TANZANIA SUSTAINABLE SOYBEAN INITIATIVE (TSSI)

REPORT

SOYBEAN GROWERS' REGISTRATION AND PROFILING

2024

SAGCOT SOUTHERN AGRICULTURAL GROWTH CORRIDOR OF TANZANIA

IITA Transforming African Agriculture

CGIAR

FARM TO MARKET ALLIANCE Making markets work better for farmers

WFP World Food Programme

ASPIRES Tanzania Agricultural Sector Policy and Institutional Reforms Strengthening

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Disclaimer

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We extend our deepest gratitude to the TSSI program management team under SAGCOT for strategic leadership and unwavering commitment to the initiative's success. Funded by the Embassy of Norway, this initiative has been implemented in collaboration with the World Food Programme (WFP) via the Farm to Market Alliance, the International Institute of Tropical Agriculture (IITA), and ASPIRES Tanzania.

Special thanks are also extended to the Ministry of Agriculture and Regional and Local Government Authorities for Rukwa, Mbeya, Njombe, Iringa, Morogoro, Songwe, and Ruvuma for their invaluable contributions and commitment to enhancing agricultural productivity and supporting sustainable livelihoods in the soybean value chain. We sincerely appreciate the dedication and resources provided by all stakeholders, which have been instrumental in achieving the objectives of this initiative.

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LIST OF ACRONYMS

CRS	-	Catholic Relief Services (international NGO that worked on soya bean production promotion in Tanzania)
DAEO	-	District Agricultural Extension Office
FtMA	-	Farmer to Market Alliance (https://ftma.org/)
IITA	-	International Institute for Tropical Agriculture
N2Africa		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 group (PPS)

FOREWORD

Agriculture is undergoing a significant transformation, driven by both local and external opportunities and challenges. Opportunities include the emergence of new markets, advancements in crop research and development, infrastructural improvements, and enhanced access to finance. Conversely, critical challenges such as climate change, unpredictable policies, and security issues in certain regions persist.

In this dynamic environment, soybean production has emerged as a promising crop with the potential to enhance soil health, increase farmer incomes, and contribute to Tanzania's broader objectives of food and nutritional security. Understanding the current state of soybean farming is essential to unlocking this potential, and the Soybean Farmers Profiling 2024 report offers valuable insights into the status of soybean cultivation in Tanzania, specifically focusing on the Southern Highlands regions.

This report presents an in-depth analysis of Tanzania's soybean farming landscape based on the registration and profiling of 20,777 smallholder farmers. It provides crucial insights into farmer demographics, cultivation practices, and market participation, thereby creating a comprehensive view of the sector.

Soybean production has experienced notable expansion, particularly in the Ruvuma region, where over 10,700 farmers are engaged in soybean cultivation. Despite this growth, productivity remains a challenge, with yields averaging between 500 and 1,050 kg/ha significantly lower than the potential of 2,500 kg/ha that could be achieved with improved farming practices. In contrast, regions such as Iringa and Morogoro, where over 4,700 farmers have recently adopted soybean farming, report higher yields, ranging from 711 to 926 kg/ha. This difference can be primarily attributed to more intensive farming practices and improved access to inputs through various project interventions.

A significant barrier to enhancing productivity is the limited application of agricultural inputs. Only 9% of farmers reported using inoculants, while 19% applied fertilizers, essential for boosting yields. Expanding access to quality seeds, fertilizers, and other inputs is vital for enabling farmers to realize the full potential of their crops.

Marketing challenges also persist, particularly in regions like Morogoro and Mufindi, where farmers face low prices and difficulty securing buyers. This results in delayed sales, prolonging the selling season. In contrast, regions like Ruvuma, where production is more concentrated, benefit from lower transaction costs and better market access, underscoring the need to strengthen market linkages across all regions.

The report further identifies three major soybean production clusters, each with distinct characteristics. Ruvuma, the largest cluster with over 10,700 registered farmers producing 4,600 tonnes of soybeans, encounters low yields due to extensive farming practices. Iringa, a rapidly growing cluster supported by various projects, produces 1,500 tonnes of soybeans with higher

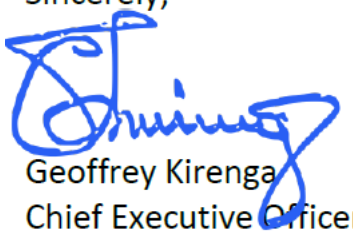
yields attributable to superior input use. Songwe, a smaller, market-driven cluster, sees farmers motivated by favourable soybean prices, although low input utilization restricts their productivity.

These findings suggest the next steps for TSSI's interventions. By addressing input gaps, improving agronomic practices, and enhancing market access, we can unlock the full potential of soybeans as a critical crop for income generation, soil fertility improvement, and food security in Tanzania. The clusters identified in the report will guide targeted interventions to ensure resources are directed where they will have the most significant impact.

We are deeply grateful to our partners, including the International Institute of Tropical Agriculture (IITA), the World Food Program/the Farmer to Market Alliance (FtMA) and ASPIRES Tanzania for their collaborative efforts in making this report possible. We also thank the Government of Tanzania, the Royal Norwegian Embassy for the financial support and the government extension officers whose contributions were instrumental in registering and profiling the farmers.

This report will be a valuable tool for policymakers, investors, and development partners as we work together to build a more resilient and prosperous soybean sector in Tanzania.

Sincerely,



Geoffrey Kirenga
Chief Executive Officer

EXECUTIVE SUMMARY

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

Yet, farmer registration also provided an opportunity to gain more insight into soya growing farmers, their experiences, their productivity, and production practices, as well as their participation in markets and farmer organisations. Such information, which is reported upon here, is of high relevance to the TSSI's development and targeting of project activities.

Below, the key findings are summarised.

Sample strategy and relevance of findings

Since the aim was farmer registration, this report does not claim to present a representative picture of the state of soya bean production in the Southern Highlands or Tanzania. Government extension workers independently registered soya growers in their respective operational areas. As *soya 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.* Yet, as the dataset of 20,777 farmers spread over 20 districts, is substantially larger and more detailed on soya production practices than the TSSI baseline survey (n=1,263) (Aspires, 2023). *This study is probably the largest sample of smallholder soya growers in Tanzania to date*.

Soya bean producers and the importance of soya beans

Soya growing in the Southern Highlands and Morogoro region – Tanzania's high potential zones for soya bean production – is geospatially uneven. There are many growers in Ruvuma and Iringa regions, but also in Mbozi district (Songwe), and in parts of Njombe and Rukwa.

Most farmers has cultivated soya for less than five seasons. Only in specific districts such as Mbeya-rural, Njombe-rural, Mbozi and in Ruvuma region, soya appears to be a more established crop. *The uptake of soya bean production is often the result of (past) NGO projects and government campaigns or learned from neighbours.* Only in Rukwa, Ruvuma and Songwe regions, farmers mention good market prices for soya as their main motivation for taking up soya production. *Soya 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 (i.e. Iringa) the gender distribution is much more even.* A higher percentage young soya farmer in some districts should not be seen as a sign that soya is an economic opportunity that attracts young farmers. *While maize is an important crop for all soya growing farmers, soya and common beans are most often among the three most important crops farmers cultivate.* In numerous districts (Mufindi, Chunya, Mbeya-rural, Kilosa, Mvomero, Nkasi, Sumbawanga-rural), soya remains a minor crop, even for soya growers.

Soya bean production, areas, productivity

Although agricultural statistics show a substantial increase over the past five years, the *increase in soya bean production in Tanzania appears to be primarily due to an increasing cultivated area and*

increasing number of farmers producing soya beans. Average yields (at district level) range from 500-1050 kg/ha, and these low figures cast doubt on the validity of FAO estimated figures (1,100-1,200 kg/ha) on soya bean production in Tanzania. Fields are relatively small (0.2–0.7 ha), and farmers often overestimate the size of their soya bean field. The largest soya fields are found in the Ruvuma region – where production is rather extensive. In Iringa-rural and Mufindi districts soya bean production is relative intensive. *High production areas are the Iringa and Ruvuma regions and the Mbozi district (Songwe).*

Soya bean production practices

In most areas soya bean production is not very intensive. *As soya can grow without fertiliser, manure and artificial fertiliser are hardly applied* (10% and 19% respectively). Yet, in some districts – i.e. Iringa-rural – about a third of soya growing farmers applies manure or artificial fertiliser on their soya crop. Farmers' limited knowledge about fertiliser use on soya is apparent in some using nitrogen fertilisers.

Farmers knowledge about seeds and inoculants is also limited. For instance, only 29% knows which soya variety they grow. Seeds are largely recycled on-farm (44%) or obtained from neighbours (26%). The distribution of new, improved seeds like Uyole 04 and SeedCo varieties appears to be limited to specific areas in Iringa, Morogoro and 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.*

Soya beans 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 soya 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 fairly widespread. *The incidence and impact of diseases in soya could be lowered if newer, more disease resistant and tolerant soya varieties could become more widely available.*

Soya marketing challenges and farmer organisation

Most farmers market their soya beans through private traders, especially in areas with more experienced soya 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, while contract farming and direct sales to processors is very limited.

Soya marketing appears to be problematic: low prices and finding a buyer is often difficult - the latter 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 soya selling season. The length of sales season differs substantially per district.

This report has revealed important differences between soya-producing areas within the Southern Highlands and Morogoro regions. We may distinguish at least three types of 'soya production

clusters' (Chapter 8) that are characterized by different patterns of development and – partially overlapping – production characteristics:

1) the 'high output, extensive production' cluster (Ruvuma region)
2) the 'new growers, project-intervention' cluster (Iringa region)
3) the 'market-driven' cluster (Mbozi district, Songwe region)

These clusters constitute a useful addition to the soya 'producer clusters' that have been distinguished (in chapters 7) for the geo-spatial targeting of TSSI activities. Although the 'production clusters' have partially overlapping characteristics, they are characterised by different patterns of development, differences in the importance of soya for farmers' livelihoods, and their production practices. The production clusters can be useful tool to quickly identify and understand different soya farmers' production practices and motivations for (not) investing in soya productivity.

1. INTRODUCTION

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

1.1. The promotion of soya bean production in Tanzania

Soya bean production has expanded substantially in Tanzania in recent years (TSSI, 2024). Soya-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 soya beans are also increasingly exported (Wilson et al., 2021; Kangile et al., 2021). Next to its value as food, feed, cash- and export-crop, soya bean 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), soya beans can enrich the soil with nitrogen, a vital nutrient for Tanzania's major cereal crop, maize. Soya beans are among the highest nitrogen fixing legume crops (Giller, 2001). The integration of soya beans into smallholder farmers' cropping systems can thus contribute to overall farm productivity – especially if soya bean production is intensified[1] – and reduce smallholder dependence on synthetic (nitrogen) fertilisers. In addition, crop diversification with soya beans can make cropping systems more resilient against pest and diseases (breaking disease cycles) and climate change. However, farmers growing soya bean are likely to be first and foremost interested in the income they can generate with the cultivation of this crop – *soya beans are predominantly produced for the market* (Aspires, 2023).

1.2. The Tanzania Sustainable Soybean Initiative (TSSI)

The Tanzanian government and agricultural development organizations have been promoting soya bean production to enhance livelihoods and food security. Together with the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), the International Institute for Tropical Agriculture (IITA), Farmers to Market Alliance (FtMA), ASPIRE and other partners are implementing the *Tanzania Sustainable Soybean Initiative* (TSSI) in the Southern Highlands regions (Iringa, Mbeya, Njombe, Rukwa, Ruvuma, Songwe) and Morogoro region, where most soya is produced. The TSSI seeks to intensify soya bean production and sustain cereal (maize) yields by reducing the use of nitrogen fertilizers while improving smallholder farmers' and resilience to climate change. The initiative taps into the multiple benefits of soya bean 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-soybean dominated cropping systems through the integration and intensification of soya bean 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

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

exercise for the TSSI. Although several organizations and projects have focused on smallholder soya bean production in recent years (notably CRS, CFI, CARE and 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, often lack (up-to-date) contact details of farmers and their current soya bean 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 soya-growing farmers also provided an opportunity to quickly profile soya growers, identify farmer networks and organizations through which soya production and marketing may be stimulated, and identify some of the production and marketing challenges soya 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 soya-growing farmers in the Iringa, Mbeya, Morogoro, Njombe, Rukwa, Ruvuma and Songwe regions of Tanzania.

While the soya farmer registration was specifically aimed at creating a database of soya bean 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-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 analyse the geographical diversity among soya-growing farmers, their investment, agronomic and marketing practice,

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

1. Create an up-to-date database of smallholder soya bean 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 soya bean 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 soya bean-growing smallholder farmers in a short period (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 soya bean growing farmers**, including: location (region/district/ward/village), GPS-location of the farmers' homestead and/or his/her 2022-23 season main soya bean field, gender, name, telephone number, farm ownership status, age and education-level;

2) **Basic soya bean production data**, including: experience in soya bean growing, main crops grown, area of the farmer's main soya bean field (GPS-measured/estimated), (inter)cropping practices, soya bean variety grown, seed source, input use (manure/fertilizers/herbicides), inoculant use, yield, pest and disease problems;

3) **Soya bean marketing and farmer participation in (production/marketing) groups**, including: marketing channels, timing of sales, group membership.

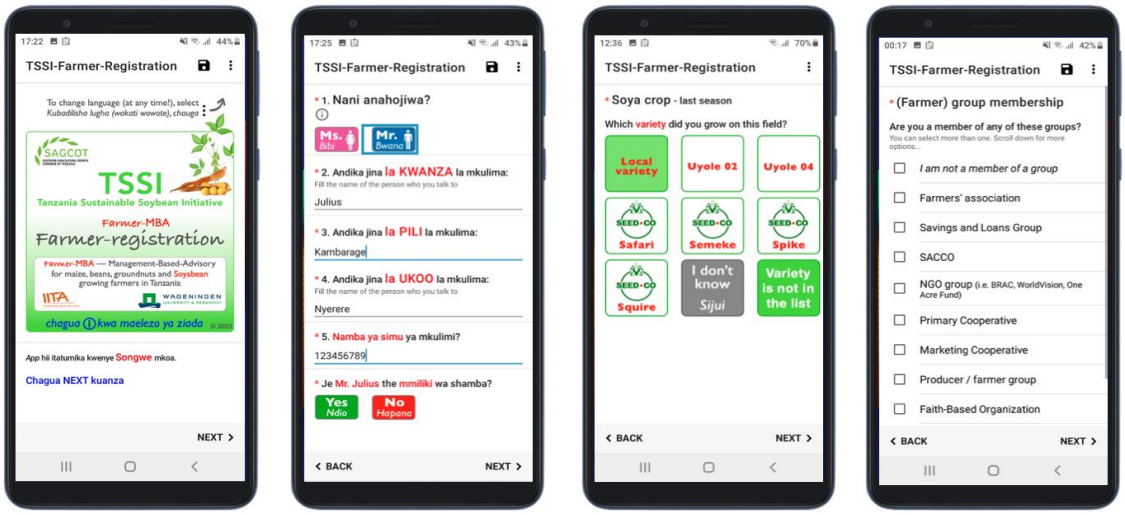


Figure 1: Selected screens of digital farmer registration tool: start-screen, personal data, information on soya bean cultivation practices and farmer participation in (producer/marketing) groups.

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 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 through 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 soya growing farmers in his/her operational area. Consequently, not all districts in the seven major soya producing regions are represented in this farmer registration exercise (Figure 2).

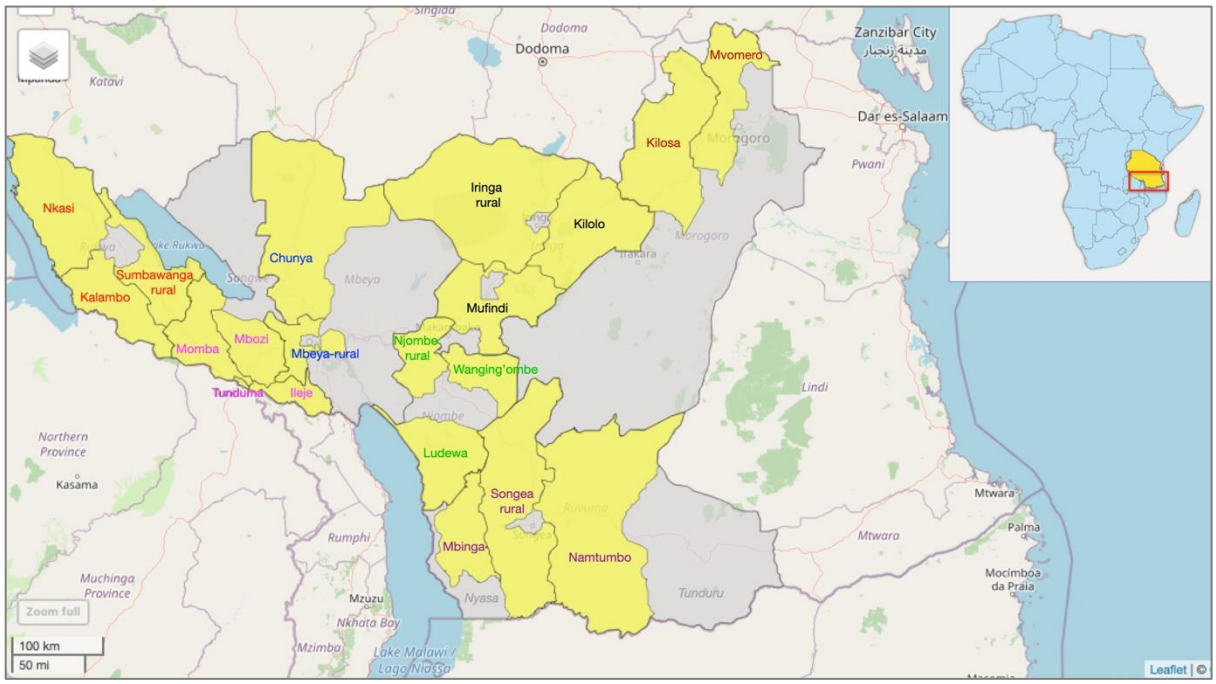


Figure 2: Focal districts of the TSSI farmer registration (yellow, label colour per region) within the Southern Highlands and Morogoro regions.

Trainings of extension workers in digital survey tool use were organized per region. The first training (by WUR) took place in Vwawa, Songwe region in July 2023, and was followed by trainings 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 a 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 (district 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 soya beans is highly concentrated in specific areas. For instance, more than half (51%) of all registered soya-growing farmers reside in only three districts of Ruvuma region (Mbinga, Namtumbo, Songea-rural). Other concentration areas are Mbozi district (Songwe region), Such uneven distribution of soya growers suggests that production of soya is concentrated in particular areas. Such concentration of production in 'soya hotspots' does not appear coincide with differences in agro-ecological circumstances or population densities.

Table 1: Number of extension workers, farmer registrations, and average registrations per extensionist, 2023

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**

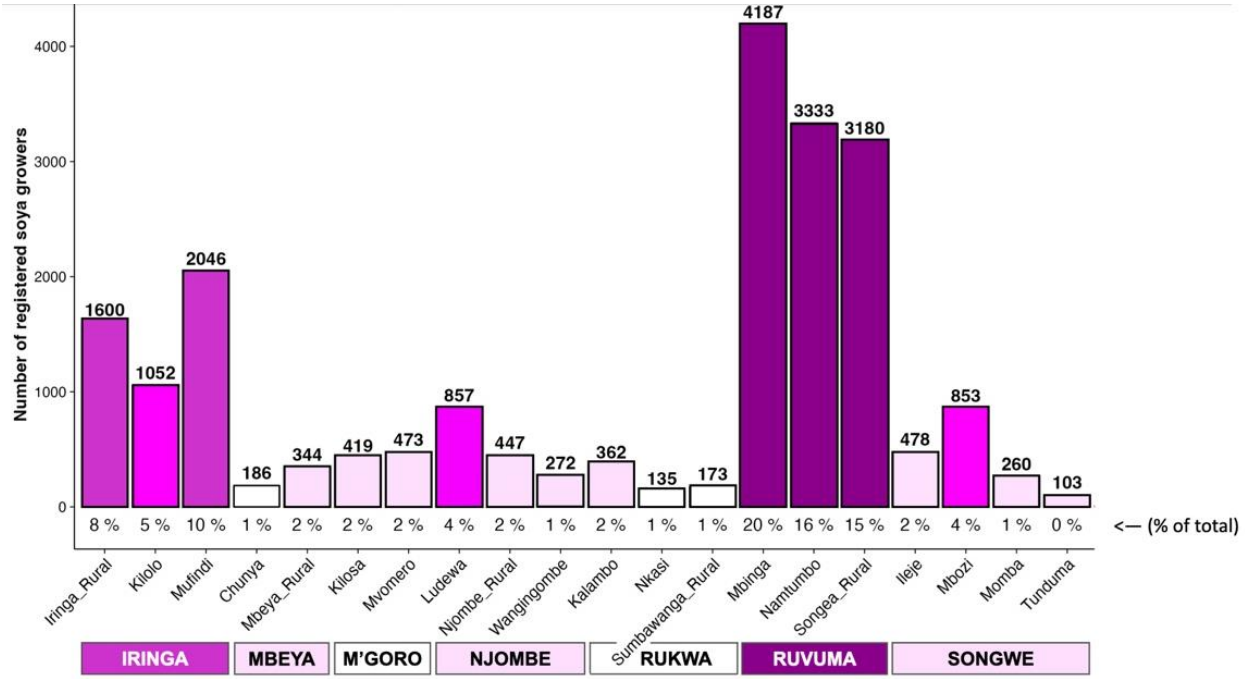


Figure 3: Number of registered soya bean growing farmers per district, in Southern Highlands regions, and Morogoro in 2022-23 season

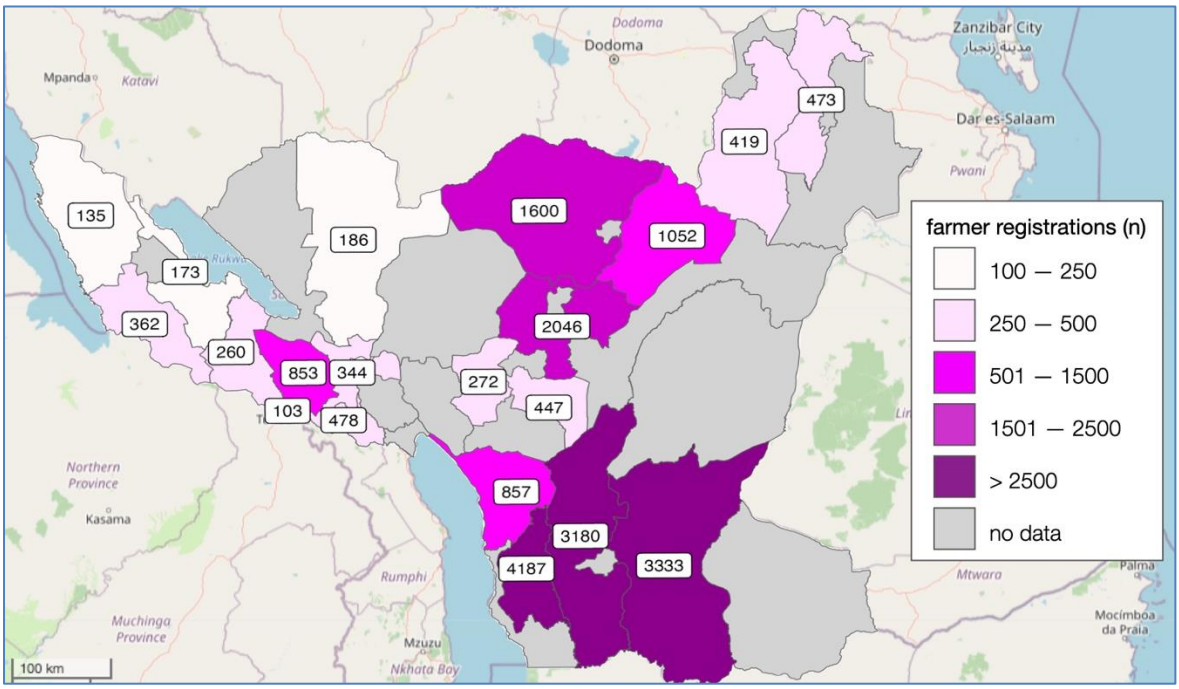


Figure 4: Distribution of registered soya bean growing farmers per district in Southern Highlands regions and Morogoro, 2022-23 season

2. SMALLHOLDER SOYA PRODUCERS

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

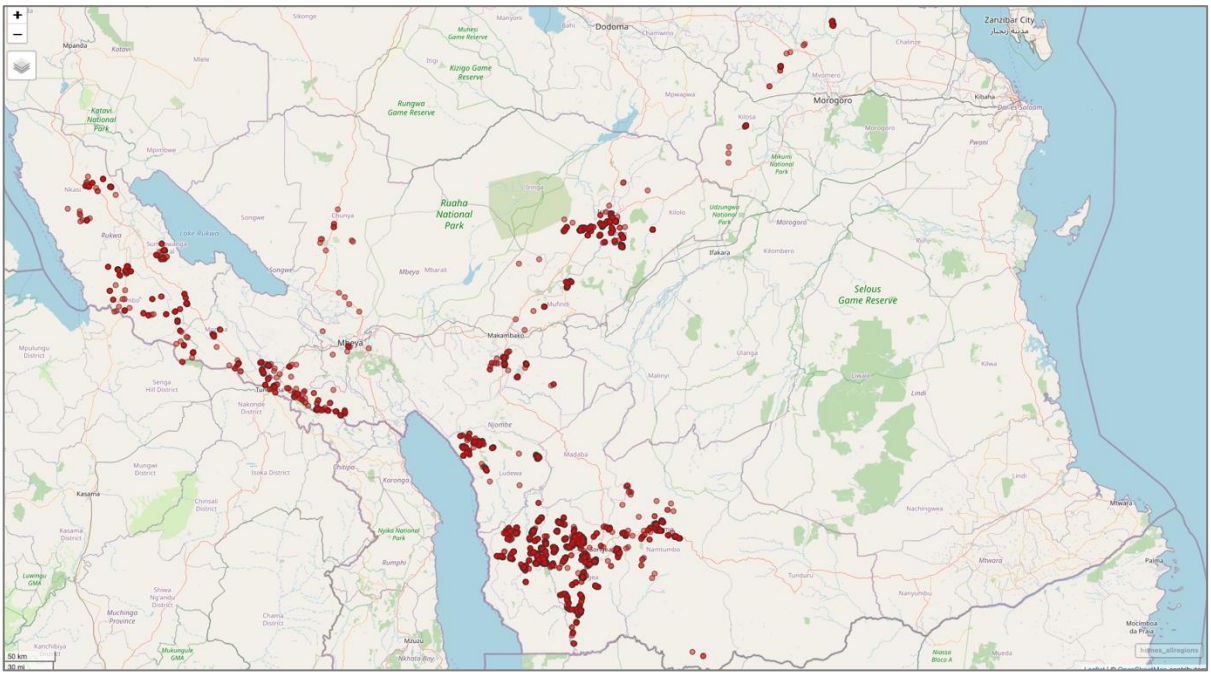


Figure 5: Spatial distribution of registered soya-growing farmers in seven regions of Tanzania, 2022-23 season. (Note! not all registered growers are visible on this map)

2.1 Who is growing soya beans?

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 soya 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 soya growing.

The average age of the registered soya grower is 46 years (for both men and women). *Soya cultivation is dominated by farmers in the 35-55 age category* (1st and 3rd quartile). Yet, the diversity among soya growers is large. For instance, in Rukwa region soya 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 soya (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 soya production, while in Ruvuma region male soya growers tend to be younger, between 30 and 50 years of age (in Figure 6). In Rukwa, and also Songwe regions, men of all ages between 30 and 60 years appear to be equally involved in soya 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).

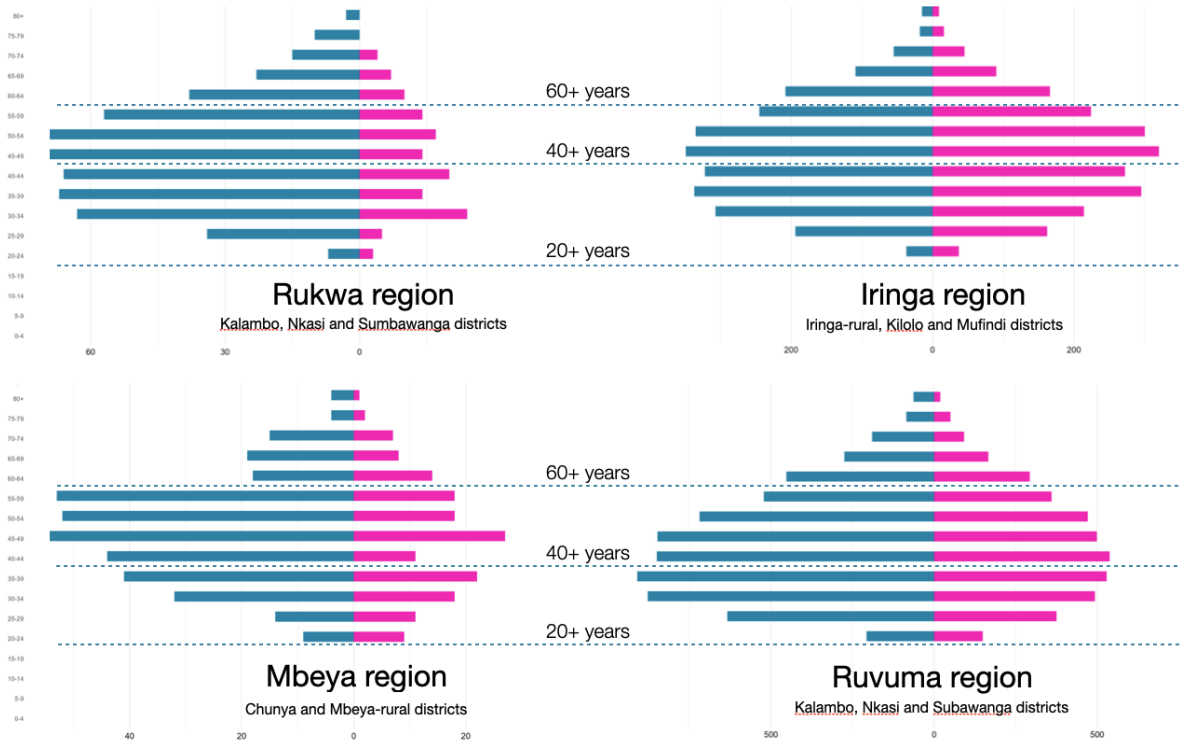


Figure 6: Population pyramids (sex-age distributions) of registered soya-growing farmers for selected regions.
Note: Only farmers above 18 years of age could be registered. category 18-20 years of age is omitted from the figure.

Soya cultivation: gender and youth

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

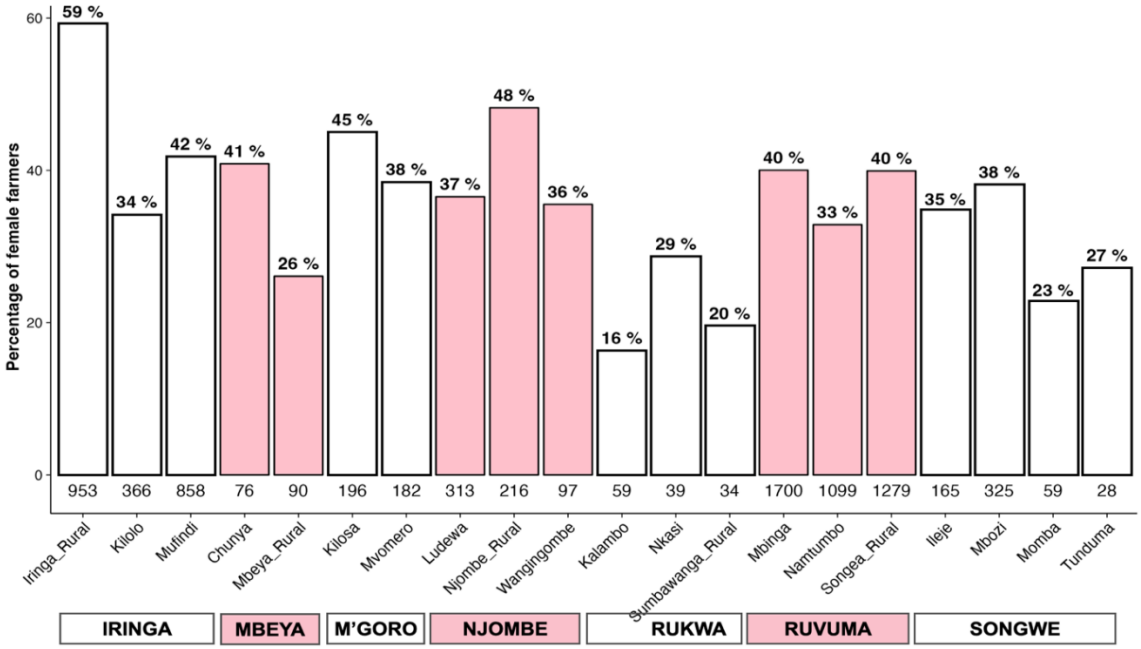


Figure 7: Percentage of registered female soya bean farmers per district, 2022-23 season (number of registrations per district below bar)

As already noted above, *soya 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 soya growers*. There are no clear observable spatial patterns in the distribution of young soya growers, arguably except for the Ruvuma region, where the percentage of young farmers in soya is slightly higher. Given the low level of productivity and intensity of production in there, this *higher percentage young soya farmers should not be seen as a sign that soya is an economic opportunity that attracts particularly young farmers.*

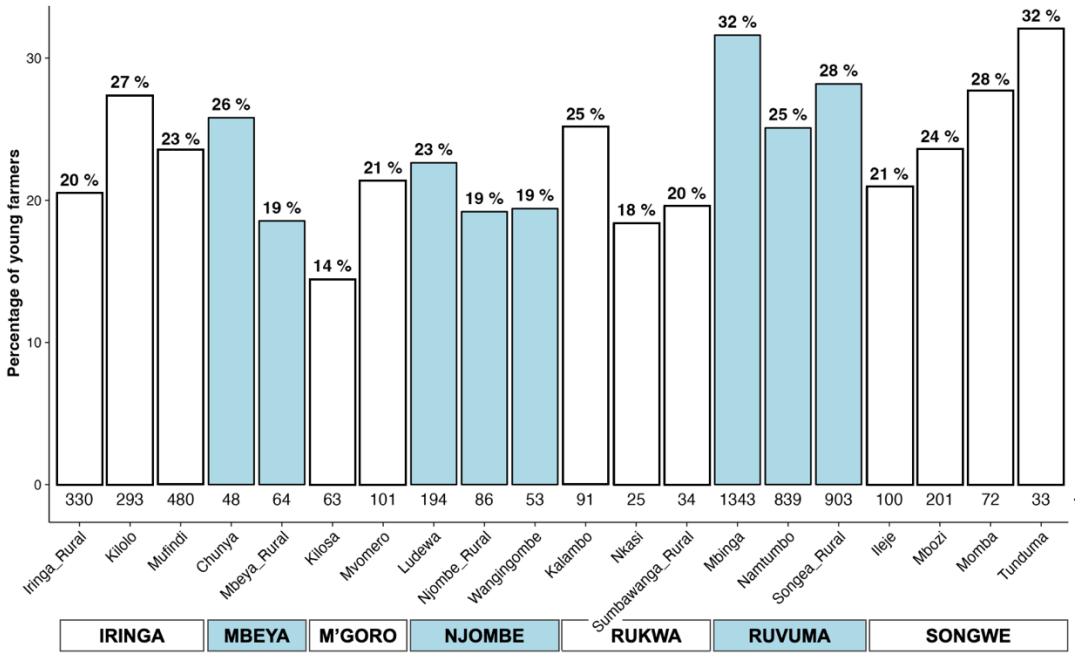


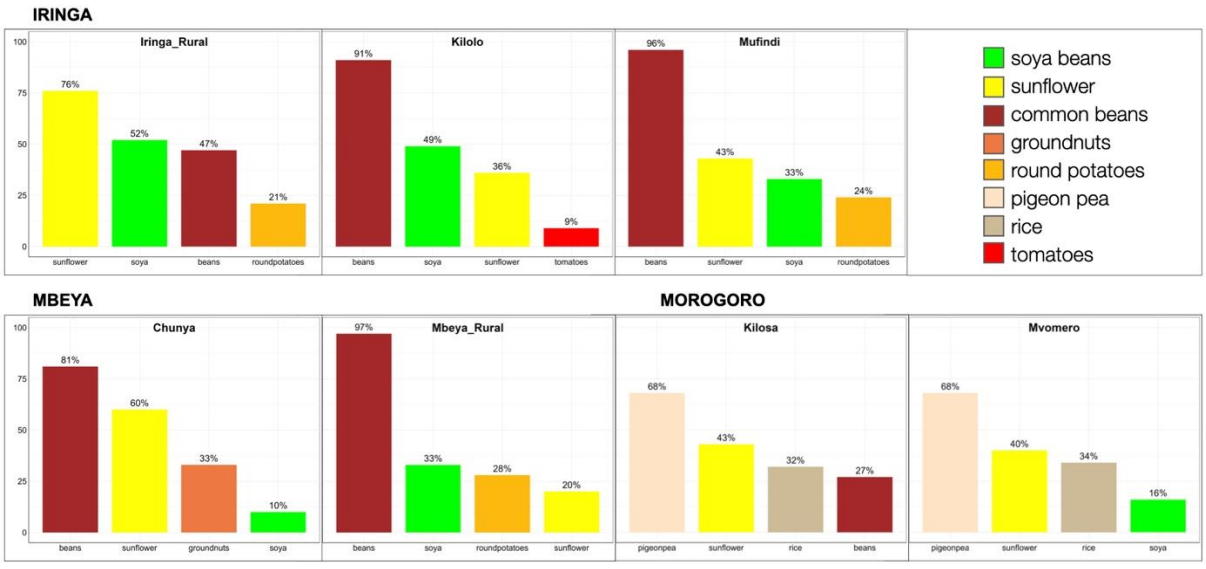
Figure 8: Percentage of registered young (<35 years of age) soya bean growing farmers per district, 2022-23 season (number of registrations per district below bar)

3. SOYA BEANS PRODUCING FARMS

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

3.1. Soya growing farmers: the relative importance of soya

All registered soya growing farmers considered maize to be one of their three most important crops. However, what were considered other important crop different per district. For instance, in Iringa-rural district most farmers viewed sunflower among their three most important crops, whereas in Kilolo and Mufindi districts, common beans where're more often among their three most important crops. It is important to note that in several districts few (or none at all) registered soya growers did not consider soya beans among their three most important crops. In these districts farmers usually considered common beans, pigeon pea groundnuts and sunflower among their three most important crops. Figure 9 shows that in Songwe region, soya growing farmers often also rate groundnuts among their most important crops. *Only in Ruvuma region, do most farmers consider soya beans among their three most important crops; in districts of Kilolo, Njombe-rural, Kalambo and in Songwe region, soya is also considered an important crop, but many other districts, soya beans are a minor crop.*



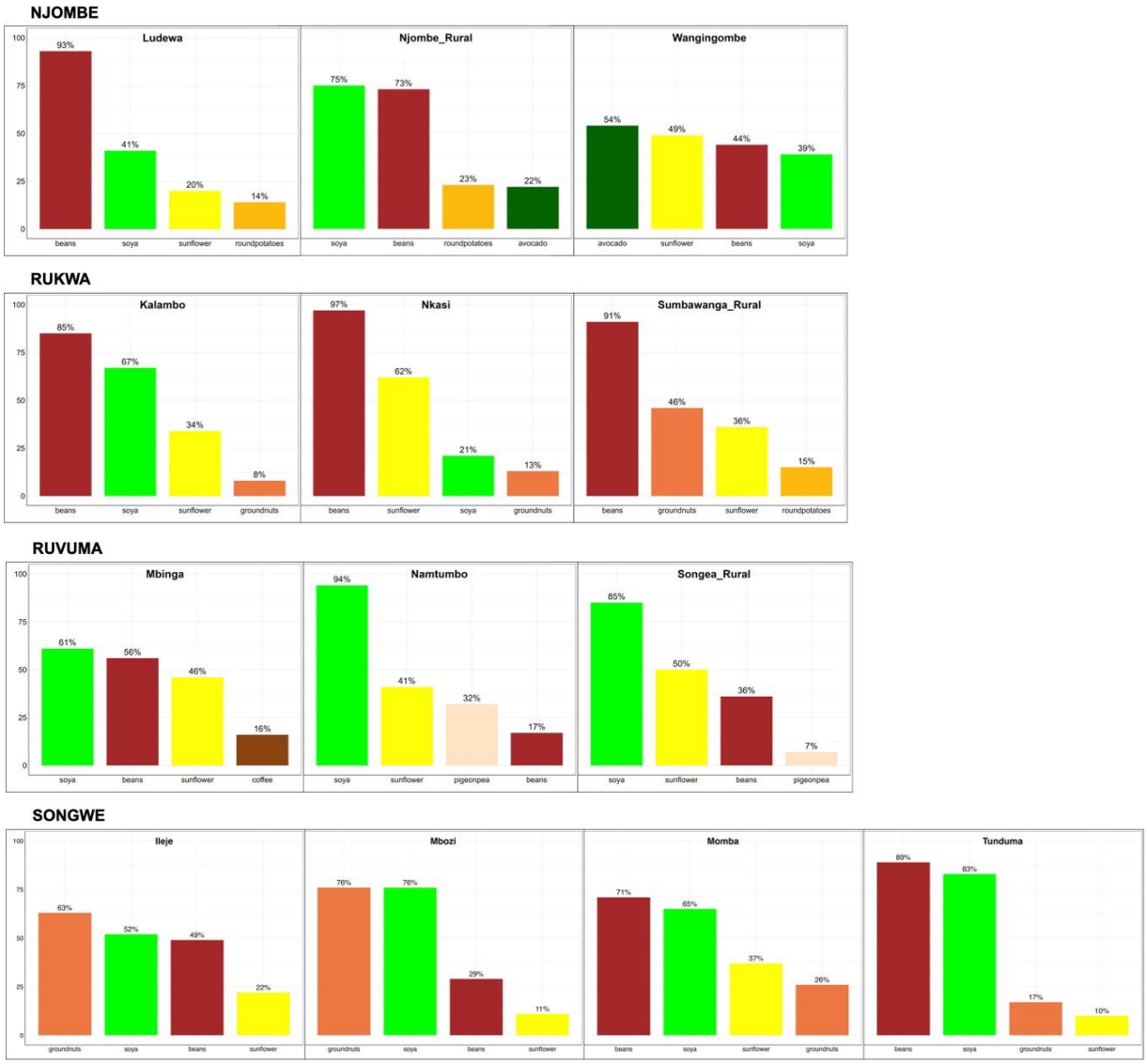


Figure 9: Soya-growing farmers' three most important crops: Percentage of farmers per district mentioning a crop. (Maize is mentioned by ≥98% of farmers and therefore not included in this figure)

Considering the relative length of the bars in, we can observe that, for instance, groundnuts or common beans are often an alternative to soya beans in Songwe region. In Ruvuma region, where most soya growing farmers were registered, there are fewer clear alternatives to soya bean production, especially in Namtumbo and Songwea-rural. *The relative importance of soya bean production for farmers in Ruvuma region, thus seems partly due to a lack of alternatives.*

3.2. Farmer experience in soya cultivation and drivers of uptake

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

When considering Figure 10 and Figure 11 together it becomes apparent that the expansion of soya production in Morogoro region and Iringa region, and especially the Mufindi district, is very recent, and largely driven by projects and government. But also, in areas with a longer history of soya 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 soya production in Morogoro, Njombe and Ruvuma regions in the period 2012-2016 (CRS,2016). In the districts of Iringa, Morogoro and Njombe region included in this study, *the uptake of soya bean production thus appears to be mostly the result of (NGO) projects and government campaigns or learned from neighbours*.

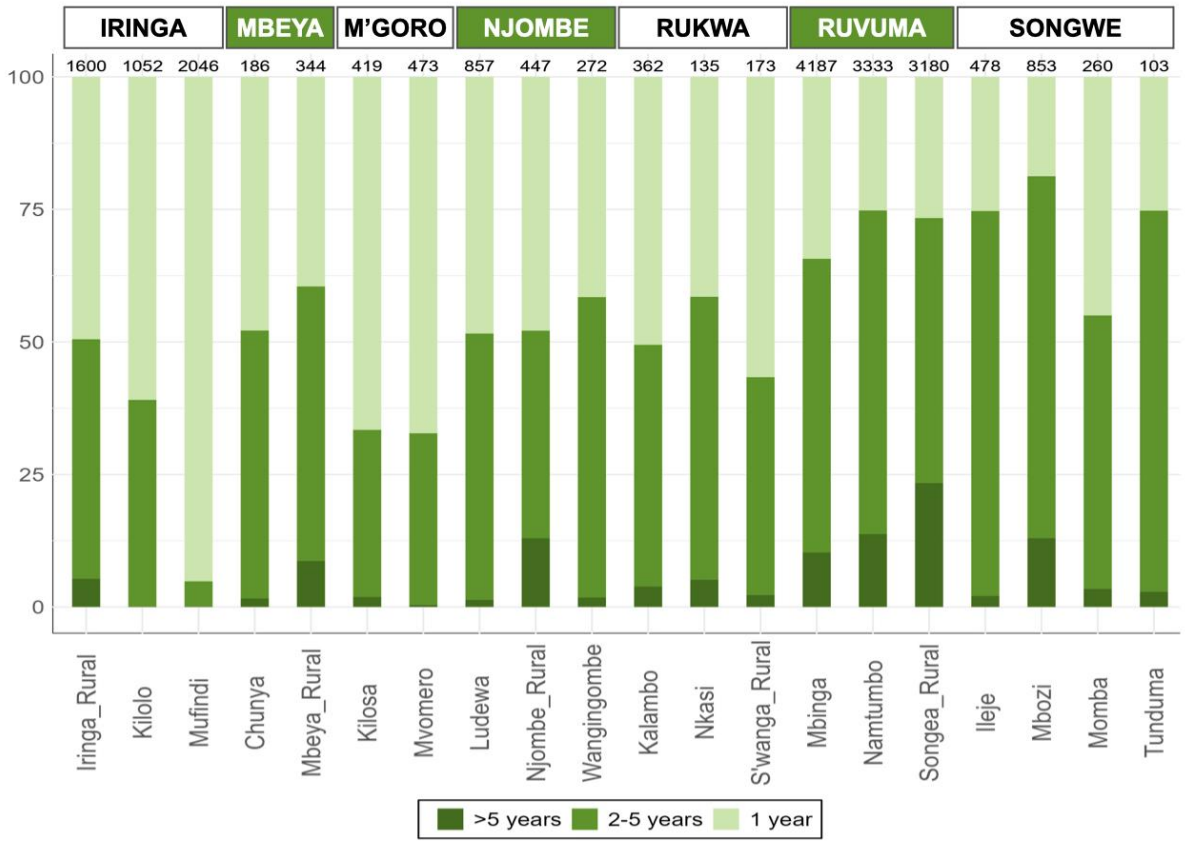


Figure 10: Number of years cultivating soya: Percentages of farmers per district (region and total number of observations above stacked bar (n=20,777)

The pattern of soya bean 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 soya, many farmers in these regions also mention the market price of soya as a motivation to start its production (Figure 11).

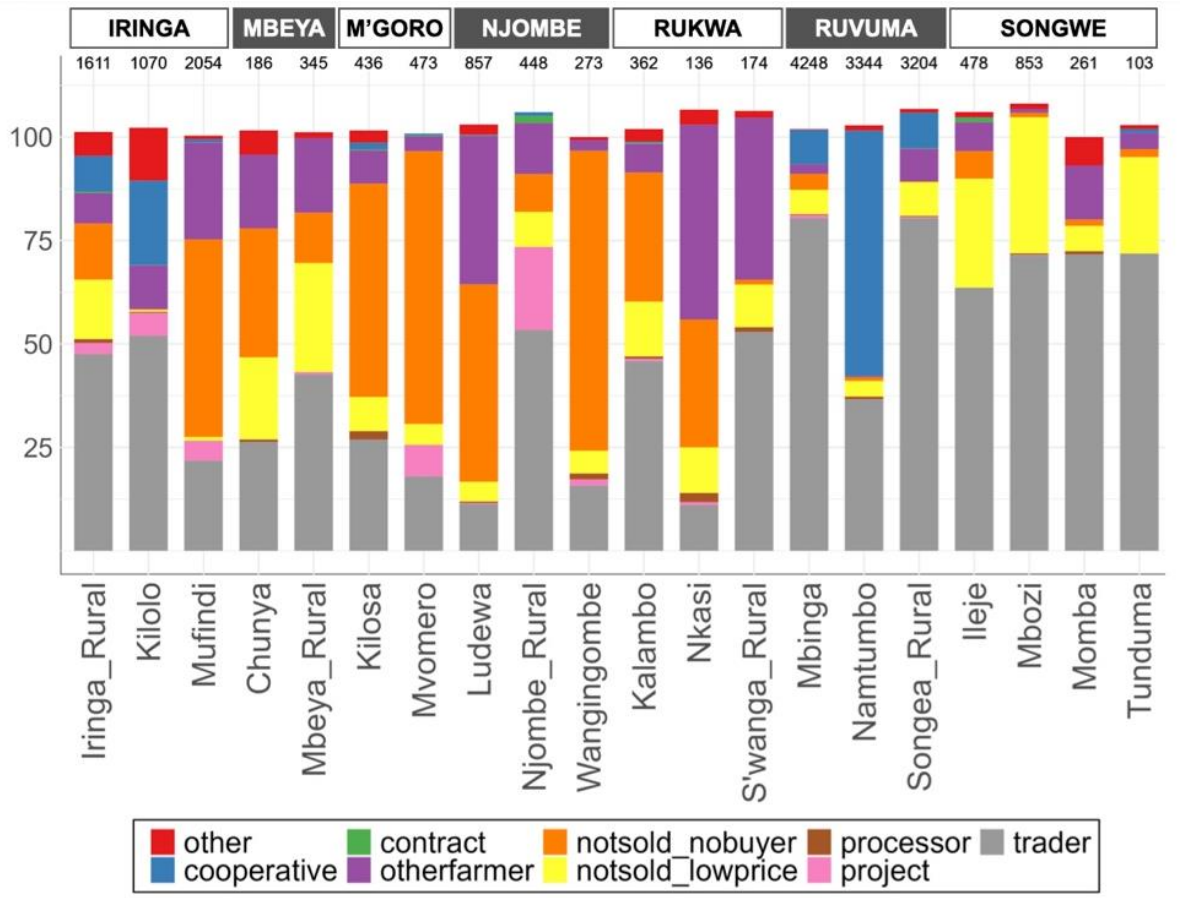


Figure 11: Percentages of farmers per district stating reasons (max. 2) for starting to grow soya beans (n=20,777). Number of observations per district above the stacked bar. Note that indicating two reasons result in >100% bars.

4. SOYABEAN PRODUCTION

This chapter presents findings on the field areas registered farmers dedicate to soya beans, the yields obtained, and soya bean production per district. Soya bean 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 district-level are generally low, yet diverse: ranging from 500 kg/ha to over 1,000 kg/ha.

4.1. Soya bean 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 a reliance on ploughing service providers' estimations who are paid per field area. Socio-economic 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 GPS-devices to measure soya bean crop areas of the 2022-23 season. *Registered farmers tend to significantly ($p<0.05$) overestimate the size of their soya field* (Figure 12). While GPS-measured soya fields were on average 0.38 ha (0.94 acres), farmer-estimated soya fields were about 47% larger: 0.56 ha (1.38 acres). Consequently, soya yields tend to be underestimated.

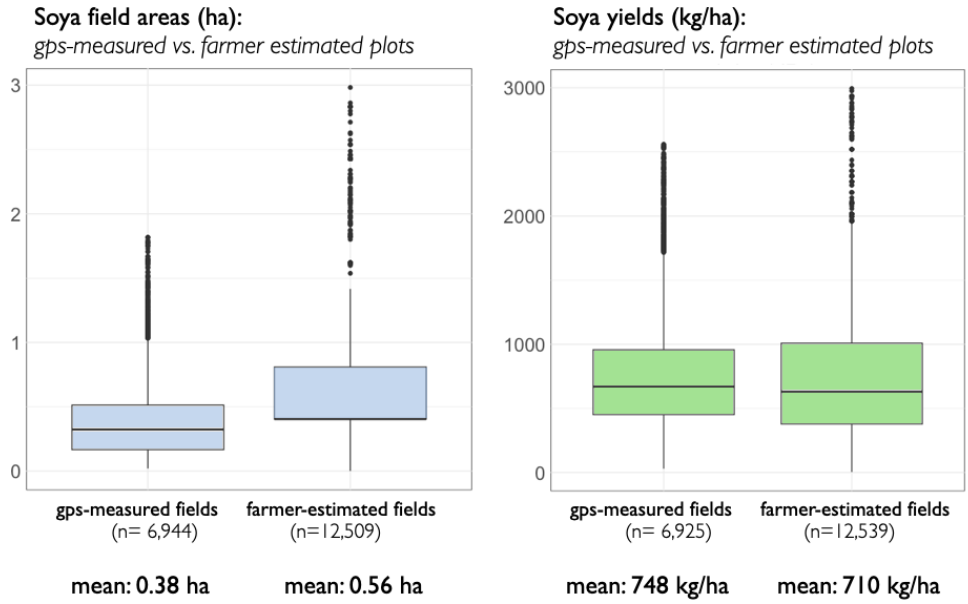


Figure 12: GPS-measured versus farmer-estimated soya field areas (ha) (blue), and yields (kg/ha) for GPS-measured and farmer-estimated fields (green), based on farmer-reported production in bags (gunia) or buckets (debe). Both field areas and yields are significantly different ($p<0.05$) for gps-measured and farmer estimate fields.

On average, the largest soya 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 have generally small soya fields (<0.3 ha). Small soya fields are also found in Njombe-rural district (0.28 ha) and Ileje district in Songwe region (0.26 ha).

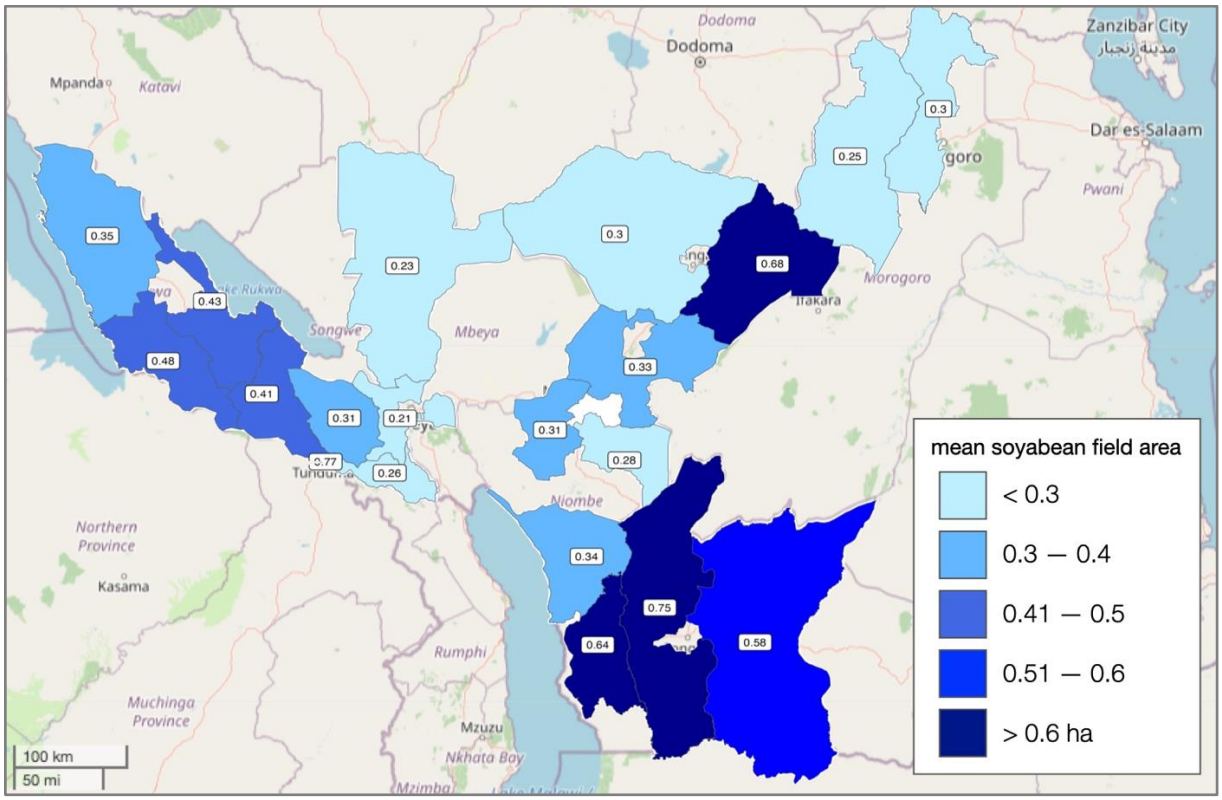


Figure 13: Average soya bean field areas (ha) in 2022-23 season (n=12,816). Labels on the map indicate average soya bean field areas of registered farmers in district.

4.2 Soya bean 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 soya yields (500 kg/ha). These yields are well below potential yields for these areas of Tanzania, which can by around 2,500 kg/ha when soya is grown as a sole crop with good agronomy (N2Africa, 2015). *As will be shown below, low input availability and use, high fertiliser prices and the importance of maize, agronomic practices, market access and produce prices are all important factors limiting farmer investment in soya bean productivity.*

The average yield figures found in this registration exercise (in Figure 14) are also much lower than FAO figures on soya bean production in Tanzania. FAOSTAT estimates of average soya bean yields in Tanzania increase from around 700 kg/ha in the year 2000, to between 1,100-1,200 kg/ha in the 2018-2022 period (FAOSTAT, 2024). As the Southern Highlands are considered a high potential zone for soya bean 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.

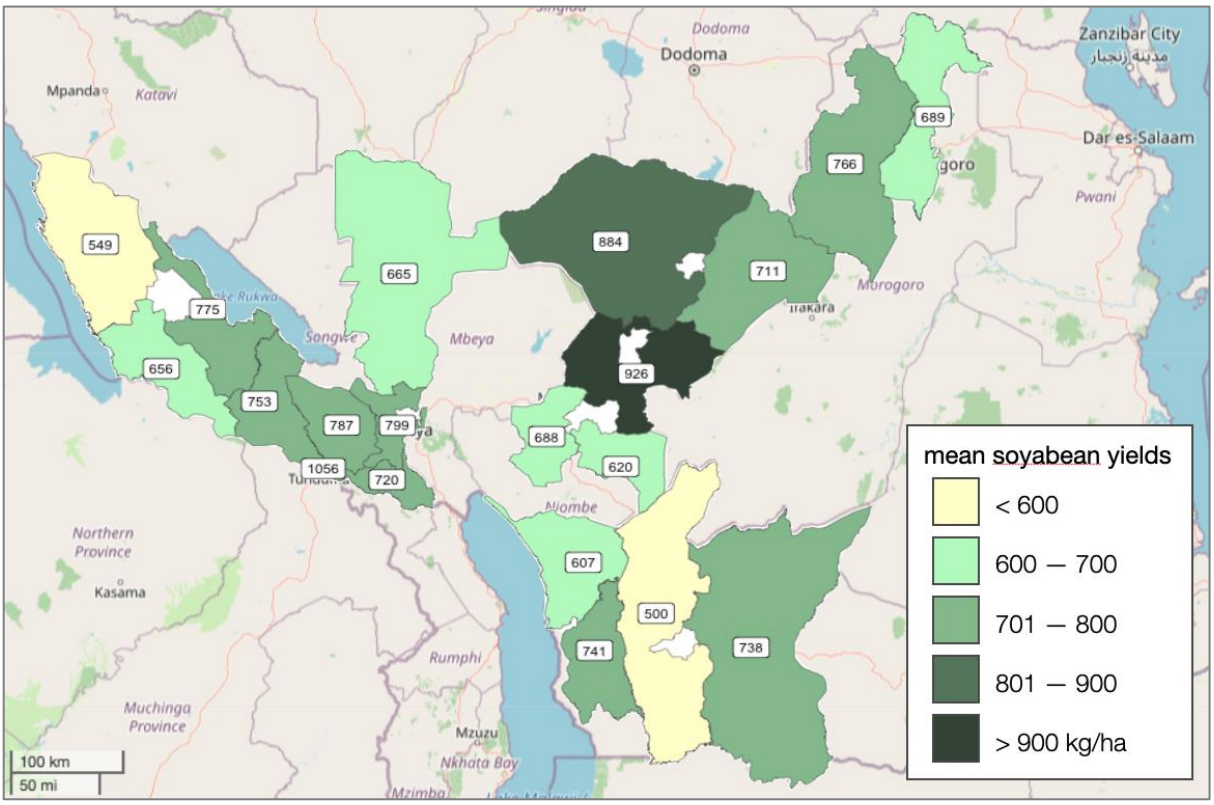


*Figure 14: Average soya bean yields per district, 2022-23 season, for both farmer-estimated and gps-measured field areas (n=20,777). Minimum number of observations per district > 100 (Tunduma: 1056 kg/ha). Outlier removal: 5*IQR = <1% of total yield observations.*

4.3 Soya bean production in the Southern Highlands

As the farmer registration exercise sought to identify concentrations of soya growers for targeting TSSI project activities (trainings 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 region alone, more than 1,500 tonnes of soya 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 tonnes, while in the relatively small Mbozi district (Songwe region), a mere 850 registered farmers produced some 215 tonnes of soya beans in the 2022-23 season. *Hence, a few districts are responsible for the bulk of soya production in the Southern Highlands*.

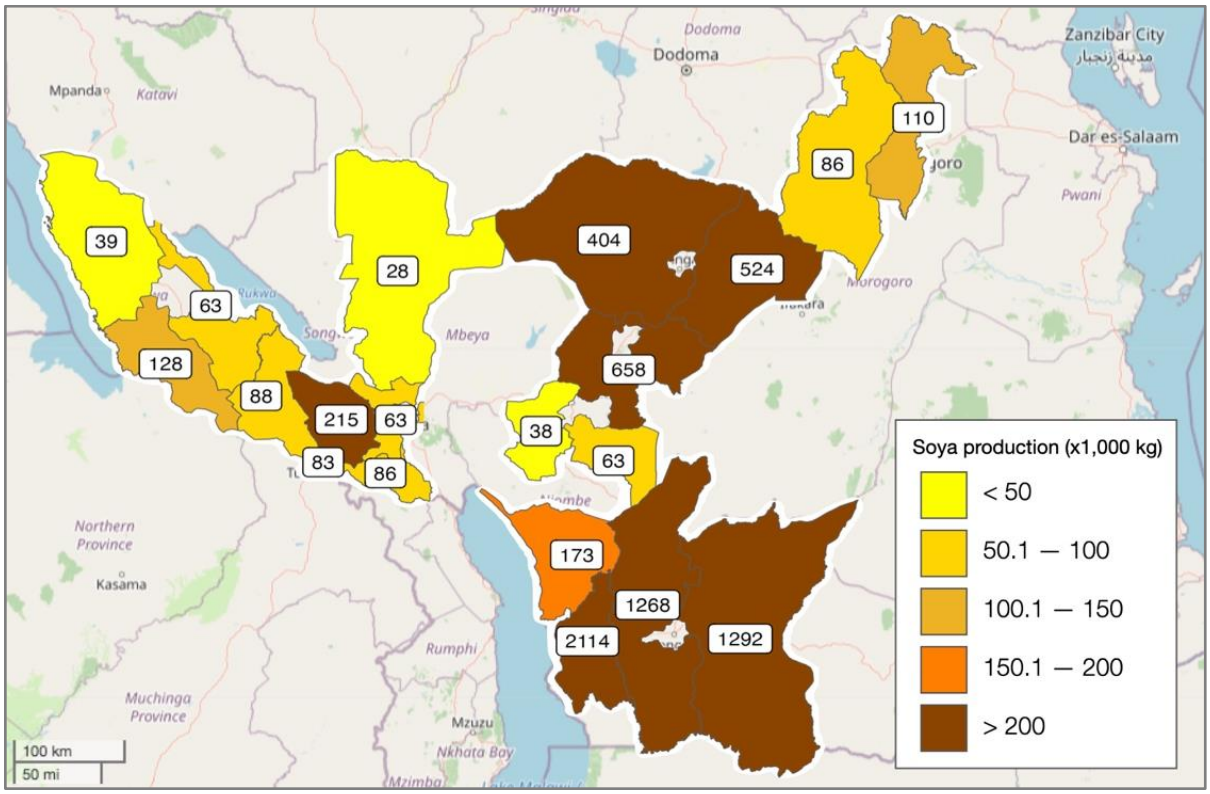


Figure 15: Total Soya bean production per district as reported by registered soya farmers (n=20,777)
*Minimum number of observations per district > 100. Outlier removal: 5*IQR = <1% of total yield observations.*

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

5. SOYA AGRONOMY: PRODUCTION PRACTICES

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

5.1. Introduction: input use on soya

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

5.2. Varieties, seed sourcing, seed rates

Although soya beans were first introduced to Tanzania in 1907 (Khojely et al., 2018), substantial production expansion is of a much more recent date. A breeding programme was started in the 1950s and the area planted to soya bean increased in the 1960s, but dropped again in the 1970s. Throughout the 1980s, 1990s and early 2000s the area cultivated to soya 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 programmes 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 all originate from these breeding programmes, yet farmers have little knowledge about the exact variety (or varieties) they cultivate, and commonly refer to their soya seed as 'local variety' (Figure 16A). As soya 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).

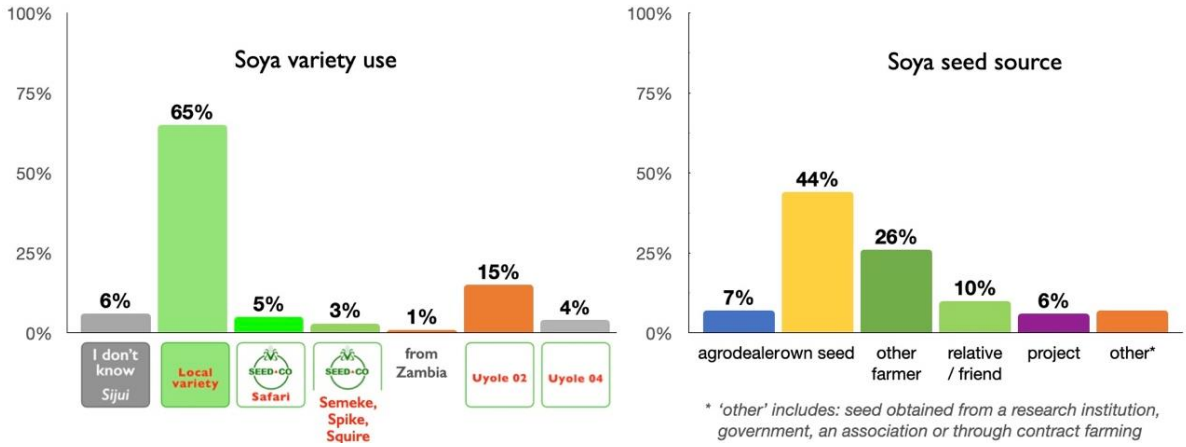


Figure 16: (A) Soya variety grown by registered farmers (n=20,777) and (B) Source of the seed grown (n=20,777)

Although most registered farmers (71 %) do not know what soya 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 programme, the determinate Uyole 02 (or Soya 02) variety appears to be most common and widely distributed. Uyole 04 (or Soya 04), an indeterminate variety mentioned by only 4 percent 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 he or she grows– 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 programme for the Uyole varieties is limited, and *the availability of commercial varieties restricted to a few centres, farmers mostly have to recycle harvested grain and use it as seed. This practice risks the build-up of seed-borne diseases in the planting material, which can negatively affect yields* (see section on pest and diseases).

Only 13 percent of registered farmers indicated to have 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 soya seeds have been active in Iringa and Morogoro and Ruvuma regions, but hardly in Rukwa, Songwe and Mbeya regions.*

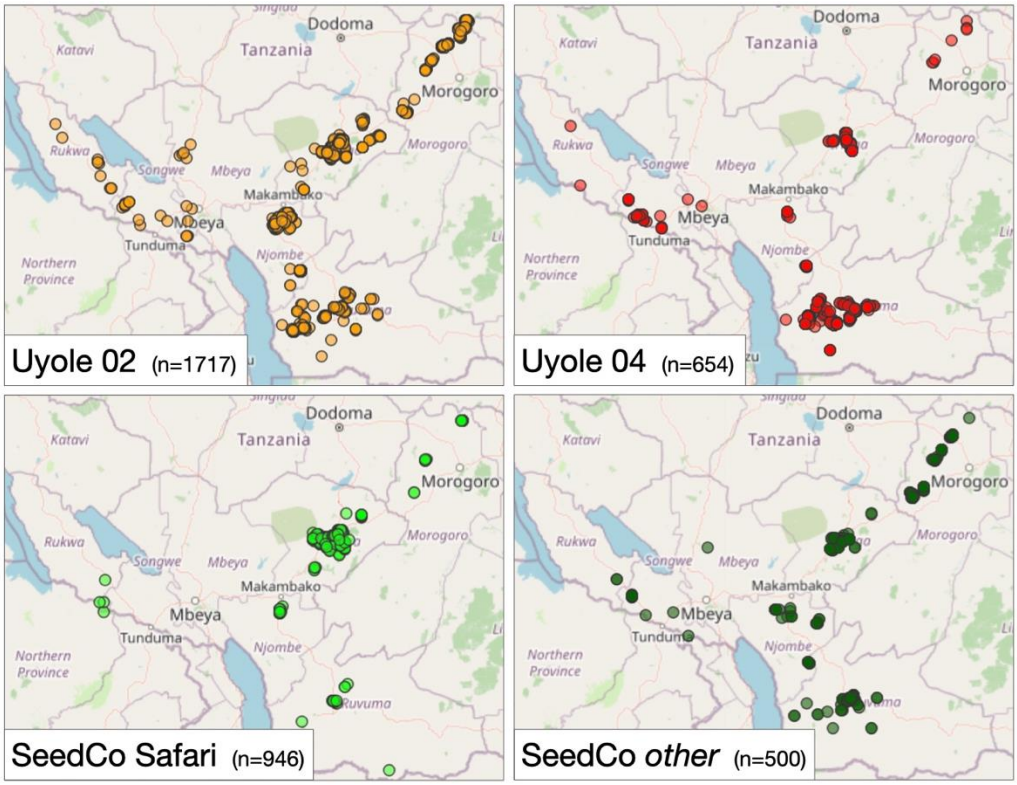


Figure 17: Spatial distribution of different varieties grown by registered soya growing farmers (n=20,777). Farmers growing Uyole 04 and SeedCo-Safari varieties are concentrated around Iringa and Songea towns.

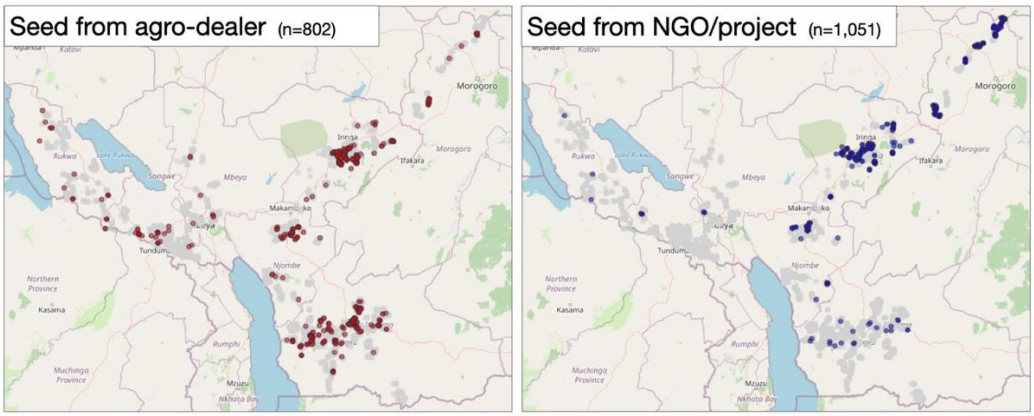


Figure 18: Source of seed for 13 percent of registered soya growers: 'obtained from agro-dealer' (left) or 'NGO/project' (right). Grey areas indicate locations of other registered soya growers.

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 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 soya fields presented in Figure 19, are merely indicative – areas with more intensive soya production and the highest yields (kg/ha) are also the areas were seeding rates are highest. *The figures suggest that seed rates are generally low as compared to the 60-80 kg/ha that is*

recommended for many varieties in Tanzania (N2Africa, 2015). In intercropped soya bean 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 soya bean farmers*.

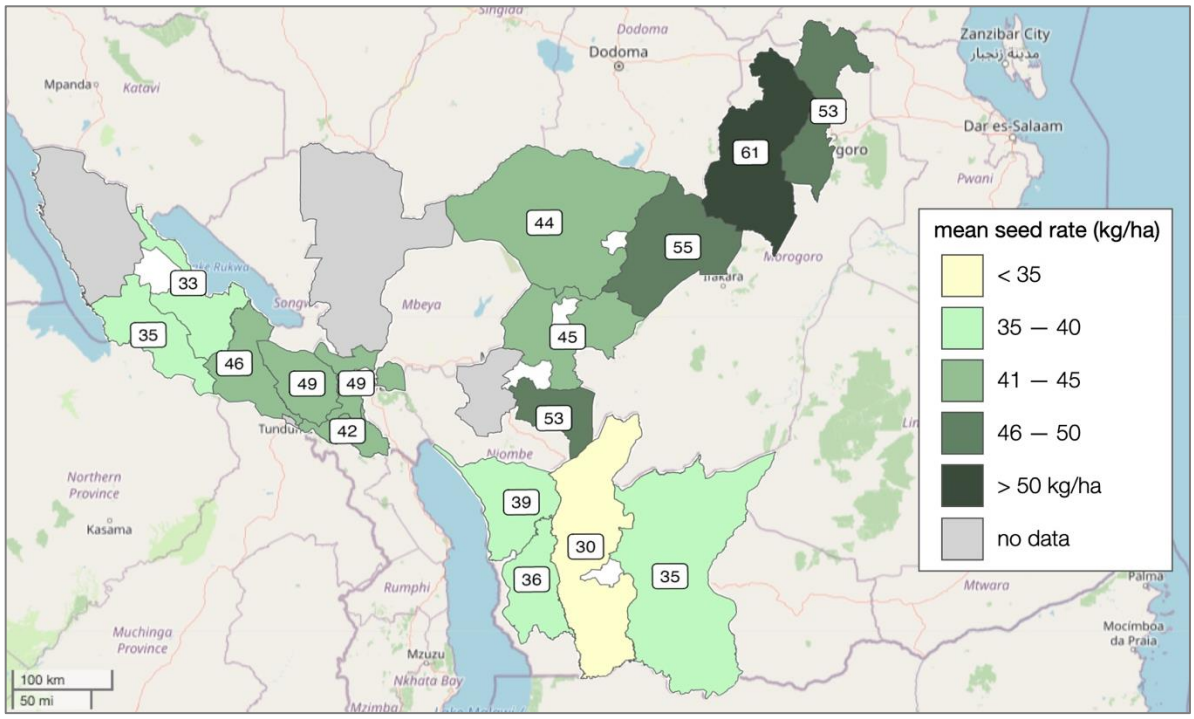


Figure 19: Average seed rate (kg/ha) on sole-cropped soya fields (n=10,550)

5.3. Inoculant use

Soya bean can fix atmospheric nitrogen in its root nodules. When soya bean seeds are inoculated with the right rhizobia bacteria, nodule formation is ensured, and the bacteria and soya bean root nodules can fix more nitrogen (Giller, 2001). The effectiveness of inoculation is, however, variable and dependant 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 soya yields (N2Africa, 2015).

Inoculants are not widely known in Tanzania. Only 15% (n=20,777) of the registered soya growers indicated that they know what inoculants are, and even fewer (9%) have used them. 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 appears to be behind the greater availability of inoculants in these areas.*

5.4. Manure and fertiliser use

Manure use in the soya field is equally low. Only 10 percent of the registered farmers indicated to have used manure on their soya field in the 2022-23 season. Less than 4 percent (n=20,777) uses manure on their soya every season, while 87% never applies any manure to their soya bean 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 on the soya field by respectively 33, 31, 45 and 32 percent of the registered farmers in those districts. The relatively high manure use on soya fields in Iringa-rural and Mufindi districts (Iringa region), combined with the high yields and production levels there, are suggestive for the importance of soya production in these districts.

Fertiliser use

The use of artificial fertiliser on soya was generally low in the 2022-23 season. High fertiliser prices and soya beans' capacity to grow without the application of fertiliser, is undoubtedly a major reason for farmers not to apply any fertiliser (80.5% of n=20,777). Yet, as with manure use, important differences can be observed: i.e. in Iringa-rural 67% of farmers (n=1,600) indicated to have used fertilisers 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, fertiliser use on soya was 62, 67 and 41 percent, respectively (Figure 20). Except for Wanging'ombe district (Njombe region), these are the same districts in which manure use was more common. But whereas high incidence of manure and artificial fertiliser 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 soya yields in Wanging'ombe district were below 700 kg/ha in the 2022-23 season.

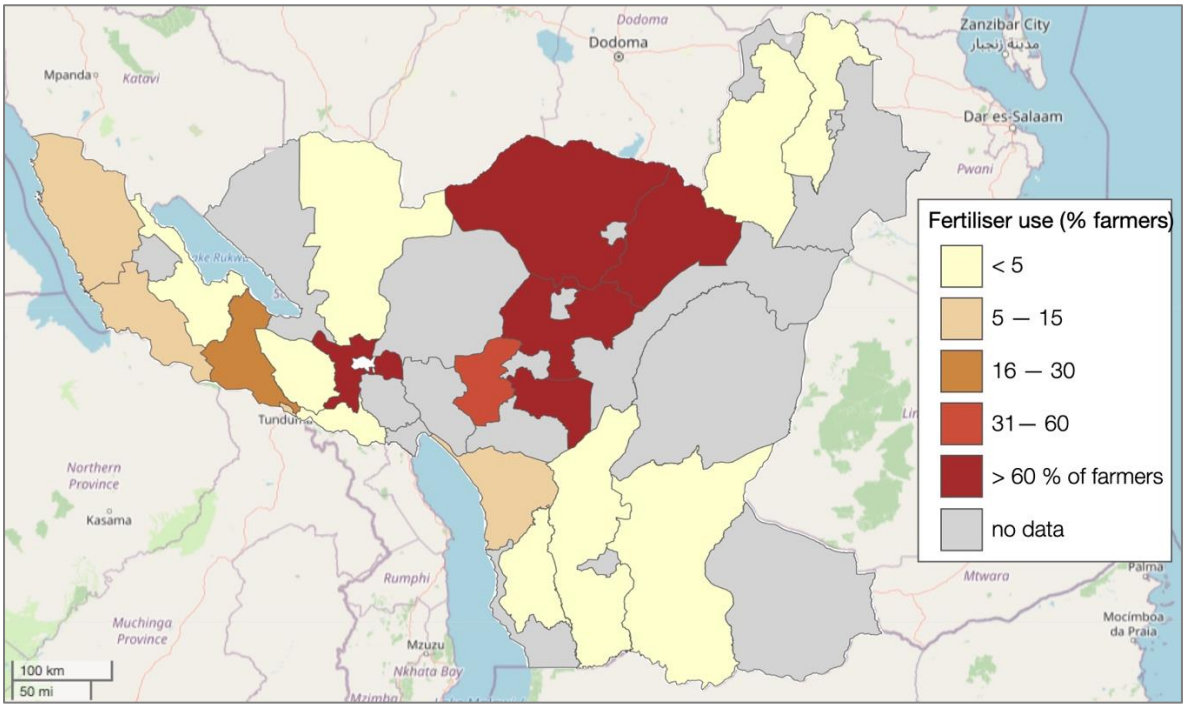


Figure 20: Percentage of farmers per district applying artificial fertiliser on sole-cropped soya bean fields (n=3,059), 2022-23 season. Note: Only districts with n >100 were included.

A higher incidence of fertiliser use is indicative for more intensive soya production (e.g higher yields, see: Figure 14), but not necessarily of the importance of soya production for farming

households' incomes. For instance, in Ruvuma region, most farmers regard soya beans an important crop (next to maize), yet virtually no farmer there applies fertiliser to their soya beans (0.35%, n=10,709). While many Ruvuma farmers cultivate soya beans there (as reflected in the number of registrations), and the region is a major producer of soya beans in Tanzania, production is rather extensive. *Although both Iringa and Ruvuma regions are major producers of soya (Figure 15), in Ruvuma region soya production is not the investment opportunity for many farmers it is in Iringa region.*

Fertiliser use practices: types and amounts

Zooming in on the 19% of registered farmers that did apply artificial fertilisers on their soya (inter)crop in the 2022-23 season (n=4,340), use of a large variety of fertiliser types is observed. On sole-cropped, fertilised soya fields (n=2,800), the vast majority (87%) of farmers uses (at least) a P-containing fertiliser as is recommended for soya beans. 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 soya growing districts of Tanzania.[2]

With no legume-specific fertilisers on the market, *farmers' limited knowledge about fertiliser use on soya, is apparent in their use of more expensive, P-containing fertilisers* (DAP and TSP are the cheapest providers of phosphorus), *and their use of nitrogen fertilisers on soya.* On more than 11% of the fertilised, sole-cropped soya bean fields, (also) N-only fertilisers were applied (nitrogen fertiliser application on soya is not necessary).

5.6. Planting practices: Intercropping

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

[2] In Songwe region, TSP was about 25% cheaper than DAP in November 2023. However, when DAP was bought under the government subsidy programme, it was about 30% less expensive than TSP.

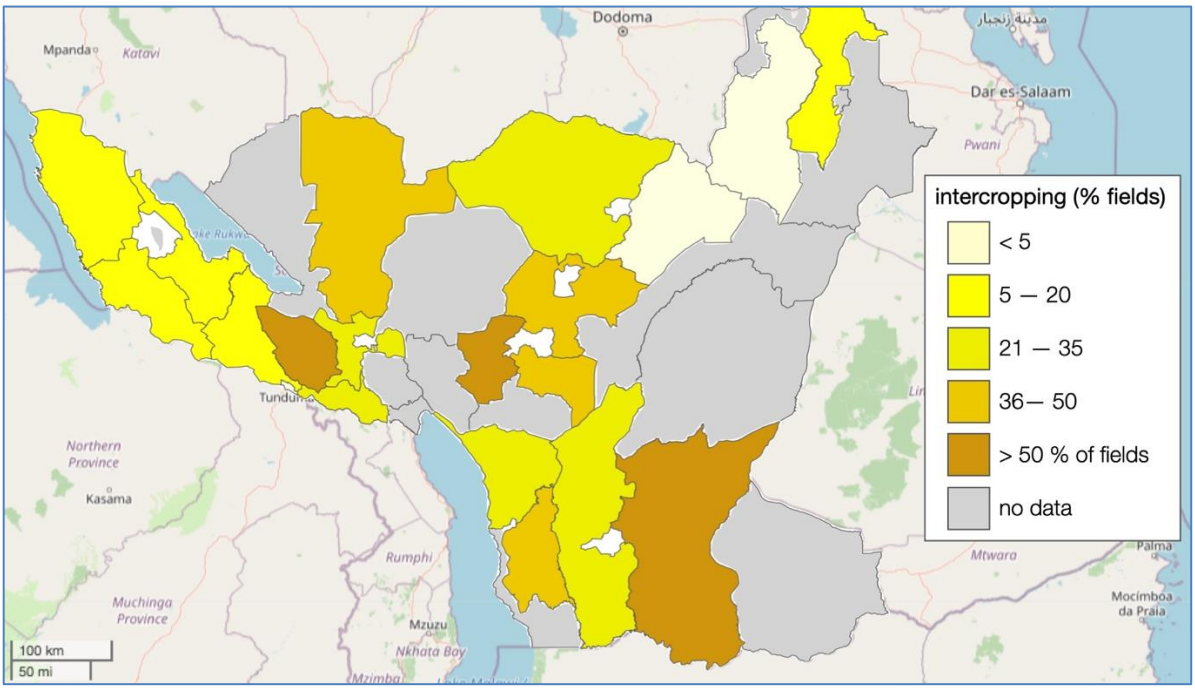


Figure 21: Percentage of intercropped soya fields per district, 2022-23 season (n=20,777).

In most districts maize and sunflower are the dominant intercrops (Table 2). As tall-growing crops such as maize and sunflower may shade the soya crop, it is likely that intercropping with soya goes at the expense of both crops' plant density (Figure 22). When soya beans are intercropped with long duration pigeon pea, this is not necessarily the case. Intercropping of soya with coffee (Mbeya-rural) or avocado (Njombe-rural, Waging'ombe districts) is likely to be limited to the first years of the tree-crop's 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 Soya-Sunflower field in Songwe region, 2022-23 season. Plant density of sunflower is reduced. (photo © J.A. Andersson)

5.7. Pests and diseases

To get some insight into what pests and diseases soya-growing farmers face (with a view on agronomy advisory development) the digital survey included pictures of several common and easy distinguishable pests – aphids and spider mites - with the question if the farmer had observed these in his/her soya bean 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' where 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 soya beans such as leaf rust are fairly 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 soya varieties – that are already released in Tanzania – could become more widely available to farmers.

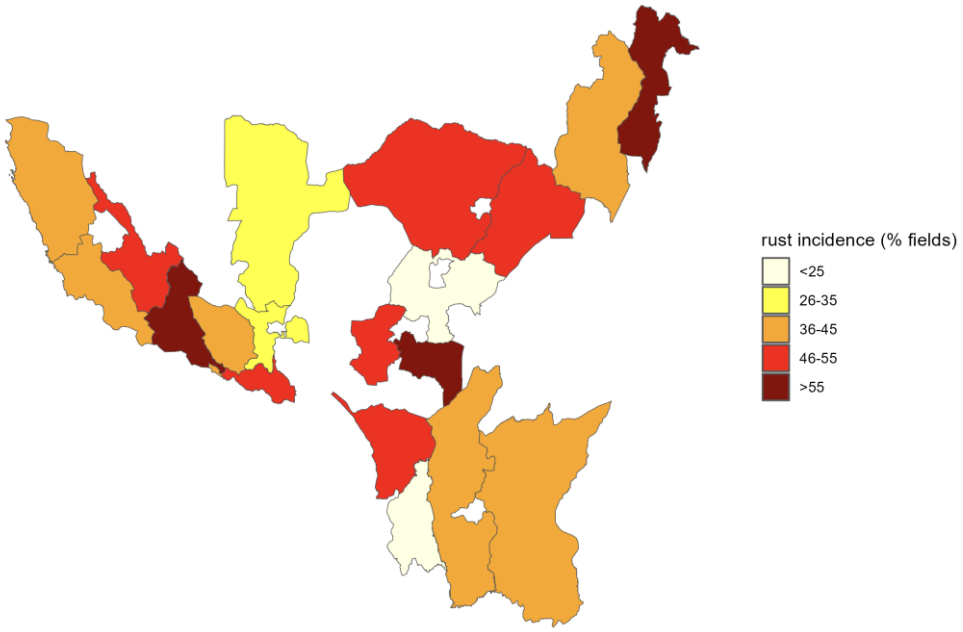


Figure 23: Incidence of leaf rust (percentages of fields per district) as observed by soya-growing farmers, 2022-23 season.

6. SOYA MARKETING & FARMER ORGANISATION

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

6.1. Marketing channels

Soya growers use various marketing channels (Figure 24). Whereas in selected districts of Ruvuma – Namtumbo district in particular – and Iringa regions substantial numbers of farmers sell their soya beans 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. Sales through projects is limited to farmers in Njombe rural district, Iringa region and Mvomero district (Morogoro region). *Contract farming of soya beans and direct sales to soya processors is generally very limited and geospatially scattered*.

In most districts soya bean marketing appears to be problematic, as evidenced by substantial numbers of farmers that postpone sales due to low prices or an absence of buyers. Especially in Morogoro region, where most registered growers were first time grower in the 2022-23 season, farmers indicate they struggle to sell their soya beans. Similar problems are also faced by many farmers in Mufindi, Ludewa and Waging'ombe districts. In the Songwe region and Mbeya-rural district, where soya growing appears to be hardly initiated by (past) project and government interventions, numerous farmers appear to delay the sale of their soya 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 soya-producing districts, to support the marketing of soya beans; 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 soya, while price information provision to farmers may help them in make decisions on sales.

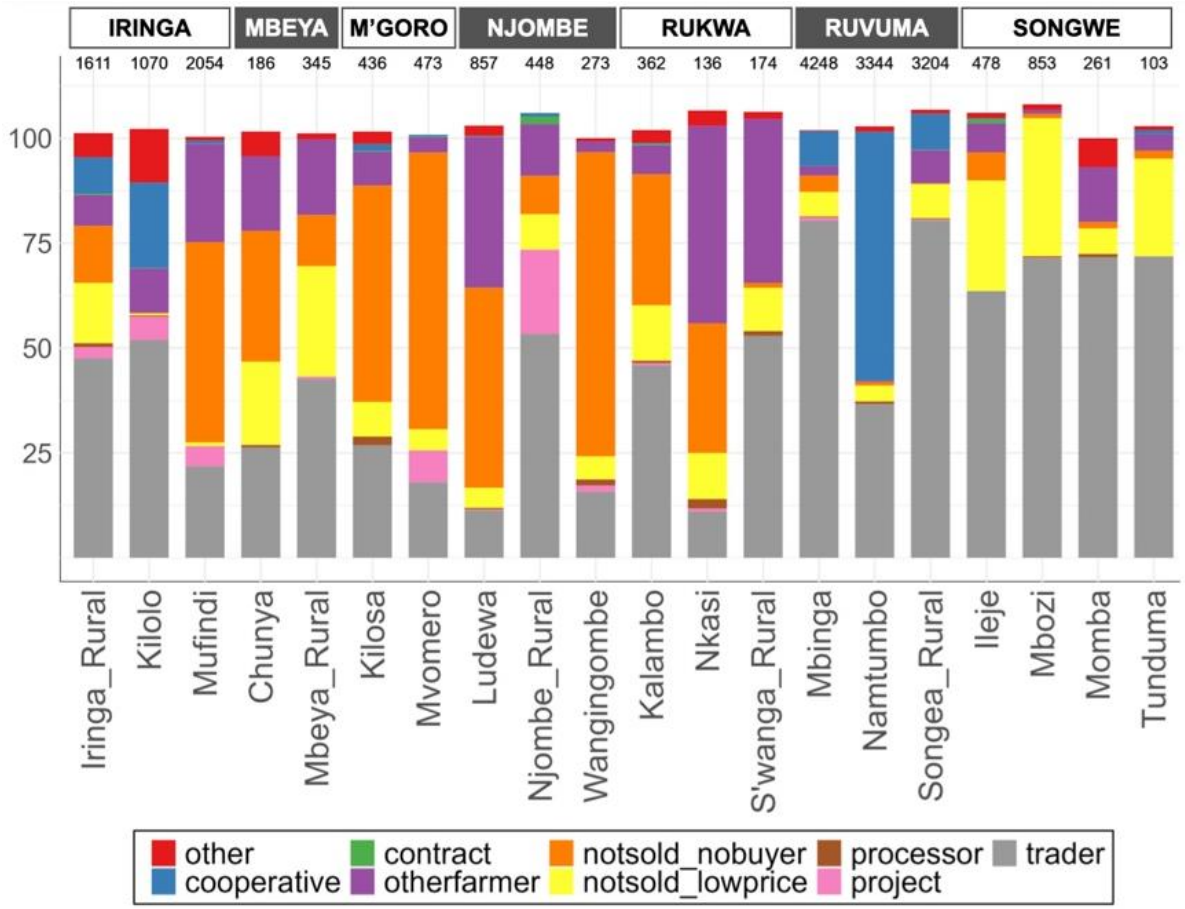


Figure 24: Percentage of farmers per district using a specific marketing channel (n=20,777).
Note! As farmers may use more than one marketing channel, totals may be > 100%.

6.2. Marketing time

Soya growers usually start selling their produce immediately after harvest and threshing. Marketing season starts relatively early, in May, in Rukwa and Ruvuma season, while in Iringa and Morogoro regions the sales start last, in July. The length of the soya bean selling season differs substantially between districts: whereas in Tunduma, Momba and Wanging'ombe districts and the whole Ruvuma region, where most soya 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 organisation – i.e. cooperatives in Ruvuma – but also a lack of buyers and low prices may cause many farmers to delay their soya bean sales*.

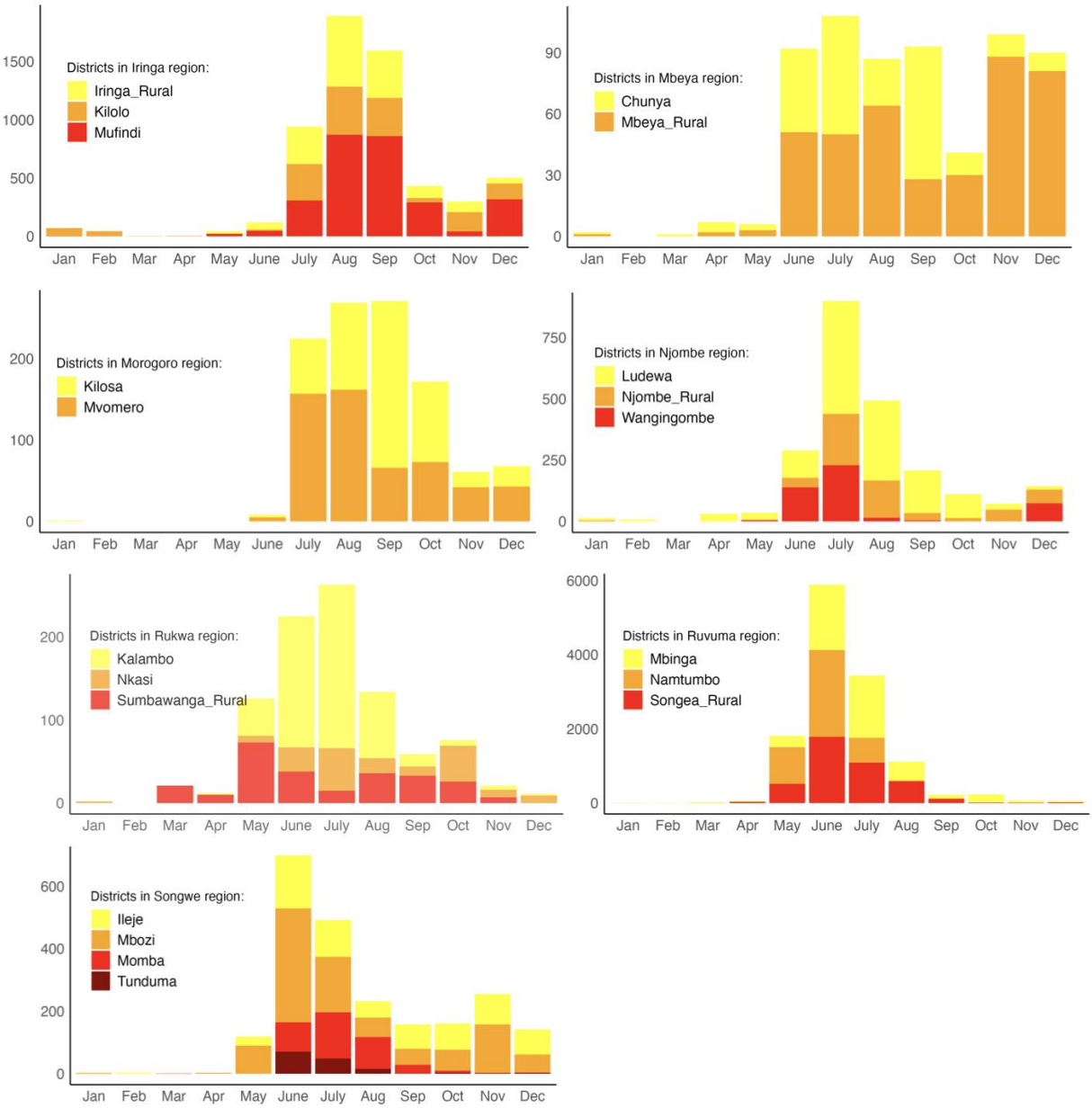


Figure 25: Months in which soya is sold, per district (n=20,777). Farmers were asked in which months (max.2) they sell most of their soya (Note! Numbers of farmers per district differ)

6.3. Farmer organisation

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

for the TSSI; there is also no obvious type of farmer organisation that unites substantial numbers of farmers in the districts with high levels of farmer organisation (Figure 26).

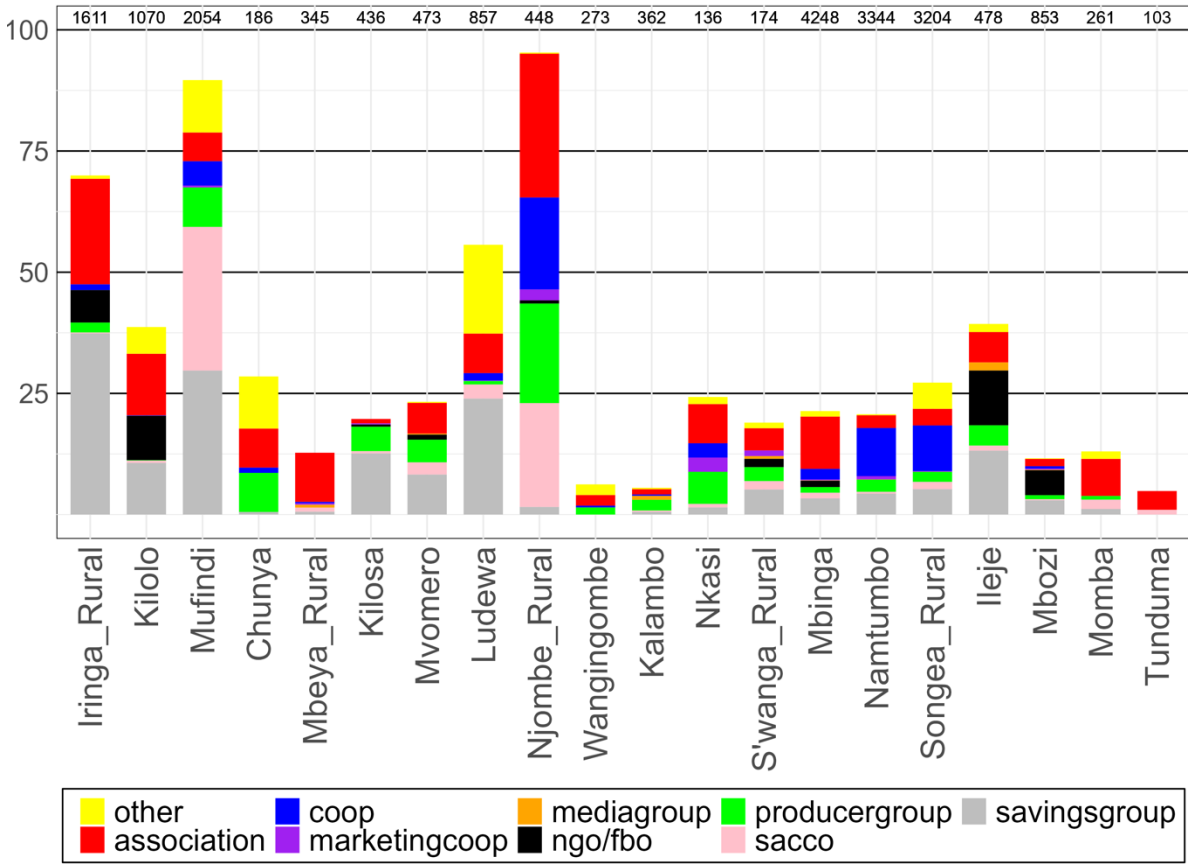


Figure 26: Percentages of farmers per district that are member of a particular type of farmer organisation (n=20,777). As farmers may be organised in several different types of organisation total may be higher than 100%.

7. SOYA PRODUCER CLUSTERS – 'HOTSPOTS'

The major aim of farmer registration and profiling exercise was to identify clusters of soya-growers, so that TSSI project activities can be targeted to these production 'hotspots'. The identified producer clusters have a 5 km radius (with the exception of 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.

Table 3: Soya production clusters and number registered farmer 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	10,709
Songwe	11	1,694

7.1 Farmer-MBA advice for soya

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

Iringa region

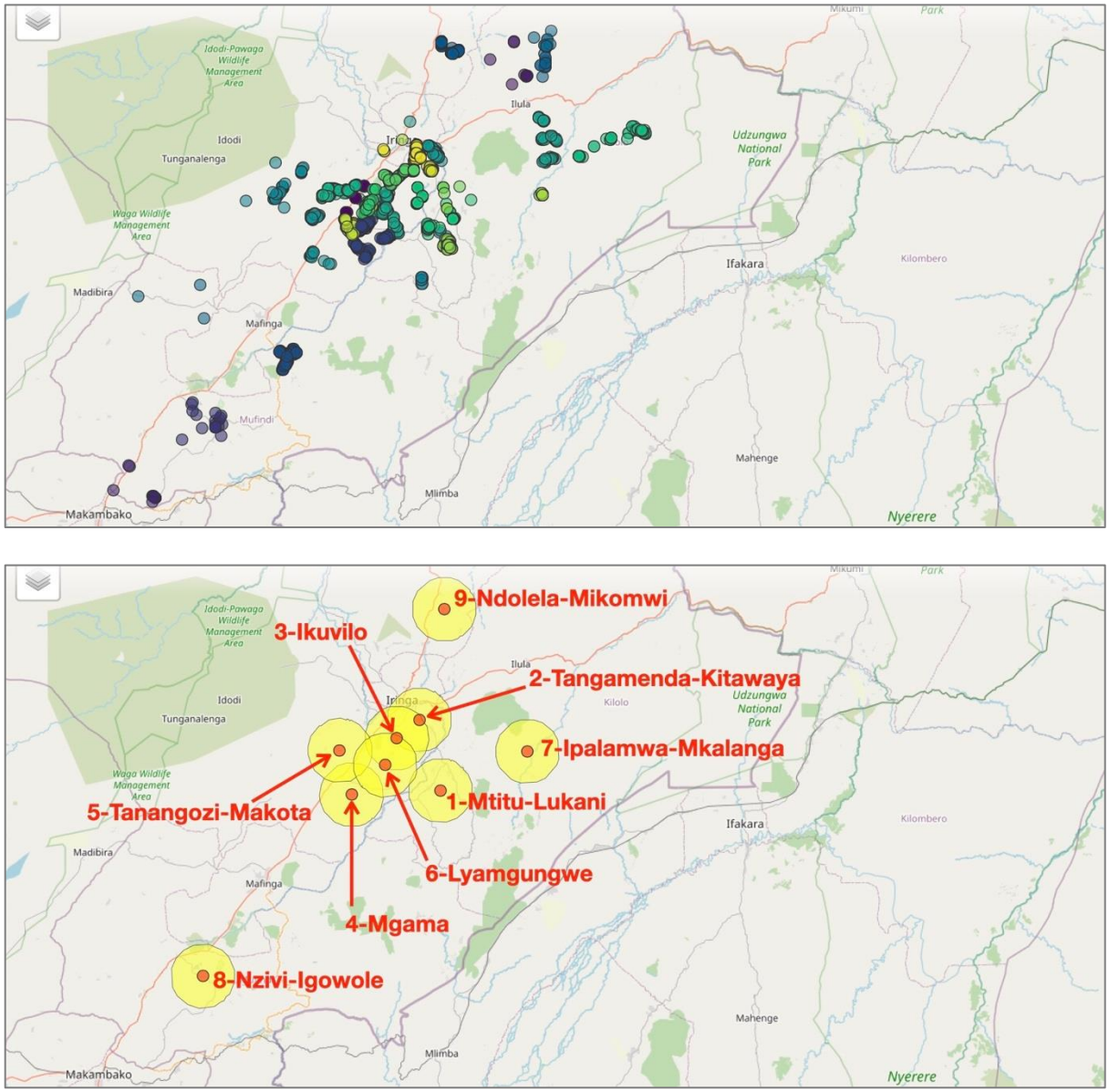


Figure 27: TSSI registered soya growers in Iringa region (n=4,703; not all appear on map): Colours represent different registering extension workers (top). Clusters (of 5 km radius) of soya growing smallholder farmers in Iringa region (bottom).

Mbeya region

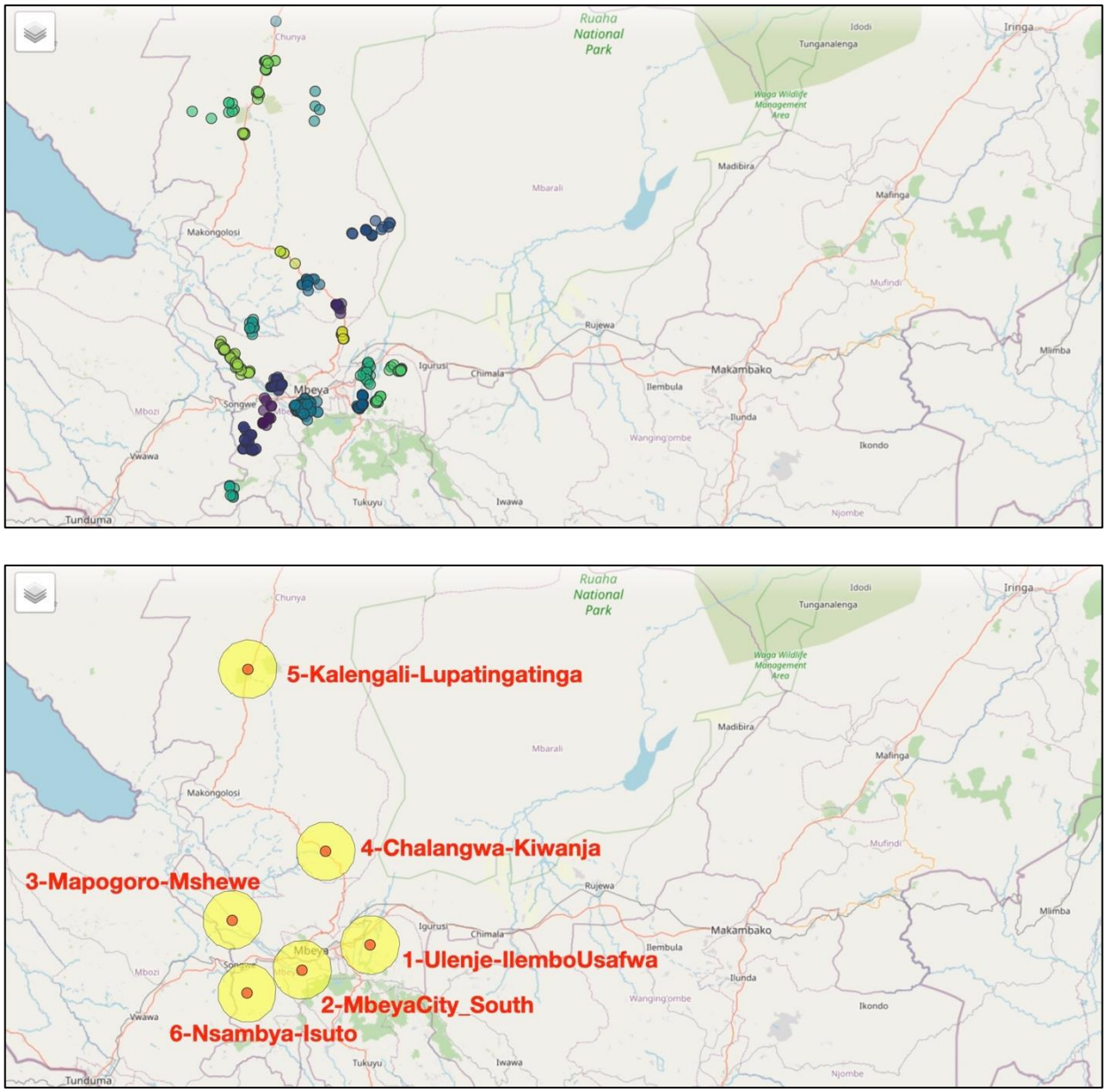


Figure 28: TSSI registered soya growers in Mbeya region (n=531; not all appear on map). Colours represent different registering extension workers (top). Clusters (of 5 km radius) of soya growing smallholder farmers in Mbeya region (bottom).

Morogoro region

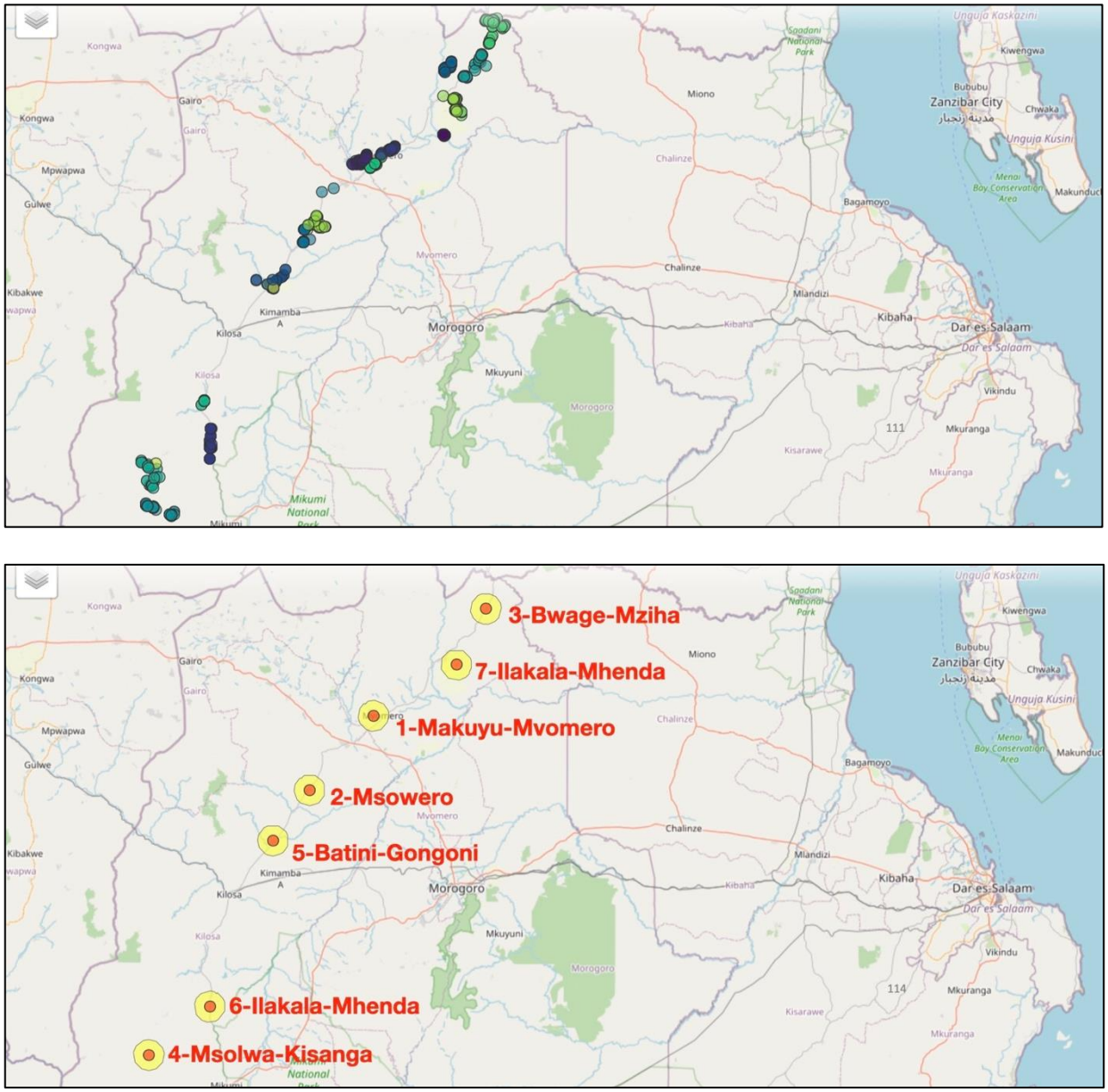


Figure 29: TSSI registered soya growers in Morogoro region (n=894; ; not all appear on map): Colours represent different registering extension workers (top). Clusters (of 5 km radius) of soya growing smallholder farmers in Morogoro region (bottom).

Njombe region

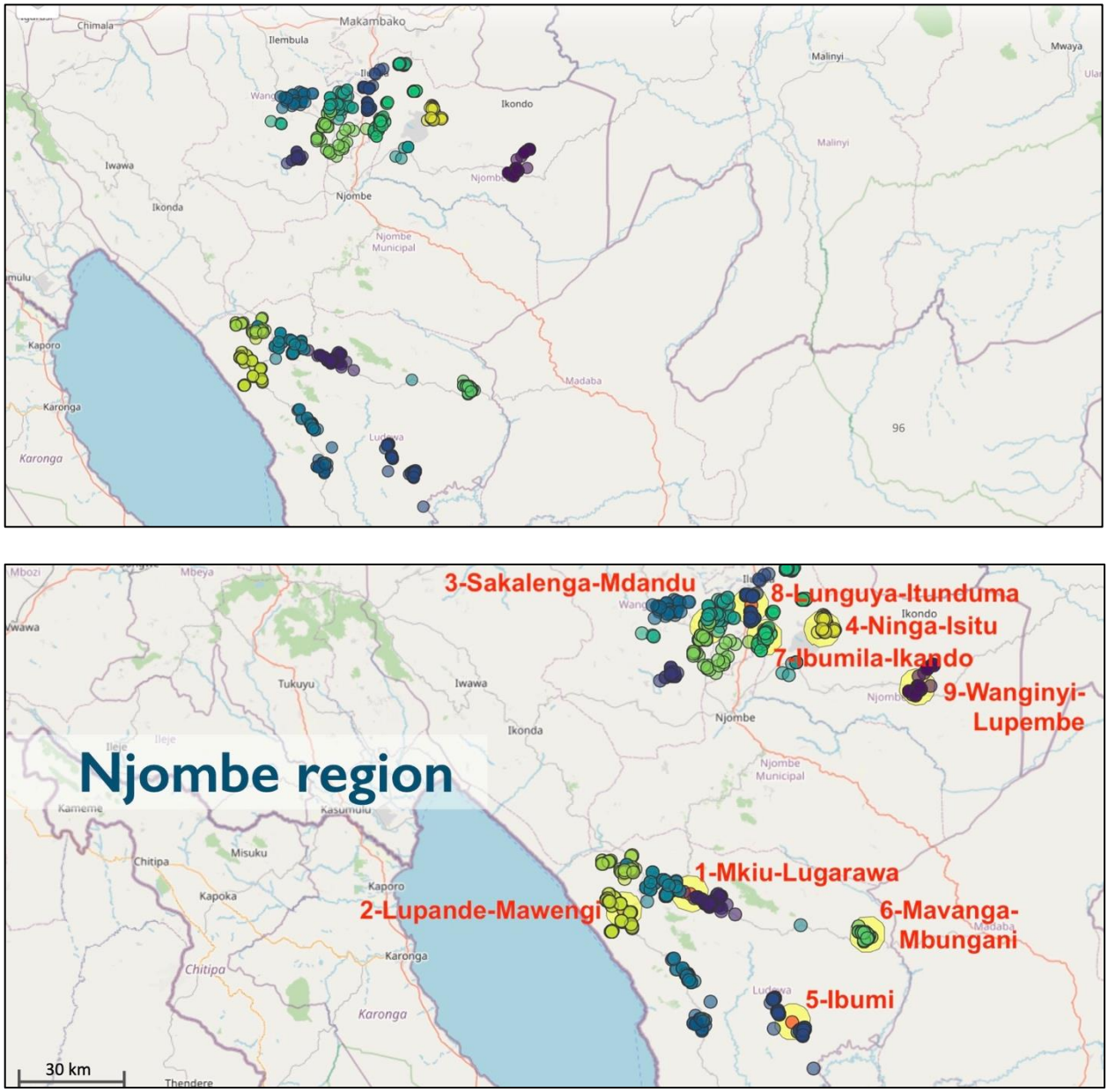


Figure 30: TSSI registered soya growers in Njombe region (n=1,576; not all appear on map): Colours represent different registering extension workers (top). Clusters (of 5 km radius) of soya growing smallholder farmers in Njombe region (bottom).

Rukwa region

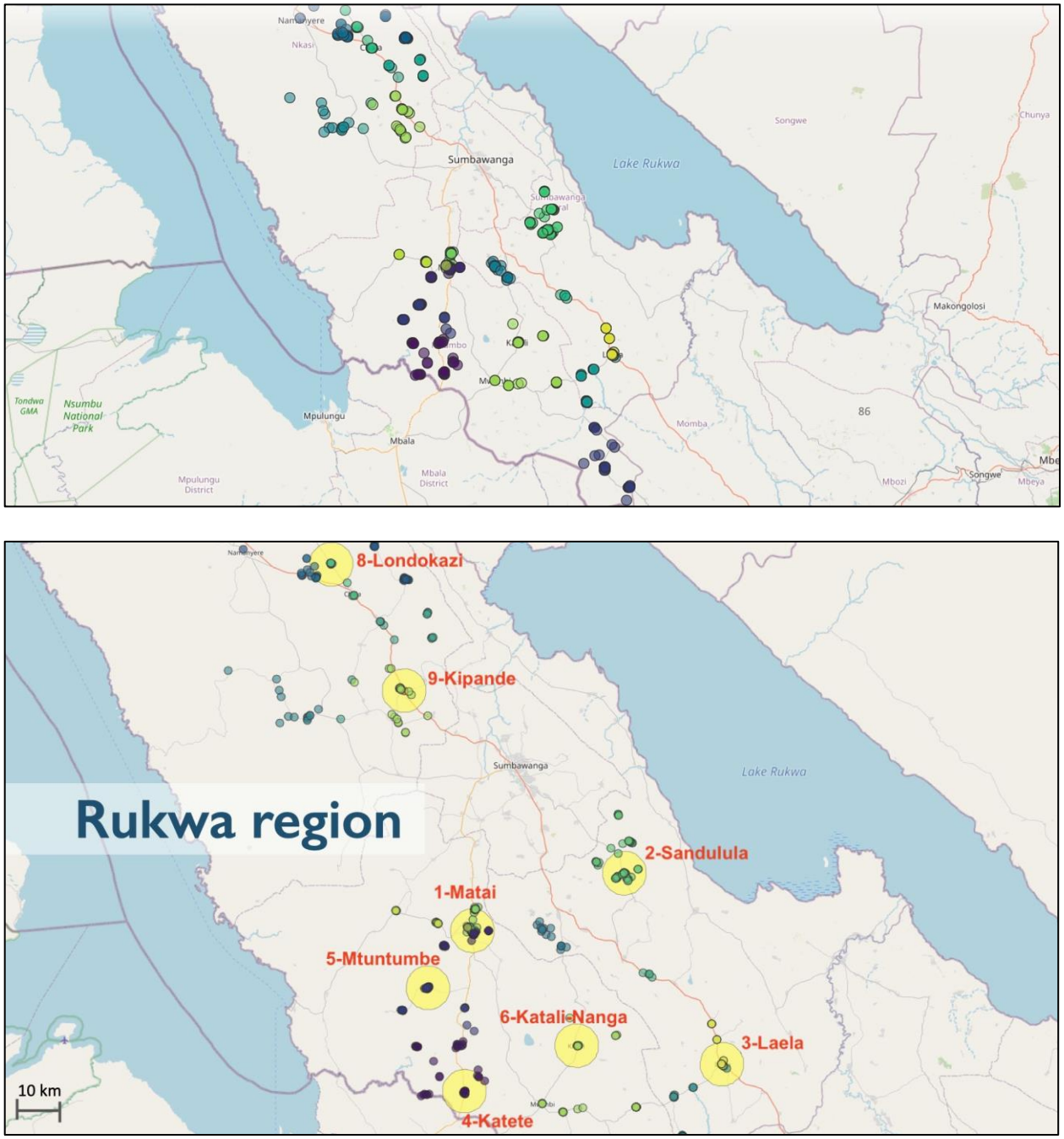


Figure 31: TSSI registered soya growers in Rukwa region (n=670; not all appear on map): Colours represent different registering extension workers (top). Clusters (of 5 km radius) of soya growing smallholder farmers in Rukwa region (bottom).

Ruvuma region

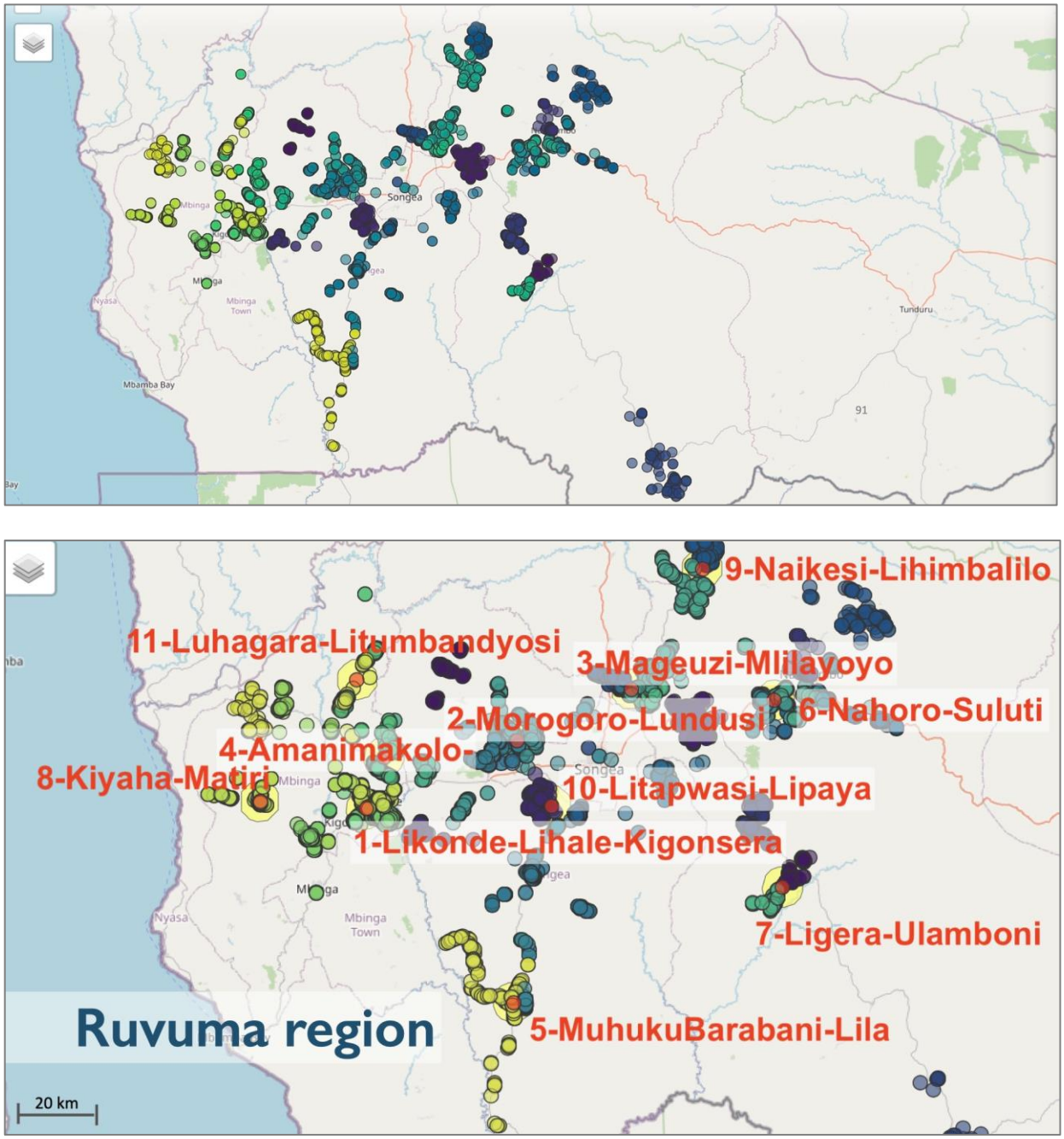


Figure 8: TSSI registered soya growers in Ruvuma region (n=10,709; not all appear on map): Colours represent different registering extension workers (top). Clusters (of 5 km radius) of soya growing smallholder farmers in Ruvuma region (bottom).

Songwe region

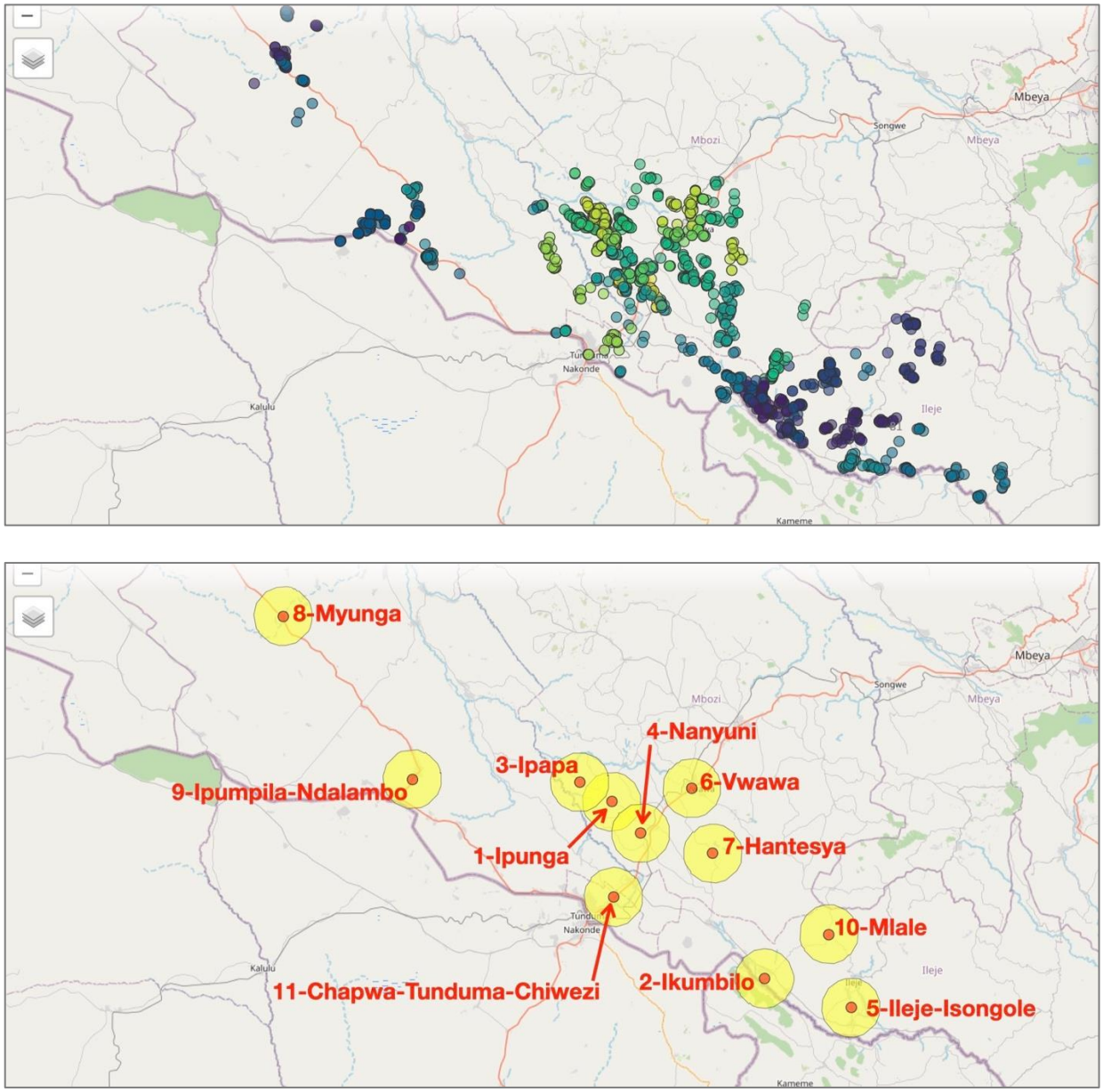


Figure 9: TSSI registered soya growers in Songwe region (n=1,694; not all appear on map): Colours represent different registering extension workers (top). Clusters (of 5 km radius) of soya growing smallholder farmers in Songwe region (bottom).

8. CONCLUSION

The recent increase in smallholder soya production in Tanzania's Southern Highlands and Morogoro region appears to be largely the result of increasing numbers of farmers taking up soya cultivation, often stimulated by projects and government campaigns, or learned from neighbours. Only in a few areas (in Songwe, Rukwa regions), the upsurge in soya production appears to be largely market (price) driven. In the Southern Highlands, soya 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 soya bean productivity include low input availability and high fertiliser 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 largest disincentive for larger farmer investments in soya production.

This report has revealed important differences between soya bean production areas within the Southern Highlands and Morogoro region. We may distinguish at least three types of 'soya production clusters' that are characterised by different patterns of development and – partially overlapping – production characteristics:

(1) The 'high output, extensive production' cluster (Ruvuma region)

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

(2) The 'new growers, project-intervention' cluster (Iringa region)

Iringa and Morogoro are the regions with the most registered farmers are first-year soya growers. There are centres of soya production in this region (around Iringa town) where farmers can obtain improved seeds from agro-dealers, and also 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 soya bean 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 soya 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 characterised by more intensive production practices: - e.g. higher average seed rates, and higher percentages of farmers using manure and/or artificial fertilisers on their soya crop. Although marketing soya is clearly problematic in some parts of this cluster – low prices, no buyers – other farmers, cooperatives and projects constitute different marketing options for farmers in the cluster. The second largest producer of soya (after Ruvuma) in the Southern Highlands, this cluster also has the highest soya yields (711-926 kg/ha), after the small Tunduma district (Songwe). Although most farmers are still new to its production, soya (projects) appears to be seen as an economic opportunity by smallholder farmers in this cluster, at least for now. Yet, soya farmers have other alternative crops in sunflower, common beans and round potatoes.

(3) The 'market-driven' cluster (Mbozi district, Songwe region)

A third, relatively small soya production cluster can be identified in the Mbozi district in the Songwe region. Unlike the Ruvuma and Iringa clusters, where (past) project interventions are at least partially responsible for the expansion of soya production, and the development of in- and output markets (i.e. cooperatives, agro-dealers stocking soya seeds and inoculants), projects and government campaigns do not appear to have driven the expansion of soya bean production in Mbozi district. Here we find relatively many registered farmers that have taken up soya production in the last 5 years (that is, since 2017/18), and the price of soya 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 soya production are found in the districts of Songwe region (but to a lesser degree also in Rukwa and Ruvuma regions). Lower transport costs (empty lorry's coming from Zambia take up loads in Songwe region to transport to Dar es Salaam[3]) may also have been a factor in this; private traders dominate the soya market in Songwe region and mobilising transport is probably cheaper here.

The relatively large concentration of soya growers in (parts of) Mbozi district probably also facilitates produce bulking, possibly lowering the transaction costs of soya sales. Nevertheless,

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

(recent) low prices for soya make many farmers to delay their sales; unlike their colleagues in Ruvuma, they seem to have alternative crops (sunflower, groundnuts, common beans, maize) to market. In terms of productivity, Mbozi soya 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 soya with sunflower, yet they use relatively high seed rates when planting soya beans as a sol crop.

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

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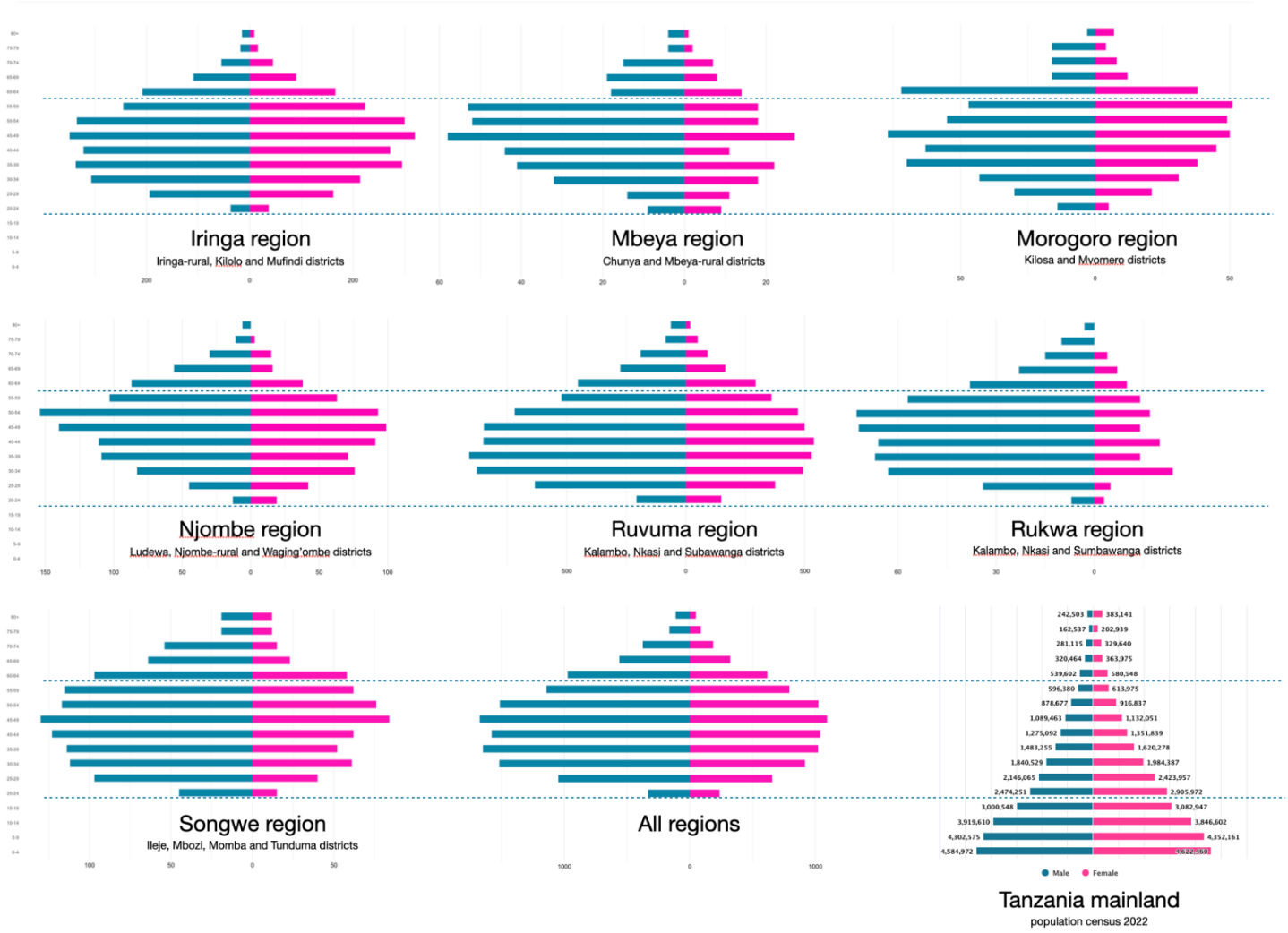
Appendix 1: Age and gender of registered soya growers



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