TSSI
TANZANIA SUSTAINABLE SOYBEAN INITIATIVE

Report on the registration of Soybean growers in Southern Highlands and Morogoro region in Tanzania

SAGCOT SOUTHERN AGRICULTURAL GROWTH CORRIDOR OF TANZANIA
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Agricultural Sector Policy and Institutional Reforms Strengthening
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WAGENINGEN UNIVERSITY & RESEARCH

Tanzania Sustainable Soybean Initiative (TSSI)

Report on the registration of Soybean growers in Southern Highlands and Morogoro region in Tanzania

April 2024

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Cover photo: the farmer in his soybean farm in Songwe region.
Photo by Gloriana Ndibalema/IITA

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Acronyms

CRS	-	Catholic Relief Services (international NGO that worked on Soybean production promotion in Tanzania)
DAEO	-	District Agricultural Extension Office
FtMA	-	Farmer to Market Alliance (https://ftma.org/)
IITA	-	International Institute for Tropical Agriculture
N2Africa		Large Bill & Melinda Gates Foundation (BMGF) funded project on legume intensification in Africa, including Tanzania (2011−2019)
SAGCOT		Southern Agricultural Growth Corridor of Tanzania https://sagcot.co.tz/index.php/en/
TSSI	-	Tanzania Sustainable Soybean Initiative
WUR	-	Wageningen University and Research (The Netherlands) Plant Production Systems (PPS) group

Preface

The Tanzania Sustainable Soybean Initiative (TSSI) is a comprehensive and coordinated approach aimed at harnessing the potential of soybean cultivation to combat climate change and promote socio-economic development. Livelihood diversification is recognized as crucial for farmers to manage climate-related risks, and soybean cultivation emerges as a versatile solution backed up by various studies and literature.

The core objective of the TSSI is to maximize the positive impact of soybean cultivation by capitalizing on export opportunities, leveraging domestic utilization, and achieving efficiency in crop contribution to soil fertility, nutrition, and livelihood diversification.

The implementation of the TSSI relies on collaboration between various organizations. The Southern Agricultural Growth Corridor of Tanzania (SAGCOT) takes on the leading role of coordinating the initiative, working alongside partners such as the Farm to Market Alliance (FtMA), the International Institute of Tropical Agriculture (IITA), and ASPIRES Tanzania. The financial support from The Royal Norwegian Embassy plays a vital role in realizing the objectives of the TSSI. The wider concept is to bring key actors and stakeholders in the soybean business under a single umbrella through a framework agreement.

The development of a comprehensive compact agreement is a key result of the TSSI, which aims to harmonize and create synergies among all relevant actors and stakeholders in the soybean sector. The agreement will provide a guiding framework for targeted investment areas and ensure a clear direction and firm commitment from participating organizations.

To achieve these ends, a comprehensive and structured approach has been adopted. This includes the establishment of national frameworks for the soybean trade including providing the required support to the Government in crafting the National Soybean Development Strategy (NSDS) and assisting in the revision of the Grazing Land and Feed Resources Act of 2010. Such reviews aim among other areas to demarcate and designate additional land to larger scale soybean farming. Moreover, the initiative involves a detailed analysis of the soybean industry and the profiling of smallholder farmers, fostering conditions ripe for growth and market entry. Finally, the initiative focuses on integrating the input-output market, ensuring that production aligns with market demands ensuring that production meets the “fit for the market” criterion. As per the Sub-grantee agreement inked on April 18, 2023, the IITA has been entrusted with leading the farmer profiling activity across the seven regions within the program’s reach. This report delineates the findings and recommendations derived from this exercise.

Executive summary

The main aims of the farmer registration exercise of the Tanzania Sustainable Soybean Initiative (TSSI) were to: (1) create an up-to-date database of smallholder Soybean producers in Tanzania's main Soybean producing areas, the Southern Highlands and Morogoro regions, and (2) to identify clusters of Soybean production, to target project interventions.

However, farmer registration also provided an opportunity to gain more insight into Soybean growing farmers, their experiences, production practices, and yields they obtain, as well as their participation in markets and farmer organizations. Such information, which is reported upon here, is highly relevant to the TSSI's development and targeting of project activities.

Below, the key findings are summarized.

Sample strategy and relevance of findings
Since the aim was farmer registration, this report does not claim to provide a representative picture of the state of Soybean production in the Southern Highlands or Tanzania. Government extension workers independently registered Soybean growers in their respective operational areas. As *Soybean production in Tanzania is highly dispersed, with a few areas where production is concentrated, the spatial distribution of the dataset of registered farmers is highly uneven.* Nevertheless, the dataset of 20,777 farmers spread over 20 districts is substantially larger and more detailed on Soybean production practices than the TSSI baseline survey (n = 1,263) (Aspires, 2023). This study is probably the largest sample of smallholder Soybean growers in Tanzania to date.

Soybean producers and the importance of soybeans
Soybean growing in the Southern Highlands and Morogoro regions (Tanzania's high potential areas for Soybean production) is geospatially uneven. There are many growers in the Ruvuma and Iringa regions, but also in Mbozi district (Songwe) and parts of Njombe and Rukwa regions.

Most farmers have cultivated Soybean for less than five seasons. Soybean appears to be a more established crop only in specific districts such as Mbeya-rural, Njombe-rural, Mbozi, and in Ruvuma Region. The uptake of Soybean production is often the result of (past) NGO projects and government campaigns or learned from neighbors. Only in Rukwa, Ruvuma, and Songwe regions do farmers mention good market prices for Soybean as their main motivation for taking up Soybean production. Soybean cultivation is dominated by farmers in the 35−55 age category. In some areas, production is dominated by men (i.e., Rukwa), in other regions, the gender distribution is much more even. A higher percentage of young Soybean farmers in some districts should not be seen as a sign that Soybean is an economic opportunity that attracts young farmers. Soybean may also be grown because of a lack of alternative cash crops. While maize is an important crop for all soya bean-growing farmers, Soybean and common beans are most often among the three most important crops farmers cultivate. In many districts (Mufindi, Chunya, Mbeya-rural, Kilosa, Mvomero, Nkasi, Sumbawanga-rural), Soybean remains a minor crop, even for Soybean growers.

Soybean production, areas, productivity

Although agricultural statistics show a substantial increase over the past five years, the *increase in Soybean production in Tanzania appears to be primarily due to an increasing cultivated area and increasing number of farmers producing soya beans*. Average yields (at the district level) range from 500 to 1050 kg/ha, and these low figures cast doubt on the validity of FAO estimated figures (1,100−1,200 kg/ha) on Soybean yield in Tanzania. Fields are relatively small (0.2–0.7 ha), and farmers often overestimate the size of their Soybean fields. The largest Soybean fields are found in the Ruvuma Region where production is rather extensive. In Iringa-rural and Mufindi districts, Soybean production is relatively intensive. High-production areas are the Iringa and Ruvuma regions and the Mbozi district (in Songwe Region).

Soybean production practices

In most areas Soybean production is not very intensive. *As Soybean can grow without fertilizer, manure and mineral fertilizer are hardly applied* (10% and 19% respectively). However, in some districts, i.e., Iringa-rural, about a third of Soybean growing farmers applied manure or mineral fertilizer on their Soybean crop. Farmers' limited knowledge about fertilizer use on Soybean is apparent as some applied nitrogen fertilizers.

Farmers' knowledge about seeds and inoculants is also limited. For instance, only 29% know which Soybean variety they grow. Seeds are largely recycled on-farm (44%) or obtained from neighbors (26%). The distribution of new, improved seeds like Uyole 04, Uyole 02, and SeedCo varieties appears to be limited to specific areas in Iringa, Morogoro, Njombe, and Ruvuma regions. Inoculant use is similarly limited—used by only 9% of all farmers. *It is often projects that have made improved seeds and inoculants more widely available.*

Soybeans are often intercropped (39% of fields)—except for Rukwa and Morogoro regions—yet the common intercrop varies per area (maize, sunflower, pigeon peas). Seeding rates on Soybean fields are rather variable (30−61 kg/ha on sole-cropped fields), both within and between districts, but generally low and probably a major cause of low yields. Common diseases in soya beans, such as leaf rust, are widespread. *The incidence and impact of diseases in Soybean could be lowered if newer, more disease-resistant, and tolerant Soybean varieties could become more widely available.*

Soybean marketing challenges and farmer organization

Most farmers market their Soybeans through private traders, especially in areas with more experienced Soybean growers. Selling to another farmer is generally an alternative to selling to a trader. Sales through cooperatives and projects are limited and occur only in some districts in Ruvuma Region, while contract farming and direct sales to processors are very limited.

Soybean marketing appears to be problematic. Low prices and finding a buyer are often difficult, especially in districts with many first-year growers (and where there are ongoing projects and government campaigns). Consequently, farmers may delay sales (or accept low prices) and thus prolong the length of the local Soybean selling season, which differs substantially per district.

This report has revealed important differences between soybean-producing areas within the Southern Highlands and Morogoro regions. We may distinguish at least three types of 'Soybean production zones' (Chapter 8) that are characterized by different patterns of development and—partially overlapping—production characteristics:

1. The “high-output, extensive production” zone (Ruvuma Region).
2. The “new-growers, project intervention” zone (Iringa region).
3. The “market-driven” zone (Mbozi district, Songwe Region).

These zones constitute a useful addition to the Soybean “producer clusters” that have been distinguished (in Chapter 7) for the geospatial targeting of TSSI activities. Although the “production zones” have partially overlapping features, they are characterized by different development patterns, differences in the importance of Soybean for farmers’ livelihoods, and their production practices. The production zones can be useful tools to quickly identify and understand different Soybean farmers’ production practices and motivations for (not) investing in Soybean productivity.

Introduction

This chapter presents a brief overview of Soybean production and marketing in Tanzania, the objectives of the farmer registration exercise and the survey methodology used to register more than 20,000 soya bean-growing farmers in seven regions of Tanzania.

The promotion of Soybean production in Tanzania

Soybean production has expanded substantially in Tanzania in recent years (TASIS, 2024). Soya bean-derived products are in high demand by an expanding domestic animal feed industry, processed into edible oils and protein-rich foods for human consumption, and Soybeans are also increasingly exported (Wilson et al., 2021; Kangile et al., 2021). Next to its value as a food, feed, cash and export crop, Soybean cultivation can also contribute to agricultural productivity (Ojiem et al., 2014; Chianu-Jonas et al., 2010). Through their ability to fix atmospheric nitrogen in root nodules in symbiosis with soil bacteria (rhizobia), soybeans can enrich the soil with nitrogen, a vital nutrient for Tanzania's major cereal crop, maize. The integration of Soybeans into smallholder farmers' cropping systems can thus contribute to overall farm productivity—especially if Soybean production is intensified[1]—and reduce smallholder dependence on synthetic (nitrogen) fertilizers. In addition, crop diversification with Soybeans can make cropping systems more resilient against pests and diseases (breaking disease cycles) and climate change. However, farmers are mostly interested in the income they can generate with the cultivation of this crop—Soybeans are predominantly produced for the market (Aspires, 2023).

The Tanzania Sustainable Soybean Initiative (TSSI)

The Tanzanian government and agricultural development organizations have been promoting Soybean production to enhance livelihoods and food security. Together with the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), the International Institute for Tropical Agriculture (IITA) and other partners are implementing the *Tanzania Sustainable Soyabean Initiative* (TSSI) in the Southern Highlands regions (Iringa, Mbeya, Njombe, Rukwa, Ruvuma, Songwe) and Morogoro Region, where most Soybean is produced. The TSSI seeks to intensify Soybean production and sustain cereal (maize) yields by reducing the use of nitrogen fertilizers, while improving smallholder farmers' income and resilience to climate change. The initiative taps into the multiple benefits of Soybean cultivation such as income to smallholder farmers, nutrition to consumers, and driving the livestock sector through the provision of plant-based proteins to the animal feed industry.

A key activity of the TSSI is to develop, adapt, and contribute to the productivity of maize-dominated cropping systems through the integration and intensification of Soybean production. To locate the TSSI's target population of smallholder farmers and identify areas for intervention, IITA engaged Wageningen University & Research (WUR) to embark on a farmer registration exercise for the TSSI. Although several organizations and projects have focused on smallholder Soybean production in recent years (notably CRS, CFI, CARE, and

1 There is a direct relation between Soybean yields and the amount of nitrogen fixed, and hence soya bean's (potential) contribution to soil fertility.

N2Africa), their activities have often been limited to specific intervention areas within the SAGCOT target regions. In addition, their databases of project beneficiaries are rather old, and often lack (up-to-date) contact details of farmers and their current Soybean production status. IITA, therefore, sought to implement a fresh farmer registration survey that can serve as a basis for planning project activities and farmer engagement in the TSSI.

Registering large numbers of soybean-growing farmers also provided an opportunity to quickly profile Soybean growers, identify farmer networks and organizations through which Soybean production and marketing may be stimulated, and identify some of the production and marketing challenges Soybean growing farmers in different locations of the Southern Highlands encounter. By building on a digital survey that could be administered by extension workers in the field, the farmer registration exercise constituted a rapid, cost-effective method to collect data from over 20,000 soybean-growing farmers in the Iringa, Mbeya, Morogoro, Njombe, Rukwa, Ruvuma, and Songwe regions of Tanzania.

While the Soybean farmer registration was specifically aimed at creating a database of Soybean growers, this report highlights some major findings of this exercise that have wider relevance. It complements the *Baseline report of the Soybean sub-sector* (Aspires 2023) that built on a much smaller sample (n = 1,263) but provided a more comprehensive overview of soya bean-growing farming households in the same production regions. This report is less comprehensive than the baseline report but presents information on substantially more farmers (n = 20,777) and is therefore better able to analyze the geographical diversity among soya bean-growing farmers, and their investment, agronomic, and marketing practices.

To summarize, by collecting basic information on smallholder farmers currently growing soybeans, the farmer registration exercise aimed to:

1. Create an up-to-date database of smallholder Soybean growers (and local-level organizations) through which the TSSI can engage.
2. Identify production “hotspots” to which TSSI activities can be targeted.
3. Identify farmer networks and organizations that can be mobilized for scaling purposes.
4. Generate an overview of the state of smallholder Soybean production to identify (and prioritize) areas of (agronomic) intervention.

This report mainly focuses on the latter three aspects. Aggregated and anonymous information from the database will become publicly available through an online database.

The digital survey methodology

To register and profile large numbers of Soybean growing smallholder farmers in a short period of time (as it needs to inform TSSI project planning), WUR and IITA developed a lean digital survey tool with a limited number of (mostly closed) questions.
Data collection focused on three themes (Figure 1).

1. **Personal data of Soybean growing farmers**, including location (region/district/ward/village), GPS-location of the farmers' homestead and/or his/her 2022-23 season main Soybean field, gender, name, telephone number, farm ownership status, age, and education-level.
2. **Basic Soybean production data**, including experience in Soybean growing, main crops grown, area of the farmer's main Soybean field (GPS-measured/estimated), (inter) cropping practices, Soybean variety grown, seed source, input use (manure/fertilizers/herbicides), inoculant use, yield, pest and disease problems.
3. **Soybean marketing and farmer participation in (production/marketing) groups**, including marketing channels, the timing of sales, and group membership.

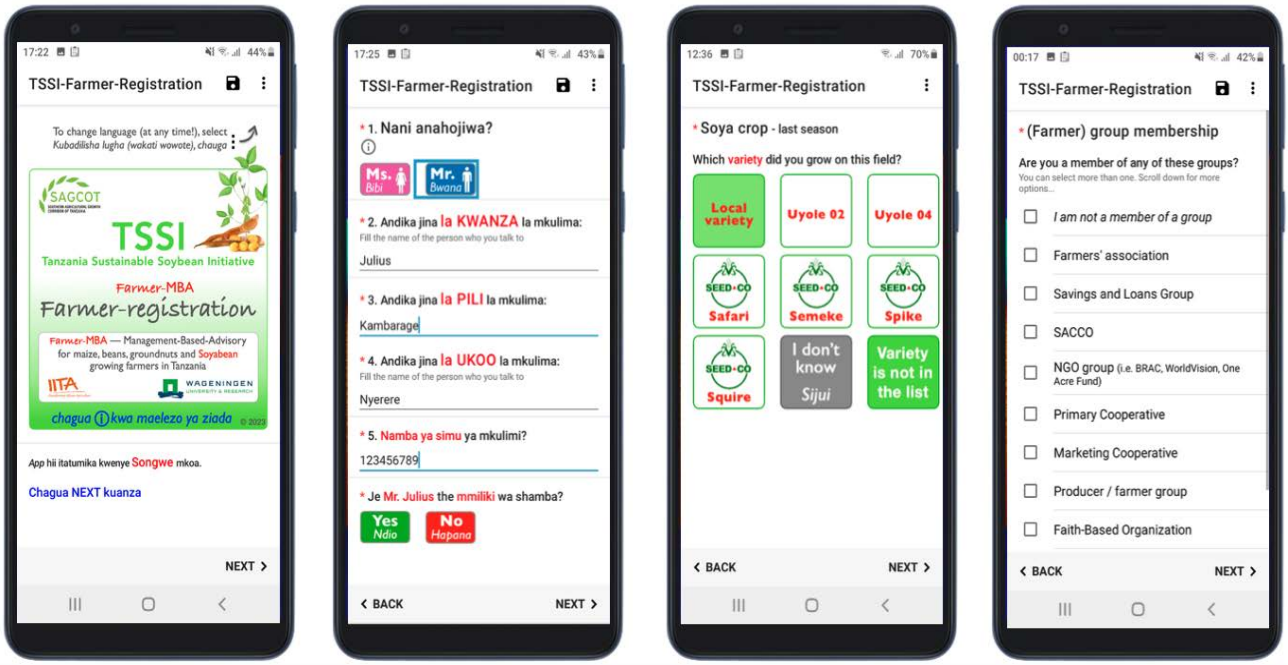

Figure 1. Selected screens of digital farmer registration tool: start-screen, personal data, information on Soybean cultivation practices, and farmer participation in (producer/marketing) groups.

Sample design and engagement of government extension workers

As Tanzania's government extension service remains the key actor in knowledge provision and the best-informed institution regarding smallholder farmers' crop cultivation practices at the village level, the farmer registration exercise deliberately sought to collaborate with the district-level extension offices to implement the survey. Agricultural extension officers, stationed in villages throughout the district were engaged for the registration exercise. The number of extensionists engaged per region was determined in conjunction with the district agricultural extension office (the DAEO) and informed by the notion that participating extension agents should be able to identify and register at least 50 Soybean growing farmers in his/her operational area. Those who would not be able to register 50 farmers were excluded from the registration exercise on the assumption that the extension workers' operational area did not have significant numbers of Soybean growers to allow for the setting up of collective input and output arrangements. Consequently, not all districts in the seven major soybean-producing regions are represented in this farmer registration exercise (Figure 2).

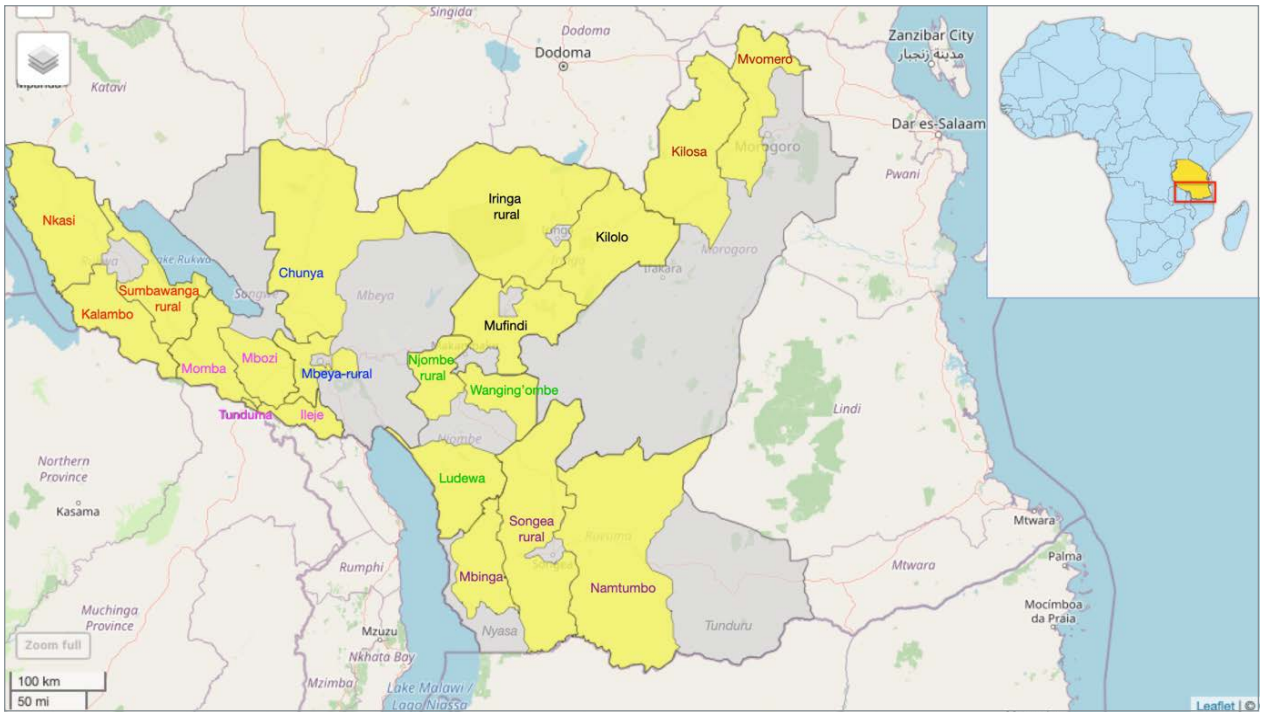

Figure 2. Focal districts of the TSSI farmer registration (yellow, label color per region) within the Southern Highlands and Morogoro region.

Training of extension workers in digital survey tool use was organized per region. The first training (by WUR) took place in Vwawa, Songwe Region, in July 2023 and was followed by training in Sumbawanga (Rukwa), Songea (Ruvuma), Njombe town, Mbeya city, Iringa city, and Morogoro town (by IITA), respectively. Equipped with a digital device (tablet or smartphone), extensionists commenced farmer registration in their respective operational area immediately after being trained for a period of 2–3 weeks. Upon device collection and data uploading, extensionists in the next region were engaged.

Table 1 shows the number of extensionists involved in the farmer registration exercise, as well as the average and total numbers of registrations per district and region (districts with less than 100 registrations have been removed from the analysis). Figure 3, which presents the number of farmer registrations per district, already suggests that the production of Soybean is highly concentrated in specific areas. For instance, more than half (51%) of all registered soybean-growing farmers reside in only three districts of Ruvuma Region (Mbinga, Namtumbo, Songea-rural). Such an uneven distribution of Soybean growers suggests that production of Soybean is concentrated in particular areas. Such concentration of production in ‘Soybean hotspots’ does not appear to coincide with differences in agroecological circumstances or population densities. Past project interventions seem more important in understanding such concentrations of Soybean production in particular areas (see Chapter 8).

Table 1. Number of extension workers, farmer registrations, and average registrations per extensionist by region.

Region	number of extensionists	registrations	average reg. per extensionist
Iringa	34	4,703	138
Mbeya	20	531	27
Morogoro	20	894	45
Njombe	22	1,576	72
Rukwa	19	670	35
Ruvuma	52	10,709	206
Songwe	37	1,695	46
Total	204	20,777	102

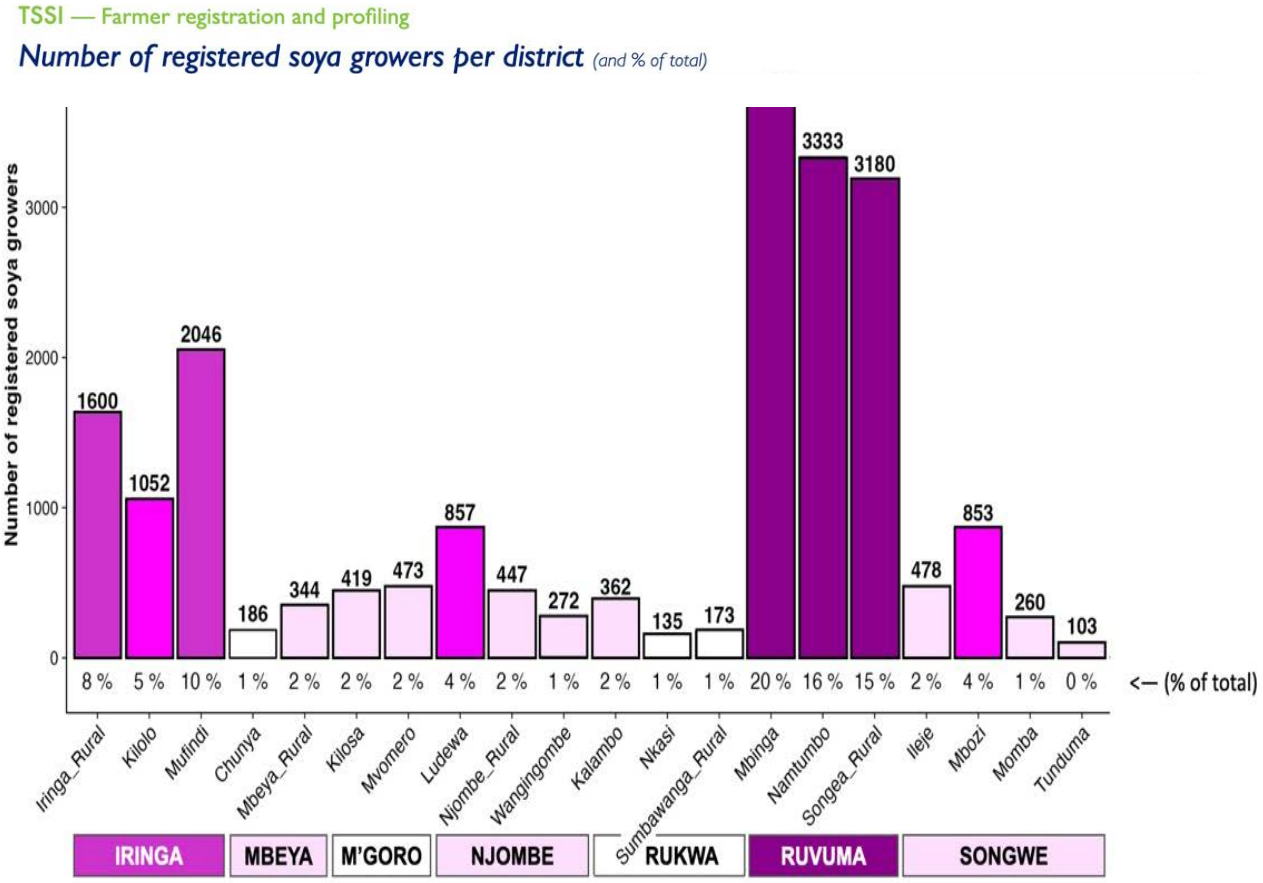

Figure 3. Number of registered Soybean growing farmers per district, in Southern Highlands region, and Morogoro in the 2022–23 season.

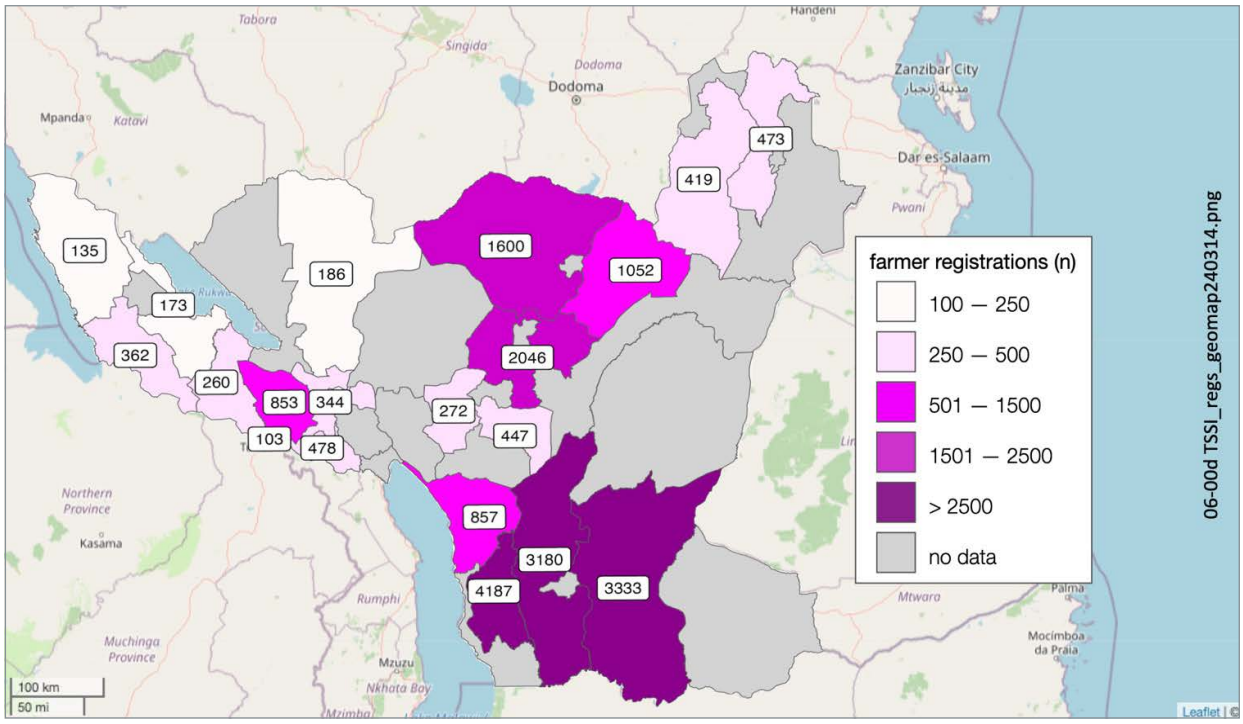

Figure 4. Distribution of registered Soybean growing farmers per district in Southern Highlands regions and Morogoro, 2022–23 season.

2

Smallholder Soybean producers

This chapter presents some characteristics of the registered smallholder Soybean growers, their production locations, and their production history. Soybean growing in Tanzania is highly dispersed (Figure 5), and large differences (concentration of growers, female and young farmers' participation) between growing areas exist.

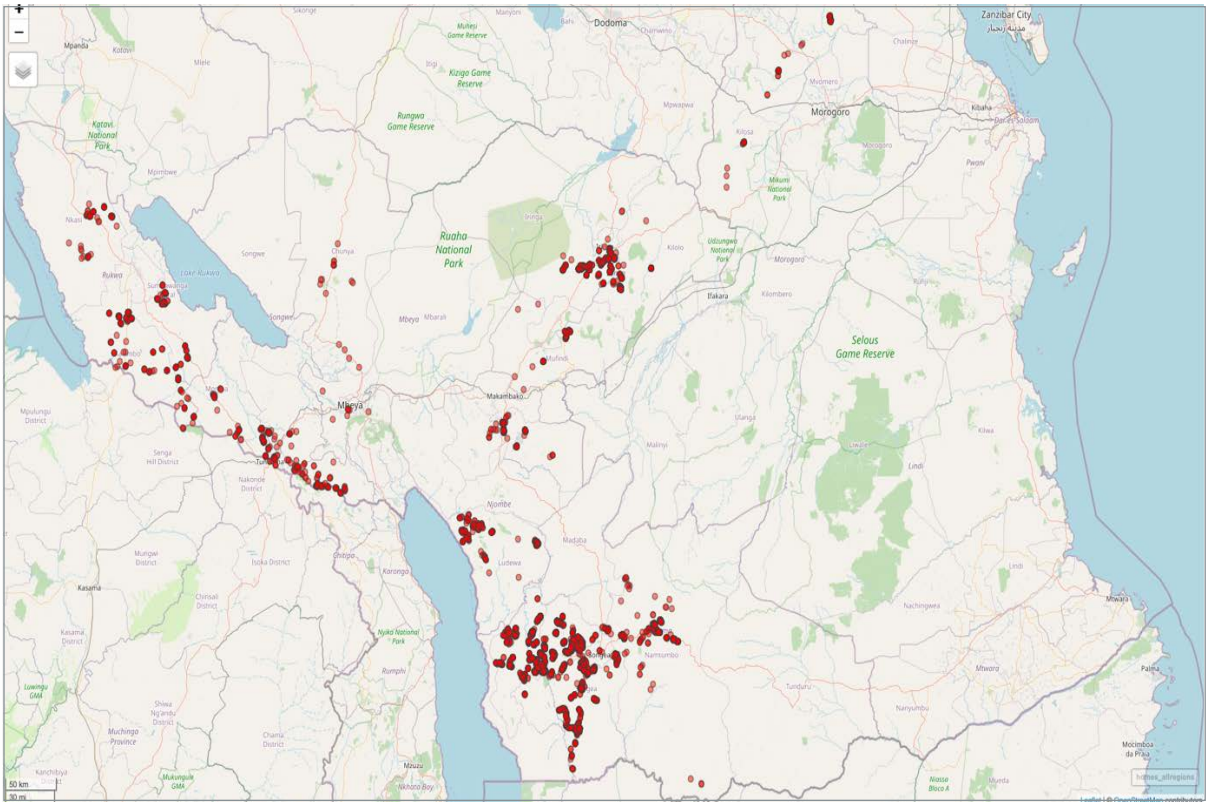

Figure 5. Spatial distribution of registered soybean-growing farmers in seven regions of Tanzania, 2022–23 season. *(Note! not all registered growers are visible on this map)*

Who is growing soybean?

Whereas rural household surveys usually focus on household heads and often assume they are the main decision-makers in the farming household, the farmer registration survey targeted those involved in Soybean cultivation, as they are the potential recipients of TSSI training and other activities. The registered farmer is, therefore, not necessarily the household head but can also be another household member involved in Soybean growing.

The average age of the registered Soybean grower is 46 years (for both men and women). Soybean cultivation is dominated by farmers in the 35–55 age category (1st and 3rd quartile). However, the diversity among Soybean growers is large. For instance, in Rukwa Region, Soybean production is very much dominated by men (e.g., wide blue and narrow pink bars in Figure 6), whereas in Iringa Region, similar numbers of men and women produce Soybean (e.g., blue and pink bars similar in length in Figure 6). In Mbeya Region, men aged between 40 and 60 years appear to dominate Soybean production, while in Ruvuma Region, male

Soybean growers tend to be younger, between 30 and 50 years of age (in Figure 6). In Rukwa and Songwe regions, men of all ages between 30 and 60 years appear to be equally involved in Soybean production. These differences do not reflect differences in population structure in the different regions, where sex-age-distribution graphs all have a familiar pyramid-like shape (see Appendix 1).

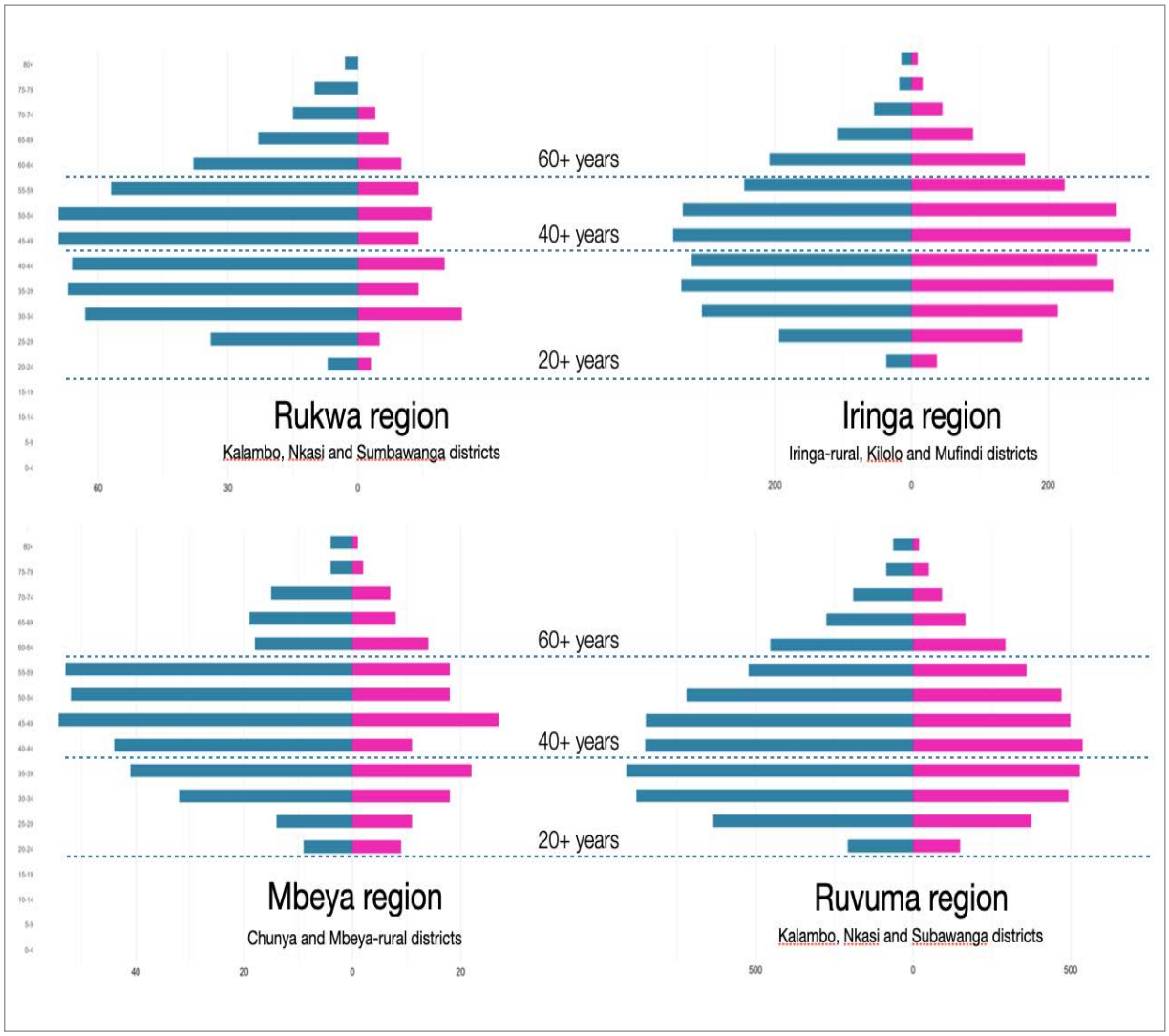

Figure 6. Population pyramids (sex-age distributions: Left, blue: men, Right, pink: women) of registered soybean-growing farmers for selected regions. Note: Only farmers above 18 years of age can be registered. Category 18–20 years of age is omitted from the figure. Appendix 1 shows a comparison with the total population of mainland Tanzania.

Soybean cultivation: Gender and youth

Of the 20,777 registered farmers growing Soybean in the 2022–23 season, 61% were men, and 39% were women. Despite our focus on actual Soybean growers, female survey respondents may have registered under their husbands' names as they may consider them the head of the household. The number of registered women farmers is, therefore, likely to be lower than the actual number of women involved in Soybean production. It is striking that in Iringa-rural, an area of relatively intensive Soybean production (see section 4.3), most of the soybean-growing farmers are women. Rukwa Region, where the number of registered Soybean growers and productivity is relatively low, is characterized by a rather low number of female Soybean growers.

As already noted above, *Soybean cultivation is dominated by farmers in the 35-55 age category, and farmers in the 20-35 years age category, only make up 14 to 32 percent of the registered Soybean growers*. There are no clear observable spatial patterns in the distribution of young Soybean growers, arguably except for the Ruvuma Region, where the percentage of young Soybean growers is slightly higher. Given the low level of productivity and intensity of production there, this higher percentage of young Soybean farmers should not be seen as a sign that Soybean is an economic opportunity that attracts particularly young farmers.

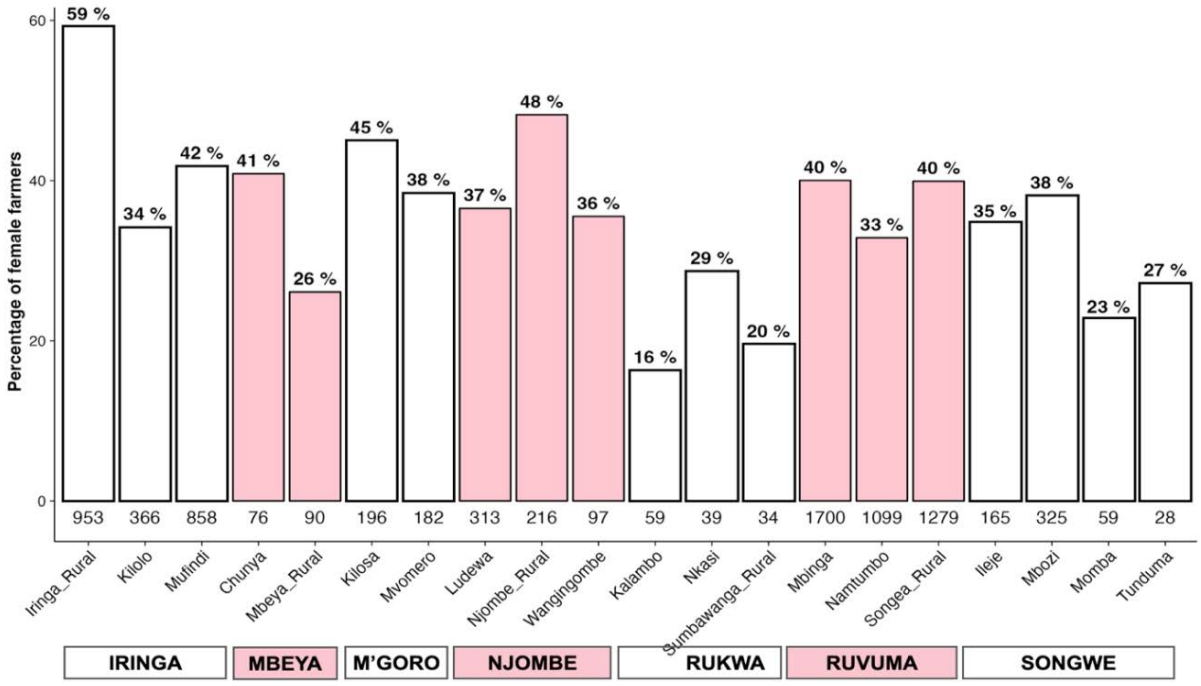

Figure 7. Percentage of registered female Soybean farmers per district, 2022–23 season *(number of registrations per district below the bar).*

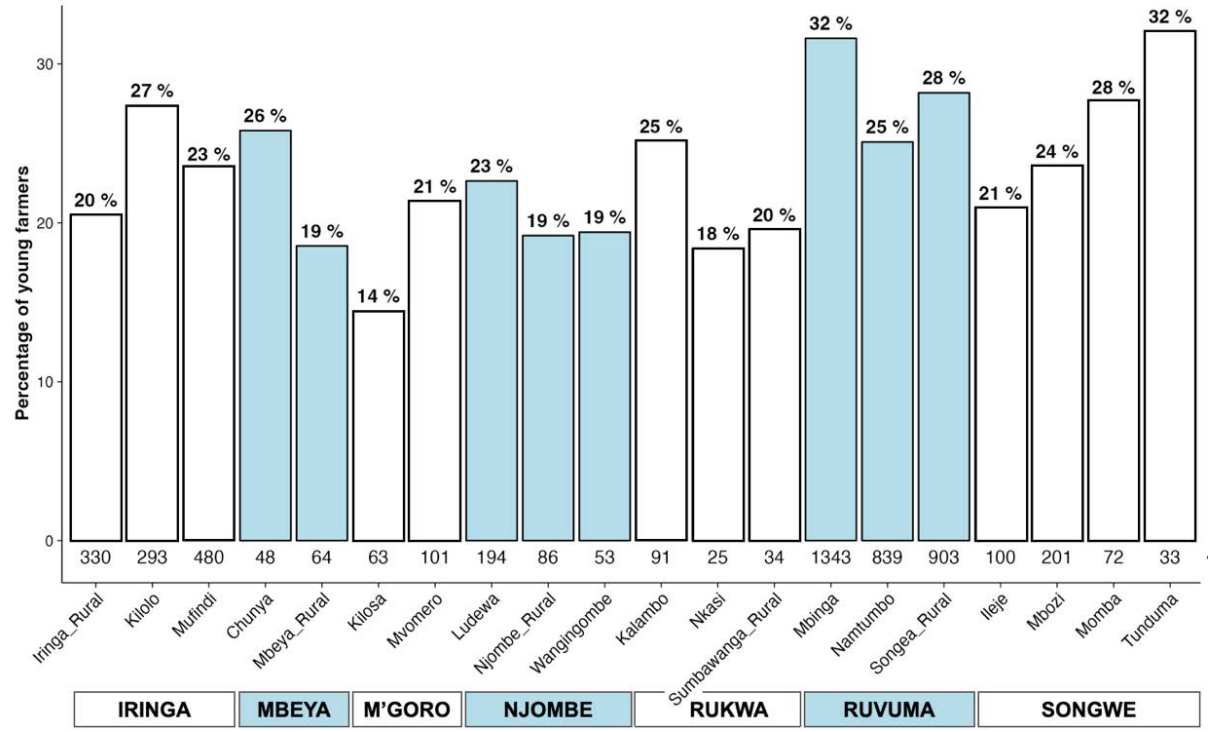

Figure 8. Percentage of registered young (< 35 years of age) Soybean growing farmers per district, 2022–23 season *(number of registrations per district below the bar).*

3

Soybean producing farms

Soybean growing is relatively new for most registered farmers. The vast majority have cultivated Soybean for less than five seasons. The uptake of Soybean production is mostly the result of (NGO) projects and government campaigns or learned from neighbors. Only in a few districts do farmers mention good market prices for Soybean as their main motivation for taking up Soybean production. While maize is an important crop for all farmers, Soybean and common beans are most often among the other two most important crops of soya bean-growing farmers.

Soybean growing farmers: The relative importance of soybean

During profiling, farmers were asked to list the three most important crops they grow. *All registered farmers considered maize to be the most important crop*. However, the order of importance of other crops differed per district (Figure 9). For instance, in the Iringa-rural district, most farmers viewed sunflower as among their three most important crops, whereas in Kilolo and Mufindi districts, common bean was more often among their three most important crops. It is important to note that in several districts, only a few farmers considered Soybean among their three most important crops. In these districts farmers usually considered common beans, pigeon pea, groundnut, and sunflower among their three most important crops. Figure 9 shows that in the Songwe Region, Soybean growing farmers often also rate groundnuts or common beans among their most important crops. Only in the Ruvuma Region do most farmers consider Soybean among their three most important crops; in the districts of Kilolo, Njombe-rural, Kalambo, and in Songwe Region, Soybean is also considered an important crop, but in many other districts, Soybean is a minor crop.

Considering the relative length of the bars in Figure 9, we can observe that, for instance, groundnut or common beans are often an alternative to Soybeans in Songwe Region. In Ruvuma Region, where most soybean-growing farmers were registered, there are fewer clear alternatives to Soybean production, especially in Namtumbo and Songea-rural. The relative importance of Soybean production for farmers in Ruvuma Region thus seems partly due to a lack of alternatives.

Farmers' experience in Soybean cultivation and drivers of uptake

Registered farmers' experience with Soybean production is relatively recent. The vast majority of farmers have cultivated Soybean for less than five seasons (Figure 10). Only in specific districts, such as Mbeya-rural, Njombe-rural, Mbozi district (Songwe Region), and Ruvuma Region, does Soybean appear to be a more established crop. This is also reflected in the fact that many farmers in Ruvuma Region consider Soybean a common crop (Figure 11).

Figure 9. Soybean-growing farmers' three most important crops: Percentage of farmers per district mentioning a crop. *(Maize is mentioned by > 98% of farmers and therefore not included in this figure)*

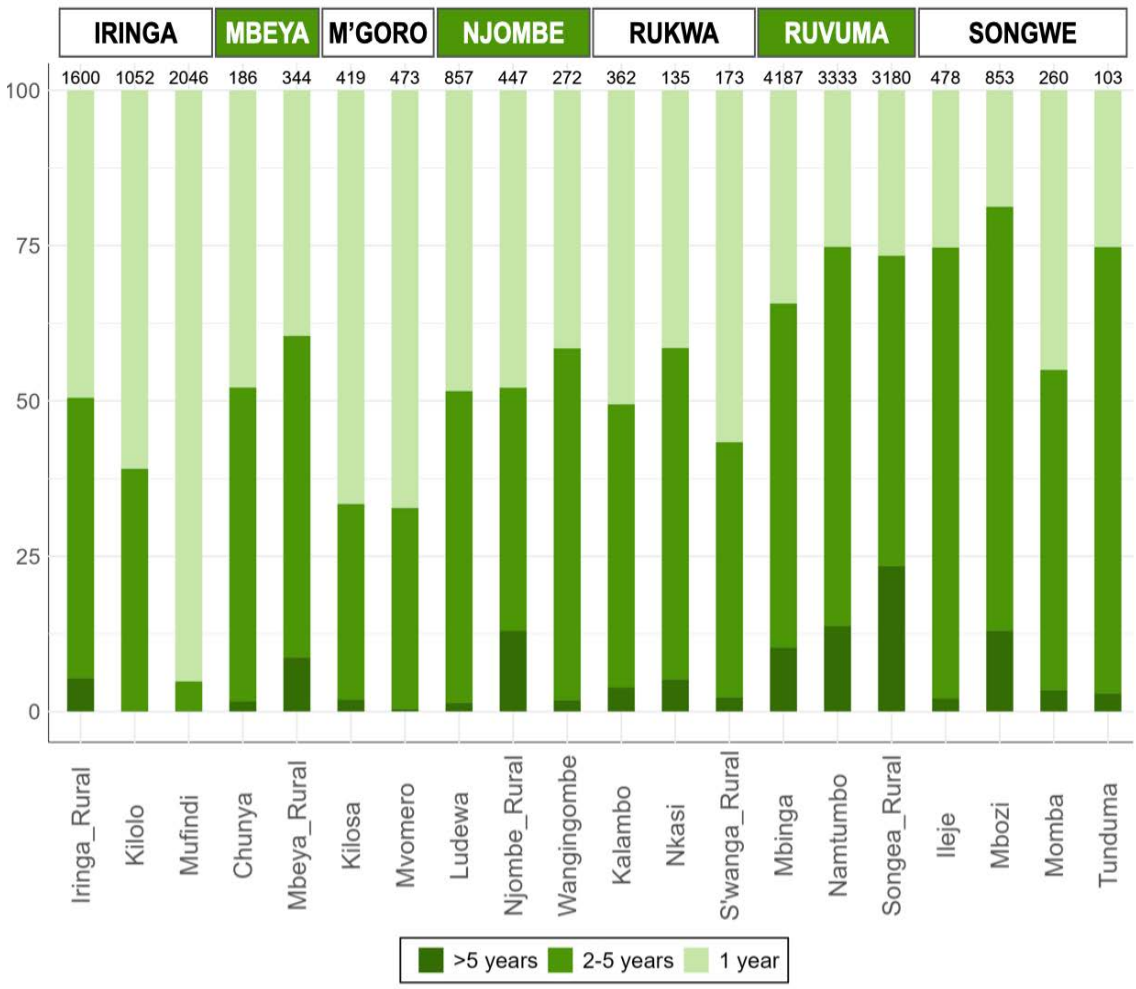

Figure 10. Number of years cultivating soya bean: Percentages of farmers per district
(region and total number of observations above the stacked bar (n = 20,777)

When considering Figure 10 and Figure 11 together, it becomes apparent that the expansion of Soybean production in Morogoro and Iringa regions, and especially the Mufindi district, is very recent and largely driven by (ongoing?) projects and government. Nevertheless, in areas with a longer history of Soybean production, such as in Njombe-rural district and Ruvuma Region (Figure 10), projects are likely to have been a major driver of uptake. For instance, the United States Department of Agriculture (USDA)-funded *Soya ni Pesa* project of CRS, has been very active in promoting Soybean production in Morogoro, Njombe, and Ruvuma regions in the period 2012–2016 (CRS, 2016). In the districts of Iringa, Morogoro, and Njombe regions included in this study, the uptake of Soybean production thus appears to be mostly the result of (NGO) projects and government campaigns or learned from neighbors.

The pattern of Soybean production expansion in Rukwa and Songwe regions appears to be more market-driven. Although there has been project activity in the Nkasi and Momba districts that motivated some farmers to start growing soybean, many farmers in these regions also mention the market price of Soybean as a motivation to start production (Figure 11).

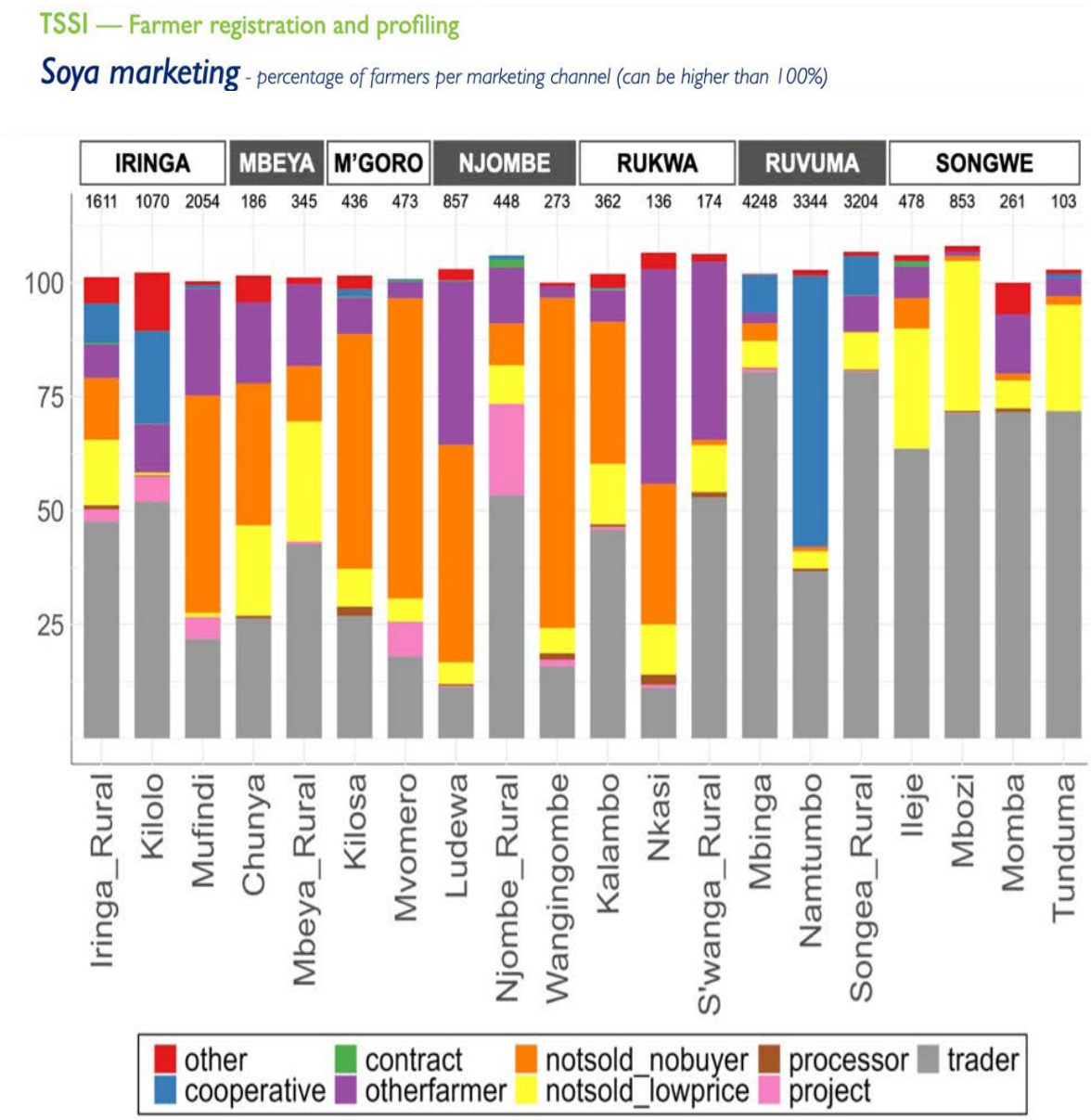

Figure 11. Percentages of farmers per district stating reasons (max. 2) for starting to grow Soybean (n = 20,777).
Number of observations per district above the stacked bar. Note that indicating two reasons results in > 100% bars.

4

Soybean production

This chapter presents findings on the field areas registered farmers dedicate to soybean, the yields obtained, and Soybean production per district. Soybean fields in the Southern Highlands regions and Morogoro are relatively small (0.2–0.7 ha) and in most areas, production is not very intensive. Consequently, average yields at the district level are generally low yet diverse, ranging from 500 kg/ha to over 1,000 kg/ha.

Soybean field areas

Farmer estimations of field areas are notoriously unreliable (Carletto et al., 2013) due to the difficulty of estimating areas (on slopes) with the naked eye, seasonal changes in the cultivated area, and reliance on ploughing service providers' estimations that are paid per field area. Socioeconomic and cultural factors may also play a role in the over- or under-estimation of field areas (Carletto et al., 2015). Therefore, the farmer registration exercise made use of GPSdevices to measure Soybean crop areas of the 2022–23 season. Registered farmers tend to significantly ($p < 0.05$) overestimate the size of their Soybean fields (Figure 12). While GPS-measured Soybean fields were, on average, 0.38 ha (0.94 acres), farmer-estimated Soybean fields were about 47% larger: 0.56 ha (1.38 acres). Consequently, Soybean yields tend to be underestimated.

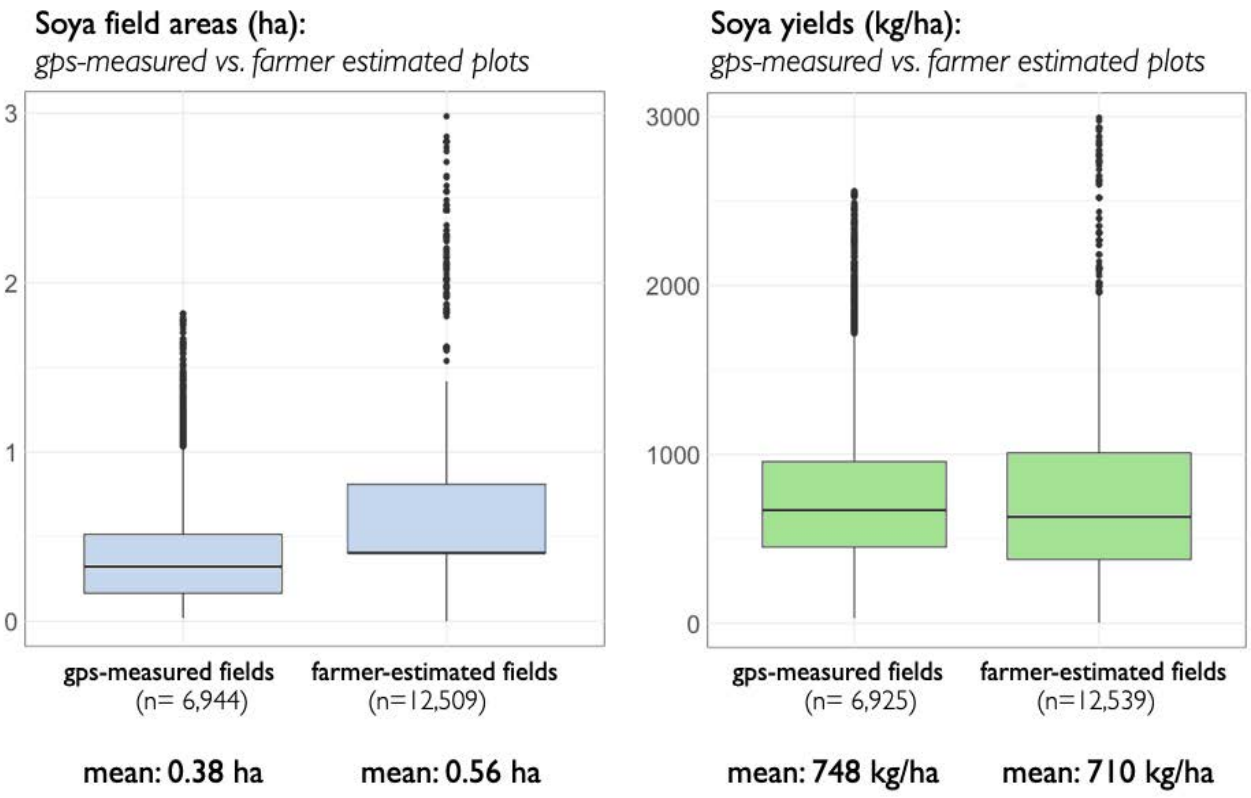

Figure 12. GPS-measured versus farmer-estimated Soybean field areas (ha) (blue), and yields (kg/ha) for GPS-measured and farmer-estimated fields (green), based on farmer-reported production in bags (gunia) or buckets (debe).

Both field areas and yields are significantly different ($p < 0.05$) for GPS-measured and farmer estimate fields

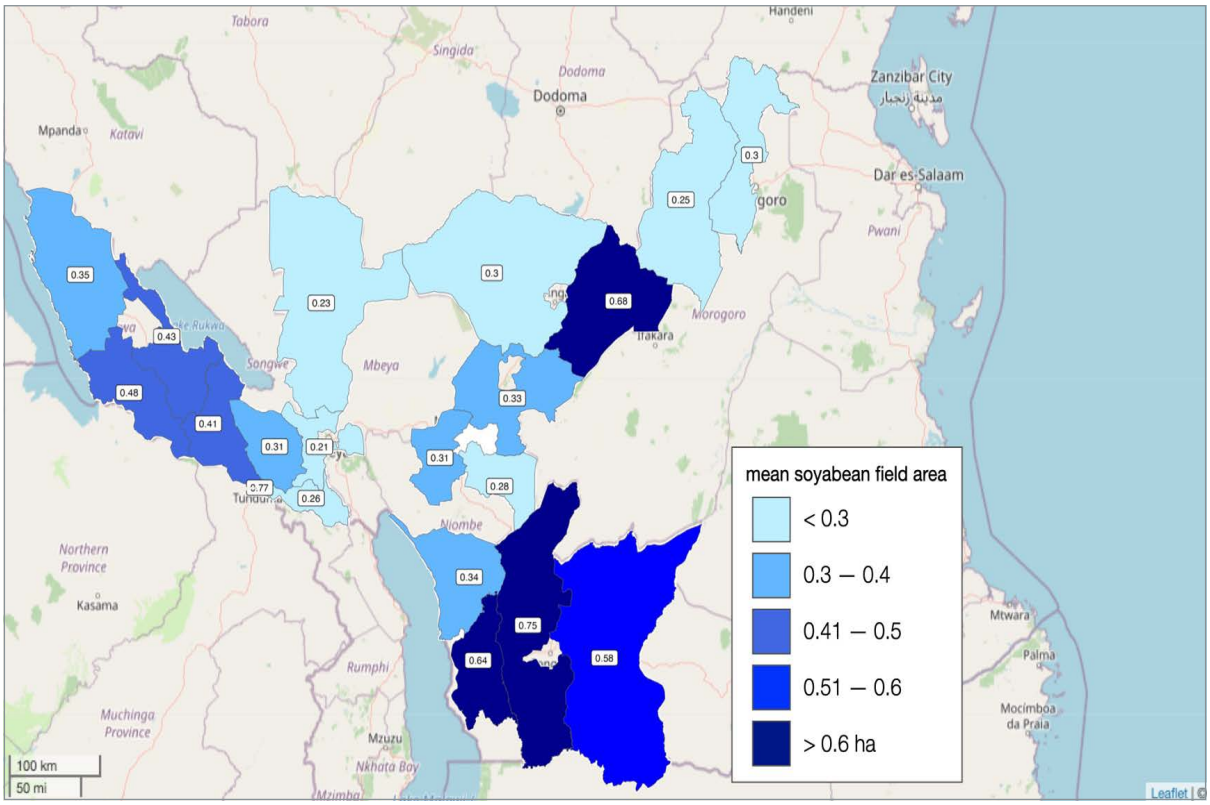

Figure 13. Average Soybean field areas (ha) in the 2022–23 season (n = 12,816). Labels on the map indicate the average Soybean field areas of registered farmers in the district.

On average, the largest Soybean fields (> 0.6 ha) can be found in the Ruvuma Region and the Kilolo district of Iringa Region (0.68 ha), while Morogoro and Mbeya regions generally have small Soybean fields (< 0.3 ha). Small Soybean fields are also found in Njombe-rural district (0.28 ha) and Ileje district in Songwe Region (0.26 ha).

Soybean productivity

Due to the large number of registered farmers in Ruvuma Region, the overall average yield figure for all farmers is unduly influenced by the figures for that region, and therefore, not very informative. Figure 14, which provides average yields disaggregated per district, shows the diversity in yields across the Southern Highlands. The highest yields are recorded in Tunduma (1056 kg/ha), on the Zambia border, and in the Mufindi and Iringa-rural districts in Iringa Region. Farmers in the Namtumbo district (Ruvuma Region) obtained the lowest Soybean yields (500 kg/ha). These yields are well below potential yields for these areas of Tanzania, which can be around 2,500 kg/ha when Soybean is grown as a sole crop with good agronomy (N2Africa, 2015). As will be shown below, low input availability and use, high fertilizer prices and the importance of maize, agronomic practices, market access, and produce prices are all important factors limiting farmer investment in Soybean productivity.

The average yield figures found in this registration exercise (Figure 14) are also much lower than FAO figures on Soybean production in Tanzania. FAOSTAT estimates of average Soybean yields in Tanzania increase from around 700 kg/ha in the year 2000 to between 1,100 and 1,200 kg/ha in the 2018–2022 period (FAOSTAT, 2024). As the Southern Highlands are considered a high-potential zone for Soybean production (Malema, 2006), and the farmer registration covered a large number of farmers from this region, it is reasonable to question the validity of the FAO yield figures.

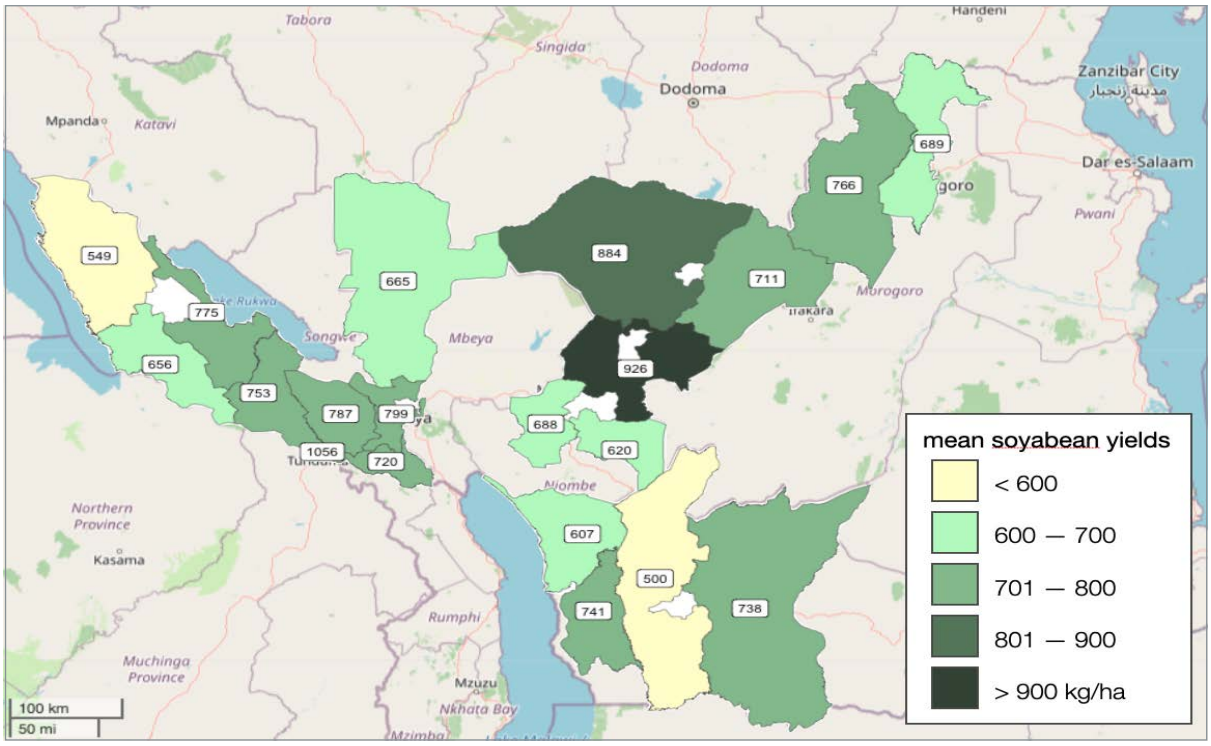

Figure 14. Average Soybean yields per district, 202223 season, for both farmer-estimated and GPS-measured field areas (n=20,777). Minimum number of observations per district > 100 (Tunduma: 1056 kg/ha).
*Outlier removal: 5*IQR = <1% of total yield observations.*

Soybean production in the Southern Highlands

As the farmer registration exercise sought to identify concentrations of Soybean growers for targeting TSSI project activities (training in agronomy, making inputs available, field-level advisory, etc.) and consequently focused on areas with many growers, aggregated production figures per district cannot be used as an indicator of total production per district. Nevertheless, Figure 15 shows that district-level production can be substantial; in Iringa

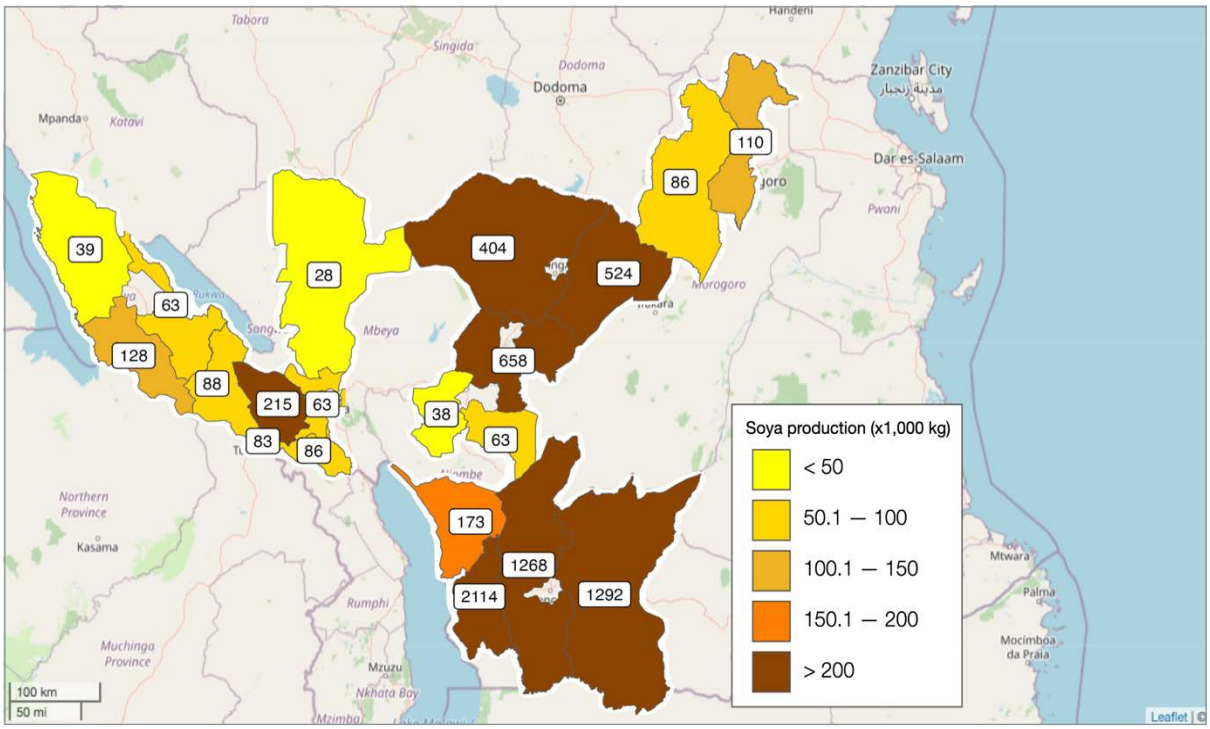

Figure 15. Total Soybean production per district as reported by registered Soybean farmers (n = 20,777)
*Minimum number of observations per district > 100. Outlier removal: 5*IQR = < 1% of total yield observations.*

Region alone, more than 1,500 tons of Soybean was produced in the 2022–23 season by the registered farmers. In three districts of Ruvuma Region (Mbinga, Natumbo, Songea-rural), production exceeded 4,600 tons, while in the relatively small Mbozi district (Songwe region), a mere 850 registered farmers produced some 215 tons of Soybeans in the 2022–23 season. Hence, a few districts are responsible for the bulk of Soybean production in the Southern Highlands.

Aggregating the registered farmers' own estimates of their Soybean production, the total production of the 20,777 registered farmers was around 7,500 tons. This amounts to about one-third of Tanzania's estimated national production for the 2018–19 season (NBS, 2021).

5

Soybean agronomy: Production practices

This chapter focuses on the production practices of the registered Soybean growers. It was found that input use on Soybean fields was generally low. However, there are districts, i.e., Iringa-rural, where about a third of Soybean growing farmers apply manure or mineral fertilizer on their Soybean crop. Knowledge and use of inoculants (which can boost yields) is very limited, and most farmers do not know what Soybean variety they grow. Soybean seeds are predominantly recycled. The availability of these inputs appears to be a major problem. There is also room for improvement in Soybean farmers' agronomic practices.

Input use on Soybean

The registered Soybean farmers generally use few inputs on their crops. Seeds are mostly obtained by saving harvested grains, and new Soybean seeds are hard to get, as few agro-dealers stock them. Available inputs, such as manure and fertilizers, appear to be preferentially applied to other crops, notably maize. Maize is the main food crop, and for many farmers in the Southern Highlands, is also an important cash crop. As fertilizer prices are rising annually and farmers are aware that leguminous crops like Soybeans can, unlike maize, also grow without fertilizer, they allocate their scarce resources to enhance the soil's fertility (manure and fertilizer) to their maize. However, as the discussion of the different input sources below will elaborate, there are notable differences in input use between Soybean production areas. Such differences in input use do not seem to reflect differences in agroecological circumstances such as climate and inherent soil fertility but are more likely related to differences in farmers' socioeconomic status, market access, and farmgate prices.

Varieties, seed sourcing, seed rates

Although Soybean was first introduced to Tanzania in 1907 (Khojely et al., 2018), substantial production expansion is of a much more recent date. A breeding program was started in the 1950s, and the area planted to Soybean increased in the 1960s but dropped again in the 1970s. Throughout the 1980s, 1990s, and early 2000s, the area cultivated to Soybean remained largely unaltered, at ca. 6,000 ha annually (Chianu-Jonas et al., 2010). Recent production increases were driven by increased market demand—from the feed industry (Wilson et al., 2021)—and export opportunities and made possible by the introduction of new varieties, notably originating from the breeding programs of IITA (in collaboration with Tanzania's national agricultural research institutes) and private companies such as SeedCo, Pannar, Pioneer-Dupont, and Zamseed (Khojely et al., 2018). The varieties currently grown in Tanzania originate from these breeding programs, yet farmers have little knowledge about the exact variety (or varieties) they cultivate and commonly refer to their Soybean seed as "local variety" (Figure 16A). As Soybean seed is hardly available in agro-dealer shops—except for Iringa town perhaps (Figure 17)—most farmers use harvest grains as seed or obtain their seed from fellow farmers (Figure 16B).

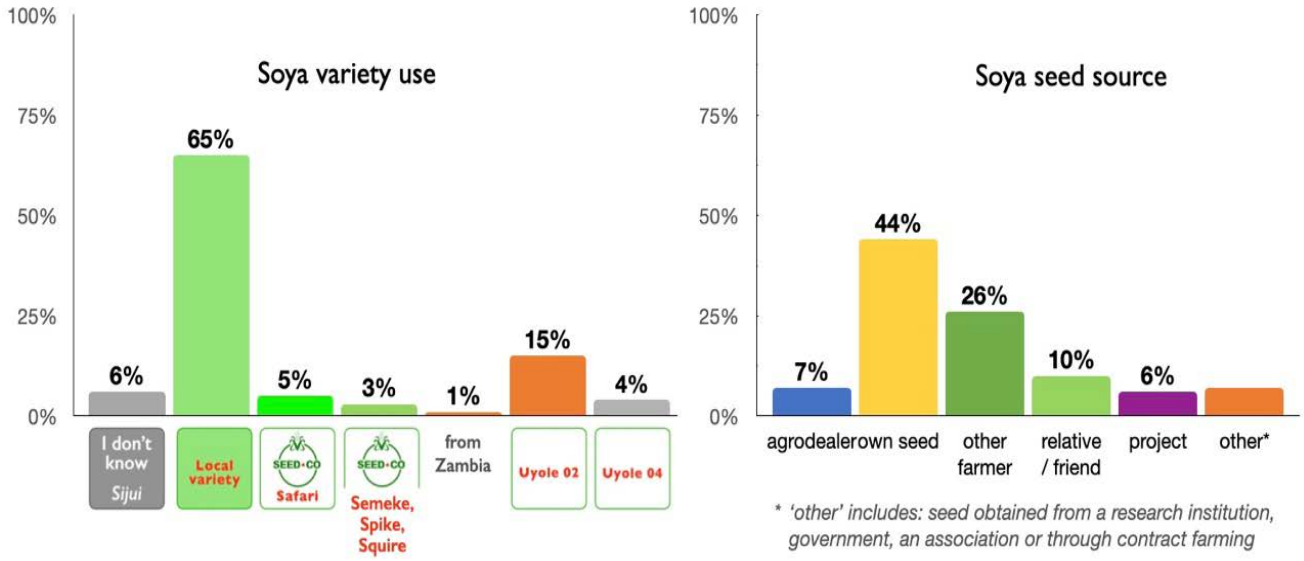

Figure 16. (A) Soybean variety grown by registered farmers (n = 20,777) and (B) Source of the seed grown (n = 20,777)

Although most registered farmers (71 %) do not know what Soybean variety they grow, for the known varieties, distinct spatial distribution patterns can be discerned. Of the varieties originating from the national breeding and seed multiplication program, the determinate Uyole 02 (or Soybean 02) variety appears to be the most common and widely distributed. Uyole 04 (or Soybean 04), an indeterminate variety mentioned by only 4% of farmers, seems far less spatially distributed. However, it is likely that many farmers who grow "local" or do not know which variety they grow actually cultivate one of the Uyole varieties. The cultivation (and availability) of the SeedCo-Safari variety, an indeterminate variety with high potential yield, is concentrated immediately southeast of Iringa town, whereas the cultivation of other, even less widely known SeedCo varieties such as Semeke, Spike, and Squire, also seems concentrated in the Mawa area near Songea town. Although registered in Tanzania, the SeedCo varieties—which have better disease tolerance—are difficult to obtain; they also do not (yet) feature on the company's Tanzanian website (SeedCo, 2024).

It is important to note that when a farmer knows the name of the variety they grow—and less than 29 percent of farmers do—this does not mean that the variety was recently obtained from an agro-dealer or other seed distributor. As the capacity of the national seed multiplication program for the Uyole varieties is limited, and the availability of commercial varieties restricted to a few centers, farmers mostly have to recycle harvested grain and use it as seed. This practice risks the build-up of seedborne diseases in the planting material, which can negatively affect yields (see section on pests and diseases).

Only 13% of registered farmers indicated they had obtained their seed from an agro-dealer shop or through an (NGO) project (not necessarily in the last season!). Figure 18 shows that agro-dealer-derived seed is a bit more common around Iringa town, near Njombe town, and in Ruvuma Region. Projects providing Soybean seeds have been active in Iringa, Morogoro, and Ruvuma regions, but hardly in Rukwa, Songwe, and Mbeya regions.

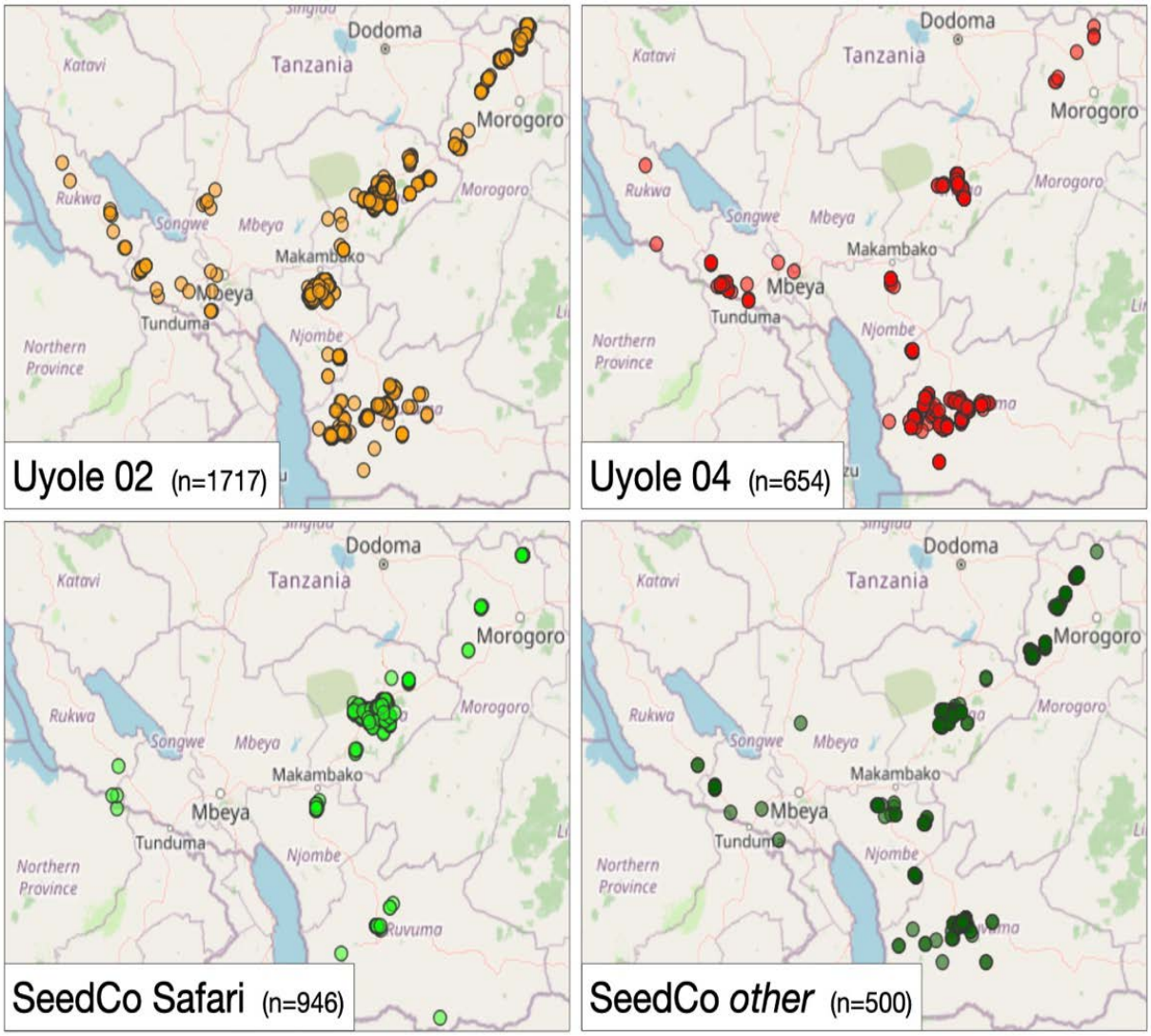

Figure 17. Spatial distribution of different varieties grown by registered Soybean growing farmers (n = 20,777). *Farmers growing Uyole 04 and SeedCo-Safari varieties are concentrated around Iringa and Songea towns.*

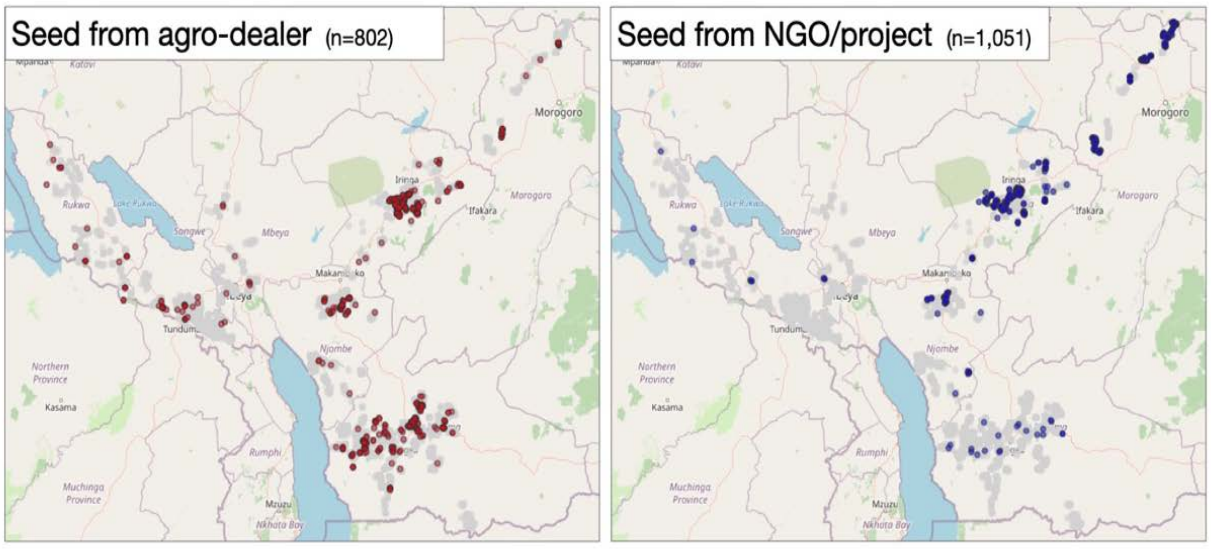

Figure 18. Source of seed for 13% of registered Soybean growers: "obtained from agro-dealer" (left) *or "NGO/project" (right). Grey areas indicate locations of other registered Soybean growers.*

Seeding rates

As many farmers use recycled grain as seed, the seed amounts farmers use are measured in *debe* (buckets) rather than kilograms or numbers of seeds. Consequently, seed rates can only be approximated. Differences in the average and the variability of seeding rates within districts can be large, ranging from 61 kg/ha (standard deviation, SD = 25) in Kilosa district (Morogoro region) to 30 kg/ha (SD = 14) in Songea-rural district (Ruvuma region). Hence, the average seed rates on sole-cropped Soybean fields presented in Figure 19 are merely indicative; areas with more intensive Soybean production and the highest yields (kg/ha) are also the areas where seeding rates are highest. The figures suggest that seed rates are generally much smaller than the 60–80 kg/ha that is recommended for many varieties in Tanzania (N2Africa, 2015). In intercropped Soybean fields, seed rates are even lower, and low seed rates are, next to low soil fertility, probably a major factor in the low yields obtained by Tanzanian Soybean farmers.

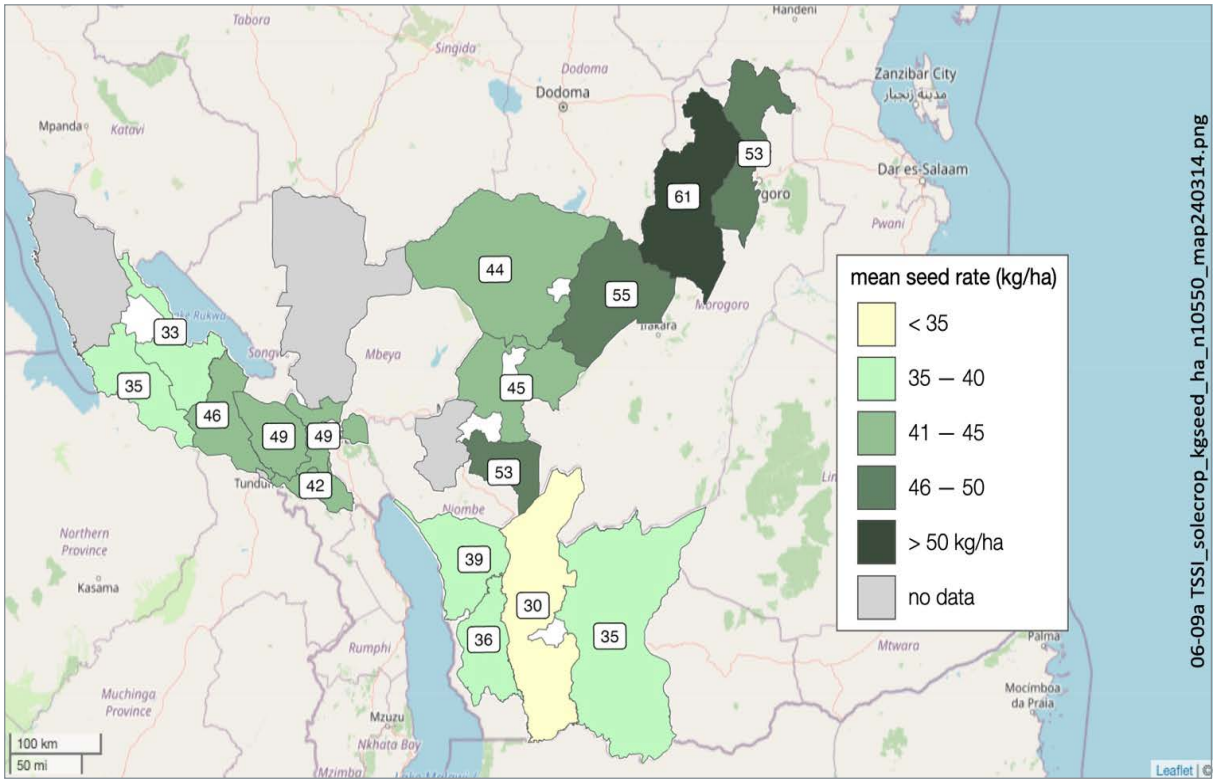

Figure 19. Average seed rate (kg/ha) on sole-cropped Soybean fields (n =10,550)

Inoculant use

Soybeans can fix atmospheric nitrogen in their root nodules. When Soybean seeds are inoculated with the right rhizobia bacteria, nodule formation is ensured, and the Soybean can fix more nitrogen (Giller, 2001). The effectiveness of inoculation is, however, variable and dependent on a number of factors (van Heerwaarden et al., 2018). Nevertheless, inoculants are much cheaper than nitrogen fertilizer and constitute a cheap, easy, and cost-effective way to boost Soybean yields (N2Africa, 2015).

Inoculants are not widely known in Tanzania. Only 15% (n = 20,777) of the registered Soybean growers indicated that they know what inoculants are, and even fewer (9%) have used them. The use of inoculants is also limited. Only some farmers in the Kilolo district

(29% of registered farmers), Kilosa district (13%), Ludewa district (13%), Mufindi district (31%), Mvomero (14%), and Njombe-rural district (33%) (can) make use of them. Legumefix and Biofix are the inoculants used. Projects appear to be behind the greater availability of inoculants in these areas.

Manure and fertilizer use

Manure use in the Soybean field is equally low. Only 10 percent of the registered farmers indicated they had used manure on their Soybean fields in the 2022–23 season. Less than 4% (n = 20,777) use manure on their Soybean every season, while 87% never applied any manure to their Soybean crop. Nevertheless, in some areas, manure use is substantially higher than these low average use figures. For instance, in Iringa-rural (n =1,600), Mufindi (n = 2,046), Mbeya-rural (n = 344), and Njombe-rural (n = 447) districts, manure was used in the Soybean field by respectively 33, 31, 45, and 32% of the registered farmers in those districts. The relatively high manure use on Soybean fields in Iringa-rural and Mufindi districts (Iringa Region), combined with the high yields and production levels there, are suggestive of the importance of Soybean production in these districts.

Fertilizer use

The use of mineral fertilizer on Soybean was generally low in the 2022–23 season. High fertilizer prices and soya beans' capacity to grow without the application of fertilizer are undoubtedly major reasons for farmers not applying any fertilizer (80.5% of n = 20,777). However, as with manure use, important differences can be observed; i.e., in Iringa-rural, 67% of farmers (n = 1,600) indicated to have used fertilizers on their field with (intercropped) soya beans, and 68% (n = 2,046) in the Mufindi district of that region. In Mbeya-rural (n = 344), Njombe-rural (n = 447), and Wanging'ombe (n = 272) districts, fertilizer use on Soybean was 62, 67, and 41%, respectively (Figure 20). Except for Wanging'ombe district (Njombe Region), these are the same districts where manure use was more common.

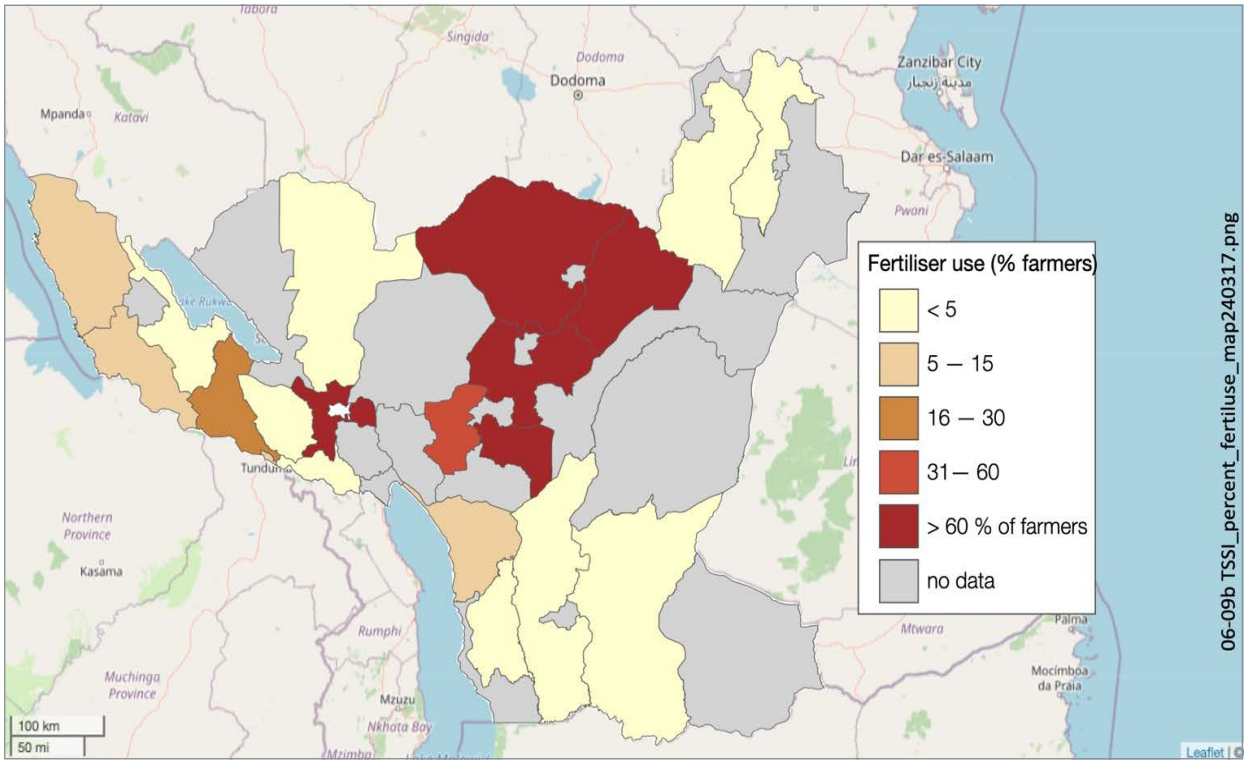

Figure 20. Percentage of farmers per district applying mineral fertilizer on sole-cropped Soybean bean fields (n = 3,059), 2022–23 season. Note: Only districts with n >100 were included.

Nevertheless, whereas the high incidence of manure and mineral fertilizer use in Iringa-rural, Mufindi, and Mbeya-rural districts appears to relate to the higher average yields (> 800 kg/ha) obtained in these districts, average Soybean yields in Wanging'ombe district were below 700 kg/ha in the 2022–23 season.

A higher incidence of fertilizer use is indicative of more intensive Soybean production (e.g., higher yields, see Figure 14: Average Soybean yields per district, 202223 season, for both farmer-estimated and GPS-measured field areas (n=20,777). Minimum number of observations per district > 100 (Tunduma: 1056 kg/ha).), but not necessarily of the importance of Soybean production for farming households' incomes. For instance, in Ruvuma Region, most farmers regard Soybean as an important crop (next to maize), yet virtually no farmer there applied fertilizer to their Soybean (0.35%, n = 10,709). While many Ruvuma farmers cultivate Soybean (as reflected in the number of registrations), and the region is a major producer of Soybean in Tanzania, production is rather extensive.

Fertilizer use practices: Types and amounts

Zooming in on the 19% of registered farmers that did apply mineral fertilizers on their Soybean (inter)crop in the 2022-–season (n = 4,340), the use of a large variety of fertilizer types is observed. On sole-cropped, fertilized Soybean fields (n = 2,800), the vast majority (87%) of farmers used (at least) a P-containing fertilizer as is recommended for soya bean. Di-Ammonium Phosphate (DAP), which contains high levels of phosphorus (18% of P_2O_5), is most common: 61%. Triple Super Phosphate (TSP), which contains the same level of phosphorus (P) (but no nitrogen), is not used. Although usually cheaper than DAP, and therefore recommended, TSP appears not to be widely known and available in the main Soybean growing districts of Tanzania.[1]

With no legume-specific fertilizers available on the market, farmers' limited knowledge about fertilizer use on Soybean is apparent in the use of relatively expensive NPK-fertilizers, rather than DAP and TSP (which constitute relatively cheaper sources of phosphorus). Furthermore, more than 11% of fertilizer-using soya growers applied nitrogen-only fertilizers to their soya, while nitrogen fertilizer application on Soybean is not necessary. Hence, there is a need for fertilizer advice for soya growers.

Planting practices: Intercropping

Soybean beans are often mixed with other crops; 37% (n = 20,777) of Soybean fields are intercropped. Intercropping is not necessarily related to the intensity of Soybean production or average yields in a district; intercropping is fairly common in Ruvuma Rin the south where production is extensive and yields generally low, but also in Mbozi district (Songwe Region), Waging'ombe district (Njombe Region), where more than half the Soybean fields are intercropped (Figure 21).

1 In Songwe Region, TSP was about 25% cheaper than DAP in November 2023. However, when DAP was bought under the government subsidy program, it was about 30% less expensive than TSP.

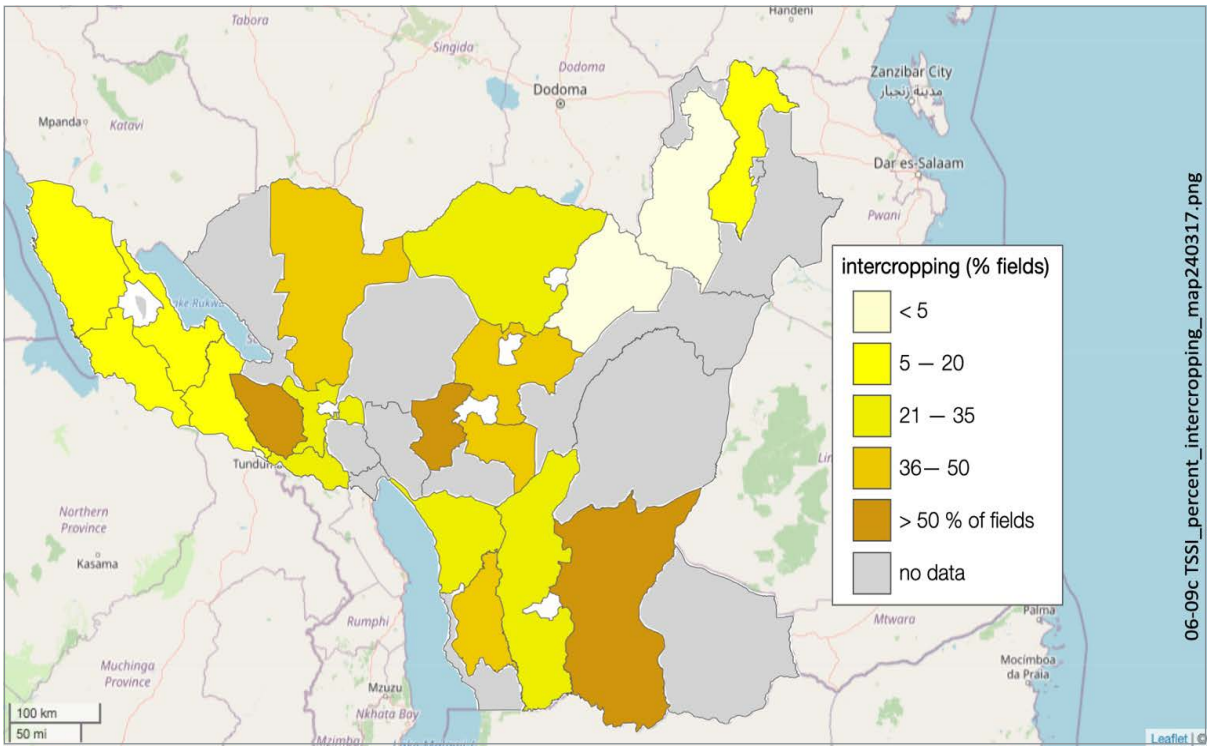

Figure 21. Percentage of intercropped Soybean fields per district, 2022–23 season (n = 20,777).

In most districts, maize and sunflower are the dominant intercrops (Table 2). As tall-growing crops such as maize and sunflower may shade the Soybean crop; intercropping with Soybean likely goes at the expense of both crops' plant density (Figure 22). When Soybean is intercropped with long-duration pigeon pea, this is not necessarily the case. Intercropping of Soybean with coffee (Mbeya-rural) or avocado (Njombe-rural, Waging'ombe districts) is likely to be limited to the first years of the tree-crops' cultivation.

Table 2. Main intercrops per district, 2022-23 season (n=7,681)

	main intercrops *(% of intercropped fields)*
Iringa	
Iringa-rural	**maize** *(91%)*
Mufindi	**maize** *(93%)*
Mbeya	
Chunya	**maize** *(68%)*, **sunflower** *(22%)*
Mbeya-rural	**maize** *(68%)*, **coffee** *(13%)*
Morogoro	
Mvomero	**maize** *(96%)*
Njombe	
Ludewa	**maize** *(91%)*
Njombe-rural	**maize** *(68%)*, **avocado** *(32%)*
Waging'ombe	**avocado** *(50%)*, **maize** *(42%)*

	main intercrops *(% of intercropped fields)*
Ruvuma	
Mbinga	**sunflower** *(69%)*, **maize** *(25%)*
Namtumbo	**maize** *(58%)*, **sunflower** *(25%)*, **pigeon pea** *(13%)*
Songea-rural	**sunflower** *(84%)*, **maize** *(11%)*
Songwe	
Ileje	**sunflower** *(70%)*, **maize** *(26%)*
Mbozi	**sunflower** *(92%)*

Note on table:
- Only districts with >50 intercropped fields are included
- Percentages indicate percentages of intercropped fields, not percentages of total fields

Figure 22. Intercropped Soybean–Sunflower field in Songwe Region, 2022–23 season. Plant density of sunflowers is reduced. (photo © J.A. Andersson)

Pests and diseases

To get some insight into what pests and diseases soybean-growing farmers face (with a view on agronomy advisory development), the digital survey included pictures of several common and easily distinguishable pests—aphids and spider mitesquestioning if the farmer had observed these in their Soybean field in the past season. A similar question was asked for common diseases: bacterial blight, frog-eye leaf spot, and leaf rust. To both questions, an additional “other pest” or “other disease” category was added to see if farmers faced other, more difficult-to-identify pests and diseases as well. It appeared that the common pests and diseases were indeed the most observed ones; unidentified “other diseases” were observed in fewer than twenty percent of fields by farmers in Sumbawanga-rural, Mbinga, and Iringa-rural districts, and in fewer than five percent of fields in all other districts. Unidentified “other pests” were observed in more areas: in fewer than twenty percent of fields in Ruvuma Region, in Ileje and Mbozi districts (Songwe Region), Iringa-rural, and in Sumbawanga-rural and Kalambo districts (Rukwa Region). In all other districts, farmers observed unidentified “other pests” in fewer than five percent of fields in the 2022–23 season.

Common diseases in soybean, such as leaf rust, are widespread, although the percentages of fields affected per district differ (Figure 23). The incidence and impact of these diseases could be lowered if newer, more disease-resistant and tolerant Soybean varieties that have already been released in Tanzania were made more widely available to farmers.

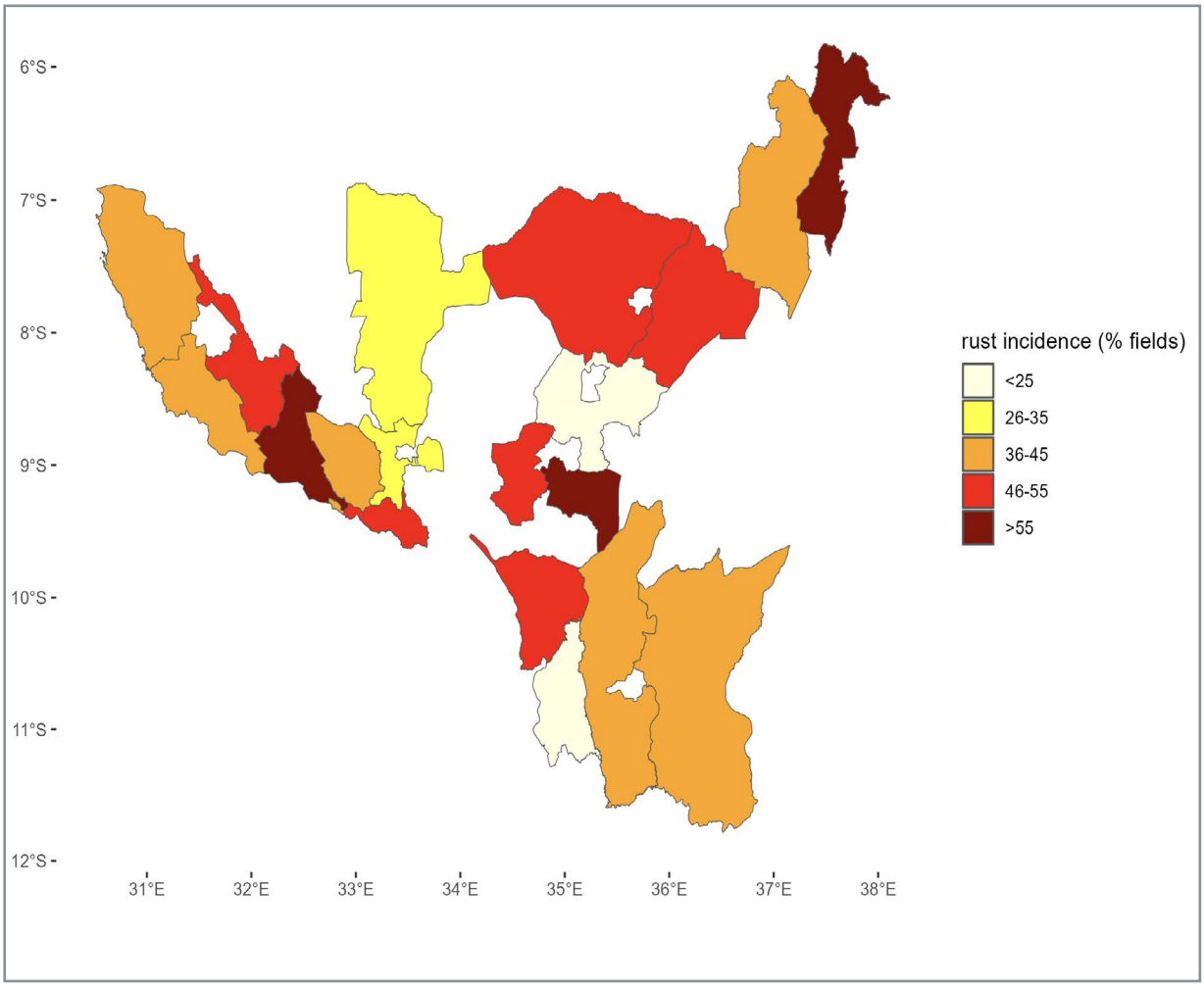

Figure 23. Incidence of leaf rust (percentages of fields per district) as observed by soybean-growing farmers, 2022–23 season.

6

Soybean marketing and farmer organization

Most registered farmers market their Soybean through private traders, especially in areas with more experienced Soybean growers. Selling to another farmer is generally an alternative to selling to a trader. Marketing Soybean appears to be problematic, especially in districts where many farmers have little experience with Soybean growing (and where there are ongoing projects and government campaigns), and finding a buyer is often difficult. Low prices constitute another reason why farmers do not immediately sell all their harvested soybean. The length of the Soybean selling season also differs substantially per district, and this is likely also related to these marketing problems. Organized sales through cooperatives are limited to some districts in the Ruvuma and Iringa regions.

Marketing channels

Soybean growers use various marketing channels (Figure 24). Meanwhile, in selected districts of Ruvuma—Namtumbo district in particular—and Iringa regions, substantial numbers of farmers sell their Soybean through cooperatives. Private traders are the most used marketing channel in Songwe Region and parts of Rukwa Region. In areas where traders constitute a less important channel—like in Nkasi, Sumbawanga-rural (Rukwa Region), and Ludewa (Njombe Region) districts—other farmers appear to take on that role. Sale through projects is limited to farmers in Njombe rural district, Iringa Region, and Mvomero district (Morogoro Region). Contract farming of Soybean and direct sales to Soybean processors is generally very limited and geospatially scattered.

In most districts, Soybean marketing appears to be problematic, as evidenced by substantial numbers of farmers who postpone sales due to low prices or an absence of buyers. Especially in Morogoro Region, where most registered growers were first-time growers in the 2022–23 season, farmers indicate they struggle to sell their soybeans. Similar problems are also faced by many farmers in Mufindi, Ludewa, and Waging'ombe districts. In the Songwe Region and Mbeya-rural district, where Soybean growing appears to be hardly initiated by (past) project and government interventions, numerous farmers appear to delay the sale of their Soybean due to low prices.

These findings on marketing channels and challenges suggest that the TSSI may build on different existing marketing channels in the different soybean-producing districts to support the marketing of soybeans; i.e., on produce-buying farmers in Nkasi and Sumbawanga-rural and Ludewa districts, or the functional cooperatives operating Namtumbo district in Ruvuma. Market information provision, e.g., on production locations and volumes, to private traders may help to overcome the problem of farmers being unable to sell their soybean, while price information provision to farmers may help them make decisions on sales.

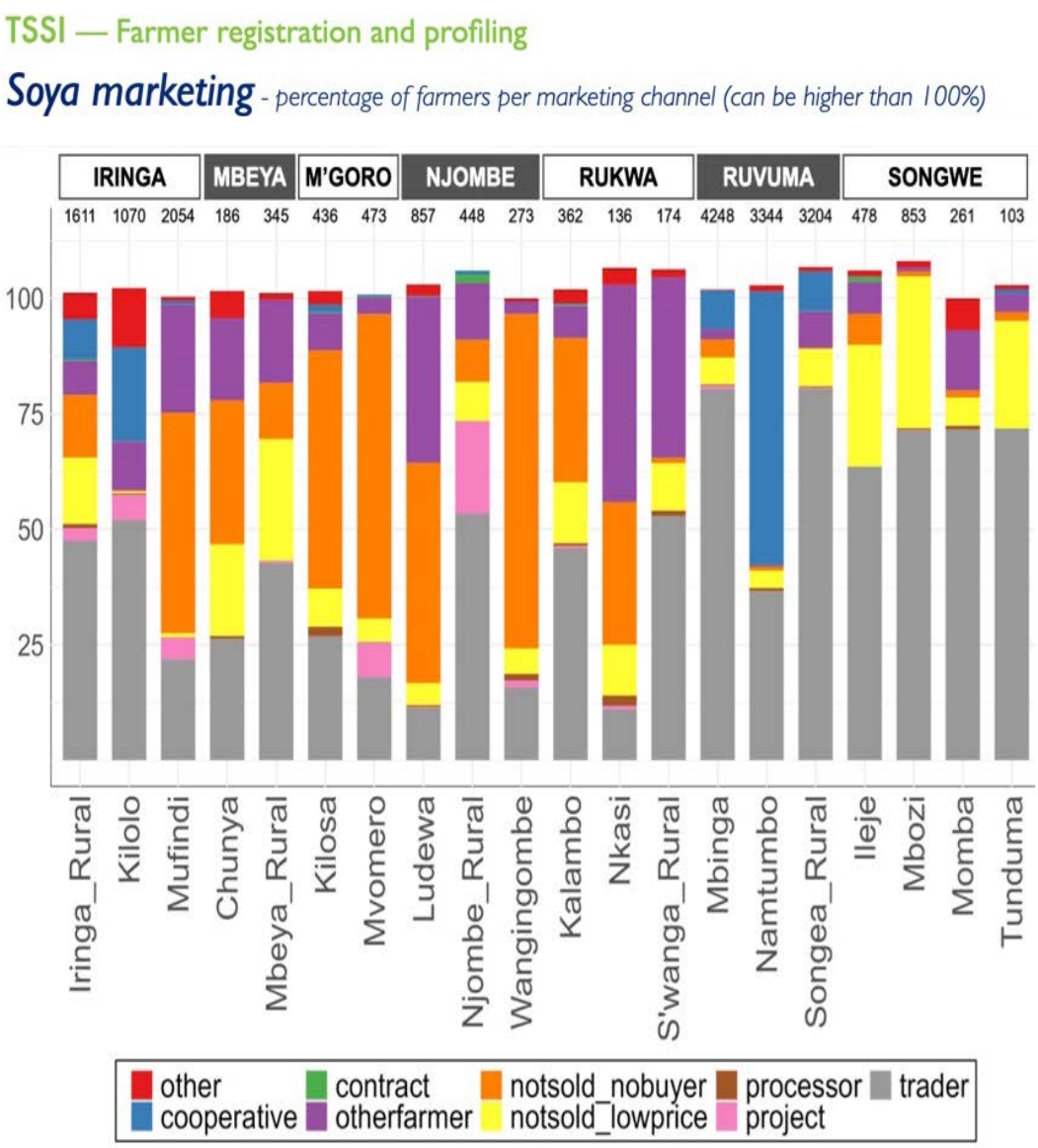

Figure 24. Percentage of farmers per district using a specific marketing channel (n = 20,777).
Note! As farmers may use more than one marketing channel, totals may be > 100%.

Marketing time

Soybean growers usually start selling their produce immediately after harvest and threshing. Marketing season starts relatively early, in May, in Rukwa and Ruvuma regions, while in Iringa and Morogoro regions, the sales start last, in July. The length of the Soybean selling season differs substantially between districts, whereas in Tunduma, Momba, and Wanging'ombe districts and the whole Ruvuma Region, where most Soybean growers were registered, the sales season takes not more than four months, in Mbeya-rural district, the selling season is spread over seven months. Such differences may be related to the different forms of market organization, i.e., cooperatives in Ruvuma, but a lack of buyers and low prices may cause many farmers to delay their Soybean sales.

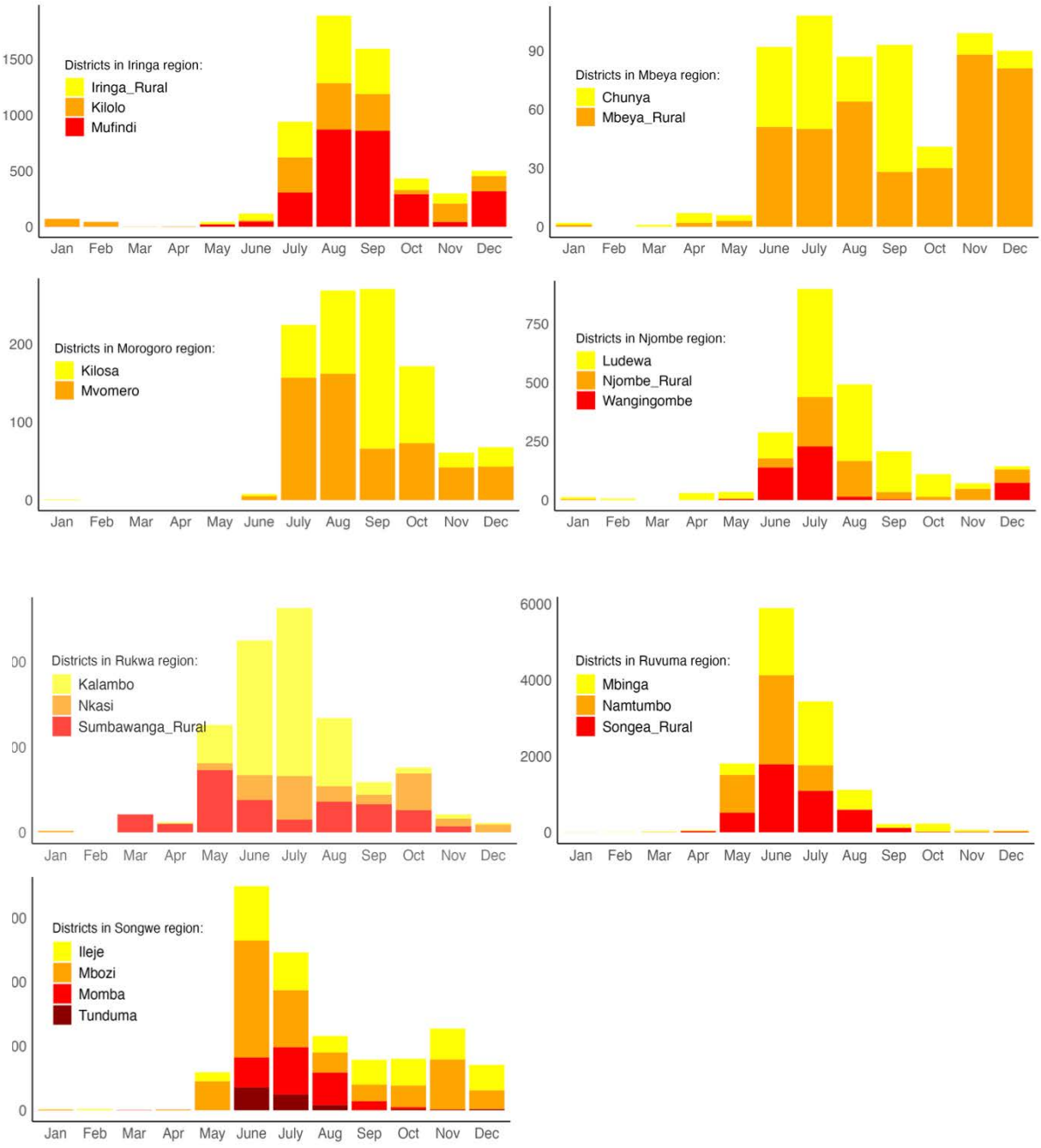

Figure 25. Months in which Soybean is sold per district (n = 20,777). Farmers were asked in which months (max.2) they sell most of their Soybean (Note! Numbers of farmers per district differ)

Farmer organization

As the TSSI may build on existing farmer organizations to target its activities, registered Soybean farmers were also asked about their membership of specific farming-related organizations. It was found that the level of organization of Soybean farmers is overall low. The highest levels of farmer organization are found in Njombe-rural district, where 77% of registered Soybean growers are members of at least one farmer organization in Iringa-rural (67%) and Mufindi (57%) districts. In all other districts, levels of organization are substantially lower, especially in Tunduma, Waging'ombe, and Kalambo districts, where 95% of registered farmers have not joined any farmer organization. Although virtually all districts have farmers in associations and savings groups, numbers are few.

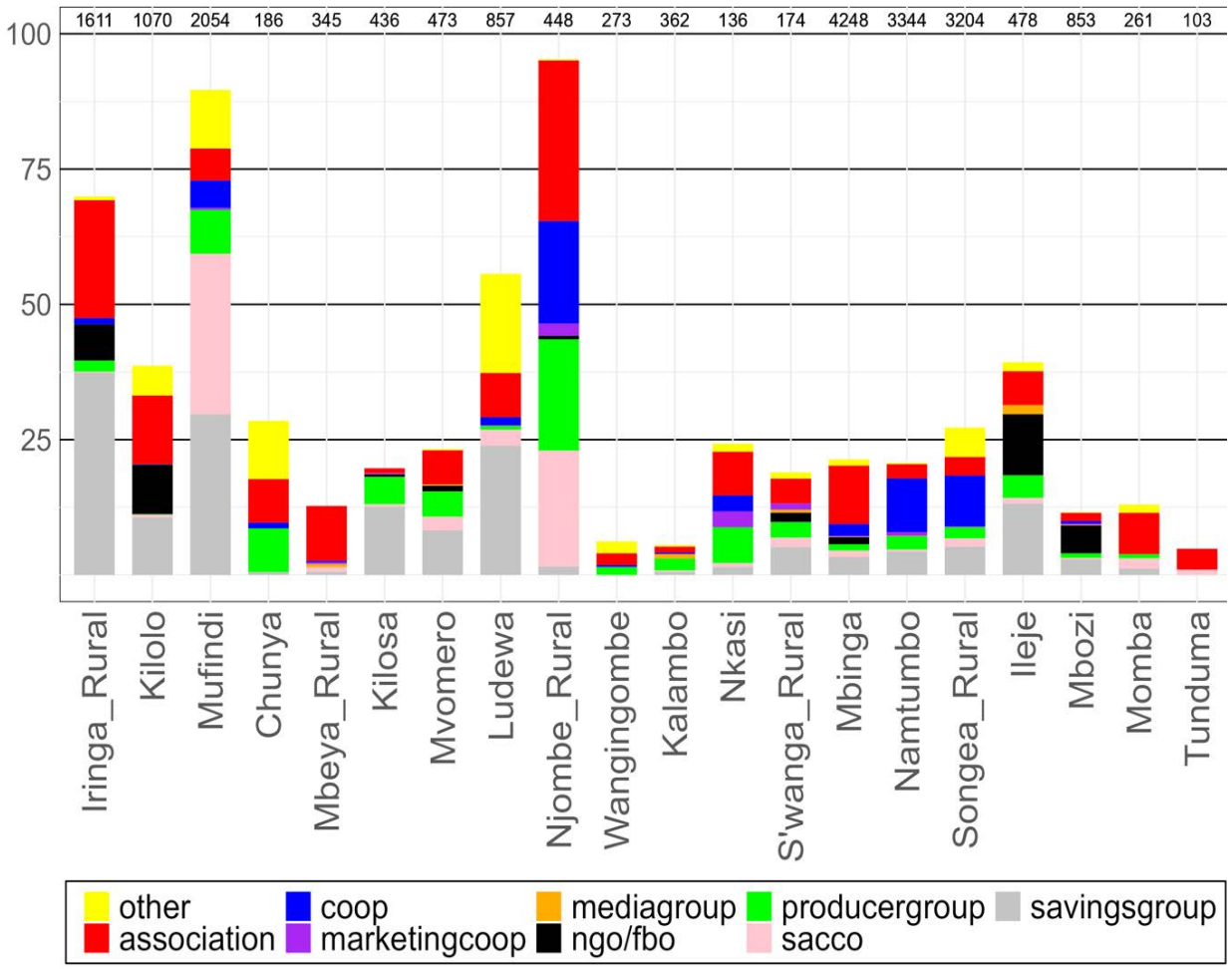

Figure 26. Percentages of farmers per district that are members of a particular type of farmer organization (n = 20,777).
As farmers may be organized in several different types of organization, the total may be higher than 100%.

Mobilizing large numbers of farmers through farmer organizations is therefore not likely to work for the TSSI; there is also no obvious type of farmer organization that unites substantial numbers of farmers in the districts with high levels of farmer organization (Figure 26).

7

Soybean producer clusters—“hotspots”

A major aim of the farmer registration exercise was to identify clusters of soybean-growers so that TSSI project activities can be targeted to these production “hotspots”. The identified producer clusters have a 5 km radius (except for Rukwa Region, where it is 10 km), and each cluster is at least served by two (or more) government extension workers. Table 3 gives an overview of the number of clusters and registered farmers per region (see also Figure 27: TSSI registered Soybean growers in Iringa Region (n = 4,703; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Iringa Region (bottom). to Figure 31: TSSI registered Soybean growers in Rukwa Region (n = 670; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Rukwa Region (bottom).33).

Farmer-MBA advice for Soybean

Identified for targeting of TSSI project activities, the Soybean producer clusters have already been used to select government extension workers for training workshops on digital soybean/maize agronomy advice provision, using the Farmer-MBA (Management-Based-Advisory) mobile phone application. Training workshops were organized in all seven regions, and about 100 extension workers have provided agronomic advice to soybean-growing farmers in advance of the 2023–24 agricultural season.

Table 3. Soybean production clusters and number of registered farmers per region.

Region	clusters	# registered farmers
Iringa	9	4,703
Mbeya	6	531
Morogoro	7	894
Njombe	9	1,576
Rukwa	9	670
Ruvuma	11	19,709
Songwe	11	1,694

Iringa Region

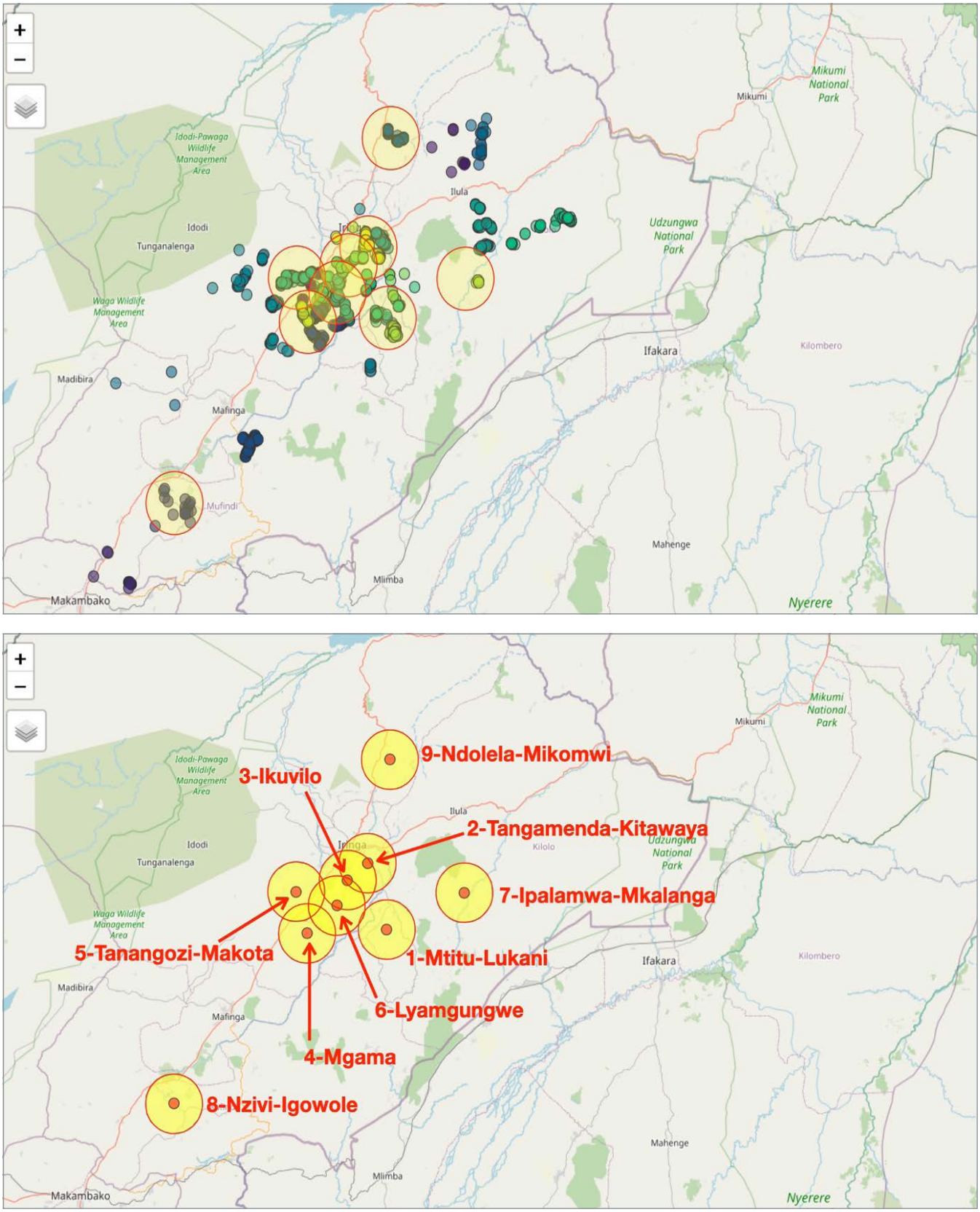

Figure 27. TSSI registered Soybean growers in Iringa Region (n = 4,703; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Iringa Region (bottom).

Mbeya Region

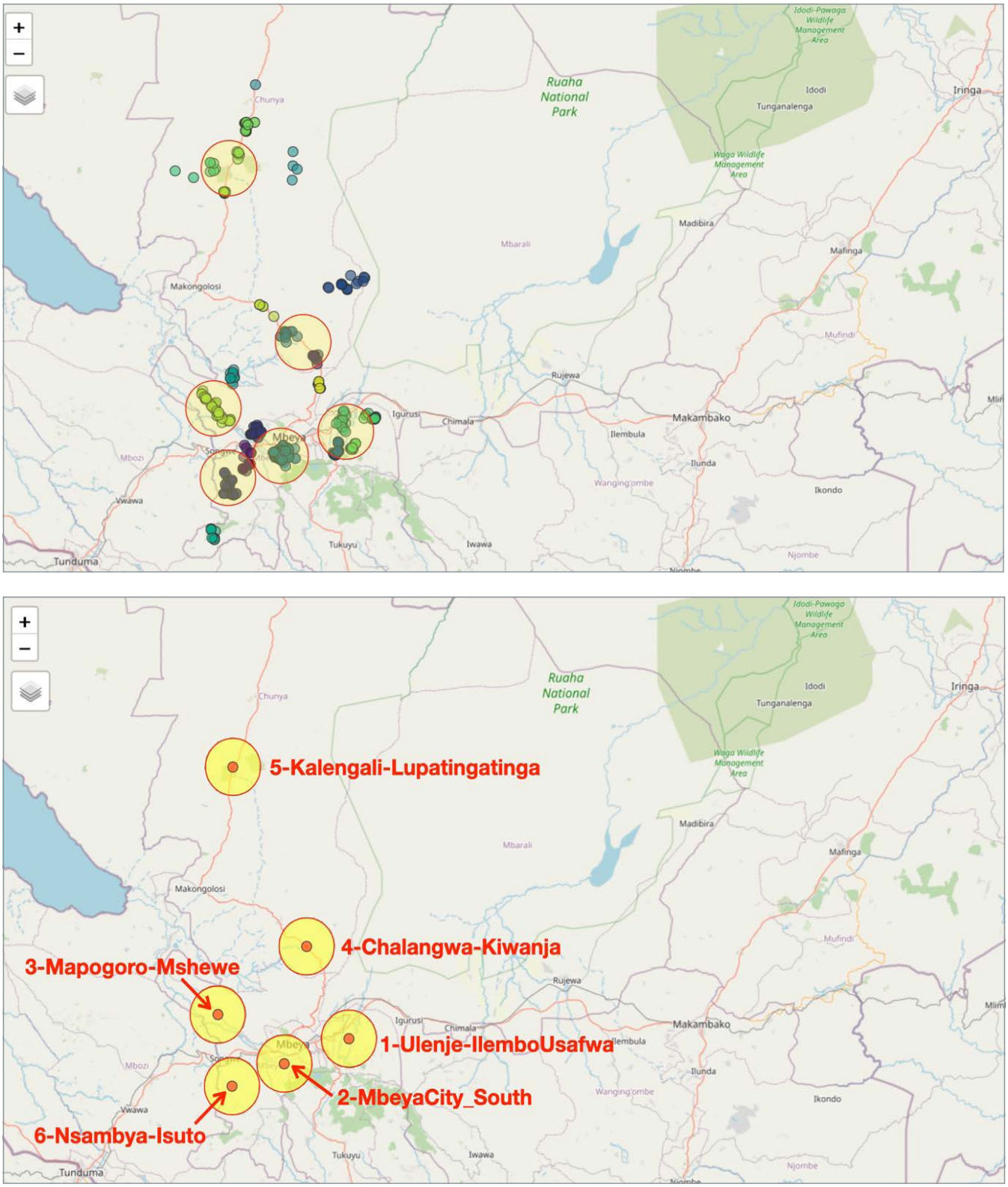

Figure 28. TSSI registered Soybean growers in Mbeya Region (n=531; not all appear on the map) and clusters (of 10 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Mbeya Region (bottom).

Morogoro Region

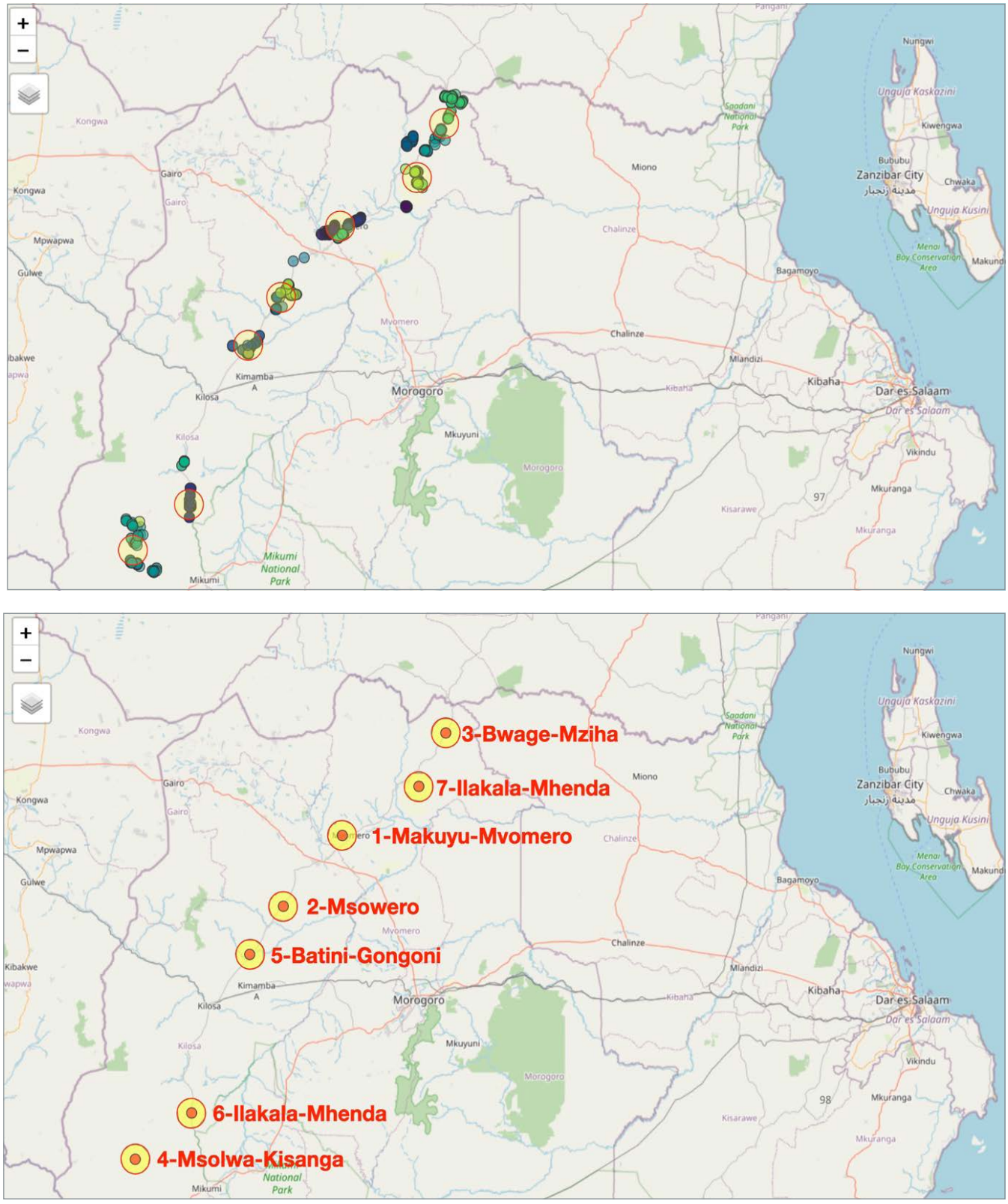

Figure 29. TSSI registered Soybean growers in Morogoro Region (n = 894; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Morogoro Region (bottom).

Njombe Region

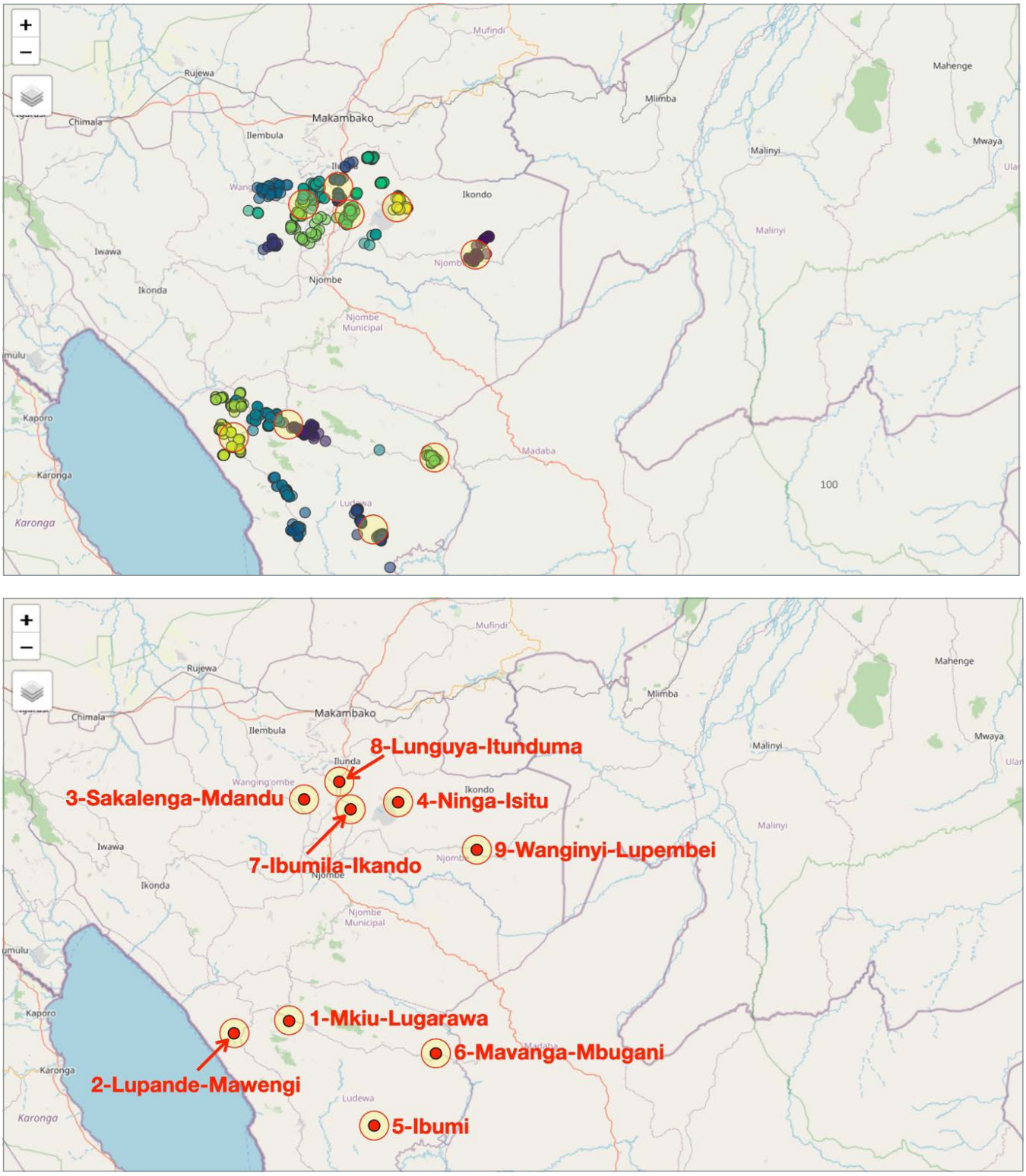

Figure 30. TSSI registered Soybean growers in Njombe Region (n = 1,576; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Njombe Region (bottom).

Rukwa Region

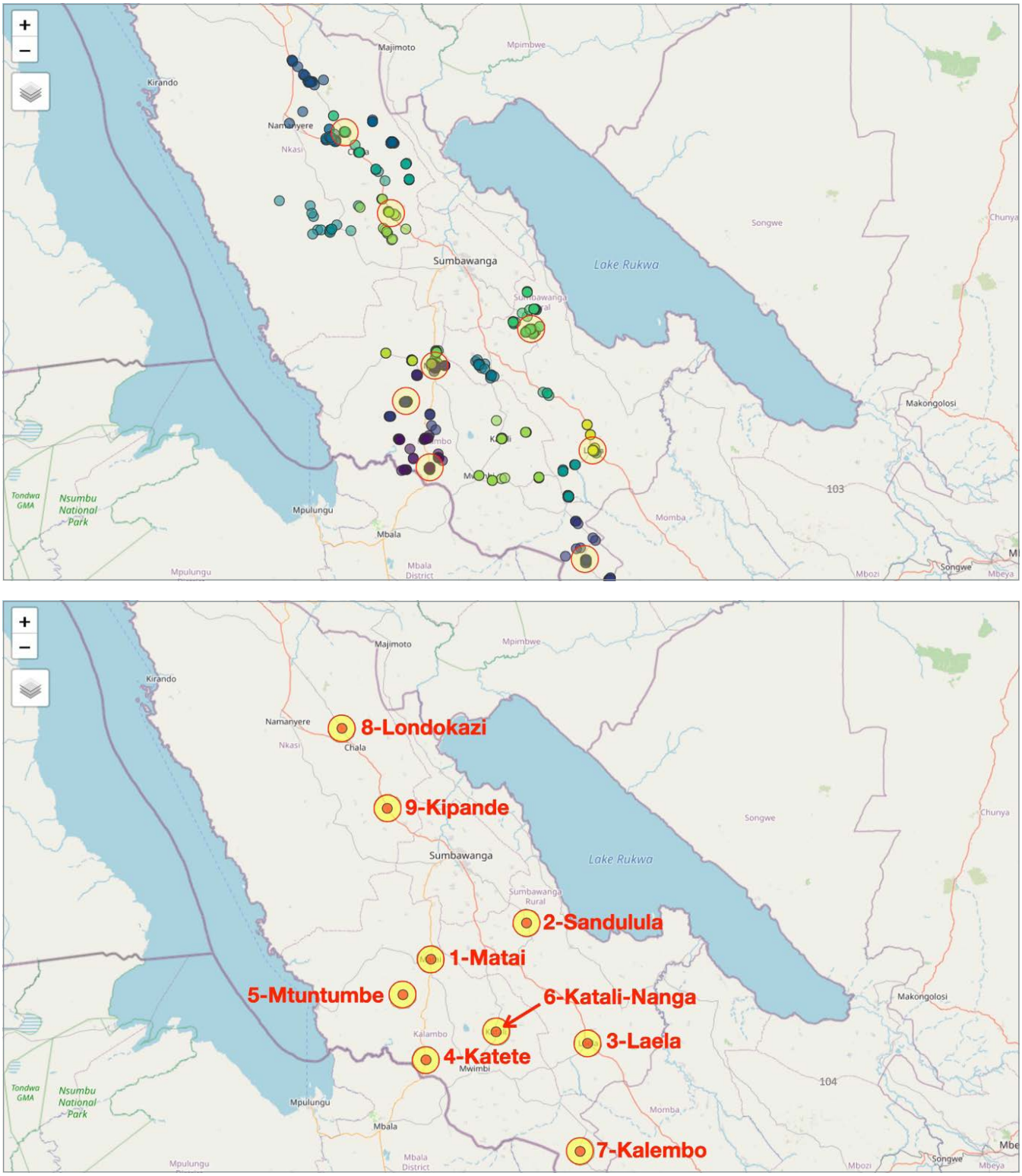

Figure 31. TSSI registered Soybean growers in Rukwa Region (n = 670; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Rukwa Region (bottom).

Ruvuma Region

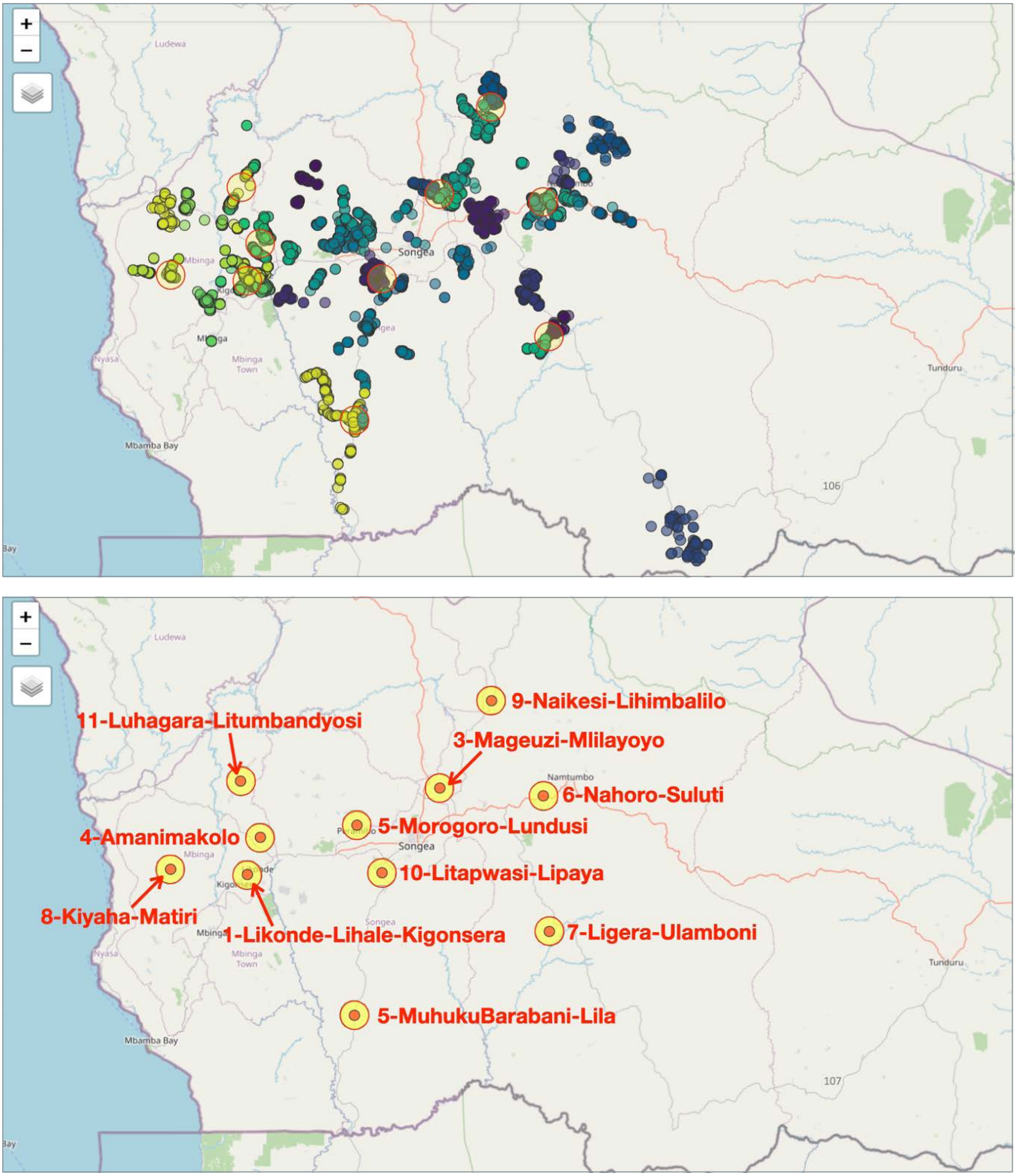

Figure 32. TSSI registered Soybean growers in Ruvuma Region (n = 10,709; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Ruvuma Region (bottom).

Songwe Region

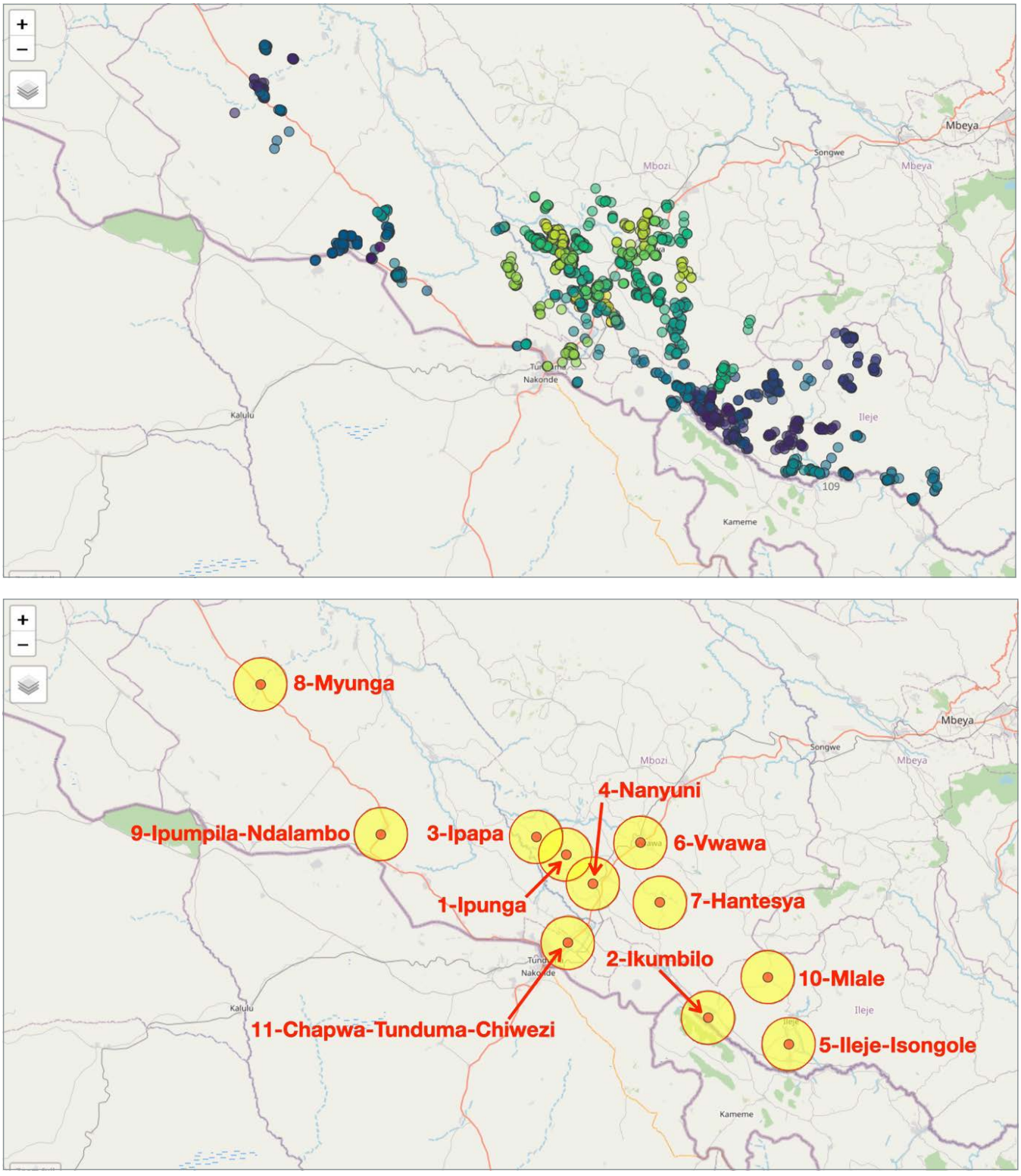

Figure 33. TSSI registered Soybean growers in Songwe Region (n = 1,694; not all appear on the map) and clusters (of 5 km radius). Colors represent different registering extension workers (top). Named clusters of Soybean growing smallholder farmers in Songwe Region (bottom).

8

Conclusions

The recent increase in smallholder Soybean production in Tanzania's Southern Highlands and Morogoro regions appears to be largely the result of increasing numbers of farmers taking up Soybean cultivation, often stimulated by projects and government campaigns or learned from neighbors. Only in a few areas (in Songwe and Rukwa regions) does the upsurge in Soybean production appear to be largely market (price) driven. In the Southern Highlands, Soybean is generally produced in an extensive manner; input use is low, and so are yields. Yields are also well below the estimated national average, as published by the FAO.

Factors limiting farmer investment in Soybean productivity include low input availability and high fertilizer prices (and their preferential use on maize), but marketing challenges such as scattered production (rising transaction costs for traders and transportation), an absence of buyers and low (and erratic) prices are likely to be the largest disincentive for larger farmers investments in Soybean production.

This report has revealed important differences between Soybean production areas within the Southern Highlands and Morogoro regions. We may distinguish at least three types of "Soybean production zones" that are characterized by different patterns of development and—partially overlapping—production characteristics:

1. The "high output, extensive production" zone (Ruvuma Region)

In the Namtumbo, Songea-rural, and Mbinga districts of this region, most Soybean farmers have been registered. Here we also find the largest numbers of experienced (> 5 seasons) Soybean growing farmers. The density of Soybean growers is relatively high in many parts of these districts, which facilitates the bulking of produce and possibly lowers transaction costs in marketing. In Namtumbo district, cooperatives play an important role in Soybean marketing, but not so much in Mbinga and Songea-rural districts. Private traders are the most important marketing channel there. The development of Soybean production in this zone seems tied up with past projects, notably the USDA-funded 'Soya ni Pesa' project implemented by CRS and partners. Although this zone appears to be the largest producer of Soybean in the Southern Highlands, production is rather extensive: Soybean fields are relatively large (0.6–0.8 ha), but yields are among the lowest. Soybean-growing farmers generally do not apply manure or fertilizers to their Soybean crop, yet most farmers rate Soybean as one of their three most important crops. Some farmers obtained improved seeds from agro-dealers, and farmers have (had) access to different Soybean varieties. Yet, average seed rates in sole-cropped Soybean fields are very low and Soybean is often intercropped. Growing Soybean in Ruvuma does not appear to be more economically attractive in Ruvuma than elsewhere; the relatively short selling season seems to relate to a lack of other cash crops and farmers' cash needs.

2. The “new growers, project-intervention” zone (Iringa Region)

Iringa (and also Morogoro) is a region where most registered farmers are first-year Soybean growers. There are centers of Soybean production in this region (around Iringa town) where farmers can obtain improved seeds from agro-dealers, and inoculant use in the Kilolo and Mufindi districts of this region is slightly above the low average use (9%) (this is also the case in Morogoro and parts of Njombe Region). The recent expansion of Soybean production in the wider Iringa area seems related to project interventions, notably by the Clinton Development Initiative and the Tanzanian Agricultural Development Bank (SAGCOT, 2022; CDI, 2014; TanzanianInvest, 2021; Wilson, 2015). The presence of large-scale farms producing Soybean in the so-called “Ihemi cluster”, south of Iringa town (i.e., Silverlands farm), a recently opened seed processing factory of SeedCo near Iringa, and several other project initiatives (in Iringa, Morogoro, and Njombe regions), all appear to contribute to this production expansion, which is characterized by more intensive production practices, e.g., higher average seed rates, and higher percentages of farmers using manure and/or mineral fertilizers on their Soybean crop. Although marketing Soybean is clearly problematic in some parts of this zone (low prices, no buyers), other farmers, cooperatives, and projects constitute different marketing options for farmers in the zone. The second largest producer of Soybean (after Ruvuma) in the Southern Highlands, this zone also has the highest Soybean yields (711–926 kg/ha), after the small Tunduma district (Songwe). Although most farmers are still new to its production, Soybean (projects) appears to be seen as an economic opportunity by smallholder farmers in this zone, at least for now. Yet, Soybean farmers have other alternative crops in sunflower, common beans, and round potato.

3. The “market-driven” zone (Mbozi district, Songwe Region)

A third, relatively small Soybean production zone can be identified in the Mbozi district in the Songwe Region. Unlike the Ruvuma and Iringa zones, where (past) project interventions are at least partially responsible for the expansion of Soybean production and the development of input and output markets (i.e., cooperatives, agro-dealers stocking Soybean seeds and inoculants), projects and government campaigns do not appear to have driven the expansion of Soybean production in Mbozi district. Here we find relatively many registered farmers that have taken up Soybean production in the last five years (that is, since 2017/18), and the price of Soybean appears to have been the main motivation for farmers to do so. The largest percentages of farmers mentioning good produce prices as a reason for taking up Soybean production are found in the districts of Songwe Region (but to a lesser degree also in Rukwa and Ruvuma regions). Lower transport costs (empty lorries coming from Zambia take up loads in Songwe Region to transport to Dar es Salaam[1]) may also have been a factor in this; private traders dominate the Soybean market in Songwe Region, and mobilizing transport is probably cheaper here.

The relatively large concentration of Soybean growers in (parts of) Mbozi district probably also facilitates produce bulking, possibly lowering the transaction costs of Soybean sales. Nevertheless, (recent) low prices for Soybean makes many farmers delay their sales; unlike their colleagues in Ruvuma, they seem to have alternative crops (sunflower, groundnut,

1 Another example of the importance of cheap transport is found in Andersson (1996), who reported on round potato being transported cheaply to Dar es Salaam in the early 1990s.

common beans, maize) to market. In terms of productivity, Mbozi Soybean farmers occupy an intermediate position; their yields are lower than those obtained in Iringa, but so is their input use. Mbozi farmers lack access to commercial (SeedCo) varieties and inoculants and often intercrop their Soybean with sunflower, yet they use relatively high seed rates when planting Soybean beans as a sole crop.

Next to the “producer clusters” per district that are used for targeting TSSI activities (see previous chapter), the “Soybean production zones” identified above can be useful to quickly identify and understand Soybean farmers’ production practices and motivations for (not) investing in Soybean productivity.

9

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Appendix 1. Age and gender of registered Soybean growers.

Population data from: https://sensa.nbs.go.tz