TANZANIA SUSTAINABLE SOYBEAN INITIATIVE

Baseline Report of the Tanzanian Soybean Sub-Sector

September 2023

SAGCOT
SOUTHERN AGRICULTURAL GROWTH CORRIDOR OF TANZANIA

IITA
Transforming African Agriculture

CGIAR

FARM TO MARKET ALLIANCE
Making markets work better for farmers

ASPIRES Tanzania
Agricultural Sector Policy and Institutional Reforms Strengthening

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Foreword:

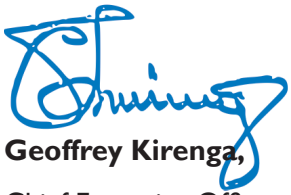
The Southern Agricultural Growth Corridor of Tanzania (SAGCOT), now transforming into the Agricultural Growth Corridors of Tanzania (AGCOT), is a public-private partnership to drive sustainable agricultural transformation benefiting all Tanzanians. Through commercializing smallholder agriculture, we seek to boost agricultural productivity, improve food security, reduce poverty, and ensure environmental sustainability. Together with our partners we have been working in the soybean value chain since 2015. We are currently working to scale up the transformation of this value chain, playing a critical role in food security, nutrition and industrial applications. By supporting the growth of this sector, we enhance the livelihoods of smallholder farmers and contribute to Tanzania's broader economic development.

This baseline report on the Tanzanian Soybean Sub-Sector provides essential insights into the current state of soybean production, the challenges farmers face, and the growth opportunities. The findings will guide our strategic interventions, helping us address critical issues such as access to quality inputs, market inefficiencies, and adopting best practices. With these insights, we can create an environment where soybean farming can thrive, contributing to a resilient and prosperous agricultural sector.

Our success at SAGCOT is built on collaboration with the government, private sector and development partners. I want to extend my most profound appreciation to our partners—The Ministry of Agriculture and Ministry of Livestock and Fisheries, the International Institute of Tropical Agriculture (IITA), the World Food Program (WFP)- the Farm to Market Alliance (FtMA), ASPIRES Tanzania, and our Development partners and project funder the Royal Norwegian Embassy. Your unwavering support has been instrumental in the development of this report. Through such partnerships, we can create a lasting impact, ensuring that the benefits of agricultural growth reach all corners of our nation.

As we look to the future, we are committed to unlocking the full potential of the soybean sector. Together with our partners and stakeholders, we will continue to forge a path towards a vibrant and sustainable agricultural landscape in which soybeans play a leading role in Tanzania's economic and social growth.

We will focus on expanding soybean farmers' collaboration to access finance and technology, strengthening market linkages, and promoting sustainable farming practices to achieve this vision. Through these concerted efforts, we are confident that we will create a thriving soybean sector that serves as a model for agricultural development in Tanzania and beyond.



Geoffrey Kirenga,

Chief Executive Officer

SAGCOT Centre

Acknowledgement

On behalf of ASPIRES Tanzania, I would like to express my gratitude to the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) and the Tanzania Sustainable Soybean Initiative (TSSI), particularly for entrusting us to carry out the soybean household baseline survey in TSSI regions and produce this report. Their technical guidance and financial support have made this exercise possible.

Many thanks also go to TSSI partners, namely the International Institute of Tropical Agriculture (IITA) and the Farm to Market Alliance (FtMA), for their valuable contribution during the assessment tool development, training of enumerators, field data collection and validation of the report.

I would also like to thank my team for their hard work and commitment to developing this report. They include Dr. Ibrahim Kadigi, Benesta Masau, Tumaini Charles, Emmanuel Domonko, Lorna Yoyo, Adelina Mbekomize, Claire Ijumba, Edith Lazaro, and Gloria Kessy.

Finally, we thank The Norwegian Embassy for their financial support.

Prof. David Nyange,

Policy Advisor - ASPIRES Tanzania

List of Acronyms

AASCL	Annual Agricultural Sample Survey for Crop and Livestock
ASA	Agricultural Seed Agency
ASDS	Agricultural Sector Development Strategy
ASPIRES	Agricultural Sector Policy and Institutional Reform Strengthening
CAB	Community Agribusiness Approach
CAGR	Compound Annual Growth Rate
CAN	Calcium Ammonium Nitrate (nitro-limestone or nitrochalk)
CRS	Catholic Relief Services
CV	Coefficient of variation
DAP	Di Ammonium Phosphate
DC	District Council
FAO	Food and Agriculture Organization
FBO	Faith-Based Organization
FMG	Farmer Marketing Groups
FSC	Farmer School Centres
FtMA	Farm to Market Alliance
GAPs	Good Agriculture Practice
GOT	Government of Tanzania
ha	Hectare
IITA	International Institute of Tropical Agriculture
ITCZ	intertropical convergence zone (ITCZ)
Kg	Kilogram
LGAs	Local Government Authorities
MAFC	Ministry of Agriculture Food and Cooperatives
Max	Maximum
MC	Municipal Council
Min	Minimum
MOA	Ministry of Agriculture
MT	Metric Tonnes
NAP	National Agricultural Policy
NBS	National Bureau of Statistics
NGO	None-Governmental Organizations
NLP	National Livestock Policy
NPK	Nitrogen, Phosphorus and Potassium
NSCA	National Sample Census of Agriculture

NSGRP	National Strategy for Growth and Reduction of Poverty
QDS	Quality Declared Seed
SAAFI	Sumbawanga Agricultural and Animal Food Industries
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SBM	Soybean Meal
SSA	Sub-Sahara Africa
STD	Standard Deviation
SUA	Sokoine University of Agriculture
TAFMA	Tanzania Feed Manufacturing Association
TARI	Tanzania Agricultural Research Institute
TDV	Tanzania Development Vision
TSP	Triple Super Phosphate
TSSI	Tanzania Sustainable Soybean Initiative
TZS	Tanzania Shilling
URT	The United Republic of Tanzania
USA	United States of America
USD	US Dollar
WRS	Warehouse Receipt System

EXECUTIVE SUMMARY

As part of the Tanzania Sustainable Soybean Initiative (TSSI) whose implementation is coordinated under the SAGCOT Centre Limited, the Agricultural Sector Policy and Institutional Reform Strengthening (ASPIRES) conducted a farm-level baseline survey on soybean to capture information on the current status of soybean production and marketing, specifically focusing on agronomic practices, yields, market outlets, and identifying challenges and opportunities in the soybean value chain. The TSSI is implemented under the coordination of the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) in partnership with the Farm to Market Alliance (FtMA), the International Institute of Tropical Agriculture (IITA), and ASPIRES Tanzania with financial support from The Royal Norwegian Embassy in Tanzania.

The purpose of the baseline survey is threefold: First, to understand the agronomic practices, productivity, and services available in the selected regions as well as the technology applied in soybean production. Second, is to establish information on the market, market structure, soya value chain governance, soya value chain coordination, pricing, off-takers, and processing capacities within the targeted regions and beyond as well as policy and enabling environment. The third objective is to generate baseline data for key indicators in the TSSI's results framework while contributing information to the national strategies for pulses and soybeans.

The baseline survey was preceded by a rapid stakeholders assessment in order to establish a sampling framework in the Southern Highlands regions plus Morogoro Region where soybean production is concentrated and the target regions for TSSI. Farmers' interviews for the baseline survey were conducted from June 26 to July 23, 2023, in 19 districts from seven regions where TSSI is planning to operate. The regions and districts covered included Morogoro (Kilosa and Mvomero), Iringa (Iringa DC, Kilolo and Mufindi), Njombe (Wanging'ombe and Njombe DC), Ruvuma (Namtumbo, Mbinga and Songea DC/MC), Mbeya (Mbeya Rural and Chunya), Songwe (Mbozi, Ileje and Momba), and Rukwa (Nkasi, Sumbawanga DC and Kalambo). The survey was conducted at the farm-level and covered 1,263 soybean-growing households.

The key findings

Sample Validity: Overall demographic and other baseline statistics are consistent with the national agricultural survey statistics and hence confirming the validity of the sampling framework (URT, 2021). Soybean-growing households are predominantly male-headed (80%). The average family size is 7 members which is above the national average of 5, thus reflecting the importance of family labor in the agriculture-intensive Southern Highlands. The majority of the soybean farming households (78%) is headed by senior adults (40–64 years old). Eight out of 10 (> 80%) heads of soybean growing households are married and living with their spouses, with less than 4% divorced or separated, and less than 5% having never been married or in a marital relationship. Over 83% of the heads of soybean growing households completed primary education (standard seven) with only 2% reported not to have attended any formal school. Conversely, only 15% of the heads of households had post-primary education.

The Importance of Agriculture among Soybean Growing Households: As expected, agriculture (crop and livestock farming) continues to remain the main source of income, as reported by most of the households (90%), the crop cultivation being more important (51.9%) compared with livestock (38.8%). Poultry and cattle are the most popular livestock reared by over 43% and 24% of the farmers interviewed, respectively.

Land Acquisition: About 55% of soybean farmers surveyed acquired their land through inheritance, where ownership is passed down from one generation to another on customary or legal rules. Land purchase is another mode of land acquisition reported by 31% of soybean farmers. Other sources of land acquisition include land leasing (6%). Land leasing and purchase demonstrate emerging farmland markets in Southern Highlands.

Land Utilization: The average total farm size for households interviewed is 4.47 hectares which is above the national average farm size of 2.3 hectares. This is expected as field crops (cereals, pulses and oil-seed) are usually land intensive. Farmers in Rukwa Region have the largest average farm size of more than 9 ha, followed by Njombe (5.82 ha), Mbeya (5.05 ha), and Ruvuma (4.04ha). Proportionally, the majority of farmers (81%) had a total farm size below 5 ha, with only 16% of farmers having 5–21 ha and only 3% of farmers having farms above 21 ha. The distribution of farm size is consistent with the National Agricultural Sample Census (2019/20) where 75% of farms were less than 5 hectares.

The Importance of Soybean Crop: The study reveals that almost 100% of the respondents mentioned maize as the primary crop, soybean as the second, and beans being the third, with sunflowers and groundnuts taking the fourth and the fifth positions, respectively. Most of the farmers (93%) in all regions started producing soybeans in the 2010s to 2020s.

Soybean Farm Size: The soybean farmers in the study regions have an average farm size of 0.53 ha (1.3 acres), which is larger than the national average of 0.43 ha. Since the average farm size is 0.53 ha, it means only 12% of the cropping area has been planted with soybeans. Strategically, this shows potential for expansion of soybean planted area by farmers in the TSSI target regions. Rukwa has the largest average soybean planted area of 0.81 ha (2.0 acres) followed by Ruvuma (0.69 ha), Songwe (0.65 ha), Mbeya (0.45 ha) and Morogoro (0.45 ha), in descending order.

Soybean Production and Yields

The average production of soybeans per household for all regions was about one metric ton (958 kg). Households in Rukwa Region have the largest average of 1.615 tonnes followed by Songwe (1.359 tonnes), Njombe (0.437 tonnes) and Iringa (0.442 tonnes), in a descending order. The overall production statistics across regions and districts provide necessary information for the private sector and TSSI partners supporting soybean aggregation and marketing.

In terms of productivity, as expected, the average soybean yield in the TSSI target regions is 0. 721 tonnes per hectare which is in consistent with the national average of 0.8 tonnes per hectare, based on the NSCS, 2019/20, for long-rain season. Comparison by regions, Mbeya (0.912 tonnes/ha), followed by Iringa (0.854 t/ha), Songwe (0.812 t/ha), Rukwa (0.787 t/ha), and Njombe (0.719 t/ha), in a descending order. Morogoro Region had the least productivity (0.528 t/ha). Strategically, there is a potential to triple soybean productivity to a global average of 3 tonnes per hectare.

However, farms planted using the Uyole 4 seed type had the highest average yield of 1,171 kg/ha (1.17 t/ha or 474 kg/acre); the yield was higher in Rukwa at 1,778 kg/ha (1.78 t/ha or 720 kg/acre), Iringa at 1,233 kg/ha (1.23 t/ha or 499 kg/acre), and Songwe at 1,212 kg/ha (1.21 t/ha or 491 kg/acre). The Spike soybean seed type was also the second seed type that had a higher yield of 810 kg/ha (0.81 t/ha or 328 kg/acre), particularly in Iringa and Njombe.

Other factors affecting yields include the application of fertilizers and inoculants as well as the prevailing farming systems, e.g., intercropping versus monocropping. Farms that were applied with fertilizers had relatively higher soybean yields of 0.892 t/ha compared with farms without fertilizer applications (0.665 t/ha). As expected, relatively lower soybean yields were due to the lower plant populations because soybean farmers intercropped

soybeans with other crops like maize or sunflower. Farmers that intercropped soybean with maize had a lower average soybean yield of 0.461 t/ha, as compared with farmers that practiced monocropping (0.734 t/ha). However, farmers who intercropped soybeans with sunflower had a slightly higher soybean yield (0.776 t/ha), as compared with farmers who planted monocropped soybean. This gives room for further research on the potential of intercropping soybeans with sunflowers. About 30% of farmers, intercropped soybean with other crops.

Farm Labor and Management: Most of the soybean farms (45%) are managed by both husband and wife, with 26% being managed by males only and 25% by females. Nearly 66% of farmers used a hand hoe as the primary tool for soybean cultivation, followed by 27% of farmers who used oxen plough. About 48% of farmers are aware of different technologies in the soybean supply chain but only 2.5% of these farmers confirmed to use modern farming technologies. Contract farming for soybean seed production is negligible in Tanzania as only 3% of the interviewed farmers confirmed cultivating soybean seeds on a contract basis.

Agronomic Practices: About 82% of the respondents reported applying crop rotation techniques to their farms and maize is the most crop planted together with soybeans by over 84% of the interviewed farmers. Also, nearly 30% of soybean farmers confirmed to intercrop their soybeans with other crops and sunflower is the most intercropping crop.

Adoption of Productivity Enhancing Farm-inputs: Over 77% of the interviewees reported using improved seed varieties, with 22% using local varieties while Uyole 4 was the most dominant type of seed planted by farmers, especially in Iringa (50%), Songwe (46%), Mbeya (40%) and Ruvuma (36.5%). About 35% of all farmers interviewed were aware of the inoculants and their applications in the production of soybeans; besides, those who were aware of the inoculants most of them applied them in their fields. About 22% of soybean farmers applied fertilizers, in which the rate of fertilizer adoption varied across regions; for instance, Iringa (59%), Morogoro (33%) and Njombe (33%).

Soybean Market Outlets and Prices: The main off-takes of soybeans include middlemen 28% and brokers 22%. The average producer price of soybeans per kilogram for the 2022/23 harvesting season ranged between TZS 700 and TZS 1,500. The average soybean price per kilogram varies across regions between TZS 710 and TZS 1,980 with the price in Morogoro being higher than other regions (TZS 1,980) compared to the least price in Ruvuma (TZS 713).

The most important source of market information for soybeans was through farmers themselves (44%) and extension officers (28%). About 90% of the interviewees reported having no access to and had never used financial services to support their soybean farm activities and about 77% of the respondents were members of the associations. Strategically, supporting the Market Intelligence Unit of the Ministry of Agriculture to include soybeans could catalyze market transparency and farmers' bargaining power.

Soybean Production Costs and Profitability: The farm-budget as felt by soybean farmers indicates the largest cost share is attributed to seed and farm labor. Strategically, ensuring seed availability, access, and affordability is critical to improving productivity. The profit margins (Appendix 34) for soybeans are very thin averaging from TZS 53,000 to TZS 270,000 per hectare). Improving soybean planted area to achieve economies of scale, promoting intercropping to offset production cost and adopting productivity-enhancing inputs, as well as access to the market would improve the profitability.

Soybean Utilization and Nutrition Awareness: Just 33% of the respondents understand the nutritional values of soybeans while the majority of soybean farmers (67%) are not aware of its nutritional values. Moreover, female-headed households had a better awareness of the nutritional value of soybeans by over 73% compared with male-headed households (65%). Strategically, there is a need to integrate nutrition education into the extension services for soybean farmers.

Surprisingly, about 67% of the respondents agreed to use soybeans as food in their households. As expected, limited domestic use of soybeans is attributed to a lack of access to home-based soybean processing tools and knowledge. The baseline survey revealed that soybean is produced mostly for cash income (> 94.5%) while only 5.5% of the producers produced soybean for family use.

The key challenges: Lack of a reliable market was reported by farmers (43%) to be the major challenge affecting the production of soybeans in the study region, followed by unavailability of quality seeds (23%). Climate variability is also among the critical challenges reported by farmers (16%) to influence the production of soybeans which is reflected in extreme weather events, including droughts and irregular rainfall patterns. Low and price volatility (12%) ranked as the fourth challenge to affect the production process of the crop. Price fluctuations and dominance of the middlemen/brokers in the industry are other challenges. Occasional government interventions including the requirement to sell soybean through the Warehouse Receipt System is another challenge. Other constraints include unreliable supply of farm inputs such as improved seed, inoculants, fertilizer, modern technology in production, and post-harvest processes. Additionally, there are limited skills on the crop's agronomic practices, as well as on its pests and disease management; and a lack of processing capacity.

Conclusion: The survey has provided important statistics that offer the baseline for key TSSI indicators as stipulated in the results framework. The baseline survey has identified some strategic interventions to improve soybean productivity and profitability for farmers.

CHAPTER ONE

1.0 INTRODUCTION

This section presents a bit of an overview of soybeans in Tanzania, the objectives of the baseline study in the selected regions, and the sample design.

1.1 An Overview of the Soybean Sub-Sector in Tanzania

The soybean sub-sector in Tanzania has been growing over the years due to many factors, including demand for protein-rich animal feed and edible oil. Areas with notable soybean production in Tanzania include the southern highland regions (Mbeya, Songwe, Iringa, Njombe, Rukwa, and Ruvuma) and Morogoro (Figure 1.1). The government and various agricultural organizations have been closely promoting soybean production to enhance food security and livelihoods. The soybean sub-sector in Tanzania can be looked upon at different levels including the production level, key stakeholders involved in production and service provision, agricultural practices, the technologies used, and the whole value chain.

Soy bean production became popular between 2010 to 2020

Figure 1.1: The Tanzania Sustainable Soybean Initiative (TSSI) regions

1.2 Soybean Productivity and Profitability in Tanzania

Soybean production in Tanzania still depends on local and traditional agricultural practices with only a few large-scale farmers who produce the crop for the livestock feeding industry. Small-scale farmers contribute to over 99% of the total production of soybeans in Tanzania (Wilson, 2015). Farmers still rely on a few agricultural inputs and they produce soybeans using local seeds, thus, leading to low productivity of less than 1,200 kg/ha (500 kg/acre) instead of the acclaimed optimal productivity of at least 2,500 kg/ha (2.5 ton/ha). The estimated productivity of large-scale farmers is about 2.5 t/ha. The higher productivity of large-scale farmers, especially the Silverlands Ndolela Company Limited, has been attributed to the quality of seeds used, high level of mechanization, good agricultural practices (GAPs), irrigation system, and modern post-harvest handling technologies. The average estimated cost (in Tanzanian Shillings) of production per ha

Tanzania has the potential to triple soybean productivity to a global average of

3 ton/ha

for most farmers ranges from TZS 370,500 to 500,000 (TZS 150,000 - 200,000 per acre). However, these costs might have increased over the past three years due to a number of factors including the Covid-19 outbreak and the prevailing Russia-Ukraine crisis (Russo-Ukrainian war). On average, the profit earned by most soybean farmers is TZS 8650,000 per (TZS 350,000 per acre) but the figures might have changed due to prevailing situations.

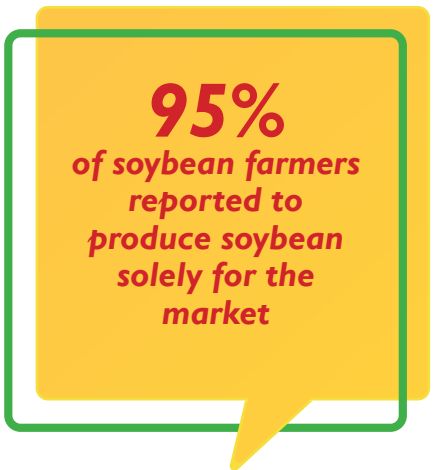
1.3 Agricultural Practices and Extension Services in Tanzania

Agricultural practices in Tanzania involve various cropping systems, but the popular ones are intercropping, monocropping, and crop rotation. Intercropping involves growing more than one crop simultaneously in alternating rows of the same field (Beets, 1990). It is a system of growing a staple crop while obtaining several benefits from additional crop(s). Monocropping involves growing only one crop on the same field season after season. Crop rotation is a system of raising crops regularly, one after the other, on the same piece of land across a series of growing seasons. This takes into consideration that land fertility may not be adversely affected and farmer's profit from land may not be reduced (Tariq et al., 2019).

The soybean farming practices in the country involve three cropping systems: intercropping, monocropping and crop rotation. Intercropping soybeans with maize, legumes, beans and groundnuts is common in the country, especially in the Southern Corridor, central and northern Tanzania. There are great benefits that farmers have realized from rotating soybeans with other crops as well as intercropping them with various crops. One of the realized benefits is nitrogen fixation which has resulted in increasing crop yields (CRS, 2018). The farming systems in the country directly affect soybean production and productivity. The extent of soybean farming in the country has increased because farmers tend to intercrop it with other crops, such as maize and sunflower. These cropping systems have accelerated soybean production in all of the crop's growing zones, namely, the Northern, Southern Highlands, Central and Lake zones (ASPIRES, 2023).

Historically and traditionally, the nation's agricultural extension services have been financed entirely by the government. Besides, in recent years there has been an increase in non-governmental organizations (NGOs), faith-based organizations (FBO), and the private sector involvement in delivering agricultural extension services. These have been providing extension services in the form of farm-led initiatives, while the private agribusinesses have already started supplying fertilizers and agrochemicals to supplement public services (Wilson, 2015). The extension services component is insufficiently able to reach out to the majority of farmers in Tanzania due to a severe deficit of extension workers and a lack of transport and equipment for workers. This calls for massive additional training of field extension staff using the Ministry of Agriculture Training Institutes (MATIs) and retraining of the existing ones to equip them with new technologies (and motivate them to get out into the field).

1.4 Soybean Markets in Tanzania



The demand for soybean and soybean products is highly increasing and is projected to increase significantly as a result of rising incomes, urbanization and the spread of nutritional education. This trend has also been influenced by an increasing number of graduates in food science and nutritional-related programs, cultural interactions and the adoption of "western" lifestyles. The increasing need for animal feeds is also a factor in the increased demand for soybean products. The total soybean use was predicted to increase to 15 kg per person per year by 2020 from only 0.5kg per person in 2010. Most of the soybeans produced in Tanzania are for domestic markets though there is an export potential for the soybean and its products to the neighboring countries within East Africa. Furthermore, MMA (2010) reported that the projected demand for soybeans in Tanzania was potentially estimated at 275,000 MT(t)/year by 2020 with 78% (216,000t) being

used for the fortified food market segment, 13% (36,000t) going to poultry feed, pig feed, and dairy feed segments shares 4% each (10,000t) and 1% (3,000t) goes to whole grains market segment.

The fast-growing animal feed industry (poultry, pig, dairy, fish) is mainly located in big cities and towns like Dar es Salaam (and surrounding coastal towns), Arusha, Mbeya, Mwanza, Dodoma, Morogoro, and many others. Wilson (2015) pinpointed that more than 150,000t/year of soybeans were needed in Tanzania to sustain the demand for protein in animal feeds. This amount of soybeans is considerably needed to replace the use of sardines ('dagaa') which are of variable quality and the amount of sand in the product causes wear to machinery. The price of 'dagaa' has also been rapidly increasing making soybean meal a safer alternative and at a (possibly) lower cost. Wilson (2015) also made it clear that dried fish are also likely to be contaminated by salmonella bacteria, which can cause food poisoning in humans. Thus soybean meal is a preferred source of protein for livestock and has several other nutritional advantages. As local production is insufficient to meet the demand of the animal feed sector, Tanzanian manufacturers import protein by sea from India and by road from Zambia. Supermarkets and elite retail shops that stock branded and packaged products on their shelves are also existing niche markets for Tanzanian soybeans.

Some of the existing animal feed actors include the International Tanfeeds Ltd., a private commercially registered company based in Morogoro, Tanzania. Others are Joshua Products (Arusha), Jamahedu Health Foods Co Ltd (Arusha), Roselyn Natural Foods (Kilimanjaro), Afco Investment (DSM), J.J. Enterprises (DSM), Power Foods (DSM), Tandale Store (DSM), Sohle Grain Mill (DSM) and Shoppers Supermarket (DSM). The soybean market in Tanzania involves various stages and challenges; smallholders who are the primary producers of soybeans in Tanzania often face challenges in accessing reliable markets for their soybeans. In most cases, farmers sell their soybeans through intermediaries (middlemen) or brokers who aggregate produce from multiple farmers and sell it to larger buyers or processors. The marketing information is also dominated by middlemen or brokers.

The market or demand for soybean and soybean products in Tanzania will continue to increase due to increased globalization and the influence of information technology. This means that more Tanzanians (both rural and urban) have access to information on health and food safety issues. Different projects run by NGOs on soybean production for income generation and nutritional issues have been operating in the country and thus providing a good environment for the development of the sector.

1.5 Market Structure of Soybeans in Tanzania

The market structure of soybeans in Tanzania is a combination of different market players and segments involved in the production, distribution and marketing of the crop. As discussed earlier, smallholder farmers are the primary producers of soybeans despite their limited resources and they primarily use traditional farming methods. There are also input suppliers including private companies/agro-dealers, projects and government institutions that supply agricultural inputs like seeds, fertilizers, pesticides and herbicides. After farmers have harvested their produce, most of them aggregate their soybeans to intermediaries. These brokers often purchase soybeans from multiple farmers and aggregate them to larger buyers or processors. Some farmers have cooperative societies or local collection points which act as alternative aggregation points.

1.6 Soybean Value Chain Governance

The value chain governance of soybeans in Tanzania involves various actors (farmers, input suppliers, agricultural extension officers, farmers' associations, aggregators and intermediaries, processors, importers/exporters), research and academic institutions (Sokoine University of Agriculture, SUA; Tanzania Agricultural Research Institute, TARI), and the government (for regulations). All these actors influence the production, processing, distribution and marketing of soybeans. The governance for the Tanzanian soybean value chain also encompasses both formal and informal arrangements that shape the flow of soybeans from smallholder farmers to end-market. Both the government agricultural extension services and NGOs provide farmers with training, information, and technical support on best practices for soybean cultivation, including pest and disease management. Agricultural research institutions collaborate with farmers and other stakeholders to

develop improved soybean varieties (e.g., Uyole 1, Uyole 2, Uyole 3, and Uyole 4) that are adapted to local conditions. Research efforts aim to enhance yields, disease resistance and drought tolerance.

Unfortunately, the major issues in the governance of the soybean value chain as observed by Wilson (2015), include underdeveloped governance mechanisms where actors operate in an uncoordinated and disorganized fashion and if rules exist they are often ignored. Besides, the chain is characterized by too many smallholder farmers with limited capacity to invest in good agricultural practices; limited organizational coordination in relation to market, technologies, and information between producers and processors; poor supervision of lower-end associations; weak associations at all levels of the chain and standard operating procedures are inadequately enforced, or not enforced at all, in part because of relaxed production and trade regulations.

1.7 Soybeans Value Chain Coordination

Currently, the soybean value chain in Tanzania is poorly coordinated and this has resulted in the establishment of TSSI to ensure a smooth flow of soybeans from producers to consumers while optimizing value addition and enhancing the overall performance of the sector. Wilson (2015), emphasized that in spite of being over-regulated, the soybean chain in Tanzania is fragmented, uncoordinated, disorganized and uncontrolled. It is not known exactly how many smallholders are producing soya, but a rough national estimate suggests about 60,000 households appear to be involved in primary production. Effective coordination in the soybean value chain needs various actors and institutions working together to achieve common goals, such as increasing productivity, improving product quality, and expanding market access. Brokers or middlemen dominate and operate across most links of the chain. The poor coordination of the soybean value chain is due to poor stakeholder collaboration, and deprived information sharing on market prices, demand forecasts, weather information, and technological advancement. In addition, there are weak market linkages that connect farmers with buyers, processors and export markets to ensure a stable and profitable market for their soybeans. Lastly, there are inadequate coordinating efforts to provide access to credit and financial services for farmers and other actors along the soybean value chain.

1.8 Soybeans Actors and Stakeholders in Tanzania

The most current soybean value chain study done by Wilson (2015) reported seven key actors across the chain. These actors include the following:

1) **Producers:** Smallholder farmers grow most of the country's soybeans. Producers are primarily located in the Southern Highlands, with another group farming around Babati (Manyara Region). Some small-scale farmers have received support from NGOs to access technology and to establish farmers' groups. Large-scale growers are concentrated in the so-called 'Ihemi Cluster' of SAGCOT around Mafinga and a few others in Rukwa, Arusha and Kilimanjaro regions.

2) **Traders:** Primary buyers in Tanzanian are brokers and buyer-agents who aggregate the beans for traders and these actors operate throughout the country wherever soya is grown. Trading usually takes place at the point of production and the majority of traders have close links with processors.

3) **Processors:** Some large-scale (and numerous small- and medium-scale) processors operate in the country and they are mainly based in Dar es Salaam and Arusha, with limited presence elsewhere. Processing helps turn soya into human food, especially fortifiers. Numerous small private retailers also sell small quantities of feed, feed additives, and supplements for animals (as many as 500 have trading licenses). The main products are chick starter feed (and a more expensive version containing a coccidiostat), layers feed, broiler starter, broiler growers and broiler finisher. In most cases, most of the animal feed products containing soya are in the form of mash and there is limited regular production of compound feeds for pigs. Many small producers purchase ingredients and mix their own feed concentrates.

4) **Wholesalers:** Most processors act as their own wholesalers and there is a limited or fewer independent specialist dealers.

5) **Retailers:** In most cases in Tanzania, processors often act as their own retailers. Supermarkets are the main retail outlets, although soya-fortified food products are also occasionally on sale in small urban and rural shops. Soybeans are usually sold through recognized but informal businesses.

6) **Input suppliers:** Most smallholder farmers make little use of modern agricultural inputs. Certified seed is available in very limited quantities through the TARI-Uyole, the Agricultural Seed Agency (ASA), and other suppliers. Fertilizers and crop health products are available at agro-dealer shops, while the Ministry of Agriculture and various municipalities alongside other local government entities provide limited extension services. Financial services are extremely limited and available only to a few.

7) **Research:** The public sector research on soya is very limited. The TARI's Uyole Agricultural Research Center in Mbeya has a single researcher working on soya. It also has responsibilities for outreach activities including training farmers and extension staff. Some large-scale farmers undertake their own 'research'.

1.9 Existing Policies, Strategies, and Programs of Relevance to the Soybean Sub-Sector

The Government of the United Republic of Tanzania plays a key role in the soybean sector through policies, subsidies and programs aimed at supporting farmers and promoting the crop's production and marketing. A supportive policy and regulatory environment has been evolving only gradually in Tanzania. Several policies and initiatives launched in Tanzania appear to be incompatible with strengthening private sector commitments to the agricultural sector. Although the effects of these emerging policies have not sufficiently produced the targeted goals, their objectives can still be used to influence the success of the TSSI. Some of these policies and regulations include the National Livestock Policy, (2006), the National Agricultural Policy (2013), the Agricultural Sector Development Strategy (ASDS), the Agriculture Sector Development Programmes (ASDP I & ASDP II), the "Kilimo Kwanza" (Agriculture First) and the Tanzania Soybean Development Strategy (TSDS) 2010-2020. Others include the Tanzania Development Vision 2025 (TDV-2025); the National Strategy for Growth and Reduction of Poverty II (NSGRP II or MKUKUTA, from its Swahili acronym); the Integrated Industrial Development Strategy (IIDS 2025); the Agricultural Marketing Strategy; the Rural Micro, Small and Medium Enterprise Programme; and the TSSI under the Southern Agricultural Growth Corridor of Tanzania (SAGCOT).

1. ***The National Agricultural Policy 2013 (NAP 2013):*** The NAP 2013 was developed to address challenges that continue to hinder the development of the agricultural sector; these include low productivity; over-dependence on rain-fed agriculture; inadequate agriculture support services; poor infrastructure; weak agro-industries; low quality of agricultural produce; inadequate participation of the country's private sector in agriculture; environmental degradation and crop pests and diseases. Through the NAP 2013, the government of Tanzania is committed to bringing about a green revolution that entails the transformation of agriculture from subsistence farming towards commercialization and modernization through crop intensification, diversification, technological advancement, and infrastructural development.

2. ***The National Livestock Policy, 2006 (NLP 2006):*** This policy was developed to supersede the 1997 ***Agricultural and Livestock Policy (ALP 1997)***: The focus of this policy was to commercialize agriculture and increase the income levels of the smallholder and livestock keepers of Tanzania. The policy had nine objectives which are: a) to assure basic food security for the nation, and to improve national standards of nutrition by increasing output, quality and availability of food commodities; b) to improve standards of in the rural areas through increased income generation from agriculture and livestock production, processing and marketing; c) in increase foreign exchange earnings for the nation by encouraging the production and increased exportation of cash crops, livestock products, other agricultural surpluses, including food crops, by-products and residues; d) to produce

and supply raw materials, including industrial crops, livestock, by-products, and residues for local industries, while also expanding the role of the sector as a market for industrial outputs through the application of improved production, marketing and processing technologies; e) to develop and introduce new technologies which increase the productivity of labour and land; f) to promote integrated and sustainable use and management of natural resources such as land, soil, water and vegetation in order to conserve the environment; g) to develop human resources within the sector in order to increase the productivity of labour and to improve ability, awareness and morale; h) to provide support services to the agricultural sector which cannot be provided efficiently by the private sector; and i) to promote specifically the access of women and youth to land, credit, education and information. The NLP, 2006, summarized the ALP 1997 rationales to three major goals namely: to encourage the development of a commercially oriented, efficient and internationally competitive livestock industry; to support the emergence of a more diverse structure of production with a large increase in the numbers of successful smallholder livestock producer enterprises; and to conserve livestock resources and put in place policies and institutions for sustainable resource development and use.

3. ***Agricultural Sector Development Strategy (ASDS):*** The ASDS was initiated in 2001 aiming to create an enabling environment for improving agricultural productivity and profitability, improving farm incomes, thereby contributing to reducing rural poverty and ensuring household food security. It focuses on productive and gainful agriculture: subsistence agriculture must become a profitable smallholder agriculture, and the spotlight must switch from public institutions to farmers and agribusinesses. Specifically, the ASDS has two complementary objectives: (1) to enable farmers to have better access to and better use of knowledge, technologies, commercial systems, and agricultural infrastructure, contributing to higher productivity, greater profitability, and increased farm incomes, and (2) to promote private investment in agriculture by improving the regulatory environment and agricultural policy.

4. ***The Agriculture Sector Development Programme I (ASDP I):*** The Agriculture Sector Development Programme (ASDP) is the first ever sector-wide programme developed in 2002-2005 and implemented from 2006/2007 to 2011/12 fiscal years. The ASDP I is a "basket fund" project that addresses the development challenge of enabling farmers to have better access to and use of agricultural knowledge, technologies, marketing systems, and infrastructure, all of which contribute to higher productivity, profitability, and farm incomes. The ASDP objectives were consistent with the development priorities of Tanzania as stipulated in the National Planning Frameworks including the Tanzania Development Vision (TDV) 2025, the ASDS, and the National Strategy for Growth and Reduction of Poverty (NSGRP). The project is structured around two components: (1) support at the local level to improve the delivery of agricultural services, the quality of agricultural investments, the local regulatory environment, and the private investment policy in agriculture, (2) support at the national level to improve the responsiveness and quality of agricultural research and policy, preparatory work and irrigation investments at the national level through public-private partnerships, improved food security and coordination in the sector, stimulation of agricultural markets and development of the private sector.

5. ***The Agriculture Sector Development Programmes 2 (ASDP II)*** - The government of Tanzania finalized the formulation of the Agriculture Sector Development Programme II (ASDP II) and it was launched in 2018. This is a ten-year programme that is being implemented in two (2) phases each divided into a five-year implementation period. The First Phase I started in 2017/2018–2022/2023 and it is a follow-up to the ASDP I implemented from 2006/2007 to 2013/2014. The ASDP II has been designed based on the lessons learned during the ASDP I implementation. The ASDP II aims at transforming the agricultural sector (crops, livestock & fisheries) towards higher productivity, commercialization level, and smallholder farmer income for improved livelihood, food and nutrition security, and contribution to the GDP. The Program's strategy is to transform gradually subsistence smallholders into sustainable commercial farmers by enhancing and activating sector drivers. Also, supporting smallholder farmers to increase the productivity of target commodities within sustainable

production systems and forge sustainable market linkages for competitive surplus commercialization and value chain development.

6. ***National Strategy for Growth and Reduction of Poverty II (NSGRP II or MKUKUTA, from its Swahili acronym):*** This strategy builds on four key fundamentals: (i) efficiently using and developing the factors of production, including human capital/resources; (ii) strengthening and establishing well-functioning institutions and markets; (iii) providing infrastructure; and (iv) ensuring good economic governance. It builds also on four strategic areas: (i) providing targeted subsidies to select food crops, identifying and promoting modern farm technologies and providing support for increased utilization of improved technologies for crop and livestock production; (ii) identifying research activities, promoting food storage technologies/facilities and enhancing agro-processing as well as environmentally friendly technologies and practices, especially for rural areas; (iii) improving road network connectivity to facilitate the flow of agricultural produce (outputs); and (iv) improving stock management and monitoring of food situation in the country.

7. ***'Kilimo Kwanza' (Agriculture First):–*** This programme was developed to accelerate agricultural transformation through fostering the modernization and commercialization of agriculture, mainstreaming Government planning processes, allocating sufficient resources, mobilizing increased investments, and mobilizing the private sector.

8. ***Integrated Industrial Development Strategy (IIDS 2025):*** This strategy was developed to provide guidance in the implementation of the Sustainable Industrial Development Policy (SIDP) 2020 objectives under the newly prevailing economic environment and to realize the targets stipulated by TDV 2025. It aims to build up internationally competitive business environment and to promote enterprises to make the industrial sector an engine of economic growth. It also promotes agricultural development-led industrialization to support the successful implementation of Kilimo Kwanza and equitable growth of the regions.

9. ***Rural Micro, Small, and Medium Enterprise Programme (IIDS 2025):*** The program supports agricultural and agro-industrial development in six target regions (the Coast, Tanga, Manyara, Mwanza, Iringa and Ruvuma). One important contribution of the programme is the provision of information to poor rural entrepreneurs in value chain coordination.

10. ***Agricultural Marketing Strategy:*** This strategy was designed to contribute towards the attainment of TDV 2025, NSGRP, ***Kilimo Kwanza***, and the Millennium Development Goals (MDGs). The strategy has a lot to do with the promotion of a competitive, efficient and equitable agricultural marketing system, including supporting the availability of internationally accredited laboratories and testing equipment for the introduction and monitoring of appropriate quality standards.

11. ***The Southern Agriculture Growth Corridor of Tanzania (SAGCOT)***: The program was initiated in 2010 to attract private investment into agriculture in ways that are socially and environmentally responsible. It addresses constraints related to uncertain policy environments, the development of private and public partnerships, and the availability of affordable and long-term financing. Investments are promoted along the trade routes that link Tanzania to Zambia (serving, within Tanzania, the Coast, Morogoro, Iringa, Rukwa and Mbeya regions). It also focuses on discrete geographical areas ('clusters') within the corridor where there are opportunities to establish a critical mass of profitable small and large operators. More recently the introduction of TSSI focuses on harnessing the potential of soybean cultivation to derive a demand-driven, private-sector-oriented, and vertically integrated value chain. The TSSI's initial activities include the comprehensive profiling of soybean farmers and a baseline survey designed to gain insights into the current state of the soybean sub-sector in Tanzania.

1.10 Objectives of the Soybean Baseline Survey

It was hypothesized that with a clear understanding of the baseline situation, agricultural extension services, policymakers, and development organizations can design targeted interventions and strategies that address specific challenges and needs of soybean producers. Furthermore, this baseline survey provides information

that serves as the reference point against which future progress can be measured. The results of this survey may be compared with the data collected in subsequent years or after implementing the suggested interventions, to evaluate the success of those interventions and adjust strategies if necessary. The soybean baseline survey will help identify areas that require more attention, whether it involves improving soil fertility, providing training on best practices, or distributing improved seed varieties. Furthermore, it identifies potential risks that might impact soybean production, such as pests, diseases, or adverse weather conditions. With the results from this survey, farmers and stakeholders can develop appropriate risk mitigation strategies.

The first objective of the baseline was to understand the productivity, agricultural practices, and services available in the selected regions as well as the technology applied in soybean production. Secondly, to establish information on the market and the market structure; the soybean value chain governance; the soybean value chain coordination, pricing, off-takers, and processing capacities within the targeted regions and beyond; as well as policy and enabling environment. The third objective was to use the findings to serve as a base for setting up the TSSI important results framework and key performance parameters and targets.

The survey was conducted to collect information about the current status of soybean production, including factors like production levels, yield, cultivation practices, challenges and opportunities. Also, to supplement some information that was already available from various reports including the soybean synthesis report (ASPIRES, 2023). The information helps actors and stakeholders make informed decisions about resource allocation, investment and policy formation. Also, the last objective of the survey was to use the findings to serve as a base for setting up TSSI's important results framework and key performance parameters and targets.

The southern highlands regions/corridor where TSSI and ASPIRES undertook the baseline study to include Morogoro, Iringa, Njombe, Mbeya, Ruvuma, Songwe and Rukwa. The sampling framework of the study regions was 1,200 households, which is 2% of the population (60,000 soybean farmers). Purposive sampling was used to deliberately choose areas (regions/villages) with the highest production of soybeans. After the study districts and villages were purposively identified, random sampling was applied to select households with farmers who had recently cultivated the targeted crop. This was done to ensure the sample represents the soybean farmers in the selected sites. The survey was meant to gather baseline information at the household level. The survey collected information on the demographic characteristics of farmers, income sources, livelihoods, natural resource management strategies, climate change and adaptation, and current risk management practices.

1.11 Sample Design of the Baseline Survey

The southern highland regions where TSSI and ASPIRES undertook the baseline study include Morogoro, Iringa, Njombe, Mbeya, Ruvuma, Songwe and Rukwa. The sampling framework of the study regions was 1,200 households, which is 2% of the population (60,000 soybean farmers). Purposive sampling was used to deliberately choose areas (regions/villages) with the highest production of soybeans. After the study districts and villages were purposively identified, random sampling was applied to select households with farmers who had recently cultivated the targeted crop. This was done to ensure the sample represents the soybean farmers in the selected sites. The survey was meant to gather baseline information at the household level. The survey collected information on the demographic characteristics of farmers, income sources, livelihoods, natural resource management strategies, climate change and adaptation, and current risk management practices.

Table 1.1 shows targeted regions, districts and the number of proposed farmers (the initial sample size), plus the number of farmers reached. The idea was to collect data from at least 50 farmers representing each of the selected districts.

Table 1.1: Proposed number of farmers vs. number of farmers reached per region per district

Region	Districts	Number of Districts	Proposed # of farmers	# of farmers reached
Iringa	Iringa DC, Kilolo and Mufindi	3	150	203
Mbeya	Mbeya Rural and Chunya	2	200	102
Morogoro	Kilosa and Mvomero	2	100	85
Njombe	Wanging'ombe and Njombe DC	2	150	198
Rukwa	Nkasi, Sumbawanga DC and Kalambo	3	150	163
Ruvuma	Namtumbo, Mbinga, Songea DC and Songea MC	4	300	306
Songwe	Mbozi, Momba and Ileje	3	150	206
TOTAL		**16**	**1,200**	**1,263**

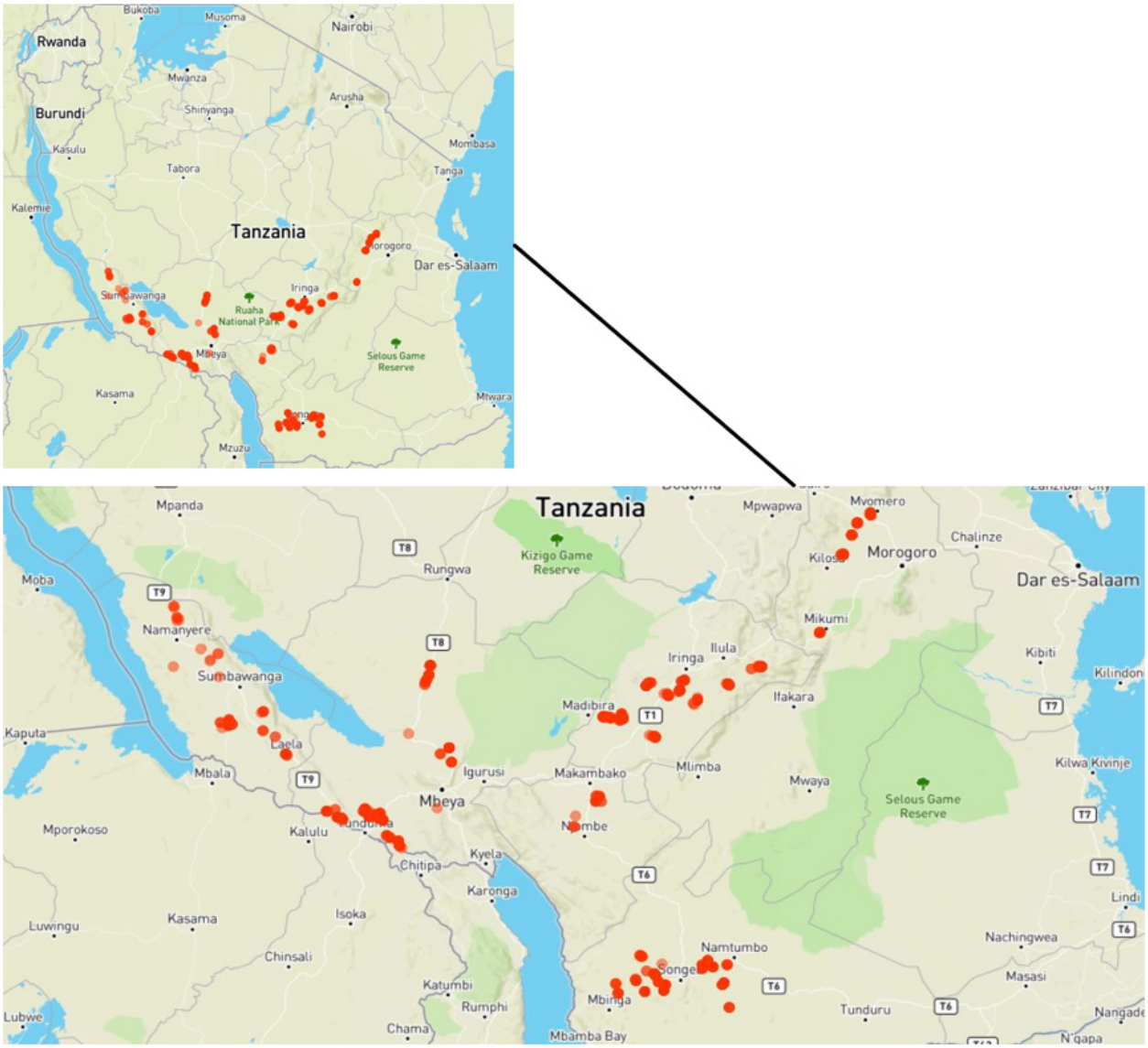


Figure 1.1b: The map showing the points (red dots) where survey data was collected

This report presents the results of an analysis of the soybeans household baseline survey, which was carried out on June 24–July 23, 2023. The survey was conducted to collect data on the current status of soybean production levels and technologies, challenges and opportunities and covered 7 regions in the Tanzania Sustainable Soybean Initiative (TSSI), reaching 1,263 households in 16 districts of Tanzania Mainland (Table 1.1). The TSSI regions include Morogoro, Iringa, Njombe, Ruvuma, Mbeya, Songwe and Rukwa. This survey is a critical milestone for understanding the current state of soybean production, identifying challenges and opportunities, and guiding informed decision-making and the development of soybean strategies. It provides a solid foundation for designing interventions that can improve productivity, profitability, and sustainability in soybean farming. The findings are organized into eight sections which are: Section One - Introduction; Section Two - Household Profile; Section Three - Crop Production; Section Four - Agricultural Technologies; Section Five – Post-harvest Handling; Section Six - Soybean Marketing; Section Seven – Financial Services and Credit Acquisition; and Section Eight - Social or Community Membership.

CHAPTER TWO

2.0 HOUSEHOLD PROFILE

This sub-section covers the collected information on the social and demographic characteristics of households and individuals who were interviewed during the survey. Thus, it provides detailed information on demographic characteristics, including farmers' distribution by age, gender, level of education, marital status and household size. Also, information on the main occupation of the head of the household, their main source of income, and the number of valuable livestock species owned by the household.

2.1 Gender of the Household Head

Information on the gender of the household head helps to understand the gender composition of the household and provides insights into various aspects of social dynamics and resource allocation within the family. The baseline survey included the gender of the household head aspect so as to understand the gender role, division of labor, access to social services, and decision-making processes within the household. The question capturing the information on the gender of the household head was included.

The overall results in Table 2 show that approximately eight in ten households (78.0%) were headed by males in the TSSI regions. The highest percentage of female-headed households across districts was in Mufindi and Iringa District Council and somehow in Tunduru, Momba, Songea District Council and Kilolo. These results are in line with the national population census (NPS) which reported that about 74% of the farm families in Tanzania were headed by males (NPS, 2022).

78% *of soybean farm households are male headed*

Table 2.1: Percentage gender distribution of households by regions and districts

Region	District	% heads of households by gender	
		Male	Female
Iringa	Iringa DC	62.7	37.3
	Kilolo DC	72.2	27.8
	Mufindi	52.4	47.6
Mbeya	Chunya	82.4	17.6
	Mbeya DC	88.5	11.5
	Rungwe	100.0	0.0
Morogoro	Kilosa	74.3	25.7
	Mvomero	73.3	26.7
Njombe	Njombe DC	79.8	20.2
	Wanging'ombe	88.4	11.6
Rukwa	Kalambo	85.1	14.9
	Nkasi	90.5	9.5
	Sumbawanga DC	76.5	23.5

Ruvuma	Mbinga	76.0	24.0
	Namtumbo	90.0	10.0
	Songea DC	73.1	26.9
	Tunduru	71.4	28.6
Songwe	Ileje	81.5	18.5
	Mbozi	83.6	16.4
	Momba	71.8	28.2
	Overall	**78.0**	**22.0**

2.2 Age of the Household Head

The age of the farmer is a crucial demographic feature that influences the formulation and implementation of policies and proposed interventions in a way that accurately meets the specific requirements of the intended community. Figure 2.1 presents the age groups and gender composition of the soybean farmers in the TSSI area and the percentage of males and females in each age group. The figure indicates that the majority of the soybean farmers in Tanzania belong to the age group of 40–64 years (middle-aged persons).

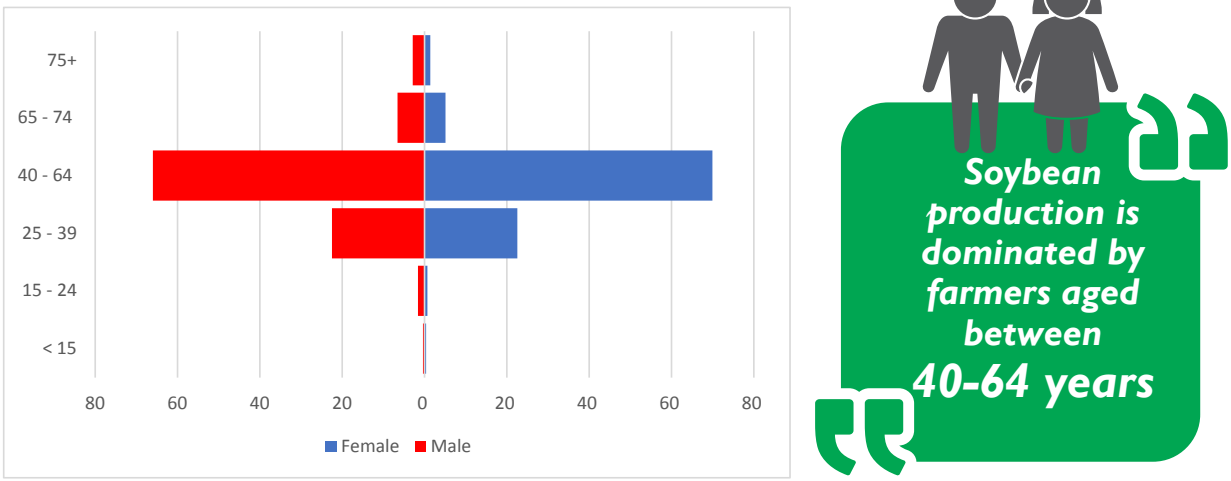


Figure 2.1: Age distribution and gender of household heads in the surveyed soybean regions

2.3 Marital Status of the Household Heads

Marital status is an important demographic variable for understanding family structures, household compositions, and social relationships within a population. This is an essential demographic factor used in various fields, including agriculture. Knowing the marital situation of farmers has implications for social support, financial and legal responsibilities, and access to agricultural benefits and services. A question was included to collect information on soybean farmers' current marital situation, that is, whether they are married, single, divorced, separated or widowed. This survey collected and analyzed data on marital status to gain insights into family dynamics and social changes. The overall results of marital status in Table 2.2 show that eight out of 10 (84.5%) households of soybean farmers are married and living with their spouses, with only less than 4% divorced or separated and less than 5% having never been married or in a marital relationship.

Table 2.2: Percentage distribution of soybean farmers by marital status

Region	Marital Status				Total
	Never Married	Currently Married	Widowed	Divorced/ Separated	
Morogoro	9.4	65.9	18.8	5.9	100
Iringa	2.0	92.6	5.4	0.0	100
Njombe	2.0	84.0	11.0	3.0	100
Rukwa	3.2	89.1	7.1	0.6	100
Songwe	5.8	85.9	4.9	3.4	100
Ruvuma	6.6	78.3	9.2	5.9	100
Mbeya	3.0	93.0	3.0	1.0	100
OVERALL	**4.5**	**84.5**	**8.0**	**3.0**	**100**

2.4 Education Levels of Household Heads

In most African families, particularly in Tanzania, the household head is often considered the head or leader of the family. He/she plays a significant role in shaping the household's socioeconomic status and well-being. Understanding the education level of the head of the household in this study provides valuable insights into the household's potential economic capacity, access to resources, and overall living conditions. The information on the education level of a household head in this survey was gathered based on the highest level of formal education attained by the individual primarily responsible for making decisions and managing the household's affairs. The highest level of education of the household head was assessed based on the number of years a person spent in formal education. The scales used to assess the education level were: 1 = Not attended formal school; 2 = Standard 1-7; 3 = Standard 8; 4 = Form 4 not completed (Form 1-3); 5 = Form 4 completed; Form 5-6, and 7= Certificate/Diploma/ Degree. The results in Table 2.3 show that over 83% of the individuals sampled completed Standard Seven with only 2% reported not attending any formal school. Farmers with at least a certificate/diploma/degree were only 3.3%.

Majority of soybean farmers (83%) have basic education (soy bean production is not knowledge intensive)

Table 2.3: The highest education levels of household heads (%)

Region	Not attended school	Standard 1 – 7	Standard 8	Form 1 – 3	Form 4	Form 5 – 6	Certificate/ Diploma/ degree
Morogoro	3.5	90.6	1.2	0.0	3.5	0.0	1.2
Iringa	1.5	86.7	0.0	1.0	7.4	0.0	3.4
Njombe	3.5	88.5	0.5	0.0	5.5	1.0	1.0
Rukwa	1.9	73.7	1.3	1.3	11.5	1.9	8.3
Songwe	2.4	85.0	0.5	2.9	5.3	0.0	3.9
Ruvuma	1.3	79.9	1.0	2.6	13.2	0.0	2.0
Mbeya	0.0	79.2	1.0	2.0	13.9	0.0	4.0
OVERALL	**2.0**	**83.1**	**0.7**	**1.6**	**8.9**	**0.4**	**3.3**

2.5 Main Occupation of Household Heads

The information on the primary job or profession of the individual who is primarily responsible for making decisions and managing the household's affairs was collected during the survey. The data on the occupation of the household head provide insights into the household's economic activities, livelihood and socioeconomic status. The results in Table 2.4 show that the majority (almost 97%) of household heads depend on agriculture/ livestock farming.

Table 2.4: Main occupation of household heads (%)

Region	Agriculture/ livestock farming	Daily labor/ piecework	Employed (private/ public)	Business	Others	Total
Morogoro	95.3	2.4	1.2	1.2	0.0	100.0
Iringa	96.1	0.5	2.0	1.5	0.0	100.0
Njombe	96.5	0.0	2.5	1.0	0.0	100.0
Rukwa	96.2	0.6	1.9	0.0	1.3	100.0
Songwe	100.0	0.0	0.0	0.0	0.0	100.0
Ruvuma	95.1	0.3	3.0	0.0	0.0	100.0
Mbeya	99.0	0.0	1.0	0.0	0.0	100.0
OVERALL	**96.7**	**0.4**	**1.8**	**0.5**	**0.6**	**100.0**

2.6 Household Size

The household size refers to the average number of people per private household living together in a single dwelling and sharing common living arrangements, facilities and resources. In this survey, the household residents/members referred to a person who has stayed in the household for at least three (3) months out of the previous 12 months. Household size is a crucial demographic characteristic that provides insights into the composition and structure of households within a community. Most of the families had 6 or more household members with an average of about 7 household size per family. These findings are not far from the National Panel Survey Wave 5 which reported that rural households had relatively larger household sizes of 5 people per household (NPS, 2022).

Table 2.5: Percentages of household sizes of surveyed soybean growing regions

Number of usual residents	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
1	0.0	0.5	1.0	0.0	1.0	1.0	1.1	0.7
2	2.4	0.0	3.0	4.4	3.0	0.7	2.2	2.0
3	1.2	2.5	0.5	5.0	5.0	1.3	13.0	3.3
4	1.2	2.0	6.0	6.9	5.0	2.6	16.3	4.9
5	2.4	3.9	7.5	14.4	10.6	3.3	23.9	8.1
6+	92.9	91.1	82.0	69.4	75.4	91.1	43.5	80.9
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Average Household Size	**7.2**	**7.4**	**7.4**	**7.0**	**6.7**	**7.2**	**4.9**	**6.9**

2.7 Household Source of Income

Households often have diverse income sources, and the combination of these sources can vary widely based on individual circumstances and regional factors. Data on household sources of income is crucial for several reasons as it provides valuable insights into economic well-being and dynamics, poverty levels, and development planning. It also supports targeted interventions to improve livelihoods and reduce poverty. Figure 2.2 shows that in the study areas, agriculture remains a significant source of income for many households by about 90% with crop cultivation occupying the highest share (51.9%) followed by livestock rearing (38.8%). Some individuals (> 6.0%) run their own businesses, such as small shops, street vending and other entrepreneurial ventures. Few households (<3.0%) derive their incomes from wage-based employment, such as factories, offices, retail, hospitality, healthcare, education, and various other sectors. A small proportion of families earn their substantial income from family members who work in other regions or towns. Moreover, some households that own properties like land earn income from renting out their land to other farmers. The information on major sources of livelihoods per region is as shown in Table 2.6.

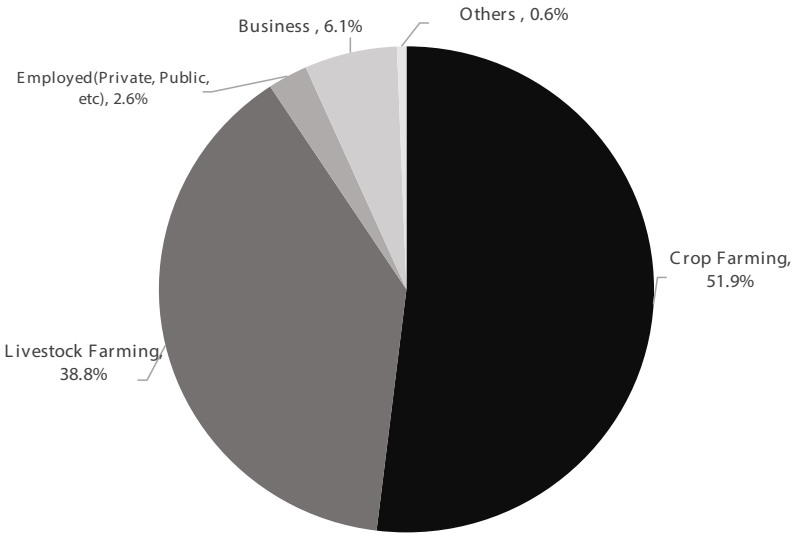


Figure 2.2: Household Income Sources

Table 2.6: Proportion of the main sources of livelihoods per region (%)

Region	Crop Farming	Livestock Farming	Employed (private/public)	Business	Others	Total
Morogoro	59.4	29.4	3.5	7.7	0.0	100.0
Iringa	45.4	42.7	4.9	6.5	0.4	100.0
Njombe	50.9	44.3	1.8	2.8	0.3	100.0
Rukwa	54.6	38.7	2.8	3.9	0.0	100.0
Songwe	53.5	38.2	0.5	7.8	0.0	100.0
Ruvuma	51.2	36.3	3.0	7.4	2.0	100.0
Mbeya	59.8	33.7	0.6	5.9	0.0	100.0
OVERALL	51.9	38.8	2.6	6.1	0.6	100.0

Furthermore, the study looked at the primary sources of income at the household level. Table 2.7 provides information on the major or primary source of household income with over 97% of the households depending on crop production with only 1.5% being salaried employees. Only 0.8% of household families depend on livestock farming as their major income source and these were found in Iringa, Njombe and Ruvuma. The study also revealed that less than 0.5% surveyed subjects consider business as their major source of livelihood.

Table 2.7. The primary source of household income (%)

Region	Crop Farming	Livestock Farming	Employed (private/public)	Business	Others	Total
Morogoro	100.0	0.0	0.0	0.0	0.0	100.0
Iringa	96.0	1.5	2.0	0.5	0.0	100.0
Njombe	97.5	1.5	1.0	0.0	0.0	100.0
Rukwa	98.1	0.0	1.3	0.6	0.0	100.0
Songwe	99.0	0.0	0.0	1.0	0.0	100.0
Ruvuma	94.6	1.3	3.5	0.3	0.3	100.0
Mbeya	99.0	0.0	1.0	0.0	0.0	100.0
OVERALL	**97.2**	**0.8**	**1.5**	**0.4**	**0.1**	**100.0**

2.8 Types of Livestock Reared

Livestock rearing, also known as animal husbandry or livestock farming is a vital component of agriculture that involves breeding, raising and management of animals for various purposes, including food production and income generation. The sector provides a significant source of animal-based protein for human consumption, like meat, milk, eggs and other products. In this particular study, livestock rearing was analyzed based on a variety of animals such as poultry, cattle, sheep, goats and swine (pigs). Of all the livestock reared poultry is the most complementary activity done by the majority of the farmers in the study area followed by cattle production, pig and goat farming (Figure 2.3).

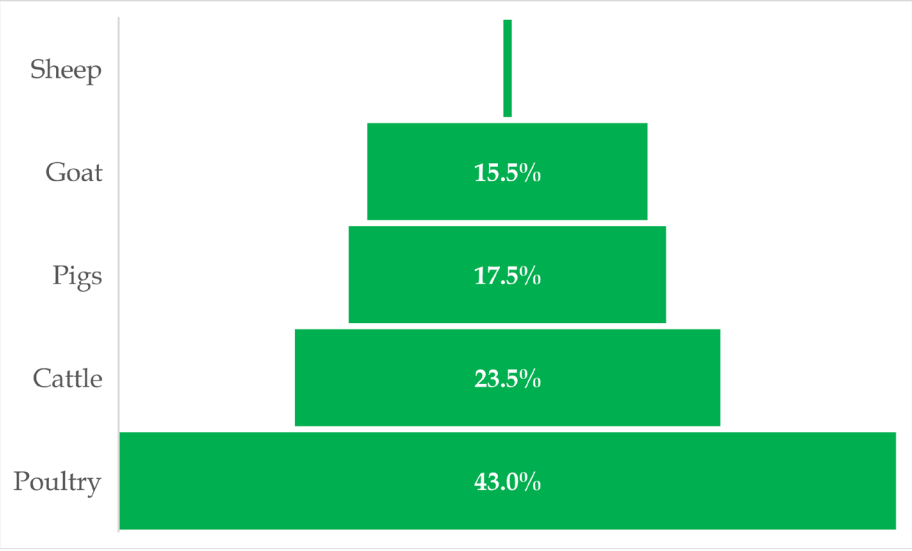


Figure 2.3: Types of livestock reared in surveyed regions

Morogoro has the highest percentage of farmers (60%) involved in poultry farming followed by Iringa (53%) and Mbeya (>52%). Njombe, Rukwa and Songwe have the highest proportion of farmers rearing cattle with Ruvuma having the least proportion. Pig rearing was common in Njombe, Iringa, Mbeya and Ruvuma (Appendix 2). Likewise, Ruvuma had the highest percentage of farmers rearing goats followed by Songwe, Rukwa and Morogoro. Sheep rearing was not common in the study area and it was observed in small proportions in Songwe and Rukwa.

2.9 Soybean Production Tools Used in the Study Regions

Soybean production equipment encompasses a wide range of machinery and tools designed to aid in various stages of soybean cultivation (supply chain), from planting to harvesting. It is crucial to understand the types of tools used in production because using the right equipment can significantly improve efficiency, reduce labor requirements, and enhance overall crop productivity and sustainability. The baseline study results show that about 80% of interviewees own at least one hand hoe with 18% owning an oxen plough. Only one percent of the farmers interviewed own tractors and 0.5% and 0.3% had power tillers and planters, respectively. Figure 2.4 shows the distribution of agricultural equipment ownership.

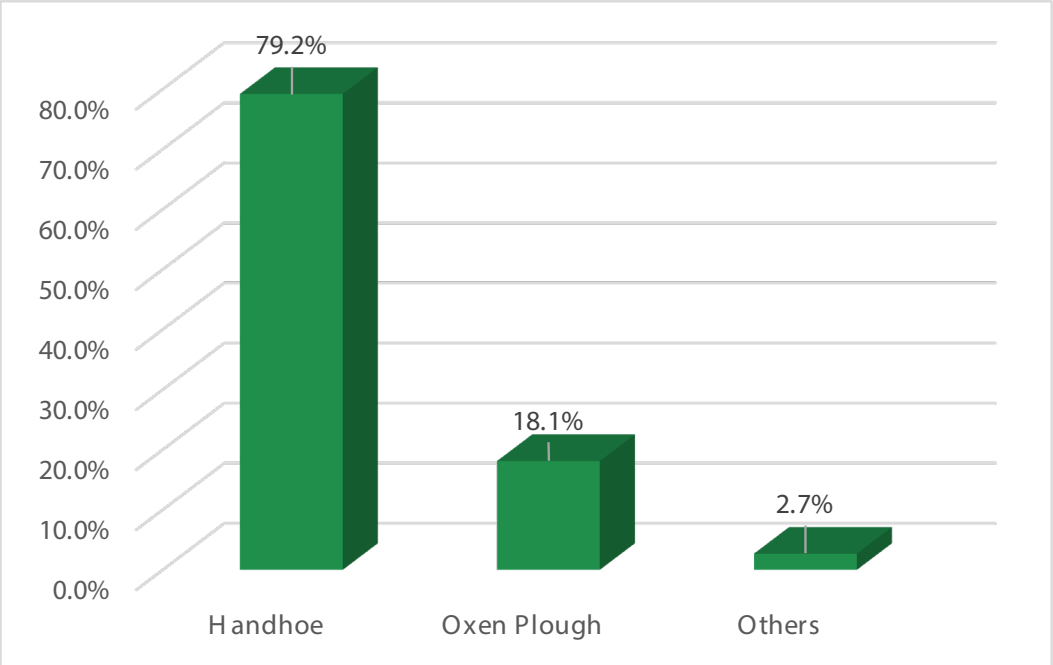


Figure 2.4: Equipment owned by surveyed soybean farmers ["others" include tractors (1.0%), power tiller (0.5%), planters 0.3%, weeders (0.1%), and others (0.7%)]

CHAPTER THREE

3.0 Soybean Production in the Study Regions

This section presents the findings on the total arable land available to each household, major crops grown, crop management, and production history of soybean farmers. The challenges of soybean production are also presented at the end of this section.

3.1 Total Amount of Arable Land Possessed by Households

Knowing the total size of land owned by a farmer is a fundamental piece of information that informs various aspects of agricultural planning, production, resource management, and individual or farmers' development. It empowers farmers to make informed decisions and contributes to sustainable and efficient agricultural practices. Usually, farmers can make informed decisions about how to utilize their land, practice crop rotation, and deploy planting schedules more efficiently based on the available land.

Table 3.1 summarizes the statistics of the total land owned by households in terms of mean, standard deviation (STD), coefficient of variation (CV), minimum, median, and maximum per region. The average farm size ranges from 2.5 ha to 9.2 ha (6.2–22.7 acres) and the minimum farm size ranges from 0.40 ha to 0.61 ha (1.0–1.5 acres). However, some farmers have a maximum farm size ranging between 12.0 ha to 81 ha (29.6–200.1 acres). Of all the regions surveyed, farmers in Rukwa Region have the largest average farm size of more than 9 ha (22.2 acres), followed by Njombe (5.82 ha), Mbeya (5.05 ha) and Ruvuma (4.04 ha).

Farmers in Morogoro have the smallest average farm size of less than 2.0 ha. Figure 3.1 presents the distribution of farm size per district, and the results show that farmers in Nkasi District have the largest farm size of more than 13 ha, followed by Kalambo (8.9 ha), Wanging'ombe (8.04 ha) and Sumbawanga (7.43 ha) and Chunya (6.13 ha). Kilosa and Ileje districts have the least farm sizes of less than 2 ha. The lower the CV values, the more precise the estimates, but the higher the CV value, the farmers' farm sizes highly deviate from the mean.

81% *of soybean farmers had farms less than* **5ha**

Table 3.1: Summary statistics of the total arable land owned by the households per region

Region	Mean	SDT	CV	MIN	Median	MAX
Iringa	2.52	2.96	117.45	0.61	2.02	39.66
Mbeya	5.05	5.46	108.19	0.40	3.64	40.47
Morogoro	1.94	1.57	80.83	0.40	1.62	12.14
Njombe	5.82	12.24	210.39	0.40	1.21	39.66
Rukwa	9.19	11.65	126.74	0.40	6.07	80.94
Ruvuma	4.04	5.02	124.46	0.40	2.83	64.75
Songwe	2.86	3.53	123.40	0.40	2.02	40.47
OVERALL	**4.47**	**7.60**	**169.87**	**0.40**	**2.43**	**80.94**

Figure 3.1 shows the distribution of total farm size per district with the Nkasi district having farmers with the highest farm size of nearly 14 ha followed by Kalambo (8.9 ha), Wanging'ombe (8.0), and Sumbawanga (7.4 ha). Other farmers in other districts have farm sizes ranging between 2 – 6.1 ha except for the Ileje and Kilosa districts having less than 2 ha.

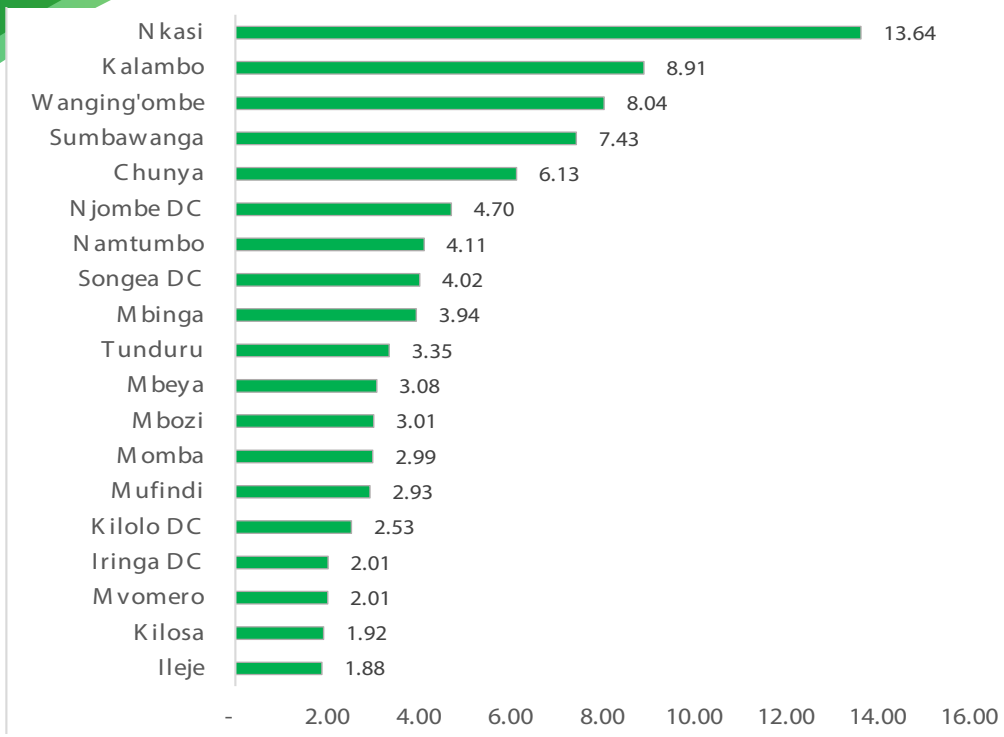


Figure 3.1: Average size of arable land (in ha) available to the household per district

3.2 Total Amount of Arable Land by Group (<5 ha, 5–21 ha, & 21 ha and above)

The study's overall results revealed that the majority of farmers (81%) had a total farm size below 5 ha, with only 16% of farmers having 5–21 hectares and only 3% of farmers having farms above 21 ha (Figure 3.2). Morogoro has the majority of farmers (almost 98%) with farm sizes below 5 ha, followed by Iringa (94.1%), Songwe (87.9%), Njombe (87.5%) and Ruvuma (79.8%). Rukwa has more farmers with arable land of 5–21 ha (44.3%), followed by Mbeya (29.5%), Ruvuma (19.5%) and Songwe (11.6%).

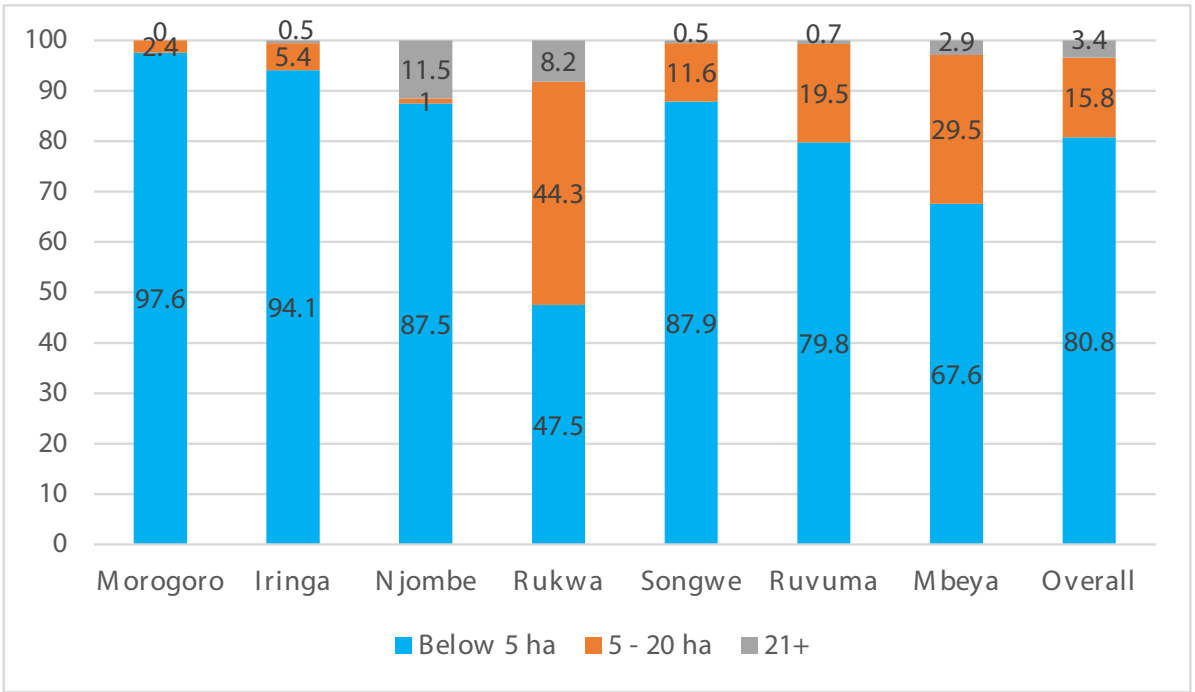


Figure 3.2: Household farm size distribution by regions (< 5 ha, 5 – 20 ha, & 21+ ha)

3.3 The Most Important Annual Crops Grown

All soyabean farmers cultivate maize as their primary crop

Knowing the most important annual crops grown by farmers is significant for a variety of reasons, ranging from food security to economic planning. Understanding which crops are most commonly grown helps ensure a stable food supply. These crops often serve as staple foods, providing essential nutrients and calories to communities. It also allows policymakers and organizations to assess whether diverse and nutritious diets are being promoted in the respective areas.

The overall results show that almost 100% of the respondents mentioned maize as the primary crop, followed by soybeans, beans, sunflowers and groundnuts, as shown in Figure 3.3. Paddy, round/Irish potatoes, sesame and peas were also mentioned by farmers but their contributions were less than 10%. Likewise, maize is the dominant crop grown by all farmers in all districts as presented in Figure 3.3. Soybeans and paddy were the second and third important crops to the sampled farmers in Morogoro, beans and sunflowers in Iringa, soybeans and beans in Njombe. Beans and soybeans were the second and third important crops in Rukwa, respectively; soybeans and groundnuts in Songwe, soybeans and sunflower in Ruvuma, and beans and soybeans in Mbeya (Appendix 1).

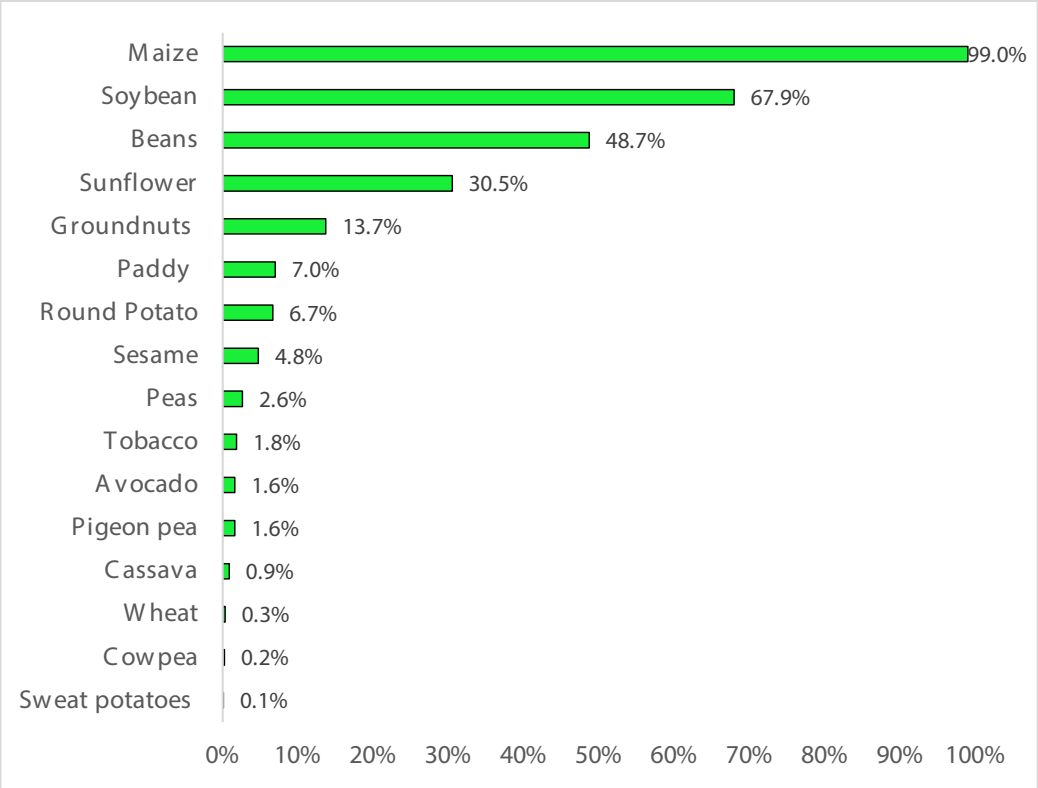


Figure 3.3: Most important crops grown in the study areas

3.4 History of Soybean Production in the Study Regions

Understanding the history of a crop in a specific area is important for various reasons such as providing valuable insights into agricultural practices, local ecosystems, cultural heritage and agricultural development interventions. In addition, the information on when the crop started in an area or village offers insights into the production trends and its profitability/economic viability. Knowing the historical background of soybeans at the household level would be important in identifying and protecting traditional varieties that may be resilient to pests, diseases and changing environmental conditions.

The results in Figure 3.4 show that most of the farmers (93%) in all regions started producing soybeans in the 2010s to 2020s. Morogoro has at least 11% of farmers who started soybean cultivation in the 2000s, followed by 9%, 7% and about 6% in Ruvuma, Songwe and Mbeya, respectively (Table 3.2). The increasing trend of soybean farmers emerging in the last two decades may be driven by increasing demand for protein-rich animal feed and edible oils alongside the availability of nutritional-related projects in the regions.

Table 3.2: History of soybean production in the study area

Region	1980's	1990's	2000's	2010's	2020's	Total
Morogoro	0.0	0.0	11.8	38.8	49.4	100.0
Iringa	0.0	0.0	0.5	21.7	77.8	100.0
Njombe	0.0	0.0	0.5	90.0	9.5	100.0
Rukwa	0.0	0.6	1.3	20.0	78.1	100.0
Songwe	0.0	0.0	7.3	45.6	47.1	100.0
Ruvuma	1.3	4.3	9.2	48.7	36.5	100.0
Mbeya	1.0	4.0	5.9	25.7	63.4	100.0
Overall	**0.4**	**1.4**	**5.0**	**44.3**	**48.8**	**100.0**

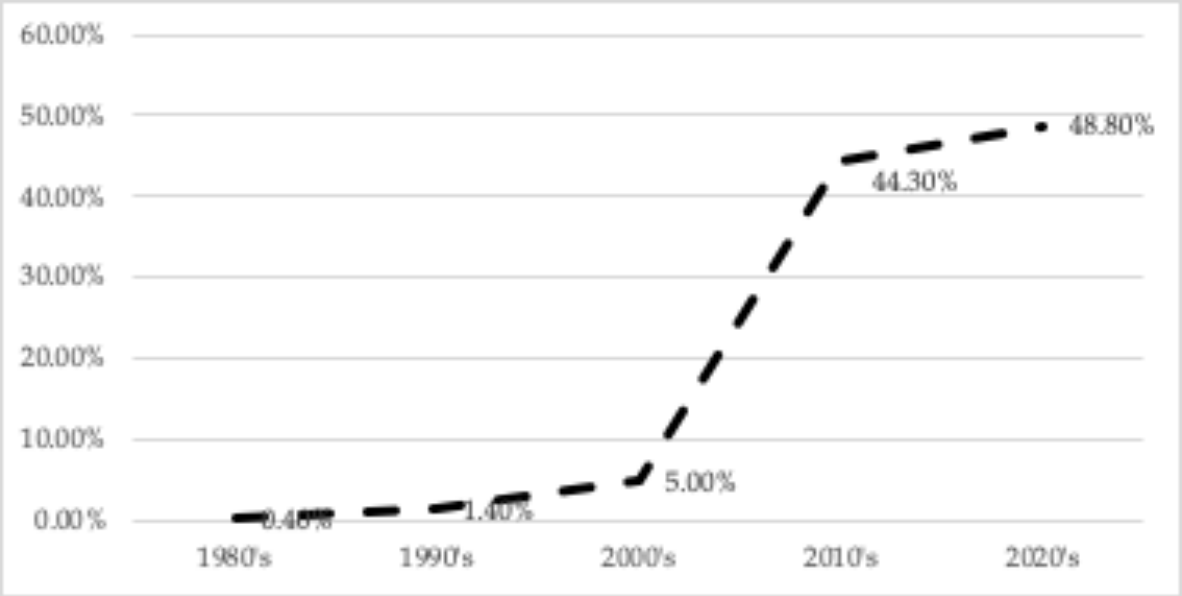


Figure 3.4:Year(s) soybeans started to be produced by the farmers

A question to reveal information on the number of farmers who cultivated soybeans for the last season (2021/22) was included and the results show that about 77% of the interviewees cultivated soybeans in the previous season while only 23% did not (Table 3.3).

Table 3.3: Percentages of farmers who cultivated soybeans for the year 2021/22

Region	Yes	No	Total
Morogoro	83.5	16.5	100.0
Iringa	43.8	56.2	100.0
Njombe	87.0	13.0	100.0
Rukwa	68.4	31.6	100.0
Songwe	95.6	4.4	100.0
Ruvuma	83.6	16.4	100.0
Mbeya	68.3	31.7	100.0
Overall	**76.6**	**23.4**	**100.0**

3.5 Number of Soybean Plots Planted by Each Household

Knowing the number of soybean plots that a farmer has planted is essential for efficient resource allocation, yield estimation, crop rotation planning, risk management, and overall farm management. Also, it helps farmers make informed decisions that contribute to successful soybean cultivation and sustainable agricultural practices. The overall results of the baseline study showed that about 88% of the farmers had only one plot with only 7.8% having two plots and 2.5% having three plots (Table 3.4). Farmers with more than three plots were less than 2%. The presence of farmers with more than two plots in regions with large farm sizes may be due to many reasons including the means to help them mitigate risks associated with pests, diseases, weather variability, and market fluctuations. The diversification across plots can reduce the impact of potential losses.

Table 3.4: Number of plots planted with soybean during the 2022/23 rainy season

Region	One Plot	Two Plots	Three Plots	> 3 Plots	Total
Morogoro	95.8	4.2	0	0	100.0
Iringa	89.9	5.6	3.4	1.1	100.0
Njombe	97.7	1.1	0.6	0.6	100.0
Rukwa	79.2	15.1	1.9	3.8	100.0
Songwe	92.4	5.6	1.5	0.5	100.0
Ruvuma	75.2	15.0	5.9	3.9	100.0
Mbeya	100.0	0.0	0.0	0.0	100.0
Overall	**87.9**	**7.8**	**2.5**	**1.8**	**100.0**

3.6 Total Farm Size under Soybean Production

The information on the farm size distribution provides critical insights into land utilization, crop management, resource allocation (including budgeting) and overall farm planning. This information would help farmers to allocate their resources efficiently, such as seeds, fertilizers, pesticides, labor, and machinery (if any) based on the available land. Likewise, proper knowledge of farm size distribution determines the appropriate portion of land dedicated to soybean cultivation while considering crop rotation, intercropping, soil fertility and overall sustainability. Results in Table 3.5a show that the soybean farmers in the study regions have an average farm size of 0.52 ha (1.3 acres) with Rukwa having the largest farm size of 0.81 ha (2.0 acres) followed by Ruvuma at 0.70 ha (1.7 acres), Songwe, 0.66 ha (1.6 acres), Mbeya, 0.46 ha (1.1 acres) and Morogoro, 0.44 ha (1.1 acres) regions. However, Iringa and Njombe regions had the smallest farm sizes of 0.25 ha (0.62 acres), and 0.23 ha (0.58 acres) respectively.

Table 3.5a: Summary statistics of the total farm sizes planted with soybeans

Region	Mean	SDT	CV	MIN	Median	MAX
Iringa	0.25	0.40	160.03	0.04	0.20	4.86
Mbeya	0.46	0.55	120.28	0.10	0.40	4.05
Morogoro	0.44	0.30	68.55	0.10	0.40	2.02
Njombe	0.23	0.12	52.34	0.08	0.20	0.81
Rukwa	0.81	1.23	151.99	0.40	0.40	12.15
Ruvuma	0.70	0.48	68.68	0.10	0.40	3.24
Songwe	0.66	0.52	79.87	0.10	0.40	4.05
OVERALL	0.52	0.63	120.42	0.04	0.40	12.15

The survey also analyzed the distribution of soybean farm sizes in terms of percentages as shown in Table 3.5b. The overall results show that over 40% of farmers cultivated on farm sizes of 0.40 ha (1 acre), followed by farmers with 0.45–0.81 ha or 1.1–2.0 acres (18.3%), and those with 0.20 ha or 0.5 acres (18.2%) and 0.85–2.02 ha (2.1–5 acres) were only 9.8%. Except for Iringa and Njombe, most farmers in Morogoro (nearly 80%), Rukwa (58.3%), Songwe (37.6%), Ruvuma (43.9%) and Mbeya (36.2%) had soybean farm sizes of 0.40 ha while 66.2% of farmers in Iringa had between 0.1 ha and 0.20 ha (0.25 to 0.5 acres). Rukwa had also a significant percentage of farmers having 0.45–0.81 ha (19.4%) and 0.85–2.02 ha (18.4%) but also nearly 4% had farm sizes above 2.02 ha.

Table 3.5b: Percentage of Farm Size (ha) Distribution of Soybeans per Region

Farm size (ha)	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
< 0.10	0.0	4.2	1.3	0.0	0.0	0.0	0.0	**0.6**
0.10 – 0.16	8.5	31.0	26.3	0.0	3.3	0.4	33.3	**11.3**
0.20	6.4	35.2	42.1	0.0	20.4	6.3	15.9	**18.2**
0.21 - 0.36	0.0	0.0	0.0	0.0	0.6	0.0	0.0	**0.1**
0.40	76.6	18.3	26.3	58.3	37.6	43.9	36.2	**40.2**
0.45 – 0.80	8.5	9.9	3.9	19.4	21.5	32.3	10.1	**18.3**
0.85 – 2.02	0.0	1.4	0.0	18.4	14.9	15.2	2.9	**9.8**
2.1 – 10.12	0.0	0.0	0.0	3.9	1.7	1.8	1.4	**1.4**
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

3.7 Land Acquisition

In Tanzania, various ways are used in acquiring land, each with its own legal and administrative procedures. The baseline survey found that over 55% of soybean farmers in Tanzania acquired their land through inheritance, where ownership is passed down from one generation to another on customary or legal rules. Another important way was through land purchases where over 31% of households purchased their land from other farmers or customary landholders. Also, 6% of the farmers acquired their land through renting (on leasehold arrangements) where the landowner grants the user the right to use the land for a specified period or season in exchange for rent or other agreed-upon terms. Furthermore, about 3% of the farmers also acquired their land through an allocation from village councils (Table 3.5a).

Table 3.5a: Percentages of soybean farm size distribution per region

Farm size (Acres)	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Inheritance	61.0	66.7	70.8	14.1	65.4	60.1	25.0	55.6
Gift	0.0	0.0	2.6	0.0	0.5	0.0	0.0	0.5
Borrowing from family member	0.0	0.0	0.5	0.0	0.0	0.7	0.0	0.2
Land allocation from the village council	2.4	0.0	0.0	0.0	1.5	10.3	0.0	2.9
Purchased	19.5	19.0	19.8	75.8	24.9	19.9	70.5	31.2
Used free of charge	0.0	0.0	2.6	0.0	1.0	0.0	0.0	0.6
Rented in	17.1	3.6	3.1	8.7	6.8	6.5	3.4	6.3
Shared rent	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.2
Shared ownership	0.0	0.0	0.5	0.7	0.0	0.7	0.0	0.3
Squatting, Clearing	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.2
Purchased and inheritance	0.0	4.1	0.0	0.0	0.0	0.0	1.1	0.7
Other	0.0	4.6	0.0	0.7	0.0	1.7	0.0	1.2
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

3.8 Productivity of Soybean in the Study Regions

The soybean production is an important factor to be addressed in the TSSI. Table 3.5b summarizes the statistics for soybean production (in kg) per region. The results show that Ruvuma Region has the largest proportion (28%) of soybeans produced in the 2022/23 season followed by Songwe (25.0%) and Rukwa (21.5%). Morogoro and Iringa produced the smallest share of soybeans. The overall average production was close to 400 kg per region with Rukwa having the largest production values (average and maximum) followed by Songwe Region while Njombe and Iringa had the lowest average values. Also, the baseline discovered that about 450,146.3 kgs (450 tonnes) of soybeans were produced by the sampled farmers. The national statistics show a production of nearly 20,000 tonnes/year, which is produced by about 60,000 farmers. Our results are not far from these statistics in the way that if 1,260 farmers produce 450 tonnes, this means there is a high probability that the current total production stands at 21,430 tonnes/year.

Table 3.5b: Summary statistics of soybean production (in kgs) per region

Region	Mean	SDT	CV	Min	Median	Max	Sum	%
Iringa	179	234	131	0.25	110	2,000	28,503.3	6.3%
Mbeya	402	480	119	10	240	3,300	35,008.0	7.8%
Morogoro	209	241	115	2	125	1,600	17,387.0	3.9%
Njombe	177	173	98	2	120	1,150	34,094.0	7.6%
Rukwa	654	1,198	183	10	400	9,000	96,807.0	21.5%
Ruvuma	439	589	134	16	240	4,800	125,669.0	27.9%
Songwe	550	504	92	27	440	3,300	112,678.0	25.0%
OVERALL	388	614	158	0.25	210	9,000	450,146.3	100.0%

Estimating the productivity of soybeans is important for several reasons, namely, it provides valuable insights into the efficiency, profitability and sustainability of soybean cultivation. Monitoring and understanding productivity enable actors (farmers, researchers, policymakers and other soybean stakeholders) to make informed decisions and optimize better agricultural practices. The global average yield of soybean is 2,814 kg/ha, while African producers produce less than half the yield at 1,394 kg/ha, the average productivity in Tanzania ranges from 800 kg/ha to 1,147 kg/ha. In this survey, we found that farmers are producing an average of 721.24 kg/ha (292 kg/acre) with a maximum yield of 2,371.2 kg/ha (960 kgs/acre) which is slightly below the global average. Mbeya, Songwe and Iringa regions demonstrated the highest average, minium and maximum values of soybean produced per unit area. Table 3.5c summarizes the productivity of soybeans in the study regions.

Our results are in line with the country statistics which suggest a productivity ranging between 400 kg/ha and 900 kg/ha. For example, the 2007/08 National Sample Census for Agriculture reported an average of 720 kg/ha for the long season. The 2016/17 Annual Agricultural Sample Survey for Crop and Livestock (AASCL) reported an average of 1,100 kg/ha with the most recent (2019/20) AASCL reporting an annual average of 900 kg/ha. Likewise, CARITAS reported soybean productivity ranging between 650 kg/ha and 1,550 kg/ha in the study done in four regions, namely, Mbeya, Songwe, Njombe and Ruvuma. Although our productivity is far from the major soybean producing countries like the USA with the highest global productivity of 3,455 kg/ha, and Brazil (3,445 kg/ha), the maximum yield observed in the study regions (2,371.2 kg/ha) is within the average yield of South Africa (2,294 kg/ha) which is the leading producer in Africa.

Table 3.5c: Summary statistics of the soybean productivity (in kg/ha) per region

Region	Mean	SDT	CV	Min	Median	Max
Iringa	854.4	460.4	53.9	1.2	815.1	2,272.4
Mbeya	912.4	452.5	49.6	24.7	988.0	2,371.2
Morogoro	528.3	474.2	89.8	4.9	444.6	1,976.0
Njombe	718.8	454.2	63.2	9.9	592.8	2,371.2
Rukwa	787.4	454.2	57.7	23.0	741.0	2,223.0
Ruvuma	548.6	375.7	68.5	49.4	444.6	1,976.0
Songwe	812.4	396.2	48.8	133.4	815.1	2,037.8
OVERALL	**721.5**	**448.1**	**62.1**	**1.2**	**617.5**	**2,371.2**

The baseline survey also went down to analyze the productivity of soybeans at a district level and the results are summarized in Table 3.6. The study shows that Momba, Mufindi, Kilolo DC, Chunya, and Mbinga are five districts with the highest average yields ranging between 889.2 kg/ha and 1,045 kg/ha (360–423 kg/acre). The CV values are relatively low for Mufindi, Ileje, Chunya, Momba and Kilolo DC indicating that the yield data points are relatively close to the mean yield, thus implying lower variability and the districts may be favorable for interventions. Conversely, Kilosa, Tunduru, Mbeya DC, Songwe DC, Njombe DC and Iringa DC have higher values of CV suggesting that the yield data points are more spread out from the mean, indicating higher dispersion/variability. Our findings are in line with the agricultural census surveys of 2007/08 and 2019/20 which estimated an average of 800 kg/ha of soybean productivity in the long season.

Table 3.6: Summary statistics of the soybean productivity (in kg/ha) per district

Districts	Mean	STD	CV	Min	Median	Max
Momba	1,044.6	498.7	47.7	135.9	1,086.8	2,037.8
Mufindi	1,033.2	395.2	38.3	192.7	1,086.8	2,223.0
Kilolo DC	987.5	479.7	48.6	98.8	839.8	2,272.4
Chunya	936.1	398.4	42.6	197.6	988.0	2,173.6
Mbinga	904.0	556.0	61.5	98.8	848.0	1,976.0
Nkasi	862.0	542.2	62.9	247.0	741.0	1,778.4
Kalambo	848.7	451.0	53.2	23.0	741.0	2,223.0
Mbeya DC	835.4	639.7	76.6	24.7	592.8	2,371.2
Mbozi	775.3	359.1	46.3	133.4	815.1	1,766.1
Wang-ing'ombe	727.7	456.7	62.8	9.9	592.8	2,223.0
Njombe DC	716.5	458.4	64	24.2	617.5	2,371.2
Ileje	679.7	279.9	41.2	266.8	574.3	1,358.5
Mvomero	590.3	356.9	60.4	247.0	568.1	1,358.5
Iringa DC	563.2	356.9	63.4	1.2	494.0	1,778.4
Sumbawanga	547.8	324.1	59.1	24.7	494.0	1,235.0
Songea DC	522.4	369.0	70.6	79.0	419.9	1,976.0
Kilosa	515.7	499.2	96.8	4.9	419.9	1,976.0
Namtumbo	514.7	284.8	55.3	49.4	527.1	1,235.0
Tunduru	382.6	366.8	95.9	98.8	187.7	1,185.6

Different reasons were mentioned by most farmers to be the causes for less harvesting than expected (Table 3.7). In Morogoro, for example, 46% of the respondents mentioned unfavorable rainfall patterns as the most influential factor followed by non-use of recommended technologies like inoculants (15%) and poor-quality seeds (11%). In Iringa, poor application of chemical fertilizers (16%), late planting (13%) and unfavorable rainfall (13%) were the most important factors. Poor weed control (32%) and unfavorable rainfall patterns (21%) were common in Njombe, while pests were dominant in Songwe. The overall results indicated higher percentage of farmers claimed unfavorable rainfall patterns, poor quality of seed and weed infestations were the most important factors for poor harvests.

Table 3.7: Reasons for low soybean harvests per region (expressed in %)

Reasons for low harvests	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Overall
Amount harvested is what/ more than was expected	2.4	1.7	3.0	2.4	22.0	3.3	12.9	5.6
Unfavorable rainfall pattern	46.1	12.9	21.2	17.1	11.5	31.4	12.9	20.8
Late planting	3.6	13.3	9.1	6.4	6.6	9.6	5.8	8.6
Poor weed control	2.4	2.2	31.6	4.9	6.6	6.6	6.4	9.6
Quality of seeds	10.9	10.3	9.8	10.9	7.7	18.6	18.1	12.2
Non-use of chemical fertilizer	4.2	16.4	7.2	14.9	5.2	1.1	9.9	9.0
Non-use of animal manure	1.2	10.5	0.0	12.9	0.7	0.2	6.4	5.0
Non-use of compost	1.8	7.0	0.7	14.0	1.0	0.2	10.5	5.1
Non-use of inoculants	15.2	8.5	7.4	12.7	0.7	0.9	4.7	6.9
Pests	9.7	3.7	2.3	2.0	23.3	5.2	6.4	6.4
Diseases	0.6	3.1	2.3	0.9	3.5	3.9	0.6	2.4
Others	1.8	10.5	5.3	0.9	11.1	19.0	5.3	8.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

3.9 Contract Farming Practices in the Study Regions

Information on contract farming for soybean seed production was surveyed to understand the availability of any collaborative arrangement between farmers (producers) and agribusiness companies (processors, seed companies or buyers) where the terms of production, supply, and marketing of soybean seeds are pre-negotiated and specified in a contract. Contract farming ensures a stable supply of quality seeds while providing benefits to both parties involved. Only 3% of the farmers confirmed to cultivate soybeans on contract arrangements for seed production (Table 3.8).

Only 7% of soy bean is produced under contract

Table 3.8: Cultivation of soybeans on contract for seed production

Region	No	Yes	TOTAL
Morogoro	100.0	0.0	100.0
Iringa	96.6	3.4	100.0
Njombe	96.5	3.5	100.0
Rukwa	99.4	0.6	100.0
Songwe	94.2	5.8	100.0
Ruvuma	97.0	3.0	100.0
Mbeya	100.0	0.0	100.0
Overall	**97.1**	**2.9**	**100.0**

What is the quantity of soybeans produced on contract?

The analysis shows that 32.1 tonnes of soybeans (nearly 7.1% of the total produce) were produced on a contract basis and were highly produced in Njombe (29.8%), Ruvuma (28.2%) and Iringa (27.7%) regions (Table 3.9).

Table 3.9: Summary statistics of soybean produced on contract

Region	Mean	StDev	CV	Min	Median	Max	Sum	%
Morogoro	-	-	-	-	-	-		
Rukwa	-	-	-	-	-	-	500	1.6%
Songwe	339.42	268.72	79.17	8.00	275.00	880.00	4,073	12.7%
Ruvuma	1,006.50	1,492.23	148.26	3.50	200.00	4,800.00	9,059	28.2%
Njombe	1,366.00	1,692.14	123.88	450.00	740.00	5,500.00	9,562	29.8%
Iringa	1,269.14	704.27	55.49	84.00	1,200.00	2,000.00	8,884	27.7%
Mbeya	-	-	-	-	-	-	-	-
Overall	891.04	1,189.38	133.48	3.50	525.00	5,500.00	32,078	100.0%

Of all the soybeans produced on contract for seed production, 40% of their buyers are NGOs or projects and 38% were other fellow farmers. Private seed companies also play a big role in contract farming (see Table 3.10).

Table 3.10: Buyer-off-taker of the soybean produced on contract

Buyer-off-taker	Iringa	Njombe	Songwe	Ruvuma	Overall
NGO/Project	50	83	8	50	40
Nucleus Farmer	14	0	0	0	5
Private Seed Company	0	17	0	38	10
Farmers' Association	21	0	0	0	7
Other Fellow Farmers	14	0	92	13	38
Total	**100**	**100.0**	**100.0**	**100.0**	**100.0**

3.10 Farm Management for Soybean Plots

Knowing whether the farm manager's spouse (wife, husband or both) is involved in farm operations can have implications for various aspects of farm management and decision-making. Also, knowing who manages the farm is important in optimizing resource management and planning for future success and sustainability of the farm. Understanding the role of both spouses can shed light on gender dynamics within the farm operation, and help to ensure equitable participation and decision-making. Also, this information is important as it contributes to a holistic comprehensive and effective farm management strategy. The baseline survey as shown in Table 3.11 revealed that over 44% of the soybean farms are managed by both husband and wife. Although males dominated the management by 26% but females (25%) who managed the farms were not very far from the males and in some regions like Njombe (49%), Iringa (28%) and Ruvuma (24%) females had a significant role in farm management. Most of the farms in Morogoro, Rukwa and Mbeya are managed by males by over 40%.

There is potential for increasing soybean production through improved technology as

66%

of farmers are still using hand hoes

Table 3.11: Soybean farm/plot managers

Soybean plot manager	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Overall
Husband	43.5	16.7	21.0	46.8	26.7	14.5	40.6	26.0
Wife	29.4	28.1	49.5	10.9	15.0	24.3	6.9	24.7
Husband & Wife	27.1	54.2	29.0	40.4	35.9	59.2	49.5	44.5
Other elderly in household	0.0	0.5	0.5	0.6	1.0	0.0	1.0	0.5
Others	0.0	0.5	0.0	1.3	21.4	2.0	2.0	4.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

3.11 Farming Tools Used in Soybean Production

Farm equipment used in production is essential for many reasons as it directly impacts the efficiency, productivity and sustainability of soybean cultivation. The baseline survey sought to understand the equipment used in different stages of soybean production such as planting, cultivation, spraying, harvesting and postharvest handling. Equipment such as seed drills, planters and combines enable timely planting and harvesting; these are crucial for achieving optimal yields. The results in Table 3.12 show that nearly 66% of farmers used a hand hoe as the primary tool for soybean cultivation followed by 27% of farmers who used oxen plough. Farmers who used tractors for land cultivation were high in Morogoro by 66% and less than 1% of farmers used weeders, power tillers and planters.

Table 3.12: Equipment used in soybean production

Soybean plot manager	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Overall
Tractor	65.9	1.5	0.0	3.8	0.0	4.6	0.0	6.3
Oxen plough	1.2	4.4	65.0	93.6	7.8	0.3	32.7	26.8
Weeder	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Power tiller	0.0	0.5	0.0	0.0	0.0	0.0	4.0	0.4
Planter	2.4	1.0	1.5	0.0	0.0	1.3	0.0	0.9
Hand Hoe	29.4	92.6	33.5	2.6	92.2	93.8	63.4	65.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

3.12 Plowing Services Provision in Soybean Production

With regards to plowing services, the findings in Table 3.13 indicate that in most cases, the plowing services are delivered by farmers themselves or members of the household (38.7%) and other fellow farmers (38.5%). But also, private tractor owners play a vital role in plowing service provision. Knowing the number of household members involved in soybean production is important for several reasons. For instance, it provides insights into labor availability, resource allocation, decision-making dynamics and overall farm management. The results on the number of household members that are involved in soybean production are presented in Table 3:14. The results revealed that at least two household members are involved in soybean production as responded by over 80%.

Table 3.13: Ploughing service providers for soybean farms

Service Provider	Morogoro	Iringa	Njombe	Rukwa	Son-gwe	Ruvu-ma	Mbeya	Overall
A soybean buyer – trader - exporter	0.0	0.0	0.8	0.0	0.0	6.7	0.0	0.4
Nucleus farming	0.0	0.0	0.0	0.0	0.0	0.0	32.7	6.8
Private tractor owner	94.7	25.0	0.0	2.0	0.0	73.3	0.0	14.7
Farmers' associa-tion	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.8
Another farmer	5.3	8.3	76.9	9.9	6.2	13.3	63.4	38.5
Myself – the household is the owner	0.0	66.7	22.3	88.2	93.8	6.7	0.0	38.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 3.14: Number of household members involved in soybean production

# of Persons	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Overall
1 Person	18.8	23.6	12.0	30.3	15.0	18.8	24.8	19.8
2 Persons	54.1	52.7	59.5	48.4	51.5	60.4	66.3	56.1
3 Persons	15.3	16.7	19.5	16.8	16.5	11.6	5.9	15.0
4 – 5 Persons	10.6	5.4	8.0	1.9	16.5	7.2	3.0	7.8
6 Persons	1.2	1.5	1.0	2.6	0.5	2.0	0.0	1.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

3.13 Challenges Facing Farmers in Soybean Production

Farmers were asked to rank the challenges based on their severity and the results show that lack of reliable market (43%) and unavailability of quality soybean seeds (23%) were the important challenges facing farmers in soybean production (Table 3.15). Climate variability was also reported as the third major challenge influencing the production of the crop.

Table 3.15: Major challenges facing soybean farmers in the study regions (expressed in %)

Major challenges	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Overall
Lack of reliable market	44	48	54	56	20	33	49	43
Low and volatile prices	2	9	1	0	38	25	6	12
Unavalability of quality seed	22	16	25	19	12	32	24	23
Unavilability of other inputs (fertilizer, inoculants, pesticides)	9	13	0	1	0	7	3	5
Climate variability	23	14	20	23	30	5	17	16
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

CHAPTER FOUR

4.0 Agricultural Technologies Used

This section presents the findings on the agricultural technologies that are available and applied by farmers. Soybean as a crop is associated with a number of technologies that increase crop production for profitability in the market.

4.1 Awareness of Agricultural Technologies

The overall results on the awareness of modern farming techniques for soybean production indicate that about 48% of farmers are aware of different technologies in the soybean supply chain (Table 4.1). The awareness is even higher in Morogoro, Njombe, and Iringa by 99%, 94% and 92% respectively.

Table 4.1: Farmer's Awareness of Modern Farming Technologies per Region

Regions	No	Yes	Total
Morogoro	1.2	98.8	100.0
Iringa	7.9	92.1	100.0
Njombe	6.0	94.0	100.0
Rukwa	88.5	11.5	100.0
Songwe	76.2	23.8	100.0
Ruvuma	81.3	18.8	100.0
Mbeya	76.2	23.8	100.0
Total	**51.6**	**48.4**	**100.0**

Table 4.2 shows that the correct planting and weeding time (17.2%), soybean-maize rotation (17.0%), use of improved seeds, and correct planting density (13%) were the most known modern farming technologies in the study regions.

Table 4.2: Knowledge of soybean modern farming technologies (expressed in %)

Soybean Farming Techniques	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Soy-maize rotation	18.3	12.9	23.7	27.5	10.9	20.2	17.3	16.9
Correct planting density	15.6	12.9	8.4	9.8	9.5	20.2	16.5	12.5
Correct planting and weeding time	21.3	13.8	20.9	15.7	13.6	23.4	16.5	17.2
Use of improved seeds	14.6	13.6	14.0	7.8	19.1	13.8	4.7	13.7
Use of inoculants	11.3	12.1	9.8	9.8	9.5	7.3	5.5	10.6
Use of fertilizers	4.3	9.8	6.9	7.8	11.4	4.1	0.0	7.8
Pest control	7.3	8.9	3.4	7.8	10.0	2.8	9.4	7.0
Post-harvest practices	5.6	8.3	7.3	5.9	8.2	5.0	14.2	7.7
Post-harvest storage	1.7	7.7	5.7	7.8	7.7	3.2	15.7	6.6
Total	**100.0**	**100.**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.**

4.2 Application of Agriculture Technologies

The baseline survey also wanted to disclose if farmers apply the farming technologies, they are aware of to their soybean farms. The overall results indicate that only 2.5% of the interviewees responded that they apply the recommended modern technologies and none of the farmers in Morogoro, Rukwa, and Mbeya used the technologies (Table 4.3). The survey also found none of the interviewed farmers were applying irrigation to their farms (Appendix 3).

There is potential to improve soybean productivity through increased use of Good Agriculture Practices (GAP) as only

2.5%

of farmers apply GAP

Table 4.3: Application of modern farming technologies per region

Regions	No	Yes	Total
Morogoro	100.0	0.0	100.0
Iringa	96.6	3.4	100.0
Njombe	96.5	3.5	100.0
Rukwa	100.0	0.0	100.0
Songwe	94.2	5.8	100.0
Ruvuma	98.0	2.0	100.0
Mbeya	100.0	0.0	100.0
Total	**97.5**	**2.5**	**100.0**

4.3 Crop Rotation

The baseline survey found that about 82% of the respondents reported applying crop rotation techniques to their farms, particularly for the farmers in Ruvuma, Njombe, Songwe and Iringa (Table 4.4). Over 94% of the surveyed farmers would rotate their soybeans with other crops every season or year (Appendix 4).

Table 4.4: Soybean rotation with other crops per region (expressed in %)

Regions	No	Yes	Total
Morogoro	46.4	53.6	100.0
Iringa	17.3	82.7	100.0
Njombe	12.2	87.8	100.0
Rukwa	33.1	66.9	100.0
Songwe	12.2	87.8	100.0
Ruvuma	7.5	92.5	100.0
Mbeya	31.8	68.2	100.0
Total	**18.3**	**81.7**	**100.0**

4.4 Type of Crop Rotated with Soybean

Intercropping soybean with maize, legumes, beans, and groundnuts is common in the country, especially in the Southern Corridor, central and northern Tanzania. There are great benefits that farmers have realized from rotating soybean with other crops as well as intercropping it with other crops, one being nitrogen fixation that has contributed to increasing crop yields (CRS, 2018). The intercropped farm in the country directly affects soybean production and productivity. The country's soybean farming level has increased because of the tendency to intercrop with other crops, such as maize and sunflowers. These cropping systems have

accelerated soybean production in the northern, southern, central and Lake zones of the country (TARI-Selian, 2023). The baseline survey disclosed that maize is the most crop planted together with soybeans by over 84% of the interviewed farmers. Other crops include common beans (9%) and groundnuts (5.3%) as shown in Table 4.5. The main reasons for soybean rotation were to improve soil (60%) and to increase yields (39%) as responded by the respondents (Appendix 5).

Table 4.5: Type of crops farmers rotate with soybean and their significance (expressed in %)

Crop Rotated with Soybean	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Maize	93.3	89.4	83.4	51.4	96.8	97.8	68.4	84.2
Groundnuts	4.4	1.1	0.5	15.3	1.6	1.5	26.6	5.3
Cowpea/pigeon pea	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Beans	0.0	9.5	10.2	31.7	1.1	0.7	5.1	9.0
Peas	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1
Potatoes	0.0	0.0	5.4	0.5	0.0	0.0	0.0	1.0
Wheat	0.0	0.0	0.5	1.1	0.0	0.0	0.0	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

4.5 Soybean Intercropping

Nearly 30% of soybean farmers confirmed to intercrop their soybeans alongside other crops in the same field during the same growing season to increase yield diversity and enhance overall farm productivity (Appendix 6). The intercropping cases were found more common in Songwe (58%) and Ruvuma (45%). Of all the intercropped crops, most farmers intercropped their soybeans with sunflower (73%), particularly in Songwe (96%), Ruvuma (87%) and Mbeya (60%). The results on crops that farmers intercropped in their soybean plots are presented in Table 4.6a.

However, we tried to find out if there are differences in yields between farmers that intercropped soybeans and sunflower or maize (the most intercropped crops in the study regions). As expected, due to lower plant population, soybean farmers that intercropped soybean with other crops like maize or sunflower had lower sunflower yield of 0.461 t/ha, as compared with farmers that practiced monocropping (0.734 t/ha). However, farmers that intercropped soybeans with sunflower has a slightly higher yields (0.776 t/ha), as compared with farmers that planted monocroped soybean (Table 4.6b).

Table 4.6a: Types of crops that farmers intercrop with soybean (levels expressed in %)

Crops Inter-cropped with Soybean	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Maize	93.8	36.4	0.0	60.0	3.4	8.5	20.0	17.4
Cowpea/pigeon pea	0.0	6.8	0.0	0.0	0.0	3.1	0.0	2.1
Peas	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.3
Sunflower	0.0	25.0	42.9	30.0	95.8	86.8	60.0	73.2
Groundnuts	0.0	0.0	0.0	5.0	0.0	0.8	0.0	0.6
Potatoes	0.0	27.3	0.0	0.0	0.0	0.0	0.0	3.5
Avocado	0.0	0.0	42.9	0.0	0.0	0.0	0.0	0.9
Others	6.3	2.3	14.3	5.0	0.8	0.8	20.0	2.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.6b: Yield differences (t/ha) for soybean farms intercropped with maize, sunflower and monocropping

Regions	Soybean monocropping	Maize-soybeans plot	Sunflower -soybeans plot
Morogoro	0.987	0.354	-
Iringa	0.890	-	-
Njombe	0.517	0.284	-
Rukwa	0.962	-	-
Songwe	0.815	0.706	0.576
Ruvuma	0.483	0.247	0.722
Mbeya	0.981	-	0.803
Total	**0.734**	**0.461**	0.**776**

4.6 Type of Soybean Seeds Planted in the Study Regions

Soybean farmers were also asked about the seed varieties they planted during the 2023 farming season. Over 77% of the interviewees reported using improved seed varieties, with 22% using local varieties (Table 4.7). Almost all farmers in Rukwa and Njombe reported using improved seeds (Table 4.7). Uyole 4 as indicated in Table 4.8a was the most dominant type of seed planted by farmers, especially in Iringa (50%), Songwe (46%), Mbeya (40%), and Ruvuma (36.5%). The planted varieties are Spike (29%), Semeki (26%), Uyole 1 (23%) and 8E (17%). Uyole 4 was dominant in Iringa (50%) followed by Safari (31%).

The study also found that Uyole 2 was dominant in Njombe at 72% and followed by Semeki at 26% while Uyole 4 was dominant in Songwe and Mbeya (Table 4.8a). Most farmers in Rukwa Region did not know the type of seeds they planted but some of them planted Semeki (27%). Also, the majority of the farmers particularly in Songwe (90%), Iringa (84%), Ruvuma (70%), Rukwa (64%) and Morogoro (61%) considered the seed varieties planted as tall with the majority of farmers in Njombe considering them as short varieties (Appendix 7).

The study also analyzed the difference in yields between the seed varieties planted by the farmers and observed that Uyole 4 had the highest yield per unit area followed by Spike. Uyole 4 did much better in Rukwa by recording the highest average yield of 1.778 kg/ha (720 kg/acre) followed by Iringa at 1,235 kg/ha (500 kg/acre) and Songwe at 1,213 kg/ha (491 kg/acre) as shown in Table 4.8b.

Table 4.7: Type of soybean seed farmers used in the 2023 rainy season

Regions	Improved Seed	Local Variety	Both Improved & Local	Total
Morogoro	90.1	8.5	1.4	100.0
Iringa	86.3	12.9	0.8	100.0
Njombe	99.5	0.5	0.0	100.0
Rukwa	100.0	0.0	0.0	100.0
Songwe	53.2	45.5	1.3	100.0
Ruvuma	32.3	64.6	3.0	100.0
Mbeya	60.0	40.0	0.0	100.0
Total	**77.4**	**21.6**	**1.0**	**100.0**

Table 4.8a: Names of the soybean seed used per region

Name of soybean seed used	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Uyole 1	23.1	0.0	1.3	9.1	0.0	0.0	0.0	3.4
Uyole 2	0.0	0.0	71.9	0.0	0.0	4.2	0.0	22.6
Uyole 3	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.2
Uyole 4	0.0	49.6	0.6	9.1	45.9	36.5	40.0	24.7
Spike	29.2	3.5	0.6	0.0	1.4	1.0	0.0	4.9
Semeki	26.2	0.9	25.6	27.3	0.0	5.2	0.0	12.7
8 E	16.9	0.0	0.0	0.0	0.0	0.0	0.0	2.1
Safari	0.0	31.3	0.0	0.0	0.0	0.0	0.0	6.8
Local	0.0	0.0	0.0	0.0	25.7	43.8	20.0	11.8
I don't know	0.0	13.9	0.0	36.4	5.4	7.3	40.0	6.3
Others	4.6	0.9	0.0	18.2	21.6	1.0	0.0	4.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.8b:Yield differences based on the type of soybean seeds used in kg/ha

Type of Soybean Seed Variety	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
8 E	454							454
Semeki	593		611	741		346		573
Spike	228	1,215	988	-				810
Uyole 1	498		-	247				372
Safari		736	-	-				736
Uyole 4		1,233	457	1,778	1,212	743		1,170
Uyole 2			900	-		291		596
Uyole 3			-	-		593		593
Local					848	478	593	640
Other (improved)	776	687	950	815	790	653	914	798
TOTAL	**510**	**968**	**781**	**895**	**950**	**517**	**754**	**674**

4.7 Testing Germination Rate

Farmers were asked if they tested the germination rate of the soybean seed and the results showed that only 30.8% had their seeds tested (Table 4.9). The germination percentage of the tested seeds was ranked very good by over 61% of surveyed farmers, and 38% of them ranked good with only 0.8% ranking poor (Appendix 8).

Table 4.9: Testing the germination rate of soybean seed (expressed in %)

Regions	No	Yes	Total
Morogoro	90.6	9.4	100.0
Iringa	48.8	51.2	100.0
Njombe	45.5	54.5	100.0
Rukwa	17.3	82.7	100.0
Songwe	98.5	1.5	100.0
Ruvuma	98.0	2.0	100.0
Mbeya	72.3	27.7	100.0
Total	**69.2**	**30.8**	**100.0**

4.8 Soybean Seed Price per Kilogram in the Last Two Seasons 2021/22 – 2022/23

Knowing the prices of soybean seeds is fundamental to the success and profitability of soybean farming operations. This information guides farmers and stakeholders involved in soybean cultivation in making informed decisions, managing risks, optimizing input use, and maximizing their returns on investment. Morogoro Region had the highest price distribution of soybean seeds than any other region for the two seasons. The average prices were TZS 3,602/kg and TZS 4,278/kg for the 2021/22 and 2022/23 seasons and the maximum prices were TZS 6,000/kg and 9,600/kg respectively. Iringa was the second region with the highest seed price distribution followed by the Njombe Region with Ruvuma Region having the lowest distribution as shown in Table 4.10.

Table 4.10: Summary statistics for soybean seed prices per kg in 2021/22–2022/23 by regions

Regions	Season	Mean	StDev	CV	Min	Median	Max
Morogoro	2021/22	3,602	1,199	33	800	3,600	6,000
	2022/23	4,278	1,249	29	2,000	4,000	9,600
Iringa	2021/22	2,440	920	38	500	2,500	6,500
	2022/23	2,565	313	12	2,000	2,500	3,600
Njombe	2021/22	2,110	777	37	300	2,000	5,000
	2022/23	1,927	152	8	1,500	2,000	2,000
Rukwa	2021/22	1,604	700	44	800	1,500	5,000
	2022/23	1,479	59	4	1,300	1,500	1,500
Songwe	2021/22	1,960	760	39	750	2,000	3,750
	2022/23	1,249	47	4	1,200	1,250	1,300
Ruvuma	2021/22	1,441	844	59	500	1,300	5,000
	2022/23	850	177	21	500	850	1,200
Mbeya	2021/22	1,767	886	50	500	1,500	5,000
	2022/23	1,627	865	53	500	1,500	5,000
Overall	2021/22	2,015	1,002	50	300	2,000	6,500
	2022/23	1,814	996	55	500	1,500	9,600

4.9 Knowledge of Seed Rate for Soybean Production and Planting Style

The majority of the farmers in the study regions particularly in Morogoro (100%), Njombe (99.5%), Iringa (94%), and Rukwa (57%) planted their soybeans in drilled or rows (Table 4.11). Other farmers in Ruvuma (95%), Songwe (84.4%) and Mbeya (61.4%) planted soybeans in ridges. The appropriate seed rate for soybean production can vary depending on several factors, including the specific soybean variety, local growing conditions, planting method, and desired plant population. For drilled or row planting (where seeds are planted in rows), the typical seed rate for soybeans ranges from 168 kg to 248.73 kg of soybean seeds per ha (68 kg to 100.7 kg per acre).

Table 4.11: Planting method of soybean (in rows/ridges/anyhow) by regions

Soybean Planting Method	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
In Rows	100.0	93.9	99.5	57.0	15.6	3.1	34.1	51.2
In Ridges	0.0	2.6	0.0	2.0	84.4	95.2	61.4	42.3
Random planting	0.0	3.6	0.0	9.3	0.0	1.0	1.1	2.1
Broadcasting	0.0	0.0	0.5	31.8	0.0	0.7	3.4	4.5
Total	100	100	100	100	100	100	100	100

It was further noted in the baseline study that over 65% of the farmers (Table 4.12) had good knowledge of the seed rates they would use per unit area and this knowledge was recorded high in Morogoro (94%), Iringa (90%) and Songwe (88%).

The overall results in Table 4.13 show the average seed rate of 95.91 kg/ha (38.83 kg/acre) with minimum and maximum values of 17 to 244.53 kg/ha (7 – 99 kg/acre), respectively. The average seed rate range is less than the recommended rate of at least 168 kg per ha (68 kg/acre). Of all the regions, Rukwa and Songwe had the highest average seed rates of above 124 kg/ha (50k/acre) with Mbeya having the least average rate. About 59% of the farmers adhered to some of the spacing standards during soybean planting, but farmers in Morogoro and Iringa highly followed the standards (Appendix 9).

When farmers were asked about the time they decided to plant their soybeans during the rainy season, most of them particularly in Morogoro (78.6%) and Iringa (53%) responded to start planting one week after the rains started (Appendix 10). In Njombe (53%), Rukwa (46%) and Ruvuma (42%) farmers started to plant soya during the middle of the rainy season.

Table 4.12: Knowledge of seed rates for soybean (kg/ ha)

Regions	No	Yes	Total
Morogoro	5.9	94.1	100.0
Iringa	10.3	89.7	100.0
Njombe	21.5	78.5	100.0
Rukwa	94.9	5.1	100.0
Songwe	11.7	88.3	100.0
Ruvuma	43.4	56.6	100.0
Mbeya	63.4	36.6	100.0
Total	**34.8**	**65.2**	**100.0**

Table 4.13: Distribution of soybean seed rates (in kg per ha) used per region

Region	Mean	STD	CV	Min	Median	Max
Iringa	79.44	85.93	244.38	17.29	74.10	244.53
Mbeya	31.59	16.03	125.28	17.29	24.70	74.10
Morogoro	104.14	87.66	207.92	17.29	74.10	244.53
Njombe	94.11	78.84	206.96	17.29	74.10	244.53
Rukwa	140.54	102.70	180.51	19.76	122.27	244.53
Ruvuma	78.57	76.59	240.83	19.76	49.40	244.53
Songwe	134.07	100.38	184.90	19.76	61.75	244.53
OVERALL	95.91	88.06	226.75	17.29	49.40	244.53

Furthermore, the analysis shows that the majority of soybean producers particularly in Iringa (79%), Mbeya (64%), Ruvuma (64%), Morogoro (62%), and Rukwa (52%) plant two seeds per hole. Farmers in Njombe (90%), and Songwe (85%) planted one seed per hole (Table 4.14a) and hand hoe is the most tool used in soybean planting by over 75% of the farmers (Appendix 11). The survey also analyzed the differences in yields for various seed rates and the results show that farmers that planted one seed per hole harvested slightly higher yields than farmers who reported to plant two or more seeds per hole (Table 4.14b).

Table 4.14a: Soybean seed rates per hole in study regions (expressed in %)

Soybean Seed Rate per Hole	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
One	33	19	90	16	85	3	27	39
Two	62	79	10	52	10	64	64	47
Three	4	2	0	8	5	29	6	10
Four	0	0	0	1	0	3	0	1
Five	1	0	0	2	0	1	0	0
More than Five	0	0	0	22	0	0	3	3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 4.14b: Yield differences (kg/ha) per seed rates used in soybean cultivation

Region	One seed	Two seeds	Three or More	TOTAL
Morogoro	492.52	512.33	440.90	481.95
Iringa	1,213.12	876.85	-	1,213.12
Njombe	922.99	509.44	-	716.23
Rukwa	785.26	870.68	817.00	824.31
Songwe	826.73	916.99	916.99	886.90
Ruvuma	426.08	627.26	655.09	569.48
Mbeya	844.74	934.75	926.25	901.92
Overall	787.34	749.74	751.25	799.12

4.10 Month of Soybean Planting

Knowing the optimal planting month for a particular crop, such as soybeans, is of utmost importance for farmers and agricultural stakeholders for several compelling reasons including yield maximization, risk management, water management, market timing, financial planning and crop management. The optimal planting month for soybeans can vary depending on location, climate and local growing conditions. This study therefore included questions to gather local information, monitor weather conditions, and adaptations to help farmers plan their planting schedule based on the unique factors affecting their farms.

The study found that the majority of farmers in Morogoro (56%) planted their soybeans in March but some of them planted in February (27%) and April (16%) while most farmers in Iringa (51%) planted soybeans in January, February (24%) and in March (15%). Nearly 91% of farmers in Njombe planted their soybeans in January while most farmers in Rukwa (82%) planted the crop in December. Likewise, farmers in Songwe (77%), Mbeya (56%) and Ruvuma (55%) planted their soybeans in December and some in January (Table 4.15).

Table 4.15: Soybean planting calendar (months)

Soybean Planting Month	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
January	1.2	50.5	90.8	14.6	14.6	40.1	39.8	39.8
February	27.4	23.5	0.5	0.0	1.5	3.8	3.4	7.2
March	56.0	14.8	0.0	1.3	0.0	0.0	0.0	6.4
April	15.5	2.0	0.0	0.0	0.0	0.0	0.0	1.4
June	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.1
August	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.1
November	0.0	0.0	0.0	2.0	6.8	1.0	0.0	1.7
December	0.0	8.7	8.7	82.1	77.1	55.1	55.7	43.4
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

4.11 Soybean Weeding Methods

The farmers were also asked if they weeded soybeans cultivated in the rainy season in 2022/23 and the methods used. It was found that only 2.5% of the respondents did not weed and those who weeded (97.5%) they did so either once or twice and some farmers had to weed a third time (Appendix 12). Many farmers in Iringa (88%) had to weed their plots twice, followed by farmers in Rukwa (69%) Njombe (62%) and Morogoro (60%). The weeding of soybean plots starts within three weeks after planting or after a month (Appendix 13). The majority of farmers in Songwe (81%), Ruvuma (71%) and Mbeya (51%) weeded their farms only once (Appendix 14). Morogoro had a significant number of farmers (nearly 27%) who weeded more than two times. About 93% of all the farmers interviewed used a traditional hand hoe with only less than 5% used both hand hoe and herbicides/weedicides (Table 4.16). In addition, farmers were asked about their awareness of herbicides to control weeds in their fields. As indicated in Table 4.17, over 79% did not know whether the herbicides could be used to control weeds.

Table 4.16: Methods of weeding in soybean farms per region

Soybean Weeding methods	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Hand hoe	98.8	97.4	93.7	94.6	83.0	92.3	97.5	92.9
Weeder	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.1
Herbicides	0.0	1.0	1.6	2.7	2.5	4.6	1.2	2.4
Both hand hoe & herbicides	0.0	1.0	4.2	0.0	1.0	2.5	1.2	1.7
Both hand hoe & weeder	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.2
Others	1.2	0.0	0.5	2.7	13.0	0.4	0.0	2.8
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 4.17: Farmers' awareness of herbicides per region

Regions	No	Yes	Total
Morogoro	91.6	8.4	100.0
Iringa	46.7	53.3	100.0
Njombe	80.5	19.5	100.0
Rukwa	95.3	4.7	100.0
Songwe	83.0	17.0	100.0
Ruvuma	88.0	12.0	100.0
Mbeya	70.4	29.6	100.0
Total	**79.1**	**20.9**	**100.0**

4.12 Fertilizer Application

The overall results in Table 4.18 show that about 22% of the farmers used fertilizers and the application of fertilizers was high in Iringa (59%%), Morogoro (33%) and Njombe (33%). Regions with less fertilizer application include Ruvuma (1.4%), Mbeya (2.3%) and Songwe (9.3%). The study also revealed that about 56% of the farmers received advice on fertilizer application from extension officers and 22% used their own knowledge and experience (Appendix 15). In most cases, Phosphate (Minjingu/TSP/DAP) was the most common fertilizer used by farmers (57%) in the study regions followed by booster (foliar fertilizer) which was highly used in Morogoro and Songwe regions (Table 4.19a). The analysis also observed that farmers that applied fertilizers in their farms had 1.3 times better yields than the farms that did not apply the fertilizers (Table 14.19b).

Only 22% of soybean farmers use fertilizer and most are concentrated in the Southern Highlands

Table 4.18: Fertilizer application in rainy seasons 2022/23 per region

Regions	No	Yes	Total
Morogoro	66.7	33.3	100.0
Iringa	41.3	58.7	100.0
Njombe	67.3	32.7	100.0
Rukwa	78.1	21.9	100.0
Songwe	90.7	9.3	100.0
Ruvuma	98.6	1.4	100.0
Mbeya	97.7	2.3	100.0
Total	**78.1**	**21.9**	**100.0**

Table 4.19a: Types of fertilizer used on soybean per region

Fertilizer type	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Organic Fertilizer (Manure)	0.0	5.6	0.0	28.6	4.2	0.0	33.3	6.4
NPK	2.8	19.8	0.0	5.7	8.3	0.0	0.0	10.2
Phosphate (Minjin-gu/TSP/DAP)	0.0	58.7	95.5	45.7	45.8	25.0	33.3	56.6
UREA/Sulphate/ Ammonia(SA)	16.7	0.8	3.0	2.9	0.0	50.0	33.3	4.4
CAN	5.6	3.2	1.5	8.6	0.0	25.0	0.0	3.7
Potassium Nitrate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Booster (Foliar Fertilizer)	75.0	11.9	0.0	8.6	41.7	0.0	0.0	18.6
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 4. 19b: Yield (kg/ha) differences for fertilizer users and non-fertilizer users

Region	Fertilizers users	Non-fertilizers users	TOTAL
Morogoro	595.27	452.97	524.13
Iringa	1,007.76	679.87	843.80
Njombe	914.52	769.41	841.97
Rukwa	980.59	775.51	878.06
Songwe	1,358.50	834.37	1,096.43
Ruvuma	-	630.67	630.67
Mbeya	-	903.60	903.60
Overall	971.33	720.92	846.12

4.13 Inoculants Application

In this study, inoculants, were defined as substances or formulations containing beneficial microorganisms, typically bacteria or fungi, which are applied to seeds, soil or plant surfaces to promote plant growth, improve nutrient uptake, and enhance soil fertility. Inoculants are widely used in soybean production for various purposes, including nitrogen fixation, disease control, and plant growth promotion. Farmers were asked about their awareness of inoculants and the use of the inoculants in soybean production. The results show that over 35% of all farmers interviewed were aware of the inoculants and their application in the production of soybeans. Moreover, the awareness was higher in Iringa (82%), Njombe (82%) and Morogoro (49%), with Rukwa (2.6%) and Songwe (9.3%) having the least awareness (Table 4.20a). The results also show that those who were aware of the inoculants most of them applied them in their fields, particularly in Songwe, Mbeya, Rukwa and Iringa (Table 4.20b). Only 14% of the farmers who used inoculants have ever been trained on how to apply them (Appendix 16).

Table 4.20a: Farmers' awareness of inoculants and their application in soybean planting

Regions	No	Yes	Total
Morogoro	51.2	48.8	100.0
Iringa	17.9	82.1	100.0
Njombe	18.4	81.6	100.0
Rukwa	97.4	2.6	100.0
Songwe	90.7	9.3	100.0
Ruvuma	88.7	11.3	100.0
Mbeya	87.5	12.5	100.0
Total	**64.6**	**35.4**	**100.0**

Table 4.20b: Farmers who applied inoculants in the study regions

Regions	No	Yes	Total
Morogoro	65.9	34.1	100.0
Iringa	29.2	70.8	100.0
Njombe	64.4	35.6	100.0
Rukwa	25.0	75.0	100.0
Songwe	5.3	94.7	100.0
Ruvuma	81.8	18.2	100.0
Mbeya	9.1	90.9	100.0
Total	**48.3**	**51.7**	**100.0**

4.14 Pest Attacks and Application of Pesticides

The overall results in Table 4.21 of pest attacks show that less than 40% of the farmers reported infestations of pests on their farms; but region-wise the pest attacks were higher in Songwe (73%) and Morogoro (52%) and slightly higher in Ruvuma (33.2%). The results also showed that about 80% of the pests that damaged the soybean crop in the 2022/23 rainy season were insects like grasshoppers, bean leaf beetle and soybean aphid (Table 4. 22). These insects were dominant in Morogoro and Mbeya by over 95% and Songwe by 84%. When farmers were asked about the methods used to reduce the damages by pests the results showed that nearly 62% of these farmers applied pesticides (insecticides and fungicides) and 37% did not apply anything (Appendix 17).

Table 4.21: Pests attack on soybean fields by regions (expressed in %)

Regions	No	Yes	Total
Morogoro	47.6	52.4	100.0
Iringa	82.7	17.3	100.0
Njombe	80.6	19.4	100.0
Rukwa	80.8	19.2	100.0
Songwe	26.8	73.2	100.0
Ruvuma	66.8	33.2	100.0
Mbeya	76.1	23.9	100.0
Total	**65.9**	**34.1**	**100.0**

Table 4.22: Soybean damaging factors/causes per region (expressed in %)

Soybean Damaging Cusers	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Diseases	0.0	24.4	17.8	18.4	7.3	16.5	4.5	12.1
Insects	95.7	73.3	75.6	76.3	83.8	71.1	95.5	80.0
Birds	0.0	0.0	4.4	2.6	1.7	5.0	0.0	2.4
Rodents	0.0	2.2	2.2	0.0	2.8	5.0	0.0	2.6
Livestock	2.2	0.0	0.0	2.6	1.1	0.8	0.0	1.0
Wild Animals	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.2
Hail (*Mvua ya mawe*)	2.2	0.0	0.0	0.0	3.4	0.8	0.0	1.6
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

4.15 Soil Fertility for Soybean Fields and Climate Smart Practices

Soil color can provide valuable information about the fertility and health of a soil. Although soil fertility is a complex interaction of multiple factors, and no single characteristic (such as soil texture, nutrient analysis, pH testing, and organic matter content), including soil color, can provide a complete picture on its own. While it is just one of many factors to consider, it can indicate certain characteristics and conditions that may affect soil fertility to small-scale farmers. Most of the soil of the fields planted with soybeans was black, particularly in Morogoro (100%), Rukwa (82%) and Mbeya (71%), while the soil was red in Ruvuma and Songwe at 83% and 49%, respectively (Table 4.24). When asked how farmers rate their soils in terms of low, medium and high fertility, over 68% of the farmers confirmed that their soybean fields' soil fertility was medium, and about 20% ranked their soils as highly fertile (Table 4.25). In addition, 29% and 20% of farmers confirmed to use crop rotation and crop residue, respectively, as the soil fertility management practices (Appendix 18).

Other soil management practices used were soil erosion control (12%), leaving their soil/plot fallow (11%), application of organic fertilizers (9.5%), and inorganic fertilizer (7.5%). Crop management practices (like crop rotation, cover crops and crop diversification) were among the climate-smart practices used by nearly 42% of the farmers followed by soil management (conservation tillage) used by 36% of the farmers (Appendix 19). On timing the harvest, 41% of the farmers would start harvesting their soybean when the pods turned straw-colored, 39% of them would start when soybean leaves start falling and 18% when the seeds are at the hard-dough stage (Appendix 20).

Table 4.24: Soil color of soybean fields in surveyed regions (expressed in %)

Regions	Black	Brown	Grey	Red soil	Yellowish (Sandy)	Total
Morogoro	100.0	0.0	0.0	0.0	0.0	100.0
Iringa	53.6	20.4	2.0	24.0	0.0	100.0
Njombe	29.6	34.7	0.5	31.2	0.0	100.0
Rukwa	81.5	2.0	0.0	4.0	12.5	100.0
Songwe	18.0	25.4	7.8	48.8	0.0	100.0
Ruvuma	10.3	1.7	1.0	82.5	4.5	100.0
Mbeya	70.5	10.2	15.9	3.4	0.0	100.0
Total	**41.2**	**14.6**	**3.1**	**37.8**	**3.3**	**100.0**

Table 4.25: Farmers' rating of soil fertility of soybean fields

Regions	Low Fertility	Medium Fertility	High Fertility	Total
Morogoro	0.0	50.0	50.0	100.0
Iringa	2.0	90.8	7.1	100.0
Njombe	32.1	66.8	1.1	100.0
Rukwa	0.7	86.1	13.2	100.0
Songwe	3.9	72.7	23.4	100.0
Ruvuma	22.3	42.8	34.9	100.0
Mbeya	5.7	84.1	10.2	100.0
Total	**12.0**	**68.4**	**19.6**	**100.0**

CHAPTER FIVE

5.0 Post-harvest Handling

Understanding the postharvest handling practices for soybean production is crucial for maintaining the quality, value and marketability of the harvested crop. Proper postharvest handling helps prevent losses due to spoilage, contamination and deterioration, ensuring that soybeans reach consumers and markets in optimal condition. The questions to capture this important information were included in this particular study.

5.1 Methods of Testing the Moisture Contents of the Soybean

Farmers were asked about the methods they use to test the moisture content of the soybeans and the results show that 75% of the soybean growers use local practices of cutting a bean into pieces using a tooth and about 14% of them do not use any method (Table 5.1).

Table 5.1: Methods farmers use to test the moisture content of soybean

Moisture content testing methods	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Use the local practice of cutting a bean into pieces using a tooth	98.8	96.0	99.5	91.0	10.7	77.6	56.4	74.5
Use moisture meter	1.2	0.0	0.0	2.6	0.0	0.7	1.0	0.6
Doesn't measure at all	0.0	0.0	0.0	0.0	72.3	0.3	22.8	13.8
Don't know how to measure	0.0	0.0	0.0	6.4	17.0	0.3	19.8	5.3
Produce sound when they are dry	0.0	0.0	0.5	0.0	0.0	3.3	0.0	0.8
Through looking by eyes	0.0	0.5	0.0	0.0	0.0	16.1	0.0	4.0
Others	0.0	3.5	0.0	0.0	0.0	1.7	0.0	1.0
Total	100	100	100	100	100	100	100	100

5.2 Methods of Soybean Harvesting

Over 91% of the respondents use traditional ways of pulling out the whole plant with 8% of farmers harvesting their soybeans by cutting the plant with a sickle, machete, or other devices, and leaving the roots in the soil (Table 5.2).

Table 5.2: Methods of soybean harvesting

Harvesting Methods	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Cutting the plant with a sickle, machete, or other device, leaving the roots in the soil	16.5	6.4	14.7	11.1	8.3	1.0	2.3	7.8
Pulling out the whole plant	83.5	88.6	85.3	88.6	91.7	97.9	97.7	91.1
Not yet harvested	0.0	5.0	0.0	0.0	0.0	1.0	0.0	1.1
Total	100	100	100	100	100	100	100	100

5.3 Methods of Soybean Drying

Knowledge of soybean drying methods is crucial for ensuring the quality, marketability and profitability of soybean production. It enables farmers to meet market requirements, reduce post-harvest losses, and make informed decisions about storage and processing. Ultimately, understanding these methods contributes to the overall success and sustainability of soybean farming operations. The baseline analysis shows that eight farmers out of ten (80%) use plastic/canvas sheets to dry their grains and about 20% dry on the ground (Table 5.3). Farmers were asked about the packaging materials they use to package their produce and the results show that over 83.4% of the farmers would package their product to 50 kg or above 100 kg bags (Appendix 21).

Table 5.3: Methods of drying the soybean before threshing

Soybeans Drying Methods	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Use plastic/canvas sheets to dry grains	95.3	78.3	59.5	87.1	60.7	99.3	87.1	80.5
Dry on the ground	4.7	16.7	40.5	12.8	39.3	0.7	12.9	18.7
Not yet harvested	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.8
Total	100	100	100	100	100	100	100	100

5.4 Farmers' Awareness of the Nutritional Value of Soybean

Soybeans are highly nutritious and considered a valuable source of essential nutrients like calories (approximately 173 calories), protein (about 16.6g/100g), fats (around 8.97g/100g), carbohydrates (about 9.9g/100g), and dietary fiber (approximately 6.0g/100g). Others are vitamins (Vitamin K, Folate, Vitamin B6), minerals (iron, magnesium, phosphorus, potassium, copper and manganese) and phytonutrients. Conversely, soybeans also contain antinutrients.

This particular study asked farmers if they are aware of some of these nutritional values and the overall results show that 33.5% of the respondents understand the nutritional values of soybeans but the majority don't (Table 5.4a). Moreover, female-headed households as shown in Table 5.4b had a better awareness of the nutritional value of soybeans by over 73% compared with male-headed households (65%). Those who are aware of the nutritional values were asked if they ever use soybeans as food in their households and about 67% of them (Table 5.5) agreed but they have limited home-based soybean processing tools that enable them to prepare the soybean for consumption (Appendix 22; Appendix 23).

Only 5.5% of the producers produced soybean for home consumption

Table 5.4a: Awareness of the nutritional value of soybean

Regions	No	Yes	Total
Morogoro	9.4	90.6	100.0
Iringa	22.2	77.8	100.0
Njombe	8.0	92.0	100.0
Rukwa	32.7	67.3	100.0
Songwe	43.7	56.3	100.0
Ruvuma	60.2	39.8	100.0
Mbeya	27.7	72.3	100.0
Total	**33.5**	**66.5**	**100.0**

Table 5.4b: Awareness of the nutritional value of soybean by gender of the household head

Gender	No	Yes	Total
Male-headed household	35.3	64.7	100.0
Female-headed household	27.2	72.8	100.0
Total	**33.5**	**66.5**	**100.0**

Table 5.5: Application of soybeans as food

Regions	No	Yes	Total
Morogoro	10.4	89.6	100.0
Iringa	40.5	59.5	100.0
Njombe	23.4	76.6	100.0
Rukwa	37.1	62.9	100.0
Songwe	55.2	44.8	100.0
Ruvuma	19.8	80.2	100.0
Mbeya	46.6	53.4	100.0
Total	**33.1**	**66.9**	**100.0**

5.5 Soybean Storage Facilities in the Study Regions

The majority of the farmers in the study regions store their soybeans in locally made traditional structures (Table 5.6). This is particularly so in Rukwa (95%) and Songwe (53%), while Morogoro is the only region with many farmers (83%) storing their produce in an improved locally-made structure followed by those in Mbeya (50%) and Songwe (43%). Other farmers particularly in Njombe (75%) and Iringa (32%) stored their soybeans in sacks or open drums and most of the farmers (nearly 70%) had enough storage capacity to store their soybeans (Appendix 24). The survey also revealed that only 17% of the farmers in the study regions had access to the community warehouses (Appendix 25) while 65% responded to having no access to the community warehouses at all. On the other hand, 67% of the respondents mentioned that community storage facilities had enough storage capacity (Appendix 26).

Table 5.6: Storage facilities of soybeans in the study area

Soybeans Storage Facilities	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Locally made traditional structure	13.1	11.6	5.5	94.9	53.4	15.3	17.6	29.1
Improved locally made structure	83.3	2.2	14.6	1.9	42.8	35.4	50.0	27.7
Modern store	0.0	8.9	0.0	1.9	0.0	2.3	13.7	3.4
Sacks/open drum	2.4	31.6	75.4	1.3	1.0	26.3	2.0	24.1
Airtight drum	1.2	7.1	1.5	0.0	0.0	0.0	0.0	1.6
Have a small room	0.0	32.0	1.5	0.0	2.9	16.2	15.7	11.4
Outside my house/ Veranda	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.6
I sell immediately after harvest	0.0	0.0	0.5	0.0	0.0	1.9	0.0	0.5
I store to our AMCOS	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.5
Other	0.0	3.6	1.0	0.0	0.0	0.0	1.0	0.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

CHAPTER SIX

6.0 Marketing of Soybeans

This section highlights various marketing channels used by farmers to sell their produce after postharvest handling processes. Understanding the marketing channels for soybeans is of utmost importance for farmers and stakeholders as it allows the actors along the chain to identify the most profitable avenues for selling their soybeans. In Tanzania, soybean is mainly produced for business purposes as revealed by the baseline survey and only 5.5% of the producers produced soybean for family use (Table 6.1). Also, this survey disclosed that the middlemen and brokers dominated the soybean market by almost 50%, and only a few of the farmers (< 10%) sold to aggregation centers and the warehouse receipt system, WRS (Table 6.2).

Table 6.1: The main purpose of soybean production for the 2022/23 season

Regions	Sales	Own use	Both Sales and Own use	Others	Total
Morogoro	23.5	4.7	71.8	0.0	100.0
Iringa	46.3	0.5	39.9	13.3	100.0
Njombe	18.0	11.0	69.0	2.0	100.0
Rukwa	26.3	1.3	71.8	0.6	100.0
Songwe	98.0	0.0	0.5	1.5	100.0
Ruvuma	72.4	10.8	14.8	2.0	100.0
Mbeya	46.6	6.9	35.6	10.9	100.0
Total	**52.6**	**5.5**	**37.8**	**4.1**	**100.0**

Table 6.2: The main buyer of soybeans for the 2022/23 season

Soybean main buyers	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Middlemen	60.5	4.0	9.5	1.3	89.7	16.6	30.7	28.0
Brockers	18.6	15.9	41.0	10.2	5.2	34.4	10.9	21.6
Company under contract	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.2
Walk in sell at farm gates	0.0	2.0	1.0	0.0	2.8	0.0	0.0	1.0
Aggregation centers	0.0	4.5	0.5	0.0	0.0	12.6	0.0	3.8
Through WRS	0.0	0.0	1.0	0.6	0.0	12.6	0.0	3.3
Company	1.2	0.0	3.0	1.9	0.0	1.0	13.9	2.1
Have not sold yet	9.3	57.2	26.0	83.4	1.9	14.6	25.7	30.2
NGOs/AMCOS	0.0	4.0	0.0	0.0	0.0	0.3	0.0	0.7
A buyer within the village	10.5	7.5	17.0	2.5	0.0	6.6	7.9	7.1
Other	0.0	3.5	1.0	0.0	0.5	1.3	10.9	2.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

6.1 Amount of Soybeans Marketed within Two-Three Months after Harvesting

The survey revealed that by the end of July over 64% of the farmers had already sold their soybeans and almost 97% of the farmers in Songwe had already traded their harvests (Table 6.3). Similarly, 85% and 81% of farmers in Morogoro and Ruvuma, respectively, had their products sold by the end of July 2023 but only 15% of farmers had done so in Rukwa. This implies that of 450 tonnes produced by the surveyed farmers 350 tonnes (77%) were already traded by the end of July 2023. These findings imply that the market for soybeans in Tanzania is readily available. Tables 6.4 and 6.5 show the distribution of the amount of soybeans (in kg) that were already sold by farmers during the survey and the quantity that remained unsold.

Table 6.3: Percentage of farmers who sold their soybeans for the 2022/23 season

Regions	No	Yes	Total
Morogoro	15.3	84.7	100.0
Iringa	63.1	36.9	100.0
Njombe	37.0	63.0	100.0
Rukwa	85.3	14.7	100.0
Songwe	3.4	96.6	100.0
Ruvuma	19.4	80.6	100.0
Mbeya	36.6	63.4	100.0
Total	**35.9**	**64.1**	**100.0**

Table 6.4: The quantity of soybeans (in kg) sold in the 2022/23 season during the survey

Region	Mean	STD	CV	Min	Median	Max	Sum	# of farmers
Iringa	156.49	211.87	135.4	10.0	100	1,200	11,737	75
Mbeya	1,037.06	3,619.67	349.0	15.0	210	25,000	66,372	64
Morogoro	293.68	480.36	163.6	-	150	2,500	21,145	72
Njombe	203.71	205.92	101.1	4.0	135	1,200	25,667	126
Rukwa	856.09	1,682.70	196.6	-	200	8,000	19,690	23
Ruvuma	395.42	530.11	134.1	-	240	4,560	96,879	245
Songwe	540.37	700.06	129.6	18.0	330	7,810	107,533	199
Overall	**434.11**	**1,190.35**	**274.2**	**-**	**200**	**25,000**	**349,023**	**804**

Table 6.5: The quantity (in kg) of soybeans left unsold for the 2022/23 season during the survey

Region	Mean	STD	CV	Min	Median	Max	Sum	# of farmers
Iringa	184.24	333.19	180.85	3	83	2000	15660	85
Mbeya	117.81	294.84	250.25	2	20	1870	6362	54
Morogoro	39.36	51.78	131.57	3	25	400	2755	70
Njombe	57.28	131.61	229.75	2	40	1500	9853	172
Rukwa	129.78	394.66	304.11	1	40	5000	56582	436
Ruvuma	123.19	288.73	234.38	1	24	2500	29319.5	238
Songwe	113.51	315.58	278.02	5	36	3850	20999	185
Overall	124.45	351.63	282.55	1	36	5000	106900.5	859

6.2 Price Distribution of Soybean in the Study Regions

The average maximum price of soybeans for the 2022/23 harvesting seasons per kilogram ranged from TZS 700 to TZS 1,500 per kilogram but in Morogoro, the maximum price was close to TZS 2,000/kg. Ruvuma had the lowest price distribution at TZS 713 per kilogram. The price variability was high in Rukwa (45%) and Songwe (39%) with Iringa and Njombe having the lowest price variability of 20% and 24% respectively. Table 6.6 summarizes the maximum price distribution for soybeans in the study areas.

Table 6.6: Summary statistics for price distribution of soybeans for the 2022/23 season

Region	Mean	StDev	CV	Min	Median	Max
Iringa	1,418.37	287.04	20.24	1000	1,300	2,000
Mbeya	1,221.60	463.62	37.95	500	1,000	2,000
Morogoro	1,979.41	587.67	29.69	500	2,300	2,600
Njombe	1,453.46	353.70	24.34	500	1,467	2,667
Rukwa	1,195.69	539.15	45.09	500	1,000	2,250
Ruvuma	713.15	205.94	28.88	360	700	2,000
Songwe	1,547.62	596.42	38.54	300	1,750	2,500
Overall	1,269.89	580.19	45.69	300	1,200	2,667

The results in Table 6.7 also showed that only 2.6% of soybean farmers graded their soybean according to the required market quality; Njombe (8%) and Rukwa (3.8%) led the number of farmers who graded soybeans.

Table 6.7: Farmers who graded their soybean (expressed in %) by region

Regions	No	Yes	Total
Morogoro	100.0	0.0	100.0
Iringa	99.0	1.0	100.0
Njombe	92.0	8.0	100.0
Rukwa	96.2	3.8	100.0
Songwe	98.1	1.9	100.0
Ruvuma	98.7	1.3	100.0
Mbeya	99.0	1.0	100.0
Total	**97.4**	**2.6**	**100.0**

6.3 Access to Market Information

Access to marketing is a critical factor in the success of any business, including the soybean sector. It refers to the ability of producers, particularly farmers, to reach and engage with various markets for their products and to acquire quality inputs for soybean production. The study revealed that 61% of the soybean farmers had access to market information on inputs and 55% were aware of the sources of those inputs (tables 6.8 and 6.9). When asked about access to the market information on potential buyers only 32% of the farmers disclosed to have access to that particular information. Also, 42% of the farmers had access to information on output prices but farmers in Songwe and Morogoro were more informed on output prices than farmers in other regions (Appendix 27).

Table 6.8: Access to the market information on input prices by region (expressed in %)

Regions	No	Yes	Total
Morogoro	8.2	91.8	100.0
Iringa	28.1	71.9	100.0
Njombe	2.0	98.0	100.0
Rukwa	49.4	50.6	100.0
Songwe	21.8	78.2	100.0
Ruvuma	83.6	16.4	100.0
Mbeya	45.5	54.5	100.0
Total	**39.0**	**61.0**	**100.0**

The most important source of market information (Appendix 28 and Table 6.10) for soybeans was through farmers themselves (44%) and extension officers (28%). Other sources of information include mobile phones (14%), cooperative unions (AMCOS) (6.7%), and middlemen (4%). Extension officers play a key role in Morogoro (82%) and Rukwa (52%) while sharing information with other farmers had a significant impact in Mbeya (61%), Njombe (54%), Ruvuma (53%) and Iringa (39%).

Table 6.9: Access to the market information on sources of inputs

Regions	No	Yes	Total
Morogoro	5.9	94.1	100.0
Iringa	26.6	73.4	100.0
Njombe	16.5	83.5	100.0
Rukwa	48.7	51.3	100.0
Songwe	35.9	64.1	100.0
Ruvuma	89.5	10.5	100.0
Mbeya	55.4	44.6	100.0
Total	**45.4**	**54.6**	**100.0**

Table 6.10: Major sources of market information for soybeans

Sources of market information	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Extension officers	81.6	36.8	30.4	51.9	2.1	2.6	18.3	28.0
Radio	0.0	0.3	1.6	2.9	0.6	11.5	0.0	1.5
Mobile phones	1.0	0.3	13.6	8.7	35.2	3.8	15.9	13.9
Newspapers	0.0	0.3	0.0	0.0	0.3	1.3	1.2	0.3
Sharing information with other farmers	12.2	39.4	54.1	31.7	46.2	52.6	61.0	44.0
Cooperatuive union (AMCOS)	4.1	19.5	0.0	1.9	0.0	21.8	0.0	6.7
Middlemen	0.0	0.0	0.0	1.0	15.1	1.3	1.2	4.0
Projects/NGOs	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.8
Other	1.0	0.3	0.3	1.9	0.6	5.1	2.4	1.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

CHAPTER SEVEN

7.0 Financial Services and Credit Marketing of Soybeans

Understanding and having access to financial services is crucial for soybean farmers and, indeed, for farmers in any agricultural sector. Access to financial services provides farmers with the capital they need to invest in their soybean farming operations. This includes purchasing seeds, fertilizers, pesticides, machinery and other essential inputs required for cultivation. Farmers can use loans and credit facilities to expand their soybean farming activities, diversify their crops, or invest in additional income-generating ventures. This would allow farmers to increase their agricultural production and profitability.

7.1 Access to Financial Services

The survey asked farmers if they have used financial services in their farm operations and the results show that over 90% of the interviewees reported having no access to and even never used financial services in their farm activities.

Table 7.1: Use of financial services for the 2022/23 season by regions

Regions	No	Yes	Total
Morogoro	100.0	0.0	100.0
Iringa	97.5	2.5	100.0
Njombe	53.0	47.0	100.0
Rukwa	96.2	3.8	100.0
Songwe	100.0	0.0	100.0
Ruvuma	93.4	6.6	100.0
Mbeya	100.0	0.0	100.0
Total	**90.0**	**10.0**	**100.0**

Unlike for farmers in Njombe, only less than 7% of the respondents had used financial services and none of the farmers have ever used crop insurance in soybean farming (Table 7.2).

Table 7.2: Use of crop insurance for the 2022/23 season by region

Regions	No	Yes	Total
Morogoro	100.0	0.0	100.0
Iringa	100.0	0.0	100.0
Njombe	100.0	0.0	100.0
Rukwa	100.0	0.0	100.0
Songwe	100.0	0.0	100.0
Ruvuma	100.0	0.0	100.0
Mbeya	100.0	0.0	100.0
Total	**100.0**	**0.0**	**100.0**

CHAPTER EIGHT

8.0 Social or Community Membership

Farmers' social or community membership holds significant importance for several reasons, as it fosters collaboration, knowledge exchange, collective action, and overall agricultural development. Being part of a farmers' community provides numerous benefits to individual farmers, their families, and the broader agricultural sector.

8.1 Presence of Social or Community Membership in the Regions

The baseline survey was aware that farmers' communities serve as platforms for sharing traditional knowledge, best practices, and innovative farming techniques. Members can learn from each other's successes and challenges, enhance their skills and agricultural expertise. Likewise, through community interactions, farmers can acquire new skills related to crop management, modern techniques, and other aspects of the supply chain. The survey disclosed that over 45% of the farmers interviewed agreed that there are farmers/producers groups in their villages (Table 8.1; Appendix 29).

Table 8.1: Presence of farmers/producers' groups in the village/area

Regions	No	Yes	Total
Morogoro	2.4	97.6	100.0
Iringa	7.4	92.6	100.0
Njombe	62.5	37.5	100.0
Rukwa	94.2	5.8	100.0
Songwe	68.0	32.0	100.0
Ruvuma	58.9	41.1	100.0
Mbeya	76.2	23.8	100.0
Total	**54.6**	**45.4**	**100.0**

8.2 Membership to Farmers/Producers/Village Associations

During the baseline surely, the farmers were asked if they were members of any farmers' groups or associations and the results in Table 8.2 show that about 77% of the respondents were members of the associations.

Table 8.2: Farmers/producers groups membership by surveyed regions

Regions	No	Yes	Total
Morogoro	9.6	90.4	100.0
Iringa	5.3	94.7	100.0
Njombe	33.3	66.7	100.0
Rukwa	11.1	88.9	100.0
Songwe	57.6	42.4	100.0
Ruvuma	27.2	72.8	100.0
Mbeya	70.8	29.2	100.0
Total	**23.3**	**76.7**	**100.0**

Furthermore, the farmers also agreed to participate in the group meetings by 96% (Appendix 28) and over 58% of the farmers confirmed to receive extension-related training as presented (Appendix 30). In most cases, the training is supported by the government by 49% and NGOs by 42% (Table 8.3).

Table 8.3: Soybeans training providers on soybean farming practices

Training Provider on Soybeans	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
The government	89.9	33.0	57.1	50.0	100.0	9.1	0.0	48.8
Research institution	0.0	9.1	0.0	16.7	0.0	0.0	20.0	6.0
NGO	6.3	57.4	28.6	16.7	0.0	81.8	60.0	41.8
Private sector	3.8	0.6	9.5	16.7	0.0	0.0	20.0	2.7
I don't know	0.0	0.0	4.8	0.0	0.0	9.1	0.0	0.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

8.3 Prospects of Soybeans in the Future

Farmers were asked about their perception of the prospects of soybeans in the future and the results in Table 8.4 show that over 85% of the farmers see a bright future for soybean production and most of them (> 48%) had a plan to expand their production areas of soybeans and expand the production levels (Table 8.5). On budget preparation, farmers agreed by 57% that they have a habit of preparing a budget when cultivating their farms for soybean production but in most cases, the preparation of the budget is done intuitively i.e., in the head (Appendices 31 & 32). In general, over 55.4% of the farmers interviewed did not have estimated costs used in soybean production (Appendix 33).

Table 8.4: Prospects of soybeans in the future

Regions	No	Yes	Total
Morogoro	23.5	76.5	100.0
Iringa	17.7	82.3	100.0
Njombe	8.0	92.0	100.0
Rukwa	17.3	82.7	100.0
Songwe	4.4	95.6	100.0
Ruvuma	12.8	87.2	100.0
Mbeya	37.6	62.4	100.0
Total	**14.7**	**85.3**	**100.0**

Table 8.5: Farmers plan for future soybean production (in the next 2–5 years)

	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Expand production areas of soybean.	31.8	50.2	43.5	48.7	58.3	48.4	52.5	48.8
Maintain the current production area.	20.0	18.7	17.5	1.9	14.6	19.4	10.9	15.4
Expand production level	40.0	18.7	25.0	38.5	17.5	19.4	5.9	22.5
Maintain the current level of production.	3.5	4.4	12.0	0.6	1.0	1.6	6.9	4.1
Cut production in favor of other legumes.	4.7	3.4	0.5	0.0	1.5	1.3	2.0	1.7
Do not have plan	0.0	1.5	0.5	8.3	1.5	2.3	11.9	3.1
Others	0.0	3.0	1.0	1.9	5.8	7.6	9.9	4.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The soybean farmers 's production cost per unit area is summarized in Table 8.6 (see also Appendix 34). The overall cost per ha distribution shows an average of TZS 452,340 with a maximum cost of TZS 1.235 million (TZS 183,134 to 500,000 per acre). Of all the regions, Iringa and Morogoro presented the highest average production cost per ha (TZS 824,071). Mbeya also is the region with the highest production costs followed by Njombe.

Table 8.6: Distribution of production cost of soybeans per ha per region

Region	Mean	STD	CV	Min	Median	Max
Iringa	824,071	278,932	33.85	370,500	864,500	1,235,000
Mbeya	449,046	100,203	22.31	247,000	456,950	592,800
Morogoro	614,146	289,084	47.07	123,500	617,500	1,235,000
Njombe	443,397	302,701	68.27	49,400	395,200	1,235,000
Rukwa	381,306	326,208	85.55	123,500	247,000	1,235,000
Ruvuma	363,609	171,877	47.27	49,400	354,445	1,111,500
Songwe	330,363	180,794	54.73	24,700	370,500	876,850
OVERALL	**452,341**	**279,836**	**61.86**	24,700	370,500	1,235,000

CONCLUSIONS AND RECOMMENDATIONS

Since farmers reported climate variability as one of the major challenges facing the soybean industry, the baseline study recommended on implementation of policies and programs to increase the availability of certified and high-quality soybean seeds to farmers. The TSSI and the soybean practitioners have to support the development of a robust seed multiplication and distribution system, including both public and private sectors, to enhance access to high-quality soybean seeds for farmers.

Allocation of resources for research on soybean varieties adapted to local conditions, including drought-tolerant and pest-resistant varieties, should be given due priority. Collaborative research between government research institutions and universities like TARI-Ilonga, TARI-Uyole, Sokoine University of Agriculture (SUA) and private seed companies to develop improved and promising soybean varieties. Also, extension services on climate-smart agriculture, conservation tillage, crop rotation and improved water management, to enhance the resilience of soybean production to climate change should be highly encouraged.

Soybean processing was reported to be one of the challenges facing smallholder farmers in Tanzania; thus, the baseline study recommends the promotion of value-addition through the establishment of soybean processing plants such as soybean oil extraction and soy-based food product manufacturing. Likewise, TSSI should invest in data collection of market information and dissemination systems to provide farmers with timely information on market prices, as well as weather forecasts, and agricultural best practices.

The survey observed low access to credit and limited access to financial services to farmers and therefore recommended the facilitation of access to affordable credit and financial services for smallholder soybean farmers. This will enable them to invest in inputs, machinery and related technologies for enhanced productivity.

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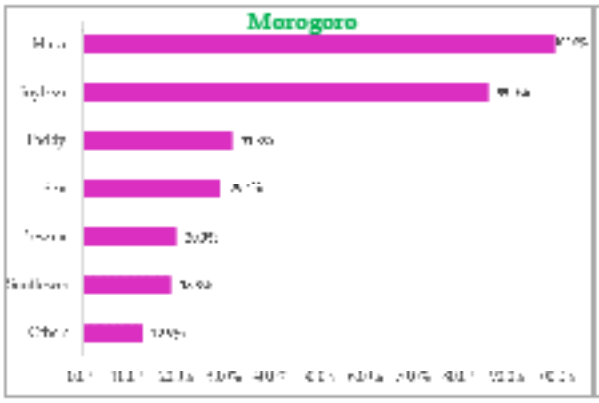
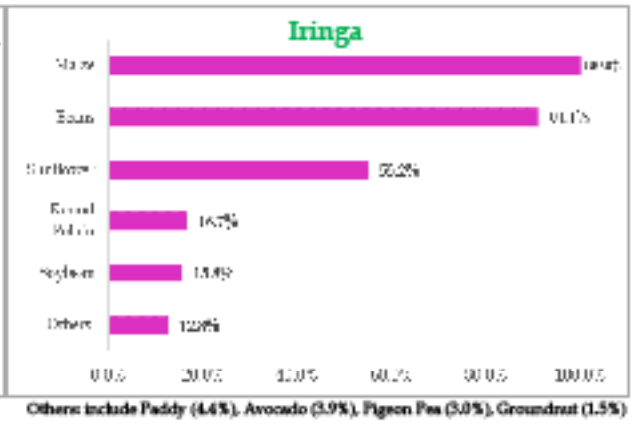
APPENDICES

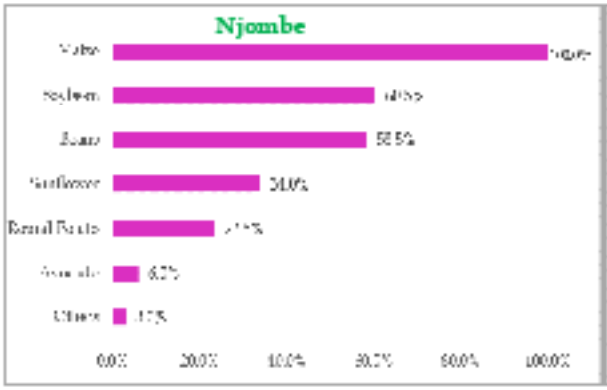
Appendix 1: Major crops grown by study's regions



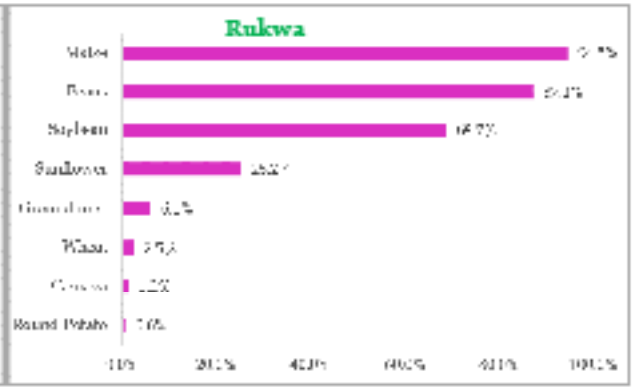
Others: include Beans (5.9%), Cassava (2.4%), Round Potatoes (1.2%).

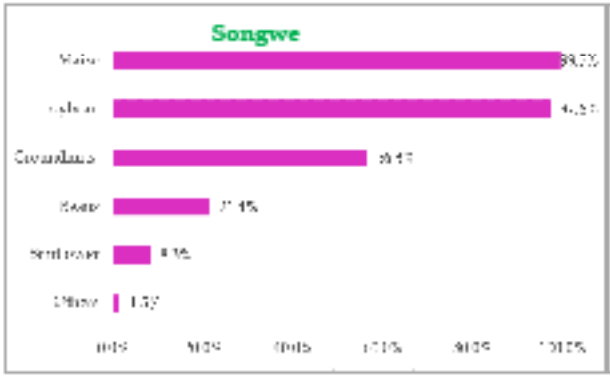


Others: include Paddy (4.4%), Avocado (3.9%), Pigeon Pea (3.0%), Groundnut (1.5%)

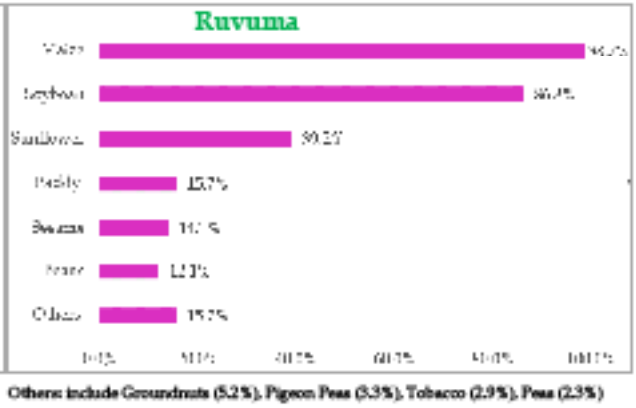


Others: include Paddy (1.0%), Pigeon Pea (1.0%), Cassava (0.5%), Cowpea (0.5%)

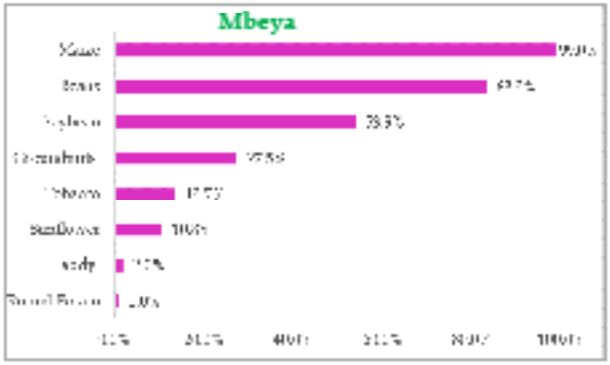




Others: include Pigeon Peas (0.5%), Cassava (0.5%), Peas (0.5%)



Others: include Groundnuts (5.2%), Pigeon Peas (3.3%), Tobacco (2.9%), Peas (2.3%)



Appendix 2: Type of Livestock reared per region

Region	Poultry	Cattle	Pigs	Goat	Sheep	Total
Morogoro	60.0	12.0	8.0	20.0	0.0	100.0
Iringa	53.0	21.2	22.8	3.0	0.0	100.0
Njombe	34.4	36.9	24.6	4.1	0.0	100.0
Rukwa	36.0	33.5	7.3	22.0	1.2	100.0
Songwe	41.3	25.6	8.3	23.1	1.7	100.0
Ruvuma	38.1	9.8	21.7	30.3	0.0	100.0
Mbeya	52.5	19.2	19.2	9.1	0.0	100.0
OVERALL	**43.0**	**23.5**	**17.5**	**15.5**	**0.5**	**100.0**

Appendix 3: Application of irrigation technologies in the study area

Regions	No	Yes	Total
Morogoro	100.0	0.0	100.0
Iringa	99.5	0.5	100.0
Njombe	100.0	0.0	100.0
Rukwa	100.0	0.0	100.0
Songwe	100.0	0.0	100.0
Ruvuma	99.7	0.3	100.0
Mbeya	100.0	0.0	100.0
Total	**99.8**	**0.2**	**100.0**

Appendix 4: Number of times farmers rotate soybeans with other crops

	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Every season	48.9	9.3	8.1	32.7	70.0	60.7	65.0	41.7
Every year	20.0	84.6	86.6	60.4	29.4	34.8	28.3	52.5
Every other year	31.1	6.2	0.6	2.0	0.6	1.9	3.3	3.5
Every three years	0.0	0.0	0.6	0.0	0.0	1.9	1.7	0.7
Only when I have problems, such as seed unavailability	0.0	0.0	4.1	1.0	0.0	0.0	0.0	0.8
Other	0.0	0.0	0.0	4.0	0.0	0.7	1.7	0.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Appendix 5: Reasons for soybean rotation

Reasons for rotation	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
To improve soil	54.9	49.2	78.1	62.3	60.2	60.6	60.8	60.4
To increase yield	44.9	50.2	21.4	36.4	39.8	39.4	39.2	39.2
I only rotate crops when I have problems, such as seed unavailability	1.2	0.6	0.5	1.3	0.0	0.0	0.0	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Appendix 6: Soybeans intercropping practices by regions

Regions	No	Yes	Total
Morogoro	79.8	20.2	100.0
Iringa	80.1	19.9	100.0
Njombe	96.4	3.6	100.0
Rukwa	89.4	10.6	100.0
Songwe	42.4	57.6	100.0
Ruvuma	55.1	44.9	100.0
Mbeya	95.5	4.5	100.0
Total	**72.6**	**27.4**	**100.0**

Appendix 7: Perception of farmers on the seeds used (in term of short/tall)

Regions	Tall	Short	Don't know	Total
Morogoro	60.6	38.0	1.4	100.0
Iringa	83.9	4.8	11.3	100.0
Njombe	2.7	97.3	0.0	100.0
Rukwa	63.6	27.3	9.1	100.0
Songwe	89.6	10.4	0.0	100.0
Ruvuma	70.0	29.0	1.0	100.0
Mbeya	40.0	20.0	40.0	100.0
Total	**52.2**	**44.5**	**3.3**	**100.0**

Appendix 8: Soybean seed germination rate (in three scales: Very Good, Good, & Poor)

Regions	Very Good	Good	Poor	Total
Morogoro	62.5	37.5	0.0	100.0
Iringa	96.2	3.8	0.0	100.0
Njombe	74.3	25.7	0.0	100.0
Rukwa	19.4	78.3	2.3	100.0
Songwe	100.0	0.0	0.0	100.0
Ruvuma	50.0	50.0	0.0	100.0
Mbeya	75.0	25.0	0.0	100.0
Total	**61.5**	**37.7**	**0.8**	**100.0**

Appendix 9: Adherence to standard spacing during soybean planting

Regions	No	Yes	Total
Morogoro	0.0	100.0	100.0
Iringa	3.2	96.8	100.0
Njombe	51.3	48.7	100.0
Rukwa	30.3	69.7	100.0
Songwe	84.4	15.6	100.0
Ruvuma	76.3	23.7	100.0
Mbeya	59.5	40.5	100.0
Total	**50.8**	**59.2**	**100.0**

Appendix 10: Planting Calendar (weeks within or after the rains)

Planting Calendar	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Within one week of rain started	19.0	19.9	17.9	21.2	9.3	24.7	25.0	19.4
One week after the rains started	78.6	53.1	27.6	31.1	20.0	30.8	35.2	35.7
Mid of the rainy season	1.2	16.3	54.6	45.7	17.6	42.1	19.3	31.8
End of the rainy season	1.2	9.7	0.0	1.3	0.0	1.7	3.4	2.5
One month after the rain	0.0	0.0	0.0	0.0	46.3	0.0	14.8	8.9
Two months after the rain	0.0	0.0	0.0	0.0	5.4	0.0	2.3	1.1
Other	0.0	1.0	0.0	0.7	1.5	0.7	0.0	0.7
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Appendix 11: Ways/methods of planting soybeans

Decision to buy	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Hand hoe	42.9	98.0	55.1	92.7	100.0	52.1	85.2	74.9
Draft animals followed by people planting	1.2	2.0	39.8	6.0	0.0	0.0	11.4	8.4
Tractor followed by people planting	0.0	0.0	0.0	0.7	0.0	2.1	0.0	0.6
Small planters	8.3	0.0	4.1	0.0	0.0	2.1	1.1	1.8
Wooden Stick	19.0	0.0	0.0	0.0	0.0	17.1	1.1	5.5
Panga (sword)	28.6	0.0	0.0	0.0	0.0	0.0	0.0	2.0
My leg/the heel	0.0	0.0	0.5	0.0	0.0	13.7	0.0	3.4
Both stick & the heel	0.0	0.0	0.0	0.0	0.0	9.2	0.0	2.2
Both stick & hands	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.6
Others	0.0	0.0	0.5	0.7	0.0	1.4	1.1	0.6
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Appendix 12: Soybean weeding

Regions	No	Yes	Total
Morogoro	1.2	98.8	100.0
Iringa	0.5	99.5	100.0
Njombe	3.1	96.9	100.0
Rukwa	1.3	98.7	100.0
Songwe	2.4	97.6	100.0
Ruvuma	2.7	97.3	100.0
Mbeya	8.0	92.0	100.0
Total	**2.5**	**97.5**	**100.0**

Appendix 13: Time for the first weeding of soybean

First weeding	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Within 3 weeks after planting	43.4	73.8	93.7	92.6	22.6	33.6	45.7	57.0
After a month (4 weeks)	55.4	26.2	4.2	7.4	65.3	61.1	54.3	39.3
Within 2 months (8 weeks)	1.2	0.0	0.0	0.0	12.1	2.1	0.0	2.6
Used weedi-cides during planting	0.0	0.0	2.1	0.0	0.0	3.2	0.0	1.1
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Appendix 14: Number of times farmers weed their soybean farms

Regions	Didn't weed at all	Once	Twice	More than 2 times	Total
Morogoro	0.0	13.3	60.2	26.5	100.0
Iringa	0.0	9.7	88.2	2.1	100.0
Njombe	0.5	37.4	61.6	0.5	100.0
Rukwa	0.0	29.5	69.1	1.4	100.0
Songwe	0.0	81.0	19.0	0.0	100.0
Ruvuma	0.0	71.1	28.5	0.4	100.0
Mbeya	0.0	50.6	42.0	7.4	100.0
Total	**0.1**	**46.5**	**50.3**	**3.1**	**100.0**

Appendix 15: Extension service provider on fertilizer application

Extension Service Provider	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Extension officers (EO)	96.4	78.3	23.4	18.2	42.1	25.0	0.0	55.5
Fellow farmers	3.6	1.7	10.9	0.0	26.3	0.0	50.0	6.0
Both EO & fellow farmers	0.0	7.0	28.1	0.0	0.0	0.0	0.0	9.8
Own knowledge	0.0	3.5	35.9	78.8	15.8	75.0	0.0	22.3
NGOs/Projects	0.0	9.6	1.6	0.0	10.5	0.0	50.0	5.7
Others	1.2	0.0	0.0	3.0	5.3	0.0	0.0	0.8
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Have you ever been trained on how to apply inoculants?

Appendix 16: Farmers who received training on inoculants

Regions	No	Yes	Total
Morogoro	12.2	87.8	100.0
Iringa	15.5	84.5	100.0
Njombe	8.1	91.9	100.0
Rukwa	50.0	50.0	100.0
Songwe	0.0	100.0	100.0
Ruvuma	18.2	81.8	100.0
Mbeya	72.7	27.3	100.0
Total	**13.8**	**86.2**	**100.0**

What methods did you use to reduce damage in your soya crop?

Appendix 17: Methods used to reduce damage in soybean fields

Fertilizer type	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Applied insecticides	35.4	32.6	5.1	31.4	21.7	4.3	4.8	19.4
Applied fungicides	0.0	23.9	10.3	5.7	0.5	0.0	0.0	3.9
Applied herbicides	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.2
Applied pesticides	60.4	39.1	74.4	34.3	37.5	15.2	33.3	38.3
Plant trap crops	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.2
Plant bad smell trees	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.2
Scary wind driven ballons	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.2
Uprooting diseased plants	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.4
Did nothing	4.2	0.0	10.3	25.7	38.6	80.4	61.9	37.2
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

What integrated soil fertility management practices do you use?

Appendix 18: Types of soil fertility management practices used

Practices	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Soil erosion control	5.7	9.0	5.1	29.2	25.0	1.2	7.8	11.9
Crop residue	40.8	19.4	19.9	4.9	20.8	27.8	19.0	20.0
Crop rotation	29.3	18.7	37.5	10.1	28.7	58.0	28.7	28.6
Fallow	16.7	13.5	11.4	7.3	8.2	6.4	19.0	11.2
Organic fertilizer	0.0	12.7	17.8	1.7	15.9	1.6	6.7	9.5
Integrated pest management	2.3	9.8	1.3	1.3	0.5	0.2	7.1	4.1
Inorganic fertilizer	1.7	10.6	0.6	21.5	0.7	2.5	7.1	7.5
Water management	3.4	0.0	0.2	23.4	0.2	0.4	0.7	3.7
Training	0.0	0.8	1.9	0.2	0.0	0.4	0.0	0.6
Microbial inoculants	0.0	5.5	4.2	0.2	0.0	1.4	3.7	2.8
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Appendix 19: What climate-smart practices are you aware of and adopted

Climate-Smart Practices	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Crop management	56.8	39.0	61.5	9.5	43.9	48.1	37.1	41.9
Soil management	37.2	37.2	15.7	25.8	43.6	45.1	40.1	35.7
Pest&diseases management	5.4	21.1	6.6	13.1	12.5	4.7	15.6	12.1
Shade trees	0.7	2.5	15.0	2.2	0.0	0.7	0.0	3.1
Water conservation	0.0	0.2	1.0	49.5	0.0	1.4	7.2	7.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

On timing the harvest, what indicators of the soy crop did you use?

Appendix 20: Indicators of the soybean on timely harvesting

Harvest Indicators	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
When the pods turned straw-colored	43.2	43.5	40.4	58.5	38.3	29.4	44.6	41.1
When the seeds are at the hard-dough stage	14.2	20.7	20.6	27.7	3.1	23.2	9.6	18.4
When soybean leaves start falling	42.6	35.9	38.8	13.8	58.3	35.7	39.0	38.5
When the plant fallows	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.7
When the grains/ seeds start peeling off	0.0	0.0	0.0	0.0	0.0	2.9	6.8	1.3
Others	0.0	0.0	0.2	0.0	0.3	5.9	0.0	0.0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

How did you package your soybeans?

Appendix 21: Packaging of soybean

Soybeans Packaging Materials	Morogoro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Place 50-kg or 100-kg bags	85.9	73.9	28.5	96.2	39.3	23.7	55.4	50.9
Above 100-kg bags	9.4	8.9	25.0	3.8	56.8	58.6	30.7	32.5
Both 50-kg to Above 100-kg bags	0.0	3.4	9.5	0.0	0.5	15.5	11.9	6.9
Never package, I sell to door-to-door buyers who do the packaging	2.4	1.5	30.5	0.0	0.0	1.3	0.0	5.6
Others	2.4	12.3	6.5	0.0	3.4	1.0	2.0	4.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Do you have home-based soybean food processing equipment that enables soybean consumption at a household level?

Appendix 22: Possession of home-based soybean food processing equipment/tools

Regions	No	Yes	Total
Morogoro	60.0	40.0	100.0
Iringa	95.1	4.9	100.0
Njombe	100.0	0.0	100.0
Rukwa	91.7	8.3	100.0
Songwe	98.1	1.9	100.0
Ruvuma	93.4	6.6	100.0
Mbeya	92.1	7.9	100.0
Total	**92.9**	**7.1**	**100.0**

Do you know how to prepare soybean for consumption?

Appendix 23: Knowledge of soybean preparation for consumption

Soybeans Drying	Moro-goro	Iringa	Njombe	Rukwa	Songwe	Ruvuma	Mbeya	Total
Don't know how	2.4	2.6	3.5	1.3	43.2	44.5	35.0	22.2
Don't have equipmant/tools	11.8	63.2	59.3	45.8	15.0	12.3	25.0	33.4
Yes, I do it traditionally	55.3	17.6	35.2	47.7	9.7	22.6	27.0	27.4
Don't use it for food	9.4	8.3	1.0	3.9	26.7	18.9	10.0	12.4
I take my soybean to milling machine	16.5	7.3	1.0	1.3	4.9	1.7	3.0	4.0
Yes, I use blender	4.7	1.0	0.0	0.0	0.5	0.0	0.0	0.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Do you have enough storage capacity to store soybean?

Appendix 24: Storage capacity of soybean

Regions	No	Yes	Total
Morogoro	3.5	96.5	100.0
Iringa	27.1	72.9	100.0
Njombe	32.0	68.0	100.0
Rukwa	41.7	58.3	100.0
Songwe	20.1	69.9	100.0
Ruvuma	43.4	56.6	100.0
Mbeya	30.7	69.3	100.0
Total	**32.8**	**67.2**	**100.0**

Do you have access to the community warehouse?

Appendix 25: Access to the community warehouses

Regions	Yes	No, haven't access	No community warehouse at all	Total
Morogoro	9.4	1.2	89.4	100.0
Iringa	31.0	5.4	63.5	100.0
Njombe	16.5	14.0	69.5	100.0
Rukwa	0.0	6.4	93.6	100.0
Songwe	0.0	30.6	69.4	100.0
Ruvuma	29.3	34.9	35.9	100.0
Mbeya	16.8	7.9	75.2	100.0
Total	**16.7**	**18.1**	**65.2**	**100.0**

Is the storage capacity enough?

Appendix 26: Storage capacity of community warehouses

Regions	No	Yes	Total
Morogoro	12.5	98.8	100.0
Iringa	44.4	55.6	100.0
Njombe	18.2	81.8	100.0
Rukwa	-	-	-
Songwe	-	-	-
Ruvuma	23.6	76.4	100.0
Mbeya	76.5	23.5	100.0
Total	**32.9**	**67.1**	**100.0**

Do you have access to the market information on potential soybean buyers?

Appendix 27: Access to the market information on potential soybean buyers

Regions	No	Yes	Total
Morogoro	22.4	77.6	100.0
Iringa	63.5	36.5	100.0
Njombe	54.0	46.0	100.0
Rukwa	89.1	10.9	100.0
Songwe	32.0	68.0	100.0
Ruvuma	98.4	1.6	100.0
Mbeya	90.1	9.9	100.0
Total	**67.8**	**32.2**	**100.0**

Do you have access to the market information on output prices?

Appendix 28: Access to the market information on output prices

Regions	No	Yes	Total
Morogoro	16.5	83.5	100.0
Iringa	57.6	42.4	100.0
Njombe	41.0	59.0	100.0
Rukwa	92.9	7.1	100.0
Songwe	6.8	93.2	100.0
Ruvuma	95.4	4.6	100.0
Mbeya	63.4	36.6	100.0
Total	**57.8**	**42.2**	**100.0**

Do you attend producer group meetings?

Appendix 29: Farmers/producers attendance to producer groups

Regions	No	Yes	Total
Morogoro	0.0	100.0	100.0
Iringa	3.9	96.1	100.0
Njombe	14.0	86.0	100.0
Rukwa	0.0	100.0	100.0
Songwe	0.0	100.0	100.0
Ruvuma	2.2	97.8	100.0
Mbeya	0.0	100.0	100.0
Total	**3.7**	**96.3**	**100.0**

Did you receive any training so far since the beginning of this season 2022/23?

Appendix 30: Training provision to soybeans farmers/producers

Regions	No	Yes	Total
Morogoro	5.3	94.7	100.0
Iringa	18.3	81.7	100.0
Njombe	67.4	32.6	100.0
Rukwa	50.0	50.0	100.0
Songwe	100.0	0.0	100.0
Ruvuma	87.5	12.5	100.0
Mbeya	28.6	71.4	100.0
Total	**41.9**	**58.1**	**100.0**

Do you always prepare a farm budget when farming?

Appendix 31: Farmers' budget preparation habit

Regions	No	Yes	Total
Morogoro	29.4	70.6	100.0
Iringa	44.3	55.7	100.0
Njombe	10.5	89.5	100.0
Rukwa	51.3	48.7	100.0
Songwe	47.6	52.4	100.0
Ruvuma	53.6	46.4	100.0
Mbeya	62.4	37.6	100.0
Total	**43.0**	**57.0**	**100.0**

What is the form of the farm budget?

Appendix 32: Type of farm budget prepared

Regions	Written	In head (intuitively)	Total
Morogoro	71.7	28.3	100.0
Iringa	85.8	14.2	100.0
Njombe	7.3	92.7	100.0
Rukwa	21.1	78.9	100.0
Songwe	14.8	85.2	100.0
Ruvuma	29.1	70.9	100.0
Mbeya	2.6	97.4	100.0
Total	**31.7**	**68.3**	**100.0**

Do you have estimates on how much it has so far costed you to cultivate one acre of soybeans in 2022/23?

Appendix 33: Cost of producing soybeans per unit area

Regions	No	Yes	Total
Morogoro	3.5	96.5	100.0
Iringa	78.8	21.2	100.0
Njombe	69.0	31.0	100.0
Rukwa	74.4	25.6	100.0
Songwe	32.0	68.0	100.0
Ruvuma	46.1	53.9	100.0
Mbeya	71.3	28.7	100.0
Total	**55.4**	**44.6**	**100.0**

Appendix 34: The Profitability of soybeans per ha at different price levels

When the farmer decides to sell at a minimum price of TZS 700 per kg		
A	Average yield (kg/ha)	721.5
B	Price per kg	TZS 700
C	Receipt (Revenue) [A*B]	TZS 505,050.00
D	Total Average Production Cost per ha	TZS 452,340.98
E	***Net Revenue [C-D]***	***TZS 52,709.02***
When the farmer sells at TZS 900		
F	Price per kg	TZS 900
G	Revenue [F*A]	TZS 649,350.00
H	**Net Revenue**	**TZS 197,009.02**
When the farm sells at TZS 1000		
I	Price per kg	TZS 1000
J	Revenue [I*A]	TZS 721,500.00
K	**Net Revenue**	**TZS 269,159.02**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