanga
51	P. Kapufi	DALDO Sumbawanga Urban	Sum-bawanga
52	Bigabo	Director Bigabo Animal Feeds	Sum-bawanga
53	CARITAS	Rural Development	Sum-bawanga
54	Dr. L. M. P. Rweyemamu.	Lecturer. Chemical and Processing Eng. Dept.	UDSM
55	S. Masud	Manager. Fida Hussein & Company Ltd. Importer, Exporter and Millers	Dar es Salaam
56	S. Ramaiya.	Marketing Manager. Mohamed Enterprises Tanzania Limited	Dar es Salaam

57	N. Msellem	Farmers Centre Limited. Veterinary Drugs and Feed Ingredients	Dar es Salaam
58	P. Njau	Power Foods Industries Limited	Dar es Salaam
59	R. Mbuya	Director. A to Z Animal Feeds	Dar es Salaam
60	Hamdun Mansour	Managing Director. Riyami Millers	Dar es Salaam
61	Dr. D. Mungo'ng'o	Verterinarian. Tausi Animal Feeds	Dar es Salaam
62	Kalugila	Fide Animal Feeds	Dar es Salaam
63	Mwanga	Animal Scientist. Hill Animal Feeds	Dar es Salaam
64	Manager	Ms. Interchick Limited	Dar es Salaam
65	S. Mataru	Ms. Twiga Feeds Limited	Dar es Salaam
66	F. Maximambali (Mrs)	Mkuza Chicks	Kibaha
67	Dr. W. Zulu	Kiluvya Poultry Farm	Dar es Salaam
68	F. Mrosso	Managing Director. Farm Com (Tanzania) Ltd	Dar es Salaam

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