

# Tanzania Seed Sector Development Strategy: First Draft



INITIATIVE ON  
Diversification in East  
and Southern Africa

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# Foreword

As it has been often said, food security begins with seed security. Seeds are the foundation of agriculture, the starting point being improved productivity, sustainability in production, and food security. Tanzania, a nation with diverse agroecological zones and a rich agricultural heritage, the role of seeds in transforming livelihoods and ensuring national food sovereignty cannot be overstated.

The formulation of this seed strategy is motivated by a myriad of factors which show clearly that the seed sector is underperforming especially when compared with other seed systems around the world. One of these indicators is that only one-third of the farmers in Tanzania use improved seed. The Tanzania Seed Sector Development Strategy (TSSDS), therefore, represents a collective commitment towards harnessing the potential of seeds to propel our agricultural sector forward and contribute to the goal of agricultural transformation in Tanzania (and in Africa more generally) through achieving a viable, sustainable, resilient, efficient and equitable seed system. TSSDS was developed with collaborative efforts of policymakers, researchers, public and private sectors, farmers, and stakeholders across the value chain with the clear aim of strengthening the seed sector, promoting diversity, enhancing resilience to climate change, and improving livelihoods for all Tanzanians.

While productivity and growth of an agricultural sector relies among others, on a dynamic seed system, planted area with improved seeds in the country accounts for only 22 percent of the total cultivated area. In the seed system, the most important steps are production (of both early generation and certified seed), availability (physical presence of the seed where it is needed and in the right form and place and in the right quantity and quality), access (ensuring that the seed is affordable especially to marginalized groups) and utilization of improved seed by farmers of all groups ensuring the use of quality seeds of adaptable crop varieties, resulting in increased productivity and production which would in turn result in income gains necessary to improve food security and reduce poverty.

Productivity is low due to several factors. The major ones being rainfall dependent agriculture, climate change, land degradation and soil fertility decline, low adoption of modern farming techniques including improved varieties and limited access to credit and inputs.

Therefore, this strategy emphasizes inclusivity, recognizing the vital role of smallholder farmers, women, and youth in driving agricultural development. By investing in seeds, we invest in the future of Tanzania—building a robust agricultural sector that supports economic growth, enhances food security, and preserves our natural resources.

As a Ministry, we have set up ambitious and yet achievable high-level targets by 2030. The key ones are: improving research, increasing seed availability from 130,000 to 250,000 tons, increasing the proportion of farmers accessing and using improved seed from the current one-third to two-thirds, increasing the number of agro-dealers from the current 3000 to 12,000 which would mean one agro-dealer for each village and doubling the area planted to improved seed from 3 million to 6 million hectares. This will require making strategic investments in research, seed production, seed availability, seed accessibility and seed utilization.

To achieve the foregoing, we will need to solidly embrace the following:

- Maintaining and sustaining the momentum in increased financing to the Ministry and ensuring that the seed sub-sector receives its appropriate share from year to year.
- Embracing the different components in the seed system—being clear about who is doing what, and the need to co-creatively design a monitoring, evaluation, accountability and learning (MEAL) plan in the seed system.

Our dream of turning Tanzania to be a regional seed hub will come true within the next five years if we firmly adhere to the laid-out strategy. I commend all those involved in developing this strategy, and I urge our stakeholders to embrace its principles and objectives with enthusiasm and determination. Together, let us sow the seeds of prosperity and resilience, ensuring that Tanzania's agricultural potential blossoms for generations to come.

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**Hon Hussein Mohamed Bashe (MP)**  
Minister of Agriculture

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## List of Abbreviations

AKIS.....	Agricultural Knowledge Information System
ASA.....	Agricultural Seed Agency
ASARECA.....	Association for Strengthening Agricultural Research in Eastern and Central Africa
CBD.....	Convention on Biological Diversity
COMESA.....	Common Market for Eastern and Southern Africa
EAC.....	East Africa Community
EGS.....	Early Generation Seeds
ESRF.....	Economic and Social Research Foundation
FAO.....	Food and Agriculture Organization
FGD.....	Focus Group Discussion
ISTA.....	International Seed Testing Association
IT-PGTFA.....	International Treaty on Genetic Resources for Food and Agriculture
IWMI.....	International Water Management Institute
LGA.....	Local Government Authorities
MEAL.....	Monitoring, Evaluation, Accountability and Learning
MoA.....	Ministry of Agriculture
NGO.....	Non-Government Organization
NPGR.....	National Plant Genetic Resources Centre of Tanzania
OECD.....	Organization for Economic Co-operation and Development
OPV.....	Open-Pollinated Varieties
QDS.....	Quality Declared Seed
SADC.....	Southern African Development Community
SUA.....	Sokoine University of Agriculture
TARI.....	Tanzania Agricultural Research Institute
TOSCI.....	Tanzania Official Seed Certification Institute
TPhPA.....	Tanzania Plant Health and Pesticide Authority
TPRI.....	Tropical Pesticides Research Institute
TSSDS.....	Tanzania Seed Sector Development Strategy
UPOV.....	International Union for the Protection of New Varieties of Plants
URT.....	United Republic of Tanzania
USAID.....	United States Agency for International Development

## Definition of Terms

**Breeder seed:** The term breeder seed is not used in Tanzania, but it is a seed class. It is seed produced by a plant breeder or by an official representative under the direction of the breeder who selects the variety. The variety is selected based on the phenotype of the plants. Breeder seed is produced under the highest level of genetic control to ensure the seed is genetically pure and accurately represents the variety characteristics identified during variety selection (Huisenga, et al. 2019).

**Pre-basic seed:** Pre-basic seed is a class of seed between breeder and basic (or foundation) seed. It is used to produce mass quantities of seed for basic seed production. Similarly, to the breeder seed, the breeder produces the pre-basic seed under very high levels of genetic control.

**Basic or Foundation seed:** Basic seed is the descendent of breeder or pre-basic seed and is produced under conditions that ensure genetic purity and identity. When this seed is produced by an individual or organization other than the plant breeder, there must be a detailed and accurate description of the variety the basic seed producer can use to eliminate impurities ("off types") during production. Foundation and basic seed are different words for the same class of seed. Basic seed is the term used in Tanzania (de Boef et al., 2019).

**Certified seed:** Certified seed is the descendent of breeder, pre-basic, or basic seed produced under conditions that ensure maintaining genetic purity and the identification of the variety and that meet certain minimum standards for purity defined by law and certified by the designated seed certification authority. In Tanzania, it is the Tanzania Official Seed Certification Institute (TOSCI).

**Quality Declared Seed:** In 1993, the Food and Agriculture Organization of the United Nations (FAO) produced and published specific crop guidelines as Plant Production and Protection Paper No. 118 Quality Declared Seed - Technical guidelines on standards and procedures (FAO Paper 185, 2003). The QDS system is a seed-producer-implemented system for the production of seed that meets at least a minimum standard of quality but does not entail a formal inspection by the official seed certification system. This system intends to provide farmers with quality assurance, reducing the burden on government agencies responsible for seed certification. The QDS system is considered by FAO to be part of the informal seed system. However, in Tanzania, the FAO QDS system was modified and adopted in the year 2000, incorporated into the formal seed system in the National Seeds Act of 2003, along with its seed rules, regulations, and procedures.

**Quality seed:** In this report, the phrase quality seed is at times used in place of certified seed or QDS to describe a quality-assured seed source without specifying certified or QDS. Quality seed must meet the basic parameters of seed quality, which are physical, physiological and genetic.

**Commercial seed:** Any class of seed which is certified and acquired through purchase and used to plant by farmers.

**Improved versus landrace (or local) varieties:** Improved varieties are the product of formal breeding programs that have gone through testing and a formal release process. A landrace is a local variety of domesticated plant species that has developed over time largely through adaptation to the natural and cultural environment in which it is found. It differs from an improved variety which has been selectively bred to conform to a particular standard of characteristics.

# Executive Summary

The Tanzania Seed System Development Strategy aims at enhancing the efficiency and effectiveness of the seed systems in the country, ensuring the availability, accessibility and utilization of high-quality seeds to farmers which will result in improving agricultural productivity, ensuring food security, and fostering economic growth. This report outlines the findings from a comprehensive literature review, focus group discussions, and an analysis of the current constraints and potential opportunities within the seed system.

A review of existing research and documentation related to seed systems in Tanzania and globally was conducted to understand the current landscape and identify best practices. We conducted focus group discussions with key stakeholders, including farmers, seed producers, policymakers, and agricultural experts, to gather qualitative insights and firsthand experiences. Through the literature review, focus group discussions and discussions with experts in agricultural research and development, we identified critical constraints impeding the development of the seed system and explored potential opportunities for improvement.

Several constraints were identified: (a) Insufficient investment in research and development; the major being fewer number of researchers, (b) insufficient quantities of early generation seed, lack of field and laboratory equipment and inadequate funding by the public sector, (c) Limits in the production and availability of locally adapted seed varieties due to lack of land, lack of interest by private sector companies in producing open pollinated varieties (OPVs), (d) Few agro-dealers, international seed companies having their operations outside the country due to high costs and lack of land for seed production and lack of awareness by farmers of the benefits accrued from using improved seed, (e) Access to seed is constrained by high cost of seed, lack of funds to procure and lack of access to credit, long distance to travel to access seeds from agro-dealers and lack of knowledge on the benefit of using improved seeds and; (f) Farmers lack knowledge on selecting seed for their agro-ecology as they do not have adequate access to extension service to know that seed alone is not adequate but need to be combined with good agricultural practices (GAP), (g) Lack of coordination among seed industry key players.

Based on identified constraints, opportunities for developing a vibrant seed sector which among others will make Tanzania a hub for the regional seed industry were determined the major being: (a) Both regional and international seed companies' focus is in production and sale of hybrid crops yet the majority of crops grown in Tanzania are OPVs whose research is conducted by public sector institutes. The public sector institutes, mainly Tanzania Agricultural Research Institute (TARI) need to be strengthened through improving capacity and number of research scientists, improving infrastructure (for field operations, irrigation systems, harvesting and drying equipment, packing and cold room) and increasing and timely disbursement of funds. (b) Seed supply should be increased by public sector (Agricultural Seed Agency (ASA) and TARI) through provision of infrastructure and by private sector through provision of land, conducive policies and access to finance. (c) Farmers (availability of improved seed and access), agro-dealers (in knowledge regarding seeds, running the business) and extension staff trained, work towards having one agro-dealer per village. (d) Improving access and utilization of improved seeds through building of a digital platform where information on the type of seed is available and where and the system should be easy to access, packaging of seeds all with TOSCI labels (in 2, 5, 10, 25 and 50 kg bags to meet different demands of farmers).

Improvements are recommended regarding partnerships and coordination among public institutes: A lot of benefits will accrue from TARI partnering with universities and international research organizations through improvement of their effectiveness in breeding and resource mobilization and addressing gaps in capacities of research staff and knowledge. In addition, coordination between TARI and ASA must be enhanced to ensure that the production of early-generation seeds meets demand. The government must enhance and better equip its Coordination Unit under the Ministry of Agriculture and membership should include, among others, representatives of TARI, ASA, Tanzania Official Seed Certification Institute (TOSCI), Tanzania Seed Trade Association (TASTA) (representing private seed companies), and agro-dealers.

TOSCI plays a critical role in the seed sector and has excellent laboratory facilities. In addition, it has experience and facilities for storing released varieties. We recommend that its gene bank be expanded to store breeder seeds of released varieties since TARI centers lack similar facilities. This will require the expansion of the gene bank, obtaining extra land near its headquarters in Morogoro, increased staffing, and increased funding. Presently, the number of locations where TOSCI are five, which is few, and the number needs to increase to eight. In addition, extension staff for seed certification need retraining and re-tooling and have joint supervision with Tawala za Mikoja na Serikali za Mitaa (TAMISEMI) in president's office.

# 1. Introduction

The agricultural sector plays an important role as a key driver for the economic growth of Tanzania and accounts for approximately 65% of the population, especially in rural areas. The sector contributes about 28% of the country's GDP and about 24% of the total exports and ensures food security in the country (URT, 2021). However, productivity is low (URT, 2021) due to several factors, including erratic rainfall worsened by climate change, land degradation, and soil fertility decline, low adoption of modern farming techniques, including improved seed varieties, and limited access to credit and inputs. On the demand side, the domestic seed industry still does not meet the demand: local production is supplemented with importation (ESRF, 2020). In addition to this supply gap, the costs of seed production, marketing, distribution, administration, and taxes imposed on seed producers are high. The supply gap and high costs have driven high prices of improved seeds, as argued by most farmers. This situation shows that investment into improved seed production by both public and private sectors is imperative.

The productivity and growth of an agricultural sector relies among others, on a dynamic seed system (AGRA, 2016). However, the total planted area with improved seeds accounts for only 22% of the total cultivated area (MoA, 2021). In the seed system, the most important steps in agriculture are production, availability, access to, and use of quality seeds of adaptable crop varieties, resulting in increased productivity and production which would, in turn, result in income gains necessary to improve food security and reduce poverty. Farmers' access to high-quality seeds of well-adapted and farmer/consumer-preferred crop varieties is key in ensuring agricultural production and productivity, improving rural livelihoods, and ensuring food and nutritional security for all. The timely production and distribution of high-quality seeds depend on strong national seed systems (Louwaars and Manicad, 2022).

Despite a commitment by governments to increase access to, and utilization of improved seeds, the vast majority of farmers in developing countries still do not use improved varieties. Apart from maize where the use of quality seeds is relatively high, the use of quality seed in other crops is very low in Tanzania. All too frequently, the policy environment does not enable the private sector to generate and meet market demand for seed in the agricultural sector, hindering industry start-up and expansion and putting improved seed beyond the reach of smallholders. Understanding the seed market is crucial to providing the right products and services at the right price. However, public seed systems in most developing countries have so far failed to involve and learn from the private sector.

Seeds are divided into three major categories: hybrid, open-pollinated (OPV), and vegetatively propagated. In Tanzania, most hybrid crops are maize and, to a lesser extent, sorghum and sunflower and are made available in the market through extensive promotion by private sector seed companies. The uptake of open-pollinated and vegetatively propagated crops is low, which is due to the following factors: (i) Farmers perceive improved and certified seed of OPV and vegetatively propagated crops as costly and having a limited impact on improving yields compared with traditionally used open-pollinated or vegetatively propagated varieties; (ii) Lack of knowledge of the economic value of using improved varieties; (iii) Limited promotion and lack of knowledge of the value of using certified seeds, including quality declared seed (QDS), which farmers consider expensive and; (iv) Limited access to agro-dealers—most small-scale farmers in Tanzania travel between 4 and 12 kilometers to access an agro-dealer. Due to the low demand, the private sector is not keen on producing OPV and vegetatively propagated seeds, which are, therefore, usually produced by public institutions (Louwaars and Manicad, 2022).

ASPIRES Tanzania, in collaboration with and sponsorship from the International Water Management Institute (IWMI) on behalf of CGIAR's Ukama Ustawi: Diversification in East and Southern Africa, and USAID SERA BORA Project, is supporting the Ministry of Agriculture in developing the Tanzania Seed Sector Development Strategy (TSSDS) to enhance agriculture productivity and improve food and nutrition security in the country. This strategy is motivated by several factors, including the extremely low productivity of the agricultural sector. For example, cereal grains are important staple foods in Africa, but yields are still too low for maize at 1.5 tons per ha compared with a global average of 4.5 tons per ha. This is partly attributed to the limited development of commercial seed markets, low use of improved seeds, and small and highly fragmented seed markets.

TSSDS will endeavor to introduce several innovative, low-cost, and sustainable procedures to ensure efficient operations among parties in the seed industry. We envision that a deliberate and intentional commitment to engaging in the following specific objectives will contribute to higher levels of efficiency in the system:

- i. Drive the co-creation of a sufficiently transparent public-private partnership (PPP) model for the seed sector armed with clear and mutually beneficial profitable outcome strategies and driven by financial and persuasive non-monetary incentives.

- ii. Encourage communities of practice between and among several parties who share a common vision in the seed system continuum. Examples are ASA, TOSCI, and the Seed Coordination Unit at the Ministry of Agriculture, just to mention a few. Communities of practice are characterized by being informal, making it possible for productive ideas to be quickly put into action with minimal bureaucracy.
- iii. Rationalize procedures to boost operational efficiencies in the different nodes/segments of the seed value chain: We note that whereas harmonization is a unified set of procedures across countries to facilitate the efficient movement of seed across national boundaries, rationalization refers to how several agencies dealing with a common sector organize themselves to ensure proper coordination to minimize inefficiencies and institutional overlaps. Seed as a commodity transcends sectors, and such cross-sectoral linkages are paramount.
- iv. Facilitate a conducive environment for EGS production through infrastructure support and strengthening the capacity of all parties involved in production and maintenance. There is a need to equip national research stations with field isolation systems, greenhouses, and irrigation systems, which will help ensure seed production during cropping season and off-season, drying and threshing systems, sorting areas, packaging areas, and cold rooms, among other infrastructure.
- v. Start a revolving seed fund system where the funds from sale remain at the institution.
- vi. Ensure private seed companies produce their seed within the country.
- vii. Foster information sharing between producers of certified seeds and public institutes, TARI and ASA, which require information from producers to advertise the produced varieties.

## 1.1 An Overview of the Seed Sector

In Tanzania, despite the use of certified seeds for major crops such as maize, rice, beans, sorghum, groundnuts, and sesame, the formal seed sector contributes only 28-34% of the seeds available and used, the informal seed system to the rest (USAID, 2013; URT, 2013a). An exception is in the use of hybrid maize seeds, which is higher. This indicates that the adoption of improved seeds is still low, a factor driving low productivity at the farm level. TSSDS must build on understanding the cause of this low uptake of improved seed varieties and propose a framework to overcome the common shortcomings that will result in increased improved seed use. As a preliminary step toward the strategy formulation, we offer a look into the enabling environment, starting with an overview of the stages in the seed value chain and different public and private actors involved in and facilitating these stages.

## 1.2 The Policy, Regulatory, and Institutional Framework

Systematic plant breeding forms standardized varietal development and release mechanisms and seed certification schemes. The Association of Official Certifying Agencies (its forerunner since 1919) and the Organization for Economic Cooperation and Development (OECD) (1958), both established evaluation, registration, and release for accepting and listing eligible varieties, as well as standardized certification schemes to strictly control generation and maintain varietal purity, identity and seed system led to the development of national policies, laws and regulations in variety testing and release; and sanitary and phytosanitary measures to name the least. The international conventions and treaties, such as the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), and biosafety laws, are recent additions significant for the national, regional, and global seed industries.

In Tanzania, the national policy framework guides the structure and conduct of the seed sector. Table 1 below summarizes the relevant acts and legislation for the seed sector.

The overarching guiding instrument is the National Agricultural Policy (NAP) 2013 (URT, 2013b), which facilitates the participation of local and international entities in breeding and seed production. Currently, there is no stand-alone seed policy. However, the NAP in addressing research and development, biotechnology and biosafety, plant breeders' rights and agricultural inputs makes several policy statements that directly support the enhancement of the seed system. The NAP also supports advancement in the development of genetically modified organisms (GMOs) which directly affects seed variety development. It states, "...new and emerging research areas that promise to mitigate low production and productivity in agriculture shall be promoted; these include the development of GMOs" (URT, 2013b, p.13).

The Seed Act and the Local Government Act are the guiding legal frameworks for QDS. The Seed Act No. 18, 2003 (URT, 2007b) provides the legal framework for seed production, certification, and marketing. It aims to ensure the availability of high-quality seeds to farmers by regulating the activities of seed producers, processors, and traders recognizes and encourages the production of QDS. It empowers the Minister of Agriculture to set rules and procedures for its certification and control. Section 10 of this Act was instrumental in establishing TOSCI, which functions as a semi-autonomous body under the Ministry of Agriculture. TOSCI is responsible for the certification and promotion of quality agricultural seeds that are bred, released, or imported for sale.

**Table 1. Seed legal and policy framework in Tanzania**

<b>Seed service</b>	<b>Policy instrument</b>	<b>Overview of relevant provision</b>
<b>Seed production</b>	National Agriculture Policy 2013	This policy allows participation of private sector players in the multiplication of pre-basic and basic seeds.
	Seed Act No. 18 of 2003	This Act recognizes and encourages QDS production.
	SADC Technical Agreements on Harmonized Seed Regulations 2008	These regulations restrict source of foundation seed to varieties on the SADC catalogue. It calls for registration of QDS producers by national seeds agencies.
	Seeds (control of QDS) regulations 2020	Defines QDS dealers, producers or grower. restricted to the village and district, eligible land size, inspection standards and fees for inspection, germination tests, soil health testing and training of persons.
<b>Production of basic seed</b>	National Agriculture Policy 2013	This policy allows participation of private sector players in the multiplication of pre-basic and basic seeds.
	TARI Act No. 10 of 2016	Founded TARI to promote national agricultural research services.
	Executive Agencies Act 2002	This Act established ASA to produce basic seed
<b>Agricultural extension and seed inspection</b>	Local Government Acts 1982–1999	The Act delineated the implementation of agricultural production and extension services
	Seed Act No. 18, 2003	This Act established TOSCI.
	National Agriculture Policy 2013	Supports strengthening of agricultural extension services.

Local Government Act No. 6 of 1999 (URT, 1999) authorizes local governments to implement agricultural production and extension services. They collaborate closely with the Ministry of Agriculture and the regional administration in charge of local governance (i.e., TEMISEMI).

The Tropical Pesticides Research Institute (TPRI) Act 1977 led to the establishment of TPRI in 1991. Under TPRI, the National Plant Genetic Resources Centre of Tanzania is a division relevant to the seed sector. Conservation of genetic materials and development of varieties are guided by the TPRI and TARI Acts, while the production of basic seeds is guided by the Executive Agencies Act. In 2002, the Plant Health Section under the Ministry of Agriculture and TPRI merged to form one authority known as the Tanzania Plant Health and Pesticide Authority (TPHPA).

The Southern African Development Community (SADC) Harmonized Seed Regulatory System, to which Tanzania is a signatory, recognizes QDS as a seed class (SADC, 2008). The regulations restrict the production of QDS varieties included in the SADC Variety Catalogue. QDS producers must be registered with the national seeds agency—TOSCI in Tanzania. TOSCI is required to inspect 10% of the seed crops (SADC, 2008).

The Agricultural Seed Agency (ASA) was established in June 2006 as a semi-autonomous body under the Ministry of Agriculture, Food Security and Cooperatives, driven by the Executive Agencies Act (URT, 2002). ASA is responsible for multiplying and distributing quality-improved seeds to seed companies and farmers and ensuring their availability at affordable prices. While ASA focuses on the production of basic seeds (focus crops: maize, rice, sunflower, sesame, common bean, wheat, and barley), they also produce certified seeds for crops that do not attract the private sector. Examples are the common bean, sunflower, pigeonpea, and rice. Its focus crops are maize, rice, sunflower, sesame, common bean, wheat, and barley. ASA's main source of pre-basic seed is TARI centers. ASA places seed orders a season in advance to TARI based on demand from seed producers. Basic seed is sold to the private-sector seed companies operating in the country and QDS producers. Buyers of basic seed need to inform ASA a year in advance for both ASA and TARI to produce the required amount.

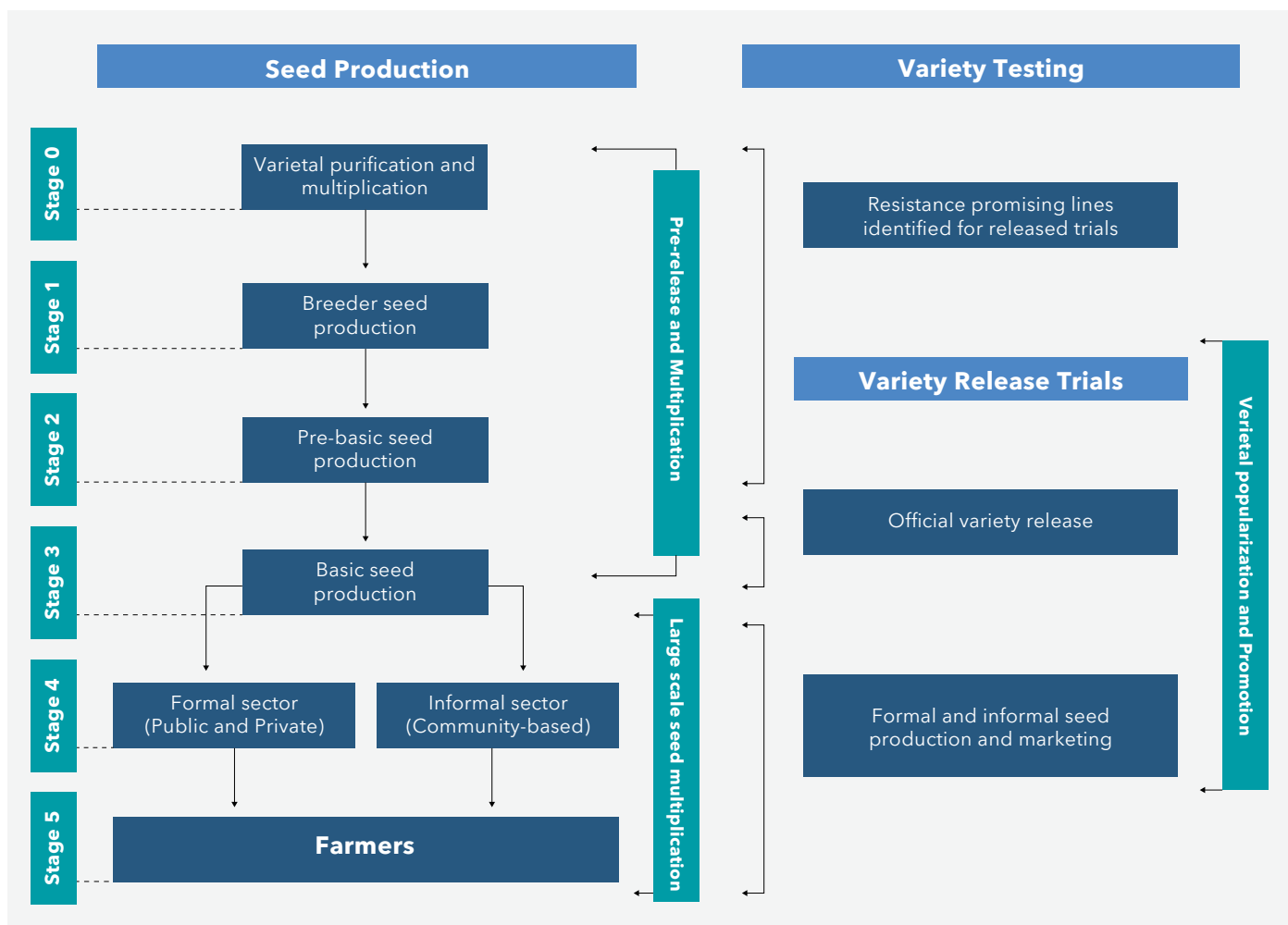
ASA faces several challenges in meeting seed demand. It has failed to project the market demand for seed from seed companies, leading to periodic underproduction and overproduction of basic seeds. During the off-season, ASA is unable to produce enough seed to meet the market demand. This is due to lack of irrigation systems and insufficient equipment. To overcome these challenges, they tend to use contract farmers who have irrigation facilities. Moreover, ASA has only few distribution outlets thereby limiting its seed sales. For example, in the northern corridor covering Kilimanjaro, Arusha, Manyara, and neighboring districts, ASA operates through its Arusha office. There is a need to have seed distributors in all districts of northern Tanzania to relieve the reliance on the Arusha office and increase its business.

Conservation of genetic materials and development of varieties are guided by the Tropical Pesticides Research Institute Act and the Tanzania Agricultural Research Institute Act. Production of foundation seed is guided by the Executive Agencies Act.

Tanzania Agricultural Research Institute (TARI) Act No. 10 of 2016 resulted in the establishment of TARI's with aim of strengthening the agricultural research system in the country. TARI is a semi-autonomous body under the Ministry of Agriculture and is responsible for crop breeding, seed multiplication, and distribution to the Agricultural Seed Agency (ASA), private sector seed companies, and farmers. It has the mandate to produce breeder and pre-basic seed in Tanzania. Most TARI centers have crop improvement mandates. For maize, it conducts research on hybrid and open-pollinated varieties (OPVs), and for the other cereal legume and oil crops, it focuses on OPVs and vegetatively propagated crops that TARI deals with are bananas, sweet potatoes, Irish potatoes, and cassava. Breeder seeds of varieties released are multiplied into pre-basic seeds which are sold to ASA for multiplication into basic seeds. TARI also multiplies basic seed for private sector seed companies that produce certified seed and for the production of QDS. TARI requires stakeholders to place orders for EGS one season in advance, which rarely happens, causing seed crises.

### **1.3 Coordination Across the Seed Value Chain**

In the seed value chain, there are two critical stages in ensuring the seed system functions along the pathway from variety development to getting the new varieties to farmers' fields: (i) small-scale early generation seed multiplication (including pre-release) of breeder seed to basic seed; and (ii) large-scale seed multiplication from basic seed to certified seed (Figure 1). In addition, there is interest in augmenting seed availability and accessibility through farmer-based seed production and marketing by producing QDS at local levels by involving farmer groups. A successful and sustainable strategy should embrace all the players in the seed value chain. This will involve NARS or private seed companies for early generation seed multiplication; the public and private seed sector and small-scale seed enterprises for large-scale certified seed production; licensed (semi-formal) and non-licensed (informal) farmer's seed producers association and cooperatives for local seed production and marketing. A major bottleneck in the seed value chain is the consistent flow of breeder, pre-basic, and basic seeds to ensure the supply of certified seed.



**Figure 1. Formal and Informal Seed Production Pathways**

Source: Authors, 2024

**Variety Development, Evaluation, and Release:** National breeding programs should aim to develop and release a wide range of varieties with diverse genetic backgrounds to achieve and maintain durable resistance to various pests and diseases. Of course, new varieties must satisfy the yield and other demands of farmers, consumers, and marketing and processing industries. But the resulting tendency of one superior variety or a few to become overly dominant in a geographic area must be resisted, partly by offering attractive varietal diversity.

**Public versus private crop breeding:** In developed countries, plant breeding is largely corporate (led by the private sector) and integrates varietal development, seed production, and seed marketing to recoup research investments. In contrast, in many developing countries, publicly funded agricultural research dominates and is responsible for setting national research and crop improvement strategies and priorities. In many countries, public seed companies have exclusive access to new varieties from NARS. However, restricted access to new publicly bred varieties and inadequate quantities of basic seed impede the desired participation of private seed companies. Such companies need access to varieties and sufficient quantities of early-generation seed if they are to fulfill the roles envisioned for them in improved national seed systems. Governments need to encourage public-private partnerships in agricultural research and variety development to exploit synergies better and make a wider choice of varieties available to farmers.

In variety evaluation and release, lengthy and slow variety testing remains a critical bottleneck hampering the speedy release of new varieties. Most countries require promising new crop varieties to undergo standard testing and release procedures before they can be multiplied and distributed to farmers. Testing for variety registration concerns its distinctness, uniformity, and stability to establish its varietal identity; performance testing considers the value for cultivation and use. National varietal testing systems actively share varietal data from international sources and consider policies for joint release within regions. As many NARS across regions evaluate similar breeding materials, the joint or harmonized regional release of varieties should be exploited. Streamlined regulatory and phytosanitary protocols can contribute to the regional harmonization of variety and seed rules and regulations and diversify the portfolio of varieties released and seed trade across countries within a region. Different varieties released in Tanzania are given in Table 2.

**Table 2. Different crop varieties released in Tanzania to date**

Crop	Type	Number				
		Public sector	Local	Regional	International	Total
<i>Cereals</i>						
Maize	Hybrid	31	38	33	73	175
	OPV	14	5	4	3	26
Rice	Hybrid	0	0	1	1	2
	OPV	22	0	0	0	22
Sorghum	Hybrid	1	3	2	5	11
	OPV	6	0	1	0	7
Pearl millet	Hybrid	0	0	0	0	0
	OPV	2	0	0	0	2
Finger millet	Hybrid	0	0	0	0	0
	OPV	3	0	0	3	6
Wheat	Hybrid	0	0	0	0	0
<i>Pulses</i>						
Common beans	OPV	46	0	0	2	46
Pigeonpeas	OPV	7	0	0	0	7
Cowpeas	OPV	8	0	0	0	8
Green grams	OPV	4	0	0	0	4
Chickpeas	OPV	4	0	0	0	4
<i>Oil crops</i>						
Groundnuts	OPV	14	0	0	2	16
Sesame	OPV	10	0	0	0	10
Sunflower	OPV	3	4	0	0	7
Soybeans	OPV	3	0	0	5	8
<i>Roots, tubers and plantain crops</i>						
Cassava	OPV	25	0	0	0	25
Sweet potatoes	OPV	23	0	0	0	23
Potatoes	OPV	4	7	0	0	11
Yam	OPV	0	0	0	0	0
Bananas	OPV	4	0	0	0	4

Data obtained from TOSCI, 2024.

ASA and TARI are currently legally allowed to produce basic and certified seeds. However, ASA also depends on TARI to supply them with pre-basic seeds. These overlapping roles between the two institutions cause unhealthy competition.

In the production of certified seeds, there are currently more than 100 private seed companies operating in Tanzania, with many involved in variety development, seed production, processing, marketing, exporting and importing seeds. These include multinational seed companies, such as Monsanto, Pannar, Dupont, and Syngenta, which have fully-fledged breeding programs. Regional seed companies often import breeding materials from their parent companies located in different countries. For example, Seed Co Ltd has its end-product breeding program in Tanzania and fully-fledged breeding work in Zambia and Zimbabwe. In addition, it derives its early generation hybrid maize seeds from the International Maize and Wheat Improvement

Center (CIMMYT), legume basic seeds from TARI, or the International Center for Tropical Agriculture (CIAT). Local private seed companies have no breeding programs and depend on TARI and CGIAR centers like CIMMYT and CIAT for EGS. Seed companies are not involved in the QDS production chain. The only exceptions are ASA and Crop Bioscience Solutions Ltd., which supply basic seed to QDS producers.

**Seed Inspection, Testing and Certification:** TOSCI is the official regulator under the Ministry of Agriculture. TOSCI's head office is in Morogoro on the Sokoine University of Agriculture campus. The other four branches are located at Tengeru in Arusha, Maheve in Njombe, Ukiriguru in Mwanza, and Naliendele in Mtwara. TOSCI performs the following activities before the basic seed is ready for the market:

- Seed field registration
- Seed field inspection
- Issuance of transport order after harvesting
- Issuance of work order to allow seed processing
- Supervision of seed processing
- Seed sampling
- Laboratory seed testing
- Issuance of seed testing certificate
- Issuance of TOSCI labels
- Supervision of labeling process
- Seed is ready for the market
- Seven months after seed testing, the owner of the seed requests TOSCI to sample carryover seed for laboratory testing.

Certification of released seed varieties includes field inspections, sampling, and testing. TOSCI trains seed producers, seed inspectors, and seed analysts. It issues certificates for qualified seed lots for packaging and marketing. It also ensures proper implementation of the QDS system.

### Box 1. Crosscutting Enabling Environment Needs in a Nutshell

#### 1. Related to EGS:

- EGS availability is one of the limiting factors in the formal sector.
- Research institutions are not able to maintain breeder seed of publicly released varieties due to lack of cold rooms, knowledge of varietal maintenance and facilities.
- Research institutions and ASA are not able to produce pre-basic and foundation seed on regular basis due to lack of infrastructure (irrigation, harvesting, drying, storage etc.).
- Lack of prior knowledge of effective seed demand.
- Competition between ASA and TARI as both are allowed to produce basic and certified seed.

#### 2. In certified seed production:

- Private sector not keen on getting involved in the production and sales of OPV and vegetatively propagated crops due to low effective seed demand.
- Publicly bred varieties effective demand not known due to lack of demonstrations and exposure to farmers.
- Need to train agro-dealers on knowledge of seed varieties to support extension staff.

#### 3. Need to increase number of locations both for TOSCI and ASA.

#### 4. Capacity and coordination issues:

- Lack of coordination and coordinated monitoring across seed sector authorities.
- Integration of seed systems, including the embracing and facilitation of the informal seed sector.

Continued >

- Development of a comprehensive seed database of knowledge and statistics (to address the information needs of all stakeholders in the seed sector).
- Development of relevant skills and expertise for seed sector development.
- Seed industry entrepreneurship and investment programs including for youth and women
- Policy organs, stakeholders, and specialized institutions must act together to agree on regional and continental agendas for the seed sector.

## 1.4 Regional Harmonization Efforts to Ease Trade and Increase Improved Seed Availability

The seed industry faces many laws, standards, and regulations in each country, which are costly. These high costs, coupled with a relatively low level of effective demand, disincentivize the local and international seed companies to make the investment required to provide the quantity, quality, and varieties of seed needed to support an expanding agricultural base in the region. It happens that seed is one of those commodities characterized by being a low-value for volume commodity. Thus, to operate in a profitable range, the producer must be able to move large consignments across a wide market area. If the trader has to meet different rules and standards when they enter multiple countries with different rules, they will not likely make a profit. The idea behind regional harmonization is to move seeds freely without a “visa” during trade across countries. Guided by the East Africa Community (EAC) and the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Eastern African countries embarked on harmonization of seed policies, rules, regulations, procedures, and laws in October 1998 (Rohrbach et al., 2003).

The laws, regulations, administrative and technical procedures that each country imposes are restrictive, impede trade and place unjustifiably discriminatory demands on imports and exports and even domestic seed producers. To reap the benefits of global advances in agricultural research and development, countries will need an environment that enables cross-border trade. Farmers can also benefit from regional cooperation in agricultural research with faster movement of seed among other inputs, across national boundaries. Regional cooperation is therefore important to conform with the emerging global standards for intellectual property rights, biosafety, phytosanitary, and biotechnology. Harmonizing seed laws, policies, standards, and regulations among the countries of the region would help establish a common regional market with a demand large enough to induce needed investment and create the competition required to establish a viable and efficient seed industry. The benefits to the region and countries, when harmonization (a unified set of procedures, laws, regulations, rules, and policies) succeeds, are:

- Easier and enhanced seed trade regionally and internationally—creating a large market and attracting investment in the sector;
- A wider selection of seeds and lower prices toward increased productivity and production,
- Empowered resource-poor farmers who will have access to quality seed of improved crop varieties from various sources both within and outside the country and the region;
- Barriers to seed trade among participating countries removed;
- Harmonized and simplified seed laws and regulations;
- An efficient phytosanitary regulatory system based on science across the region;
- Private companies increasing their role in the research and commercialization of seeds and focusing on crops with higher profit margins;
- Harmonized procedures for variety evaluation, release, and registration, addressing institutional overlaps and reducing the length of the testing period to release a variety;
- Increased income of seed subsector participants including agri-food system value chain players, and improved food security in the region.

While the above-mentioned benefits of harmonization may seem straightforward, the process of adopting this practice through aligning seed procedures, rules, regulations, laws, and policies regionally has been challenging. Although the process was as inclusive and participatory as possible, along the path, there have been several backslidings, reversals, and sometimes complete abandonment of previously agreed stands. Compliance with decisions has often been erratic based on the claims of state sovereignty and harmonization being a non-binding soft agreement, allowing countries to depart from the previously agreed upon decisions. Although frequently denied by some regional authorities, anecdotal evidence showed that membership in multiple development and trade communities such as EAC, SADC, and COMESA creates issues as these have varying frameworks preventing cross-regional harmonization. In this case, a member country finds itself not clear about which framework to follow.

We note that as per the ToRs of this strategy formulation, harmonization of seed policies is a *sine qua non* for ensuring seed availability in all its forms in the region, and as such, it will be given due emphasis moving forward.

## 1.5 Principles for Harnessing the Formal and Informal Seed Sectors

The seed system can be divided into formal and informal systems. The formal system involves a chain of activities leading to genetically improved products: certified seeds of verified varieties. The chain starts with plant breeding or a variety development program that includes a formal release and maintenance system. Guiding principles in the formal system are to maintain varietal identity and purity and to produce seeds of optimal physical, physiological, and sanitary quality. Certified seed marketing and distribution take place through a limited number of officially recognized seed outlets, usually for sale.

The informal seed system (also called a local seed system) is based on farmer-saved seed or QDS. Varieties in the informal system may be variants of improved varieties originally sourced from the formal system or they may be landrace varieties developed over time through farmer selection. There is no emphasis on variety identity, genetic purity, or quality seed. The same general steps or processes take place in the local system as in the formal sector (i.e., variety choice, variety testing, introduction, seed multiplication, selection, dissemination, and storage) but are integral parts of farmers' production systems rather than discrete activities. The steps do not flow in a linear sequence and are not monitored or controlled by government policies and regulations. Rather, they are guided by local technical knowledge and standards and by local social structures and norms. In the formal system, there is a distinction between seed and grain: seeds are marketed for sowing, while grains are market for direct consumption as food. The informal system has no such clear distinction, although some farmers treat seeds as special. While the formal seed system needs to be strengthened, the informal seed system is equally important.

## 1.6 Pasture

In a sense, pasture is important in Tanzania due to its role in livestock keeping. The importance of gearing toward improved pasture seeds and consequently their availability accessibility and utilization should not be underestimated. Increased crop productivity as a result of increased improved seed use is likely to increase the availability of crop residues for animal feed. This is especially the case for cereals, pulses and oil-seed.

The estimated number of livestock in Tanzania are 37.9 million cattle, 27.6 million goats and 9.4 million sheep (Ministry of Livestock and Fisheries 2024). The livestock industry can broadly be categorized as traditional extensive and commercialized intensive production systems. It is estimated that over 96% of Tanzania's ruminant population is kept under extensive traditional systems of management using communal grazing practices mostly in natural pastures. However, natural pastures are characterized by low productivity due to the predominant year-round presence of coarse and early maturing grasses that have low feed value. Indigenous forage legumes, which have higher feed quality than grasses, are scarce and poorly distributed throughout the year, and are in short supply in the dry season. Only 4% of the country's ruminants are raised under the semi-intensive and intensive commercial production systems. The semi-intensive system production is mostly in large-scale ranches and dairy farms while ruminants under the intensive commercial system are kept in feedlots (for beef cattle) or under zero grazing (dairy cattle). The intensive or commercialized system, though limited in size, has been receiving more in investment and improvement because of its contribution to the market-oriented economy.

Several pasture plants are commonly grown to support livestock production and improve grazing lands. These plants are selected based on their adaptability to local climates, soil types, and their nutritional value for livestock but a few are officially tested and released in Tanzania. Some of the major pasture plants with potential in Tanzania are either grasses [e.g. Napier grass *Pennisetum purpureum*, Rhodes grass (*Chloris gayana*), Boma Rhodes grass (*Chloris roxburghiana*), Boma Rhodes grass (*Chloris roxburghiana*), *Brachiaria* species (*Brachiaria brizantha*, *Brachiaria decumbens*)] or legumes [Lucerne (*Medicago sativa*), Stylo (*Stylosanthes guianensis*), *Desmodium* species (*Desmodium intortum*, *Desmodium uncinatum*)], and in addition crop residues that can be improved for use as feed and these include cereals such as maize and sorghum stalks and legumes such as *Dolichus (Lablab purpureus)*. Smallholder farmers, who make up the majority of livestock keepers in Tanzania, often use locally sourced or unimproved pasture seeds due to their low cost and availability. However, there is a growing awareness of the benefits of improved pasture seeds, but adoption rates are still low due to limited availability, high cost, and lack of knowledge.

Currently, there is a heavy reliance on imports for high-quality seeds. Some authors have estimated the supply of improved seeds as meeting only 1% of the demand (Ministry of Agriculture, 2020; Lyimo, 2019). The high demand for these materials and the often-limited availability and accessibility have resulted in a pasture seed deficit in the region and led to increased

prices. The market price of Urochloa hybrid seeds hover between \$40-50 USD/kg – a lot of money for a smallholder farmer and considering the amount of 8-10kg required to establish one hectare. This represents a significant barrier to the adoption of this technology on farms.

The Government has made efforts to improve the pasture seed sector. This includes initiatives to support local seed production and improve seed distribution systems. Various NGOs and international research institutions are also involved in projects aimed at enhancing the availability and use of improved pasture seeds. Generally, research on pasture is not as vigorous as on other commodities and this trend has to change in the years to come.

Moving forward, priority should be on increased production of seeds of cereal and legume pasture and selection of maize and sorghum crops for quality straw.

## 1.7 Seed Demand Estimation

Findings from a comprehensive seed demand study in Tanzania (ESRF, 2020) have shown that the seed industry fails to meet the existing farmer demand: current local production is supplemented with importation. Such situation has led to selling of improved seed at a high price as reported by majority of farmers. Apart from market forces (i.e. supply and demand for improved seed) which is one of the factors determining the selling price of improved seed; cost of seed production, marketing and distribution costs, administrative costs and taxes imposed to seed producers were highlighted as the main factors used by seed producers to set prices for improved seed. The projected gap between seed supply and demand for selected crop under this study for the next five year was positive. A situation that dictates that more effort to invest in improved seed production by both public and private sector is imperative. More often than not seed demand mentioned in several reports mostly refer to seed requirement which in essence refers to estimated area to be planted times the seed rate of that particular seed. However, effective demand is more involving to determine and this refers to the amount of seed a farmer or seed company is willing, able and ready to buy at a given price of the seed. A critical question to continuously address is “How many farmers who were willing and ready to buy improved seed at the prevailing price and were not able to get the seed?” This is the economic meaning of demand which most often is used synonymously with seed requirement.

## 1.8 Techniques for Estimating Seed Demand

These techniques vary in complexity, cost and credibility of the results. Five of them are outlined below:

### i. Target setting

This method is mostly used in developing countries where by a government has to take an action in planning and seed supply direct to the farmers. Targets setting are applied at each level from national to region level. The government organizes meeting with the farmers so as to catch their intuition in understanding the estimate of the seed demand, also the seed companies may be organized to set a target for an ideal sales level (Langyintuo, 2005).

### ii. Survey Method

A seed firm can determine the demand for its products through a market survey. The survey indicates real demand for the product in the locality. The accuracy of the approach can be improved if the farmers in the study are aware of the benefits of improved seeds (Teklewold, 2012).

### iii. Market experiment

According to Teklewold (2012), market experiment can be adopted to overcome the survey problems as they generate a huge amount of data before introducing a seed variety or implementing a policy.

Market experiments are of two types:

- Test marketing: Variety or hybrid is sold in a particular area and then the demand is forecasted based on the response received.
- Controlled experiments are conducted to test demand for a new seed variety or hybrid in a selected group of farmers by collecting the feedback.

#### iv. Questionnaire method

Boughton (2020) used questionnaire method to determine the estimate of the seed demand which involved:

- Asking farmers their preferred seed variety?
- Asking amount of seed, they are willing to buy
- The price which they are willing to incur (This stated willingness to pay)?
- Frequency of seed purchase were combined and extrapolated to the study area to get an estimate of effective and ineffective demand for quality seed. Effective demand is defined as the quantity of seed farmers are willing to purchase at the price equal to or above the reported current market price. Ineffective demand is defined as the quantity of seed farmers are willing to purchase at the price less than the reported current market price.

#### v. Growth trends

This approach is based on the assumption that the rate of growth of seed demand as seen in past years will continue. The Terms of Reference for this assignment demanded that we estimate seed demand up to the year 2030. It is the process of making projections of demand for the seed by examining past and present demand levels, combined with an assessment of available products and markets. This may be carried out within the government service or by individual companies in a purely commercial context (Gowda, 2020). This is the method used in responding to the requirement of this assignment. Some of those above may require very rich data sets as well as a lot more time to do than the time allocated to this assignment. But this may give unrealistically estimate but it is used when there is high need of understanding the seed demand since it is easy to estimate by considering the last demand (Gowda, 2020). In our case we did not assume a blanket growth rate for all types of crops. Thus, by reading the literature as well as based on our understanding about local and export demand for the various products originating from the respective seeds we handled different crops differently. In our estimation, we estimated the demand for the set of seeds most commonly addressed by TOSCI except cotton seed (Appendix iv for details).



Photography by Nana Kofi Acquah / IWMI

# 2. The Tanzania Seed Sector Development Strategy

## 2.1 The Scope

In its Greek origins, the word strategy is a military term referring to specific plans to win a war. To develop an effective strategy, all stakeholders, collaborators, and partners, including the government, must show great commitment and dedication and present the same understanding of the issues and needs leading to that strategy development, reducing the risks of knowingly or unknowingly obstructing strategy outcomes. To ensure success, the seed sector development strategy must entail, among others, a clear plan that clarifies the scope of the strategy, a set of achievable objectives, an implementation plan, a Monitoring, Evaluation, Accountability and Learning (MEAL) roadmap, and a deliberate resource allocation plan to cover the whole range of the strategy implementation period. Nevertheless, the strategy will need to be revised periodically to address emerging challenges and needs in the sector.

Although Tanzania currently does not have a seed sector strategy, public efforts in the seed sector are guided by a number of policies and authorities that are considered partners and will lay the groundwork for TSSDS. These include Agricultural Sector Development Programs I and II, community seed banks, TARI leading the breeding efforts, and local government authorities implementing sector programs and projects, some of which support QDS. TSSDS aims to build on and add value to these existing efforts as follows:

- A strategy solely focused on seed with cross-sectoral considerations;
- A comprehensive look at the entire seed value chain, from production, availability, accessibility and utilization to capacity building, financing, and enabling environment as core pillars;
- An inclusive approach considering the needs and local practices of small-, medium-, and large-scale farmers and enterprises, including women, youth, and marginalized groups;
- A participatory approach that identifies the strategy steps and needed investments based on the views and experience of seed sector stakeholders;
- Follows a co-creation principle, referring to a strategy formulated, implemented, and evaluated together with its stakeholders and beneficiaries from beginning to end and owned by them. During technical assistance, USAID and IWMI acted as partners and facilitators, not experts or strategy writers.

The advisory team facilitating TSSDS recognizes that a seed system has to contribute to the overall goal of agricultural transformation in Tanzania and align with the overall economic and agricultural sector targets. We realize that the seed system alone cannot bring about this transformation, and similarly, the success or failure in agricultural transformation cannot boil down to the performance of one sub-system, such as seed. TSSDS will address the bottlenecks preventing the sector from growing and functioning effectively and foster a competitive seed market with extensive rural outreach. It will provide concrete strategic objectives and interventions to enable a more vibrant subsector.

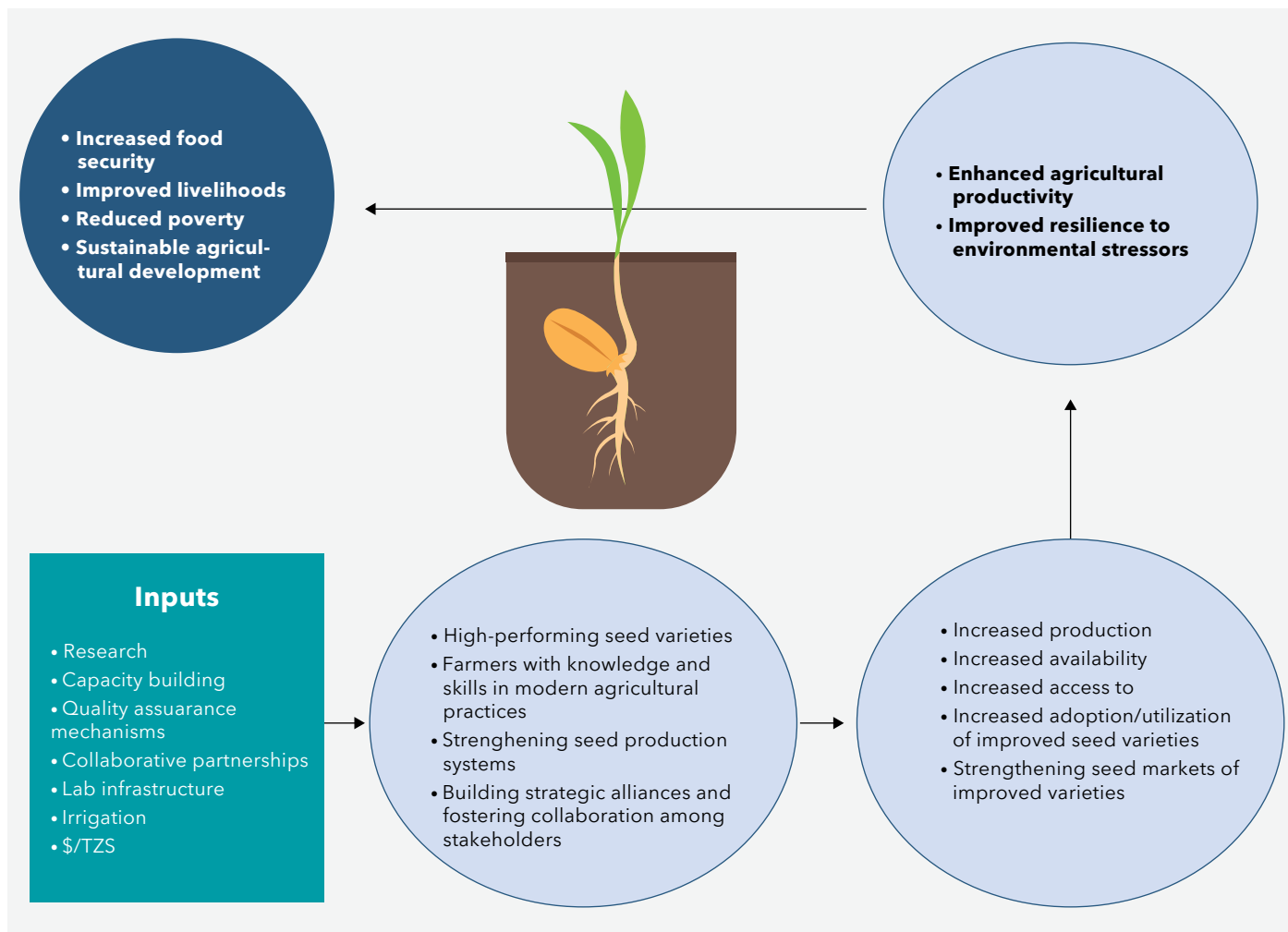
## 2.2 The Theory of Change

Through strategic interventions and coordinated efforts, we aim to catalyze transformative change within the seed sector, leading to increased production, availability, adoption, and utilization of improved seed varieties. By investing in research, capacity building, quality assurance mechanisms, and collaborative partnerships, we believe that:

- Enhanced research and development will yield high-performing seed varieties tailored to local agroecological conditions, addressing specific challenges like climate variability and pests.
- Empowering farmers with knowledge and skills in modern agricultural practices, including seed selection, planting techniques, and crop management, will enable them to make informed choices and maximize the potential of improved seeds.
- Strengthening seed production systems through rigorous quality control measures and certification processes will ensure the availability of reliable and high-quality seeds for farmers.

- Building strategic alliances and fostering collaboration among government agencies, research institutions, private sector actors, agro-dealers, extension staff, NGOs, and farmers' organizations to disseminate and adopt improved seeds across diverse farming communities efficiently.

As these activities unfold, we anticipate a series of intermediate outcomes, including increased access to improved seeds, enhanced agricultural productivity, improved resilience to environmental stresses, and strengthened seed markets. Ultimately, we envision a significant positive impact on food security, livelihoods, and sustainable agricultural development, contributing to the well-being of farmers and communities. Through ongoing monitoring, evaluation, and adaptive management, we will continuously refine our approach, respond to emerging challenges, and maximize the effectiveness and sustainability of our seed strategy. Diagrammatically, the theory of change is illustrated in Figure 2. below.



**Figure 2. Theory of change**

**Goal:** To transform the Tanzanian agricultural sector by moving it to higher levels of productivity in all of its subsectors, meanwhile enhancing the quality of the environment

**Mission:** Develop a dynamic, sustainable, resilient, equitable, inclusive, and productive seed system through the application of innovation, technologies, improved business environment and policies, coordination, and enhanced institutional capacity.

**Strategic Objectives:** To achieve a vibrant seed sector, the following seven identified strategic objectives will be the focus of this strategy:

1. Increase production of all classes of seed through enhanced collaboration between TARI, ASA, seed companies, QDS producers, and TOSCI;
2. Increase availability of seeds (i.e., physical presence of the seed required at the right time, right place, and in the right form);

3. Improve seed access by farmers by increasing the number of agro-dealers, which would help demonstrate the advantages of using improved seeds and ensure that seed prices are affordable;
4. Enhance seed utilization whereby farmers of all scales embrace the use of improved varieties;
5. Create enabling policies, institutions, and services permitting public and private sectors both on the local and international levels to invest in the seed sector;
6. Enhance private and public sector capacities in all seed value chain nodes and segments through training and collaboration;
7. Enhance financing in the seed system in strategic areas by key stakeholders (government, private seed companies and development partners).

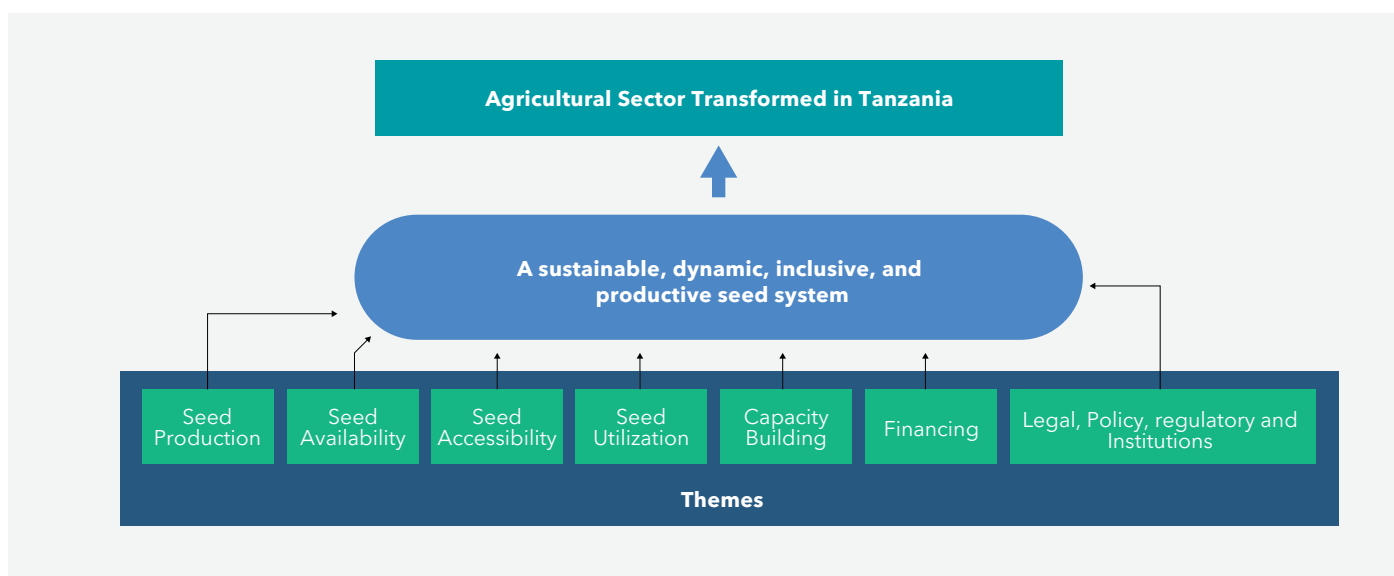
## 2.3 The Logical Framework

We identified a number of pillars as having the most pressing needs during the stakeholder consultation in the inception meeting that will receive attention in developing the TSSDS as follows:

- Seed production;
- Seed availability;
- Seed accessibility;
- Seed utilization;
- Legal, policy, regulatory, and institutions relevant to the seed system (enabling environment);
- Capacity development and strengthening of actors and organizations supporting the above-listed;
- Financing.

The architecture of this logical framework is shown in the sketch below. Expected outcomes are elaborated in the subsequent logical framework matrix.

The architecture of this logical framework is shown in the sketch below (Figure 3) and expanded in Table 7. The Ministry of Agriculture has highlighted a set of high-level targets (Box 2) that TSSDS aims to adhere to through the objectives, outcomes, and indicators described in Table 7 and steps to achieve indicated in Appendix III.



**Figure 3. TSSDS Logical Framework**

## Box 2: MoA high-level targets

Target area	Current Status	High Level Target by 2030
Seed Availability	Demand: <b>130,000</b> tons	
	Availability: <b>64,000</b> tons	Availability: <b>250,000</b> tons
	Deficit: 66,000 tons	
Seed Accessibility	Current Number of Agro-dealers: <b>3,000</b>	<b>12,000</b> agro-dealers (one per village)
Seed Utilization	Current area planted with improved seed: <b>3 million hectares</b>	○ Area planted with improved seed: <b>6 million hectares</b>
	Smallholder farmers using improved seed: <b>33%</b>	○ Smallholder farmers using improved seed: <b>66%</b>

Table 3. Logical Framework Matrix

Objective Description	Expected Outcomes	Key Performance Indicators
1. Increased seed production	i. Increased supply of EGS through enhanced PPP collaboration-ASA/seed companies/TOSCI/TARI	○ Number of interagency memoranda of understanding among MoA/TARI/TOSCI/ASA/private sector developed and or reviewed per year aimed at smoothing collaboration among the parties
	ii. Broaden the base of variety development from the narrow maize/beans/rice band to capture several others to reflect the reality of the country	○ Annual % increase in real budget allocation on each of the following key parameters/infrastructure in seed production—irrigation, isolation, threshing, drying, sorting, packaging and cold storage facilities ○ % Increase in the number of breeders for all key crops per annum for all commodity categories
	iii. Increased quantity and quality of vegetatively propagated material (cassava, yam, sweet potato, bananas)	○ Number of hectares made available to ASA, certified seed producers ( <i>What is needed here is not a hand out of land but rather facilitation to acquire such land</i> )
	iv. Increased clarity on the position of QDS country-wide	○ Number of consultations per year and agreements on refined procedures of QDS in each region
	v. Production of certified seed promoted through deliberate private-public-partnership mode	○ % annual increase in production of certified seed by private seed companies

Continued >

Objective Description	Expected Outcomes	Key Performance Indicators
2. Increase Availability of Seeds (Physical presence of the seed required at the right time, right place and in the right form)	i. Rationalized system of seed business operations to attain optimal efficiency levels (e.g., the merging of Tanzania Pesticides Agency and Tanzania Plant Health Inspectorate Services)	○ % annual increase in EGS made available to those who require it.
	ii. Fair competition facilitated to bring more seed at the table	○ Number of new entrants in the production of EGS
	iii. Lasting commitment to sustainable regional harmonization of seed policies, rules, regulations enabling among others imports of preferred varieties of seed to expand the menu of seed varieties available at home	○ Number of harmonized procedures implemented by the national seed system
	iv. The Seed Coordination Unit (in MoA) in a timely manner includes in their information system amount of seed of different classes and type available at different locations	○ Number of media established and used per year in communicating to stakeholders
	v. A system developed to facilitate and encourage agro-dealers in remote places to stock a variety of seeds making them available to farmers to purchase (This establishes a link between supply and demand centers)	○ Number of innovations developed per annum to encourage agrodealers in remote area to stock inputs
	vi. Seed packaging which meets the requirement (1, 2, 5, 10, 25, 50 kg) of different producers in terms of income and farm area developed and implemented	○ Number of farmers per annum adopting the use of fertilizer because of more availability of small pack
	vii. Effective and efficient seed information system that provides timely information on seed along the value chain	
3. Improved Access to Seeds	i. Farmers who genuinely need seasonal credit to overcome temporary cash squeezes identified and assisted	○ % of farmers in need of credit assisted
	ii. Farmers who genuinely require smart subsidies to be identified and assisted	○ % of farmers who require subsidy identified and assisted
	iii. Bulk procurement of seed facilitated by LGAs, SACCOs and extension and financial markets resulting in lowering the price per unit.	○ % of total seed sold through bulk procurement
	iv. Facilitate increased volume of authentic seed from local and foreign sources to increase competition and hence lowering the price of seed	○ % increase in the number of local and foreign seed companies
	v. Deliberate programs developed to improve rural roads infrastructure (when transportation is made easier, the cost of transport is minimized and the real price of seed per unit is reduced	○ % increase in the number of km of rural roads per annum ○ % increase in km covered by TOSCI staff arising from improved infrastructure ○ % of farmers using improved seed arising from improved infrastructure ○ % increase in the number of agrodealers in the last mile

Continued >

Objective Description	Expected Outcomes	Key Performance Indicators
4. Enhanced Seed Utilization	i. Increased adoption of improved seed utilization through ii. Farmers trained and made more aware of the use of improved seeds iii. Extension agents trained on the use of improved seed (Training of trainers) <ul style="list-style-type: none"> <li>○ Extension agents trained on the use of improved seed (Training of trainers)</li> <li>○ Evidence-based scholarly research on the profitability of improved seed utilization financed and implemented</li> <li>○ Increase knowledge of benefit of use of improved seed based on targeted agro-ecologies</li> </ul> iv. Increase seed use based on varieties and agro-ecology	<ul style="list-style-type: none"> <li>○ Agro-dealers sell varieties suitable for agro-ecology</li> <li>○ Farmers procure seeds suitable to their area</li> <li>○ Many demonstrations conducted to increase the knowledge of stakeholders on the suitability of crop variety</li> <li>○ % Increase in sales of seed based on agro-ecology</li> <li>○ Increase knowledge by farmers agro-dealers and farmers of suitable varieties -outcome</li> </ul>
	v. Increased yields and profitability through the use of improved seed	<ul style="list-style-type: none"> <li>○ Percentage increase of improved varieties grown by farmers</li> <li>○ Percent yield gains per unit area through use of improved seeds</li> <li>○ Improved profitability through growing improved varieties</li> <li>○ Proportion of farmers receiving agricultural advisory services on fertilizers among others</li> <li>○ Progress in the development and updates on soil maps and efficient fertilizer recommendations based on soil tests</li> </ul>
5. Enabling Policies, Institutions and Services Permitting Public and Private Sectors both Local and International to Invest in the Seed Sector	i. Tanzania seed policy aligned with regional seed policies ii. TOSCI expands its presence to several agro-ecological zones iii. % increase in the number of seed companies registered and establishing breeding programs in the country increase iv. Increase in volume and types of seed produced, distributed and bought	<ul style="list-style-type: none"> <li>○ % increase in seed traded across borders</li> <li>○ Number of new TOSCI stations established per annum</li> <li>○ % increase in extension staff trained by TOSCI to oversee the evaluation and inspection of varieties.</li> <li>○ % increase in the number of seed companies operating in the country</li> <li>○ % increase in seed companies having fully-fledged breeding programs</li> <li>○ % increase in sales</li> </ul>

Continued >

Objective Description	Expected Outcomes	Key Performance Indicators
6. Enhanced Private and Public Sector Capacities	i. Knowledge and skills increased in all the seed value chain nodes.	○ increase in number of skilled personnel in each node per annum
	ii. Higher learning agricultural institutions produce skilled graduates in strategic seed value chain nodes to replace the aging cadre	○ % increase per annum in the number of skilled graduates
7. Enhanced Financing in the Seed System	i. Increased investment in strategic areas in the seed system by i) government ii) private seed companies and iii) development partners	○ % increase in resource allocation procure and replace various equipment and infrastructure especially irrigation and harvesting and cooling systems

## 3. Methodology and Rationale

### 3.1 Co-creation

We sought to co-create a sustained seed sector development strategy. Co-creation is a practice of collaborating with stakeholders to guide strategy development. A stakeholder is defined as an individual, group, or organization impacted by the outcome of an initiative, activity, project, or program. Co-creation as a method has been used in different domains for collaborative and creative work, where it brings together people from different backgrounds and expertise to make creative outputs. The TSSDS drew from this method to explore how to increase the adoption of improved seed varieties successfully (based on the problem that the use of improved seeds in Tanzania is below 30% despite many years of research and development and the presence of many seed companies operating in the country). The TSSDS process recognized and included diverse stakeholders from different backgrounds and encouraged them to make creative inputs based on their respective roles and frequent interactions in different segments and nodes of the seed sector value chain. Stakeholders from similar nodes and backgrounds are grouped in the same focus group and expert discussions to obtain specialized information. Thereby, the facilitators of co-creation and strategy development collected critique and valuable insights and could get holistic views of what the strategy should contain. We drew from the co-creation principle by inspiring stakeholders to participate in stakeholder and validation meetings and fieldwork interviews, emphasizing that we aim for wins for all, thereby ensuring enthusiastic participation. Nevertheless, we accept that not every idea and suggestion can be feasible, appropriate, or adopted. We, as facilitators, have been prepared for this and encouraged stakeholders to also revise and refine their ideas aligned and relevant considering defined objectives.

### 3.2 Data Collection: Focus Group and Expert Discussions

Focus Group Discussions (FGDs) will be carried out in three zones, namely Arusha, Morogoro and Iringa. FGD objectives are to: i) identify the roles of each stakeholder group in the seed system, noting specifically technology development, transfer, and utilization (technology referring to improved seeds) by farmers; (ii) to establish the extent to which these stakeholders are coordinated and their capacities to access, share and generate information; and iii) inventorize the currently available information that can be documented and made available to other areas within the seed system. Various stakeholders will be required to join the co-creation, implementation, monitoring, evaluation, and learning and benefit from TSSDS. We made a preliminary identification of different categories of stakeholders and showed some ways in which they may benefit and or influence the seed system positively or negatively (Appendix I).

The seed industry is made up of a few large global players and a large number of small and medium enterprises that operate at regional, and national levels. The seed business model of the global players includes research and development, seed production, marketing and sales, and capacity building. However, the small and medium companies in many cases mainly focus on three areas (research, seed production and sales). In order to provide a knowledge base for strategic planning for TSSDS we conducted three intensive stakeholder consultation meetings through Focus Group Discussions in Arusha, Iringa, and

Morogoro, followed by consultation with key experts from national agricultural research systems, public sector seed producers, the public sector organization involved in seed policy, seed certification, release, registration, and quality assurance sector, and representatives from the private sector.

In selecting informants to participate in discussions in each of the three zones, based on logistics and budget considerations, we targeted five stakeholder groups comprising FGDs, each with 7-10 participants including actors from the EGS node, researchers, NGOs, agro-dealers, government officers (local government authorities, regional and district agricultural officers), extension agents, and farmers (small, medium, large), split as in Table 8 below. For each zone, we expected about 35 participants, while expecting higher participation in Arusha—the seed capital of Tanzania—than in other zones. In sending invitations, we endeavored to get participants who we thought were able, willing, and ready to share information and eager to participate in discussions. A checklist of information required was shared immediately with those who accepted the invitation. The actual participation, however, as would be expected differed from the planned. Table 4 in the Appendix shows the actual participants by stakeholder category that attended. the differences between actual and planned is quite small—just 8 participants—i.e., 97 vs 105.

S/N	Stakeholder Category	Arusha	Morogoro	Iringa
1	EGS (ASA, TOSCI, Selected Seed Companies, TASTA)	7	7	7
2	On the ground researchers, academia	7	7	7
3	NGOs	5	5	5
4	Agro-dealers	7	7	7
5	LGAs Regional and District Agric Officers	4	4	4
6	Extension Agents	2	4	4
7	Farmers (small, medium and large)	3	3	3
<b>Total</b>		<b>35</b>	<b>35</b>	<b>35</b>

In addition to FGDs, we facilitated semi-structured interviews with key informants from the seed industry to collect certain specialized information that FGD stakeholders could not provide. TSSDS consultants visited key institutes illustrated in Appendix II for this purpose. Some of the experts we interviewed are involved in research around the development and

Some of the FGD participants and facilitators. Photography by ASPIRES.



release of improved crop varieties, multiplication of EGS, multiplication of certified seeds and sales, and seed certification and regulations. More specifically, the focus of expert discussions included:

1. Research activities targeted at developing seed varieties with desirable traits such as higher yield, consumer preferences, disease resistance, drought tolerance, and nutritional quality.
2. Quality assurance protocols and standards for seed production, handling, and storage.
3. Seed certification procedures, seed testing methods, and quality control measures ensuring that seeds meet regulatory requirements and perform optimally in the field.
4. Policies, regulations, and institutional frameworks related to seed systems. The informants offered recommendations for policy reforms, regulatory harmonization, and institutional strengthening to create an enabling environment for seed sector development, investment, and innovation.
5. Feedback on constraints related to human capacity, physical infrastructure and financial constraints.



A group of participants in sessions. Photography by ASPIRES.

# 4. Findings

Focus group discussions and expert discussions showed considerable convergence of thinking on major trends, directions, challenges and emerging opportunities among diverse stakeholder groups which influenced the formulation of TSSDS. Data was collected and merged into seven categories as discussed in the methodology sections, with findings categorically illustrated below.

## 4.1 Findings from Focus Group Discussions

### 4.1.1 Seed Availability

Seed availability is defined as the presence of seed at the right place, form, quality, and quantity ready for individuals willing to obtain or purchase. A related definition by FAO describes adequate seed availability as when farmers can source enough seed at the right time to meet their needs from available sources, and even when farmers' own seed saving is reduced, seed continues to be available from other sources, especially local markets (FAO, 2015; Jones et al., 2002; Sperling, & McGuire, 2010). Stakeholders who assembled for FGDs in three locations listed a number of challenges and opportunities related to seed availability.

Stakeholders reported that the biggest seed availability challenge in Tanzania is inadequate production and distribution networks (20% of respondents) (Figure 4). A group of agro-dealers argued that inefficient seed production systems have resulted in insufficient quantities of seeds being produced to meet the demand of farmers, and this shortage has particularly impacted remote or rural farmers who face limited access to markets and distribution networks. On another note, farmers in the three centers stated that geographical disparities and inadequate distribution networks have led to unequal distribution of seeds, with certain communities having better access to seeds than others. This has exacerbated disparities in agricultural productivity and has contributed to seed insecurity in specific rural settings. Extension officers, NGOs, and government officials pointed out that weak distribution networks result in delays and mishandling during transportation, storage, and timely delivery of seeds to farmers, leading to poor availability of quality seeds.

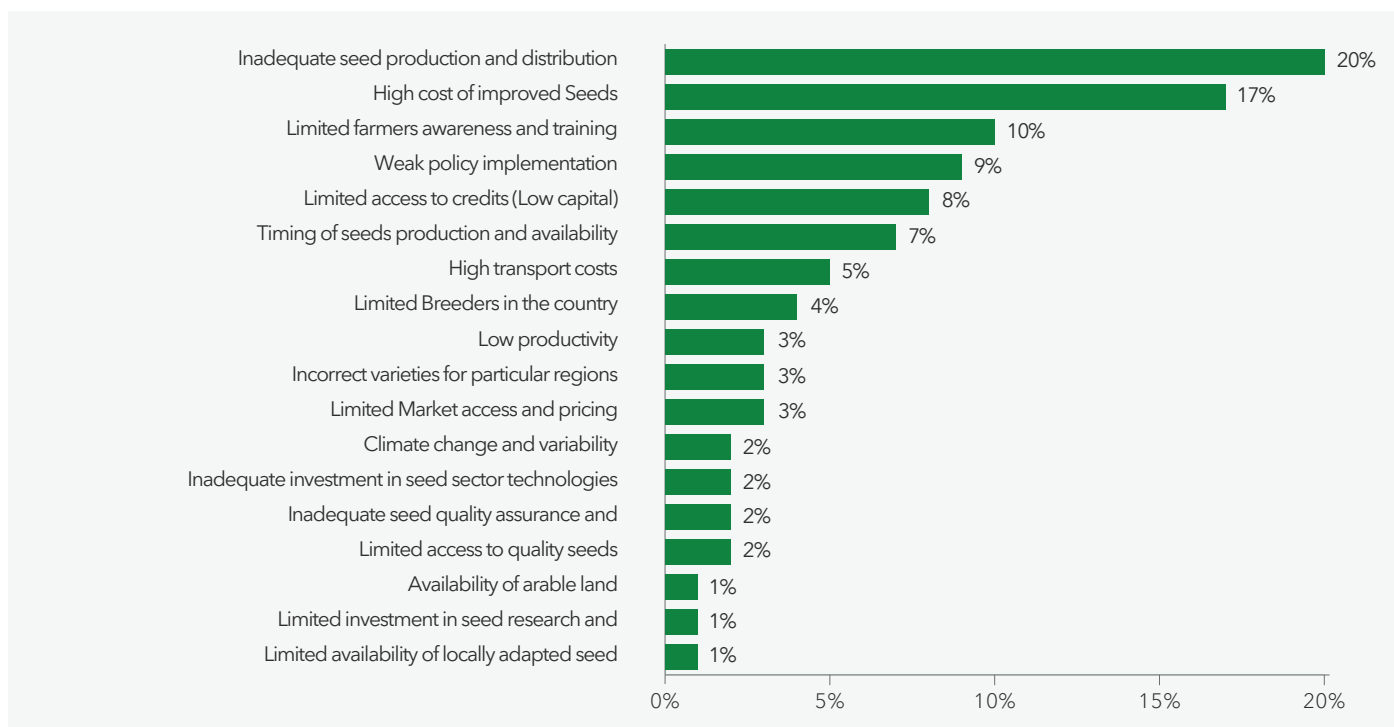


Figure 4. Challenges Facing Seed Availability in Tanzania

The high cost of quality seed perceived among farmers (17%) was the second challenge affecting seed availability. It was stated that smallholder farmers often have limited financial resources and find it challenging to afford the high upfront costs associated with purchasing improved seeds. As a result, they usually opt for cheaper, lower-quality seeds or rely on traditional seed-saving practices, which result in low yields. Seed producers and breeders appealed that the high cost of improved seeds leads to low adoption rates among farmers, particularly those with limited access to credit or financial services. With limited financial resources, farmers become reluctant to invest in expensive seeds without assurance of their performance or profitability, especially if they face uncertain market conditions or weather-related risks. FGDs with NGO participants added that the high cost of improved seeds does not only affect low-income families but highly disproportionately affects vulnerable groups, such as women, youth, and marginalized communities, who have limited access to productive resources and face additional socio-economic barriers. This exacerbates inequalities in agricultural productivity and exacerbates seed insecurity among these groups. Agro-dealers and extension officers stated that high prices pose challenges for seed producers regarding market competitiveness, as they struggle to attract buyers willing to pay higher prices for improved seeds. This limits the scale of seed production and investment in research and development of new seed varieties, ultimately affecting seed availability in the market.

The third principal challenge in seed availability was limited farmers' awareness and training on the benefits of using improved seed varieties (10%). The FGD participants said that a lack of training and awareness programs results in low adoption rates of improved seeds, leading to low demand and availability in the market. In Iringa, participants stated that farmers prefer traditional seed-saving practices as they lack knowledge of modern seed production and management techniques, which also limits the availability of certified seeds in the market and hinders efforts to promote improved varieties. In Arusha, participants argued that a lack of awareness of the importance of seed quality makes farmers unable to distinguish between high-quality and low-quality seeds. The Morogoro participants mentioned that insufficient knowledge and skills on proper storage, handling, and managing seeds throughout the cropping cycle lead to seed deterioration, reduced germination rates, and increased susceptibility to pests and diseases, ultimately limiting seed availability for future planting seasons.

As the fourth most significant challenge, FGDs found that weak implementation of seed policies, rules, regulations, and procedures as agreed upon regionally (East African Community and SADC) has been impacted by backsliding and go-stop modalities (9%). Restricted trade and seed inflows from the region have contributed to the limited availability of seeds, especially those suitable to and providing high yield under local agroecological conditions, and farmers' preferred varieties. Participants from the private sector added that weak policy implementation also put off investment in the seed sector, including research and development of seed varieties, infrastructure improvement, and capacity-building.

Another challenge facing seed availability is the limited capital among seed producers to finance seed production (8%). Seed production requires upfront investment in land preparation, inputs (such as seeds, fertilizers, and pesticides), labor, and postharvest technologies. The private sector, with limited access to credit, struggles to secure the necessary funds to cover these costs, leading to reduced investment in seed production activities and lower seed availability in the market. Farmers stated that limited access to credit constrains seed producers' ability to innovate and improve seed quality, diversity, and availability. NGO participants in Iringa added that if seed producers have access to credit, it would be easier to invest in research and development of new seed varieties, adoption of improved seed technologies, and infrastructure development (such as irrigation systems, greenhouses, and storage facilities).

Some of the FGD participants (6.8%) argued that the timeliness of seed production and distribution affects seed availability to farmers. They added that farmers typically require seeds at specific times of the year corresponding to planting seasons. Delayed seed production and distribution do not align with these seasonal demand patterns, leading to periodic seed shortages or surpluses. Delays and inefficiencies at any stage of seed production, including breeding, multiplication, processing, certification procedures, and packaging, each requiring time and resources, result in delays in seed availability, impacting farmers' ability to access seeds promptly for planting.

To address seed availability challenges, some FGD participants suggested that seed sector authorities conduct accurate demand forecasting and production planning to align seed production schedules with farmers' planting cycles. Also, seed production technologies and practices should be invested to improve seed production timeliness and minimize production risks. Moreover, the need to improve coordination and collaboration among stakeholders along the seed value chain, including seed producers, distributors, extension services, and farmer organizations, is highlighted. It was also suggested that seed storage and handling infrastructure be enhanced to ensure optimal seed quality and longevity, and seed certification and quality assurance processes be streamlined to expedite seed availability without compromising quality standards.

Other reported challenges concerning seed availability included limited numbers of breeders in the country, limited market access and pricing, incorrect varieties for particular agro-ecological zones, low productivity, inadequate investment in seed sector technologies, climate change and variability, limited access to quality seeds, inadequate seed quality assurance and certification processes, availability of arable land, limited availability of locally adapted seed varieties and limited investment in seed research and development.

In sum, three principal challenges in seed availability, as identified by the approximately 130 seed stakeholders, were (i) inadequate seed production and distribution (20%), (ii) high cost of improved seeds (17%), and (iii) limited farmers' awareness and lack of training (10%). Fifteen other reasons were mentioned but in each case with a minor proportion of the total number of stakeholders.

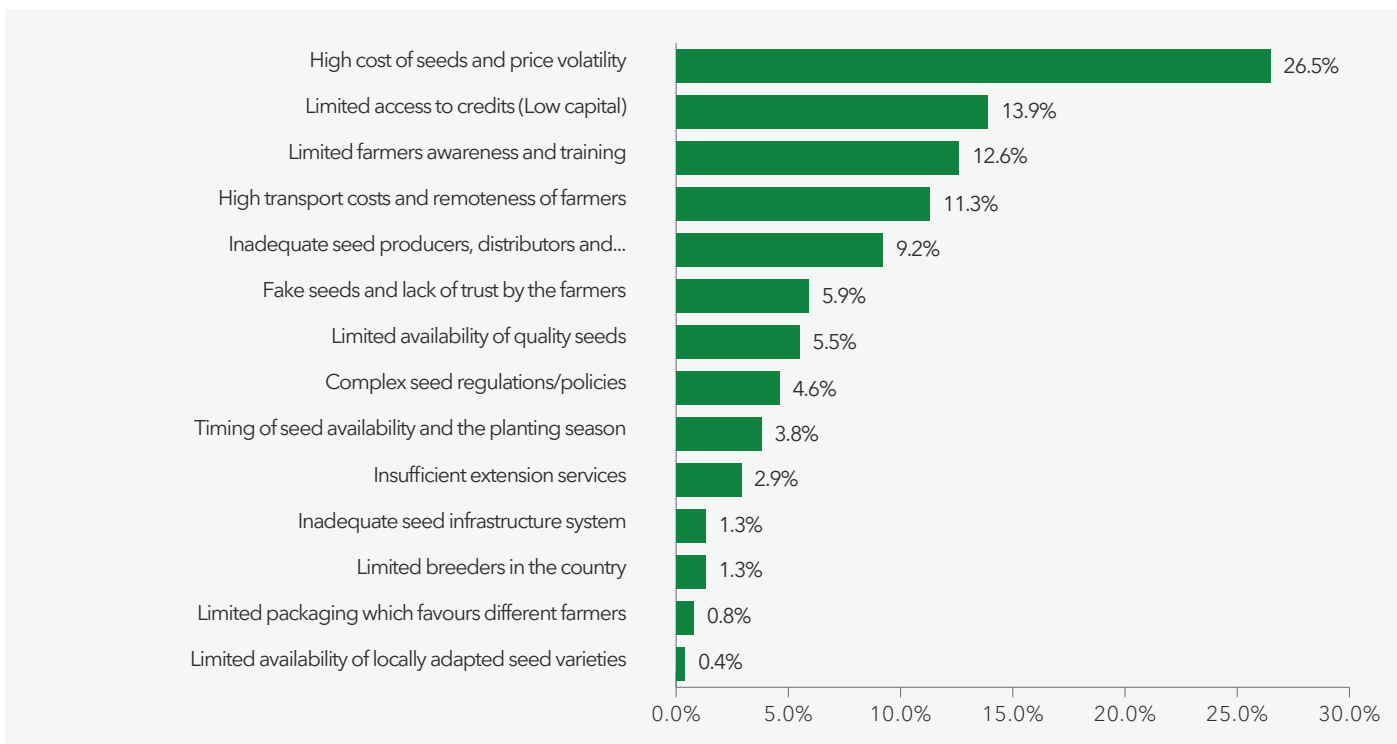
Stakeholders emphasized several opportunities to enhance seed availability based on what has already been tested and found viable. Some of these opportunities are illustrated as follows:

- i. Digital platforms set up to provide aggregate information about the available varieties, their characteristics, and suitable areas for their production and performance. The rising prevalence of electronic means of communication and mobile internet are opportunities to inform potential consumers on what seeds can be found, where, and when. In addition to digital platforms, other forms of media, such as radio broadcasts and flyers can be used.
- ii. Road infrastructure in Tanzania has improved in the last decade, although impediments such as roadblocks and lack of maintenance remain. Maintaining the quality of the transportation network presents an opportunity for agricultural trade, including rapid distribution of seeds and other inputs, across northern and southern regions in less than two days.
- iii. Field days and demonstrations to raise awareness and train farmers, agro-dealers and the extension staff.

#### **4.1.2 Seed Accessibility**

Accessibility in the context of the seed system refers to the financial power the farmer or grower has in purchasing the seed, which, to some extent, overlaps with seed availability. The high cost of quality seed was the most important challenge affecting seed accessibility mentioned by 26% of stakeholders (Figure 5). It was stated that smallholder farmers often have limited financial resources and find it difficult to afford the high upfront costs associated with purchasing improved seeds. As a result, they usually opt for cheaper, low-quality seeds or rely on traditional seed-saving practices, which result in low yields. Seed producers and breeders mentioned that the high cost of improved seeds leads to low adoption rates among farmers, particularly those with limited access to credit or other financial services. With limited financial resources, farmers become reluctant to invest in expensive seeds without assurance of their performance or profitability, especially if they face uncertain market conditions or weather-related risks. FGDs with NGO participants added that the high cost of improved seeds does not only affect low-income families but highly disproportionately affects vulnerable groups, such as women, youth, and marginalized communities, who have limited access to productive resources and face additional socio-economic barriers. Agro-dealers and extension officers stated high prices pose challenges for seed producers in terms of market competitiveness, as they struggle to attract buyers willing to pay higher prices for improved seeds. This limits the scale of seed production and investment in research and development of new seed varieties, ultimately affecting seed availability in the market.

Informants added that the price volatility of quality seed makes it difficult for farmers to predict and plan for their seed purchases. This is because fluctuations in seed prices force farmers to choose cheaper but potentially lower-quality seeds or to forego purchasing seeds altogether. Seed companies added that high seed costs contribute to the consolidation of the seed industry, with fewer companies dominating the market. This consolidation often leads to a narrower range of available seed varieties, as companies focus on producing high-yielding, commercially viable crops rather than diverse, locally adapted varieties.



**Figure 5. Challenges around Seed Accessibility in Tanzania**

The second challenge that limits seed accessibility was reported to be low capital and limited credit access. One of the most direct effects of low capital is the inability of farmers to purchase seeds. Agro-dealers from all the regions claimed that quality seeds often come with a price tag that may be beyond the financial means of many small-scale farmers, especially in villages with limited credit options. As a result, farmers respond by using low-quality or saved seeds, which leads to reduced yields. NGOs participants added that access to credit is often essential for farmers to adopt modern farming techniques that require investment in inputs such as improved seeds, fertilizers, and machinery. Without access to credit, farmers will be unable to modernize their farming practices, leading to lower productivity and competitiveness in the market.

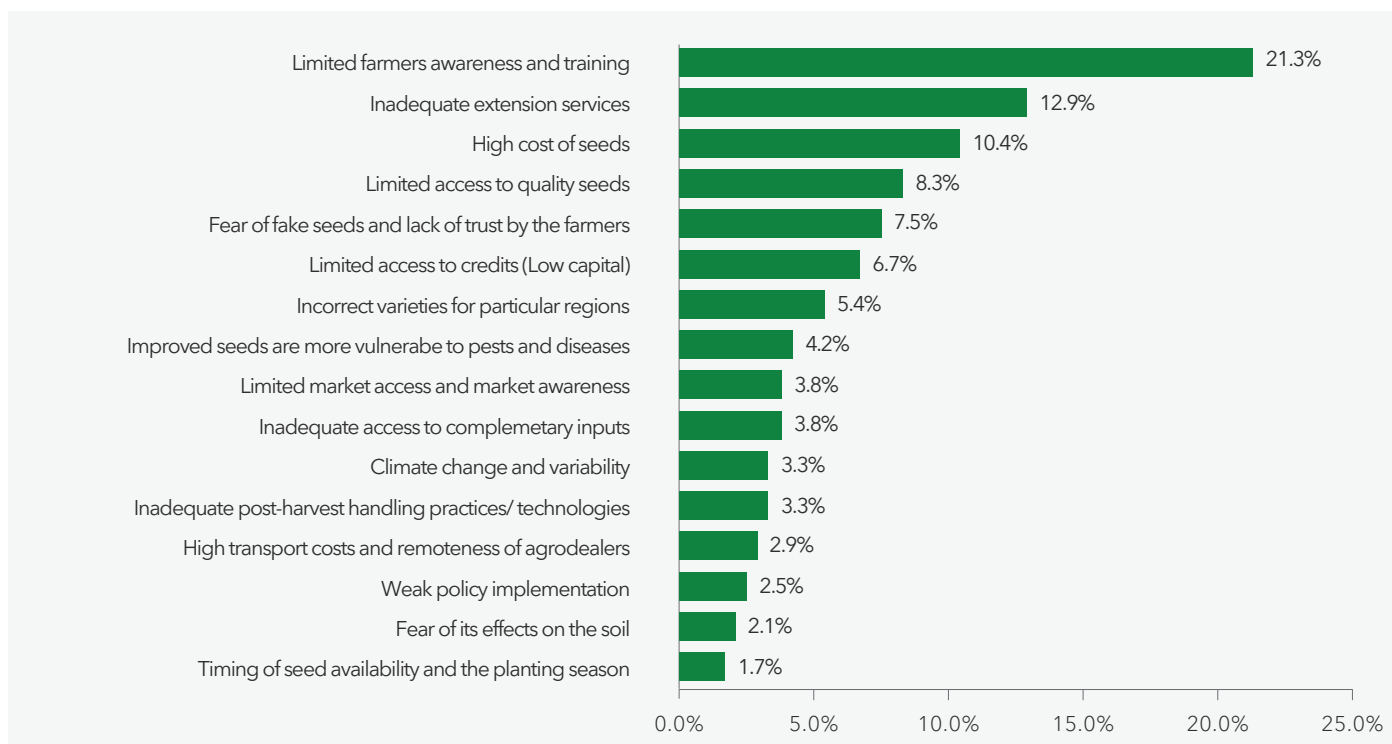
The third challenge was limited farmers' awareness and training. FGDs showed that many farmers in Tanzania are unaware of the benefits of improved seed varieties that are adapted to local conditions, have higher yields, or are more resilient to pests and diseases. They tend to compare these seeds with traditional varieties and find them more expensive without being aware of their comparative yield and income advantages. The debated value of seeds and the lack of interest are reported as accessibility issues.

The fourth challenge was the high transport costs and remoteness of farmers. High transport costs discourage seed suppliers from reaching remote rural areas with a smaller and dispersed customer base. For this reason, the government targets to have one agro-dealer per village by 2030, enabling sufficient quantities and diverse varieties of seeds to be even remotely stocked. By decreasing the transportation costs, seed costs to farmers will decrease as well, making seeds more affordable and accessible in a timely way, meeting the demand during peak planting seasons.

Fortunately, currently, there are several opportunities directed to enabling farmers to access credit. The Ministry of Agriculture is in discussions with relevant banks such as CRDB and TADB to provide seasonal loans to offset temporary cash squeeze to farmers during the agricultural season. Another opportunity related to increasing access to seed is that the policy of the ministry is to continue with the fertilizer and seed subsidies, which will provide a significant relief to accessing improved seeds by farmers.

### 4.1.3 Seed Utilization

Discussions regarding utilization include how seeds are handled, stored, and planted, and awareness among farmers about good agronomic practices (GAP) that need to be combined with improved seed to realize the intended higher yield potential from the improved seed. The first and arguably the most pressing challenge reported about seed utilization was limited farmers' awareness and training (21%) (Figure 6). It was revealed that farmers who lack awareness and training struggle to select the most suitable seeds for their specific agroecological conditions, cropping systems, and market preferences. As a result, many farmers in Tanzania end up using seeds that are ill-suited to their needs, leading to suboptimal yields, lower-quality crops, and reduced profitability. Extension officers argued that farmers unaware of the benefits of quality seeds are hesitant to adopt improved varieties, leading to missed opportunities for productivity gains and income generation.



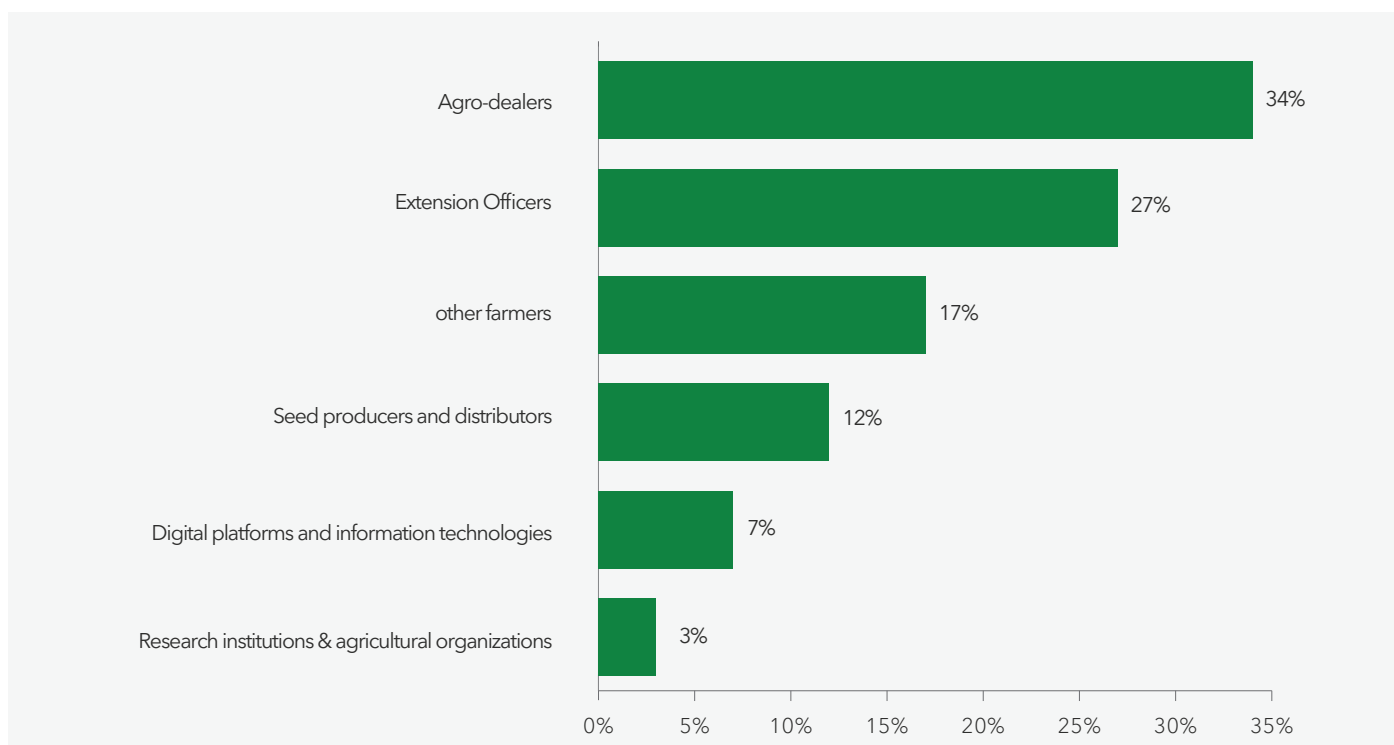
**Figure 6. Challenges Facing Seed Utilization in Tanzania**

The second utilization challenge was inadequate extension services (13%). Participants explained that extension services are often the primary source of information for farmers on new seed varieties, improved farming techniques, and market trends in Tanzania. Thus, when extension services are inadequate or unavailable, farmers lack access to critical information needed to make informed decisions about seed selection, management, and utilization. The FGD participants emphasized that extension agents provide training and technical assistance to farmers on seed selection, storage, planting techniques, and crop management practices. When extension services are inadequate, farmers lack the necessary training and support to effectively utilize seeds, resulting in suboptimal yields, lower crop quality, and reduced profitability.

The fourth challenge facing seed utilization was limited access to quality seeds—a crosscutting challenge. Agro-dealers emphasized that when quality seeds are prohibitively expensive, farmers opt for cheaper alternatives, such as low-quality or saved seeds from previous harvests. While these options may be more affordable in the short term, they often result in lower yields, decreased crop quality, and reduced profitability in the long run. Participants underlined that quality seeds often possess traits such as higher yield potential, disease resistance, and tolerance to environmental stresses. Limited access to these seeds means farmers cannot harness their land's full potential, leading to lower crop yields and diminished agricultural productivity. The participants also added that limited access to quality seeds can decrease farmers' profitability. Lower yields and reduced crop quality translate to lower revenues, while the costs associated with inputs like labor, fertilizer, and water remain constant. This situation perpetuates poverty and food insecurity among rural farming communities.

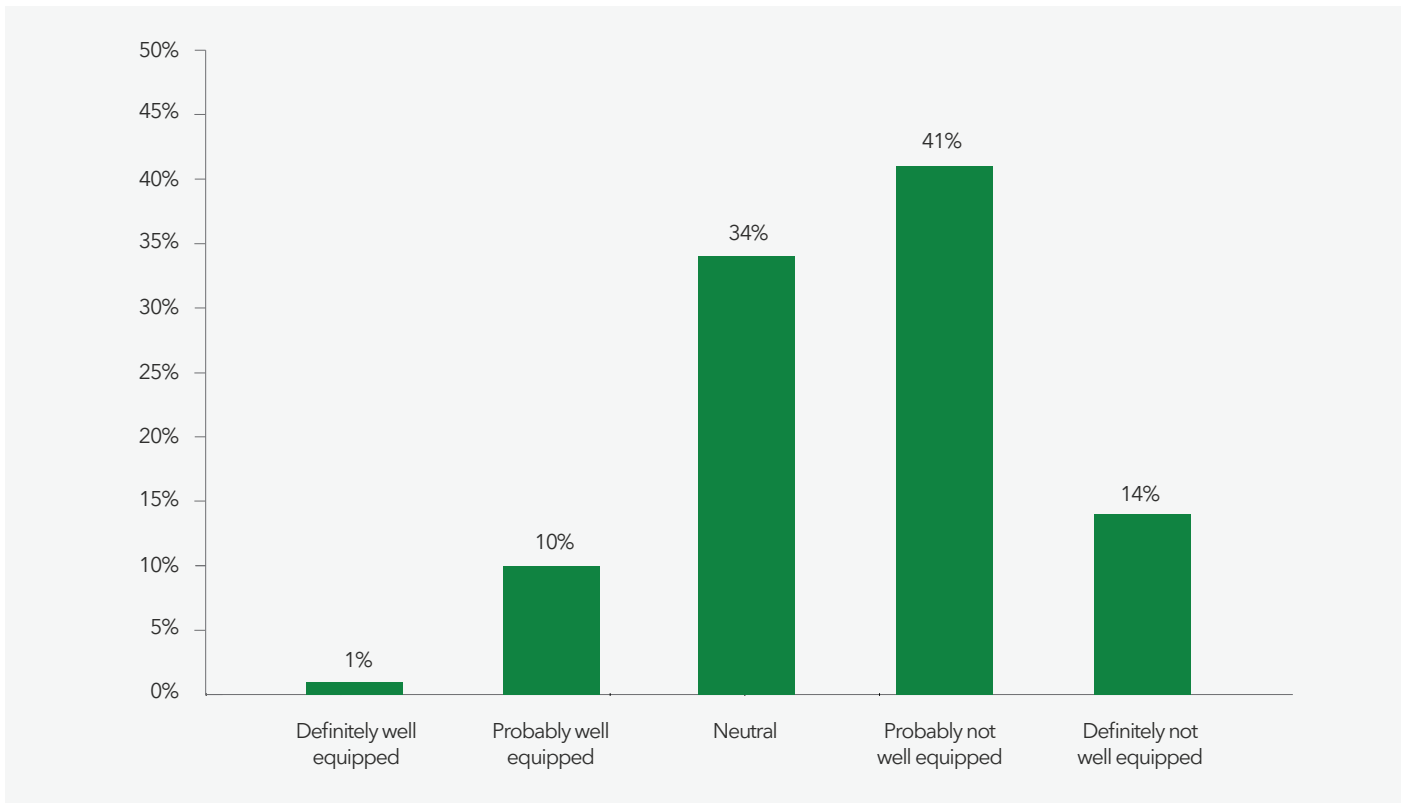
The last principal challenge facing seed utilization was the fear of fake seeds and the lack of trust in seed branding information on packaging among the farmers (7.5%). The FGD participants ascertained that, farmers hesitate to invest in purchasing seeds, especially higher-priced quality seeds if they are uncertain about the authenticity of the seeds being sold. The fear of purchasing fake or low-quality seeds leads to reluctance to invest in seeds. Government officials and researchers argued that farmers who have been deceived or disappointed by seed suppliers (agro-dealers) lose confidence in the reliability and integrity of the seed market. This loss of confidence erodes trust in formal seed systems and increases reliance on informal seed sources, such as seed saving and sharing within communities. Participants in the research & academia group added that farmers who lack trust in seed suppliers may become risk-averse and prefer to stick with traditional seeds or saved seeds from previous harvests, even if these options offer lower yields or are less adapted to local conditions. This risk aversion can stifle innovation and limit farmers' willingness to adopt new seed varieties or agricultural technologies.

There are various opportunities to strengthen seed utilization. Recently, we have witnessed a shift in the agricultural knowledge information system (AKIS), whereby agro-dealers have emerged as the number one principal source of agricultural knowledge for farmers. This phenomenon was also evidenced in the nationwide FGD, where 34% of all stakeholders mentioned agro-dealers as the key source of knowledge for farmers (Figure 7).



**Figure 7. Sources of knowledge for farmers on seed utilization**

Whereas this presents a great opportunity to broaden the base of knowledge sources in the future, it challenges the MoA in arranging for the formalization of this trend. This formalization will call for profiling and characterizing the different grades of these agro-dealers followed by arranging customized training to the respective strata of those agro-dealers training. This is one way to ensure that the knowledge they transmit to farmers is authentic. This is evidenced in Figure 8, where 41% responded saying, agro-dealers are “probably not well-equipped.”



**Figure 8. FGD participants' perception about how equipped agro-dealers are in transmitting seed knowledge to farmers**

## 4.2 Findings from Expert Consultations

Typically, the production node of seed can be divided into two sections. First is the production of early generation seed (EGS) which comprises breeder, pre-basic and basic seeds. These processes are highly specialized and are carried out by breeders in the public and sometimes in the private seed companies too. The second part of seed production typically involves the multiplication of basic seed to produce certified seed. Again, this is usually done by seed companies who purchase the basic seed from ASA and large-scale farmers. In most cases, therefore, an ordinary farmer is not involved in seed production. Instead, they buy the certified seed - open-pollinated or hybrid - to grow it to get grain. We, therefore, found it profound to conduct deep dive consultations with experts to get the scientific know-how of the process of producing EGS, which is the step taken before certifying seed. These experts are from research organizations (Tanzania Agricultural Research Institute-TARI, Consultative Group on International Agricultural Research-CGIAR, and International Agricultural Research Centers-IARCs) on seed research in Tanzania, Agricultural Seed Agency (ASA), Tanzania Official Seed Certification Institute (TOSCI), and TASTA.

### 4.2.1 Seed Research: TARI, CGIAR and IARCs

Research drives the development, release, and certification of improved varieties. TARI plays the most important role in research and, thus, Tanzania's seed sector development by promoting and coordinating basic, applied and strategic agricultural research which has resulted in a number of released crop varieties. Some key functions of TARI include research and development, crop improvement and breeding, technology exchange and extension, natural resource management, adaptation to climate change, value addition and postharvest management, policy support, capacity building, and collaboration and partnerships. TARI has 17 research centers, and each center has its mandate crop. Varietal release and, hence, improved seeds are based on an effective breeding program. Three major areas contribute to the effectiveness of breeding: human, physical, and financial capital. Currently, individual centers do not have strategy documents for their stations. Annual center meetings (which would involve review and planning) are not usually conducted although centers participate in the broader TARI annual review and planning meeting. For a TARI center to effectively carry out its mandate, it is required to develop its strategy and have annual planning meetings, which will result in scientists focusing on agreed research and external partners ensuring that the support provided is based on the agenda laid down. Of critical importance is also to make sure that the center strategy is tied to a very clear and broadly co-created monitoring, evaluation, accountability and learning (MEAL) plan.

TARI produces breeder and pre-basic seed; the latter is sold to ASA. In addition, they produce basic seeds, which are sold to ASA, private seed companies, and QDS producers, and they themselves produce certified seeds. The production of basic and certified seeds by TARI and ASA, on one hand, enhances their availability and access and, on the other, may cause unnecessary competition. Currently, the demand for certified seed is greater than the supply. Collaboration between TARI and ASA can bridge this gap, with TARI increasing its production of breeder and pre-basic seeds.

Currently, research institutions have limited capability in maintaining early-generation seeds (EGS) of released varieties, leading to loss of true-to-type variety due to a lack of processing facilities, cold rooms for maintaining the viability of seeds, and lack of funding and knowledge. Since TOSCI has a gene bank for keeping a reference set of released varieties, its role may be expanded and funded to include breeder seeds of released varieties, which TARI can draw from on a need basis.

*Vegetatively propagated seed material:* The major vegetatively propagated crops (VPC) are cassava, sweet potatoes, potatoes, and bananas. Over several decades, efforts have been made to develop crop varieties that are high-yielding and disease-tolerant and meet the quality requirements of farmers. Farmers have, over the years, incurred significant losses due to the infection of local varieties by diseases, which means that there is a strong willingness to pay for disease-resistant varieties. Compared to grain crops, VPC seed systems are underdeveloped. Also, EGS for vegetatively propagated crops has been a challenge, but recently, protocols have been developed. TOSCI, for example, supported and facilitated the development of a potato variety catalog for Tanzania (Buvigule and Bonthuis, 2022; Ngowi, 2023). In addition, through working with TOSCI, protocols for certification are in place. The most common approach in generating EGS includes tissue culture, which uses in vitro propagation methods and clean planting material for sweet potato, cassava, banana, and potato. The focus is on availing EGSs of improved varieties, which, in addition, are disease-free. Some of these crops, such as cassava and sweet potatoes, can be multiplied by research institutes and sold to farmers and QDS producers. Potatoes and bananas can be multiplied by the private sector. Two CGIAR centers (International Institute of Tropical Agriculture-IITA and International Potato Center-CIP) have been supporting the training of TARI scientists and private companies in seed multiplication of VPCs. Infrastructure for the initiative is expensive to procure and maintain and needs specialized TARI centers.

*Vegetable seed production:* Vegetables are classified into two broad categories: (1) global or exotic vegetables such as tomato, onion, cabbage, and peppers and (2) traditional vegetables. Global vegetables are bred by multinational seed companies, tested and released in Tanzania. Most of them are hybrids. In Tanzania, TARI-Tengeru is a leading center in vegetable research and development. It works closely with the World Vegetable Center, which has a regional center that is very close to it. Most of the vegetable seeds are small, and the private sector is not very keen on producing and selling them. Only tomato and onion seeds of open-pollinated varieties are sold by the private sector; the rest are by QDS producers and farmer groups.

Key constraints addressed regarding research and development are as follows:

*Human capital:* Most centers lack breeders with PhD degrees, and in addition, breeders are few. Where there are breeders, there is a need either to develop a succession plan or for young scientists to be mentored. At the very least for each station and for each strategic crop there should be at least one senior breeder and a junior scientist.

*Physical capital:* Infrastructure for an effective breeding program is lacking. Land is not the limiting factor, but all institutes do not have sufficient and efficient equipment for land preparation, planting, weeding and pest control, harvesting, drying, threshing, sorting, packaging, and storage. Centers depend on rainfall for their research, and it is not reliable. Centers do not have efficient irrigation systems that can supplement rainfall received or permit the growing of two crops per year, particularly for seed off-season.

*Financial capital:* Agricultural research heavily relies on funding for innovation in areas such as crop breeding, pest management, soil health, and sustainable farming practices. Without adequate funding, researchers may struggle to develop new technologies and techniques to improve agricultural productivity and resilience. TARI lacks adequate funding, and to supplement its resources, it depends on collaborative research with external partners such as CGIAR and advanced research institutions, which are external organizations and sometimes have different interests than TARI's. The government needs to increase funding for infrastructure and research. Each institute needs to develop its strategy and have an annual planning meeting, which will result in scientists focusing on agreed research and partners ensuring that they support their agendas.

## 4.2.2 Agricultural Seed Agency

ASA was established under the Executive Agencies Act Number 30 of 1997 to ensure the availability of high-quality seeds of publicly bred varieties to farmers at affordable prices. Initially, ASA used to obtain pre-basic seed from TARI to produce basic seed, which would then be sold to private sector seed companies to produce certified seed or to QDS producers. Over time, ASA has taken additional responsibilities by producing certified seeds, which are sold to agro-dealers (stockists) and farmers. Foundation seeds are produced on ASA farms, while certified seeds are produced on ASA farms and through contracts by seed companies and farmers who meet the set conditions. To increase demand for certified seed, ASA needs to conduct promotions through demonstrations and work closely with agro-dealers.

The focus crops grown as basic or certified seeds by ASA are maize, rice, sorghum, wheat, beans, pigeon peas, green gram, groundnut, sesame, sunflower and soya. Seeds are harvested, dried, threshed, cleaned and packed for sale. Certified seeds are sold to stockists or farmers. ASA has a total of 16 farms countrywide. Msimba Farm has 2600 ha, and depending on rainfall, 600-1000 ha is used annually. ASA has excess land that can be leased to private seed companies.

Pre-basic and basic seed requirements by ASA are based on the demand by private seed companies and QDS producers, who are supposed to provide their requirements a year in advance, but this, in most cases, does not occur and leads to underproduction or overproduction. ASA does not have cold rooms for storage, and the seeds produced lose viability. There is a need to develop an online platform for the provision of information. ASA provides crops in a variety of forms, and private sector and QDS producers can identify their requirements, and ASA then produces them.

The key areas identified for improvement are:

*Human capital:* The number and competency of staff in seed systems, breeding, marketing, communication, and agricultural engineering need to be increased.

*Physical capital:* Infrastructure for effective seed value chain needs enhancing. Land is not the limiting factor but requires efficient equipment for land preparation, planting, weed and pest control, harvesting, drying, threshing, sorting, packaging, and storage. Seed production by ASA depends on rainfall, which is frequently erratic, and, thus, yields are unpredictable. The government needs to accelerate the installation of irrigation systems to supplement rainfall cultivation and permit the growing of seeds off-season. A sustainable irrigation system requires hiring graduates in irrigation engineering. ASA should have cold rooms to store excess seeds.

*Financial capital:* Institutions require efficient funding to carry out operations. The government needs to increase funding for infrastructure and operations and promotions.

*Determining demand for EGS:* There is a lack of a digital platform indicating the type of EGS available, which would allow growers of basic, certified seeds and QDS to request the amount and type a season before.

ASA interviews indicated a need for all public and private institutions involved in certified seed production must have their operations in the country, which is currently not the case. In Tanzania, the production of certified seed involves a mix of public institutions, private companies, and non-governmental organizations. Public institutions involved in seed production are TARI and ASA. They are major producers of EGS which they then use a part to produce certified seeds. Private seed companies are local, regional, and international. Local seed companies are often small-scale ventures that are not involved in a fully-fledged breeding program. They often depend on sourcing foundation seeds from research institutions like TARI or ASA, thus crucial in ensuring farmers have access to high-quality seeds. Regional and international seed companies have either all or part of their operations within the country or bring certified varieties into the country for sale.

Private seed companies face several constraints in their seed business and require coordinated efforts from the government, private sector, and development partners to create an enabling environment for seed production, through availing land, improving infrastructure, accessing affordable financing, ensuring accessibility to foundation seeds from public institutions and increased investment in the seed industry.

Upon testing, release, and registration of varieties, TOSCI keeps samples as a reference in its gene bank, and TARI has to maintain breeder seed and multiply it into pre-basic seed. However, TARI does not have cold rooms to keep breeder seeds of released varieties, resulting in a loss of released lines. TOSCI has a gene bank where it keeps a reference set of released varieties. Since TOSCI has trained staff to maintain breeder seeds, including regeneration, its role should be expanded to include breeder seeds of released varieties, which TARI can draw from as needed. It will require building a large cold room for

keeping breeder seed, increasing the number of scientists familiar with genetic resources, and creating a large farm for seed regeneration complete with an irrigation system and associated funding.

### 4.2.3 Tanzania Official Seed Certification Institute

Overall, TOSCI plays a critical role in promoting agricultural productivity, food security, and rural development in Tanzania by ensuring the availability of high-quality certified seeds to farmers and facilitating the growth of a vibrant seed industry. The major functions are:

*Seed Certification:* TOSCI is responsible for releasing and certifying the quality, purity, and authenticity of seeds produced and marketed in Tanzania. This involves conducting inspections, tests, and audits to verify that seeds meet established standards for germination, purity, and free from diseases and contaminants.

*Quality Assurance:* TOSCI upholds high seed quality standards through continuous monitoring and evaluation of seed production, processing, and distribution practices. By enforcing quality control measures, TOSCI helps protect farmers from the risks of poor-quality seeds.

*Variety Purity Maintenance:* TOSCI ensures the maintenance of varietal purity in seeds to guarantee that farmers receive the specific crop varieties they intend to plant. This involves verifying the genetic identity of seed lots and preventing unintentional mixing or contamination during production and processing.

*Market Regulation:* TOSCI regulates the seed market in Tanzania to promote fair competition and protect farmers from fraudulent or substandard seed products. By enforcing regulations and standards, TOSCI contributes to the integrity and transparency of the seed industry.

*Capacity Building and Training:* TOSCI provides training, technical assistance, and outreach programs to seed producers, processors, extension workers, and other stakeholders. These capacity-building efforts aim to enhance knowledge, skills, and awareness of seed production, quality assurance, and certification processes.

*Research and Development:* TOSCI may engage in research activities on seed technology, crop improvement, and seed certification methodologies. By supporting these initiatives, TOSCI contributes to innovation and advancement in the seed sector.

*International Collaboration:* TOSCI may collaborate with international organizations, seed certification agencies from other countries, and regional bodies to exchange knowledge, expertise, and best practices in seed certification and quality assurance. TOSCI is now a member of all key international seed agencies, including the International Seed Testing Association (ISTA), the International Union for the Protection of New Varieties of Plants or (UPOV), and the Organization for Economic Co-operation and Development (OECD), an international organization established in 1960.

From discussions with key actors in TOSCI, several issues came out:

*Companies operating outside Tanzania:* Seed companies in Tanzania are local, regional, and international. Most regional and international seed companies currently produce all classes of seed outside Tanzania and import certified seed. The biggest reasons for this include the high cost of doing business and the lack of access to land in Tanzania. TOSCI has been advocating for seed companies that conduct breeding outside Tanzania to move them into the country. Through this advocacy and by recently having started to pay dividends to seed producers (e.g., Seed Co.), the government is working on creating a conducive enabling environment for them to operate within the country. A further needed step is to facilitate and put in place institutional arrangements to enable idle ASA land to be leased to seed companies based on their needs. Discussions should also take place with large-scale farmers to contract with seed companies on long-term agreements to produce seed for seed companies. These farmers could have loans on concessional terms to procure infrastructure for seed production. Furthermore, the government needs to look at taxes and how to reduce and thus entice seed companies to move their seed operations into Tanzania making the country a hub for producing seeds for the region.

*Certification:* TOSCI has a well-developed system of certification and registration of seed produced by the public sector, companies, and QDS. This is for both grain seeds and vegetatively produced crops. The institution has its headquarters in Morogoro and regional offices in Arusha, Mwanza, Mtwara and Njombe. For a large country, the number of stations is low. To complement their work, they are supposed to have trained able extension staff in seed inspection in every district. However,

trained seed certification extension staff are not in every district and where they are, they are not facilitated. The government needs to increase funding to allow the construction of more TOSCI locations, strengthen and fund extension staff in certification, and institutionalize a system of self-certification.

*Stockists (agro-dealers):* Stockists are nearest-located to farmers and are referred to as last-mile service providers. They are extremely important in the seed system. They require support through training to be last-mile extension staff. They also need training to operate their activity as a business. Those who genuinely need financial facilitation should also be assisted. Presently, their number is low, about 3,000, and there is a need to be ramped up to 12,000 by 2030, which would translate to one agro-dealer per village.

#### **4.2.4 The Tanzania Seed Traders Association**

Tanzania Seed Traders Association (TASTA) plays a key role in contributing to the development and regulation of the seed industry in Tanzania. Some of its primary functions include:

*Representation and Advocacy:* TASTA represents the interests of its members in discussions with the government and other stakeholders, advocating for policies that promote a conducive business environment for the seed industry. The association engages with regulatory bodies to ensure that the regulations governing the seed industry are fair and supportive of growth and innovation.

*Capacity Building and Training:* TASTA organizes training sessions and workshops for seed traders and producers to enhance their knowledge and skills in seed production, marketing, and business management. It provides technical assistance to members to help them comply with national and international standards in seed quality and production.

*Quality Control and Certification:* Working with relevant authorities to ensure that seeds produced and traded by its members meet the required quality standards. Assisting members in the certification process to ensure that their seeds are certified and meet both local and international market requirements.

*Market Development and Promotion:* Helping members access new markets by providing market information, facilitating trade partnerships, and participating in trade fairs and exhibitions. Promoting the use of quality seeds among farmers to increase agricultural productivity and sustainability.

*Information Dissemination:* Providing members with up-to-date information on market trends, regulatory changes, and new technologies through newsletters, bulletins, and seminars. Facilitating forums for knowledge exchange and best practices among seed traders and producers.

*Networking and Collaboration:* Building networks with local, regional and international organizations, government agencies, research institutions, and other stakeholders to foster collaboration and partnerships. Encouraging collaboration among its members to address common challenges and opportunities within the seed industry.

In consultations, TASTA informants indicated that a vibrant seed industry will require:

1. Research institutions and ASA to have long-term funding and not based on an annual budget for operations and infrastructure. That is funds availability to be predictable and on time, and infrastructure for land preparation, agronomy, irrigation, harvesting, threshing, sorting treating seeds, packaging, distribution and storage.
2. Personnel, particularly as it relates to TARI, ASA and agro-dealership, needs to be improved in terms of number, quality and skills.
3. There should be a strong partnership between TARI and CGIAR centers on the one hand, private sector seed companies and TASTA on the other.
4. The government needs to create a conducive environment for private seed companies to produce seeds locally - this involves reforms in associated taxes, provision of land and water, and ease of exporting seeds to other countries.
5. There are many large-scale farmers with big farms. Since seed fetches a higher price than grain, there is a need for large-scale farmers to be part of the producers of seed through contracts on a long-term lease basis. This will require training them in seed production and connecting them to favorable funding sources.

6. One area that is costly but necessary is the promotion of seeds from publicly bred varieties. This requires long-term funding commitment for it to yield dividends instead of one-off funding arrangements. Strengthen and widen the agro-dealership network through training and funding.

There is a need to improve coordination between all involved in the seed industry (e.g., TOSCI, TARI, ASA). The Seed Coordination Unit under the Ministry of Agriculture should be empowered to have the necessary skills to coordinate all these seed-related institutions. Improved coordination is necessary to ensure smooth and cost-efficient seed production, availability, accessibility, and utilization.

## 4.3 STRATEGIC FOCUS AREAS FOR TANZANIA SEED SYSTEM

### 4.3.1 Preamble

Moving forward, and guided by information from the literature, and our commitment in the Logical Framework regarding the key expected outcomes, the responses to questions we posed to over 100 seed subsector stakeholders and feedback obtained from our seed experts' consultations, we propose below key areas which the seed system needs to focus on in the next five years in order to achieve the set objectives by the year 2030:

### 4.3.2 Strategic Focus Area 1: Research

Research in developing varieties for release requires an effective crop breeding research program. It involves several strategies encompassing the selection of breeding objectives, the utilization of modern technologies, the management of genetic resources, and the integration of interdisciplinary approaches. In addition, it requires a number of things; human capacity, infrastructures and financial resources. The following guide will ensure a robust and an effective crop breeding research program which will result in farmer and market preferred varieties:

- Development of institute's research and development agenda supported by a co-created strategic plan owned by all research and non-research staff at the institute. This strategic plan should have been cascaded from the overall umbrella TARI strategic plan (SP). This center SP should be backed by a collective monitoring and evaluation, accountability and learning (MEAL). Holding of semi and -annual planning and review meetings will help check whether the center strategic plan is moving in accordance with the plan. The approach helps the institute set clear objectives and priorities, ensuring that resources are allocated effectively to the most critical areas. The approach in addition will determine progress toward achieving the objectives and ensuring that partner support is within the institute's priorities.
- Ensures efficient use of financial, human, and technological resources are used efficiently, maximizing their impact and in addition attracting financial support.
- Currently the number of scientists is low and are not enough staff trained at PhD level. Moreover, they lack international experience thus putting them at a competitive disadvantage. For each crop, and at the minimum, there should be one breeder with a PhD degree and a younger scientist to support and understudy the senior scientist for every center by 2030. Since plant breeding is a multidisciplinary endeavor, there should be in addition scientists in phenotyping and genotyping in crop protection, nutrition and an agronomy. A strategic plan should also include components for staff training and development, enhancing the overall capacity and expertise of the institute.
- Effective breeding requires diversity in germplasm (building block). Research centers need to maintain a diverse collection of germplasm to ensure a wide genetic base for breeding and centers lack facilities for safe maintenance of germplasm or breeder seed. In addition, research institutions have limited capability in maintaining early generation seeds of released varieties due to lack of processing facilities, cold rooms for maintaining viability of seeds, lack of funding and knowledge. Several approaches are being recommended: Since TOSCI has a gene bank for keeping reference set of released varieties, its role should be expanded and funded to include breeder seeds of released varieties which TARI can draw from on a need basis; germplasm can be maintained at the Plant Genetic resource Unit of Tanzania Plant Health and Pesticides Authority (TPHPA) or at each of the research centers.
- Infrastructure is extremely important in effective crop breeding and is lacking in TARI. Land is not the limiting factor but all institutes do not have sufficient and efficient equipment for land preparation, planting, weeding and pest control, harvesting, drying, threshing, sorting, packaging and storage. Centers depend on rainfall for their research, and it is not

reliable. Centers do not have efficient irrigation system that can be used to supplement rainfall received or permit the growing two crops per year, particularly for seed off season. There is need to provide funding on sustainable basis for the said infrastructure. Centers that deal with vegetatively propagated crops or for biotechnology need to modernize to strengthen their capabilities.

- Funding is a major constraint. Through strategic planning and annual review and planning meeting, centers should include budget for the operational costs which should be approved and funded on time.
- Collaborations with other research institutions, universities, CGIAR centers and private companies is extremely important to share resources and knowledge and to improve breeding that meet farmers, needs.

### **4.3.3 Strategic Focus Area 2: Production**

Developing a robust seed production system by public sector and private seed companies involves a multifaceted approach that addresses various nodes in the seed production process, from research and development to distribution through key strategies. Starts with varietal development, release, registration, production of early generation seeds (EGS), certified seeds and QDS.

#### **Early Generation Seeds**

The production of high-quality early generation seeds (EGS) of crops to meet standards and demand requires a systematic approach. Early generation seeds, which include breeder, pre-basic and basic, and registered seeds, are critical for maintaining the genetic purity and quality of crop varieties.

Breeder and pre-basic seed are produced by TARI and basic seed is produced by both TARI and ASA, the latter getting pre-basic seed from TARI. Vegetable seeds from TARI are mostly sold to QDS producers, Regional and international seed companies produce their EGS and mostly outside Tanzania. Both TARI and ASA should conduct market surveys or through digital platform and engage with stakeholders, QDS producers, seed companies, and extension services, to estimate the demand for different crop varieties. This will allow for production of different classes of EGS based on demand.

The production EGS faces a number of constraints which should be overcome through increase in the number of scientists armed with knowledge in seed production through degree training and retooling, provision of infrastructure (land, efficient equipment for land preparation, planting, weeding and pest control, harvesting, drying, threshing, sorting, packaging and storage, well equipped laboratory and reliable irrigation system) and sustainable funding.

#### **Production of certified seeds and Quality Declared Seeds**

Seed producers should ensure that high quality seeds of crops are produced to meet the highest standards and adequately meet the demand, ultimately supporting sustainable agricultural productivity through use of high-quality basic seeds from accredited research institutions or certified suppliers to ensure genetic purity and quality. In Tanzania national seed companies obtain their basic seed for certified seed production from ASA and TARI and both TARI produce certified seeds. Certified seed sold in Tanzania by regional or international companies are mostly imported and now the Government is encouraging them to produce their seeds within the country. Quantities required for most vegetable seeds are small and most are hybrids, and there are several international seed companies involved in their production and sales and thus will depend on them.

Successful public seed groups (ASA and TARI) should be operated as businesses by ensuring that they conduct market surveys and engage with stakeholders, including farmers, seed companies, and extension services, to estimate the demand for different crop varieties, and develop a detailed production plan that aligns with the projected demand, including timelines for planting, harvesting, and processing, packaging and operation costs. The aim of the Government is to ensure that farming is profitable and is a business. It should, therefore, ensure that both intuitions have well trained staff, well-funded and well equipped with field and laboratory equipment and irrigation facilities. Public sector seed producers reported that field demonstrations of improved varieties are expensive and support for demonstrations of improved seeds would create demand and should be supported.

The Government's aim is for Tanzania to operate as a regional hub and is encouraging international and regional private sector seed companies to have all their operations in Tanzania by providing incentives. These include provision of excess land held by ASA and tax incentives. The Government in addition should broker a deal with large scale farmers to grow seed through long term contracts.

Quality Declared Seed (QDS) producers are critical in the seed industry because they act as a between bridge those who can and those who cannot effort certified seeds and in addition they operate in remote areas where certified seeds may not be sufficiently available. The aim is to ensure that they conduct their businesses in a sustainable way; by ensuring they follow regulatory frameworks and their capacities built in seed production and business.

#### **4.3.4 Strategic Focus Area 3: Seed Availability**

Seed availability in crops refers to the presence of seed at the place and time for farmers and agricultural stakeholders to obtain the seeds needed for planting specific crops. This is critical for agricultural productivity, food security, and the sustainability of farming systems. To achieve this, several steps are recommended:

- Public seed and private seed companies ensure that seeds produced are of quantity and quality demanded by farmers, packed and distributed in a timely manner to meet the planting schedules of farmers. It will in addition involve developing a robust supply chain to transport seeds to stockists (agro-dealers)
- Expand networks of agro-dealers and seed retailers to increase the availability of seeds in remote and rural areas. Establish multiple access points such as agro-dealer networks and cooperatives. Agro-dealerships should not be tied to seed companies. Every district should have wholesale dealerships and retail dealership in every village. The approach will ensure that seeds reach the farmers who need them
- Ensures that farmers are informed about the availability of different types of seeds and their specific benefits, and price which will be through digital platforms established which include SMS and WhatsApp messages, stockists, and extension staff
- Capacities of stockists and extension staff enhanced through training farmers through training, field days and seed fairs
- The MoA seed coordination unit in collaboration with TASTA to maintain a vibrant digital platform which will display in real time varieties available and where as well as providing other relevant details that can help prospective buyers make decisions on procuring them.

#### **4.3.5 Strategic Focus Area 4: Seed Accessibility**

Accessibility in the context of seed system refers to the financial power the farmer or grower has in purchasing the seed. Improving seed accessibility involves addressing various barriers and enhancing the systems and processes that ensure seeds reach farmers effectively. Here are several strategies to improve seed accessibility:

- Improve logistics and infrastructure for seed storage, transportation, and distribution to ensure timely delivery of seeds
- The Government implements programs that provide seeds at subsidized rates to ensure affordability
- Seed producers to pack seeds in small (2kg), medium (5-10 kg) and large packs to give farmers flexibility in buying according to their needs
- Provide microfinance options and loans to help farmers solve their seasonal cash squeeze and hence enabling them to purchase high-quality seeds
- Strengthen agricultural extension services to provide farmers with information about available seed varieties, their benefits, and best practices for seed use

### 4.3.6 Strategic Focus Area 5: Seed Utilization

Effective seed utilization is crucial for maximizing crop yields, ensuring food security, and promoting sustainable agricultural practices. By focusing on these aspects, farmers can optimize the use of seeds to achieve better productivity and profitability. Effective seed utilization requires several steps:

- Providing training to agro-dealers, Government extension services and NGOs who will consequently educate farmers on best practices for seed utilization.
- Training in identifying authentic TOSCI labelling to reduce use or sales of fake seeds
- Facilitating the exchange of information and experiences among farmers to improve seed utilization practices through TV, radio, field days and demonstrations
- Realization that seeds alone cannot make the best variety reach its potential, thus the need to include good agricultural practices (GAP) in all training packages
- Deliberate funding allocation for training of agro-dealers, extension workers, NGOs and farmers and for conducting demonstrations, field days, TV and radio programs which will result in increased utilization of improved seeds.

### 4.3.7 Strategic Focus Area 6: Legal, Policy, Regulatory and Institutional Environment in Seed

The above mechanisms are designed to create a vibrant, efficient and equitable seed industry environment in Tanzania, through enhancing seed quality, promoting access to improved seed varieties, and providing a level playing field for stakeholder participants. Ultimately the goal is to contribute to increased agricultural productivity and food security and economic growth. What is required is for all seed stakeholders to tune these policies and Acts in their entirety:

- **Seed Act of 2003 and its amendments.** The Act provides the legal framework for seed production, certification, and marketing. It aims to ensure the availability of high-quality seeds to farmers by regulating the activities of seed producers, processors, and traders.
- **National Agricultural Policy (NAP) 2013.** There is no stand-alone seed policy. However, the NAP (2013) in addressing Research and Development, Biotechnology and Biosafety, Plant Breeders' Rights and Agricultural Inputs makes several policy statements that directly support the enhancement of the seed system. The NAP also supports advancement in the development of Genetically Modified Organisms (GMOs) which directly affects seed variety development. It states, "...New and emerging research areas that promise to mitigate low production and productivity in agriculture shall be promoted; these include the development of GMOs" (URT, 2013b, p.13).
- **Tanzania Official Seed Certification Institute (TOSCI).** TOSCI is responsible for seed certification and quality control. It ensures that seeds produced and sold in Tanzania meet the required standards. This includes field inspections, seed testing, and labeling. In addition, TOSCI acts as a bridge connecting Tanzania to the seed regional and international authorities and agencies such as International Seed Testing Association (ISTA), Organization for Economic Co-operation and Development (OECD) and the International Union of Protection of New Varieties (UPOV) of which in the latter, the Head of TOSCI was once Chair of the Administrative and Legal Committee of UPOV. Membership in these organizations is sine qua non for promoting seed trade between Tanzania and other countries
- **Public-Private Partnerships (PPP).** The Government encourages partnerships between public institutions and private companies to enhance the seed sector. These partnerships aim to boost the production and distribution of improved seed varieties, especially for staple crops like maize, rice, and beans.
- **Regional Seed Policies Harmonization.** Tanzania is a member of the Southern African Development Community (SADC) and the East African Community (EAC). These regional bodies work towards harmonizing seed policies, rules, regulations, procedures, laws and standards to facilitate seed trade, improve seed quality and increase seed availability and choices across member states. This calls for Tanzania to be at all time ready to tune (contribute to) amendments of these provisions when necessary and also to tune to (implement) the agreed upon provisions.

The Government is keen to ensure that farmers access to improved seed is assured by putting into place subsidy programs and whenever possible attempting to make the subsidies as **Specific, Measurable, Achievable, Realistic and Time bound (SMART)** as possible.

#### 4.3.8 Strategic Focus Area 7: Coordination and Teamwork

Coordinating the seed sector industry in Tanzania involves multiple stakeholders and needs a holistic approach. This coordination will involve regulatory oversight, stakeholder engagement, capacity building, infrastructure development and financing to ensure efficient production, distribution, and utilization of quality seeds, resulting in increased use of improved seeds. This coordination does not happen just by talking about it. It must be cultivated and nurtured and be given opportunity to grow over time. We propose the following activities/structures to foster coordination and teamwork within and across entities in the seed system which are either doing similar but different functions or those that are dependent on one another:

- Establishment of community of practice among TARI, TOSCI, ASA, TASTA and the Seed Coordination Unit in the MoA. Communities of practice are characterized by being informal and conducting of business without necessarily following official laid out procedures. When this is executed and all in good faith a lot gets done
- Joint technical annual public and private sectors planning meeting bringing TOSCI, ASA, TARI, MoA Seed Coordination Unit (SCU) and TASTA together, with TASTA Chief Executive Officer and Head of the SCU as co-chairs of this meeting. This will help put into practice the PPP credo.

## 5. Conclusion

The formulation of this seed strategy is prompted by a myriad of factors that show clearly that the seed sector is underperforming, especially when compared with other seed systems worldwide. One of these indicators is that only one-third of the farmers in Tanzania use improved seeds. The Tanzania Seed Sector Development Strategy (TSSDS), therefore, aims to contribute to the goal of agricultural transformation in Tanzania by achieving a viable, sustainable, efficient, and equitable seed system.

TSSDS is developed through four interconnected major steps carried out in a co-creative, inclusive, participatory, and transparent fashion, bringing all key stakeholders to the table. Based on the literature and initial preliminary stakeholder consultations, a framework for the strategy and tools (checklist of questions and issues) for operationalization were constructed, constructively, and extensively debated, followed by validation by the TSSDS Technical Committee.

About 150 stakeholders (including farmers, researchers, agribusiness men and women, academics, etc.) were reached to provide information on issues surrounding challenges, opportunities, weaknesses, and threats in the seed sectors. They focused mostly on their respective nodes in the seed value chain since that is the area they would be most knowledgeable about.

A deep dive into understanding how things are on the ground was done through physical visits to a select number of agricultural research institutions and seed agencies mandated to do various activities in the seed value chain. These visits provided an opportunity to have first-hand information on field and laboratory layouts, the state of machinery and equipment, and the availability and adequacy of cold rooms and irrigation facilities.

Stakeholders from the focus group discussions and experts' consultations provided information pointing to challenges and opportunities surrounding the seven strategic objectives which were set in the logical framework, i.e., seed production; seed availability; seed accessibility; seed utilization; legal, policy, regulatory and institutional arrangements; public and private capacity strengthening; and financing.

The findings were analyzed to form a basis for developing a minimum set of critical focus areas (recommendations) where the system will need to focus to deliver on the strategy in the next five years. Without putting them in any order of priority, the areas are as follows:

- *Research:* focusing on long-term degree training to enable each principal commodity and station to have at least one breeder with a PhD accompanied by a succession plan to address the aging factor; Center strategic plan which originates from the overall TARI strategic plan and accompanied by a co-created monitoring, evaluation, accountability and learning plan (MEAL); Basic physical infrastructure in terms of machinery and equipment end especially for irrigation.
- *Seed production:* The emphasis here is on early-generation seed, which is the genesis of the entire seed system. The system needs to continue being enhanced to operate at the highest standards and maintain the quality and quantity needed at all times. Production of certified seed should be better coordinated across interested producing institutions.
- *Seed availability:* Expansion of the agro-dealer network is needed; upgrading the information system to include digital platforms to provide real-time data on the amount of seed available when and where and what amount, and at what price.
- *Seed accessibility:* Expanding the agro-dealer network will also help increase accessibility because the real price of the seed is reduced when the farmer travels less distance to fetch the required seed. Also, a deliberate attempt to assist farmers resolve the season cash glitches through the provision of SMART subsidies or arrangements to access concessionary loans from agricultural-related financial institutions.
- *Financing:* Maintaining and sustaining the momentum in increased financing to the MoA and ensuring that the seed sub-sector receives its appropriate share is a sine qua non of the seed strategy.
- *Coordination:* Coordination is not costless. However, a lot can be achieved with very little investment in coordination. This involves creating a culture of communities of practice in the seed system and ensuring that all agencies are very clear about their mandates and putting in place mechanisms of checks and balances to ensure that each one is meeting the targets set at the planning stage.

Devising detailed action plans around these recommendations will help enable Tanzania to achieve its objectives in the seed sector and contribute to agricultural transformation in Tanzania.

# References

- AGRA – SSTP. (2016). Tanzania Early Generation Seed Study for the United States Agency for International Development. <https://agra.org/wp-content/uploads/2020/07/SSTP-WAVE-2-mid-term-evaluation-USAID.pdf>
- Boughton, D. (2020). Estimating Seed Demand Using Survey Methods: Approaches and Findings. *Journal of Agricultural Economics*, 25(4), 312-327.
- Buvigule, P., & Bonthuis, H. (2022). Potato Variety Catalogue of Tanzania. TOSCI, Tanzania.
- de Boef, W., Huisenga, M., Atwood, D., Mennel, J., Dassel, K., Prabhala, P., ... & Taintor, M. (2019). Early generation seed study-- summary. *Gates Open Res*, 3(182), 182. <https://gatesopenresearch.org/documents/3-505> (accessed on 15 October 2022)
- ESRF - Economic and Social Research Foundation. (2020). Annual Report. <https://esrf.or.tz/wp-content/uploads/2021/10/ESRF-Annual-Report-2021.pdf>
- FAO. (2006). Quality Declared Seed System: Expert Consultation, Rome 5-7 May 2003 : FAO Seed and Plant Genetic Resources Service. Food and Agriculture Organization of the United Nations.
- FAO. (2015). Seed Security Assessment: A Toolkit for Practitioners. Food and Agriculture Organization of the United Nations.
- Gowda, M. (2020). Challenges and strategies in seed demand forecasting. *International Journal of Agricultural Sciences*, 12(3), 237-245.
- Jones, R.B., Audi, P.O., & Tripp, R. (2002). The Role of Informal Seed Systems in Disseminating Modern Varieties: The Example of Pigeonpea from a Semi-Arid Area of Kenya. *Experimental Agriculture*, 38(4), 411-421. <https://doi.org/10.1017/S001447970100046>
- Langyintuo, A.S. (2005). Analysis of the seed systems in sub-Saharan Africa: Focus on maize seed in Southern Africa. *African Journal of Biotechnology*, 4(5), 145-150.
- Louwaars, N. P., & Manicad, G. (2022). Seed systems resilience—an overview. *Seeds*, 1(4), 340-356. <https://doi.org/10.3390/seeds1040028>
- Ministry of Agriculture. (2021). National Sample Census of Agriculture 2019-2020. [https://www.nbs.go.tz/nbs/takwimu/Agriculture/2019-20\\_Agri\\_Census\\_Main\\_Report.pdf](https://www.nbs.go.tz/nbs/takwimu/Agriculture/2019-20_Agri_Census_Main_Report.pdf)
- Ministry of Finance and Planning. (2021). National Five-Year Development Plan (FYDP3) 2021/22 - 2025/26. <https://repository.mof.go.tz/handle/123456789/107>
- Ngowi, B. (2023). Procedure for Registration of Potato Varieties. Tanzania Plant Health and Pesticides Authority. [Pamphlet edited by Patrick Ngwediagi of TOSCI].
- Rohrbach, D.D., Minde, I.J., & Howard, J. (2003). Looking beyond national boundaries: regional harmonization of seed policies, laws, and regulations. *Food Policy*. 28. 317-333. <https://doi.org/10.1016/j.foodpol.2003.08.005>
- SADC. (2008). The Southern African Development Community (SADC) Harmonized Seed Regulatory System & Guidelines. <https://www.sadcseedcentre.com/policy-advocacy/sadc-harmonized-seed-regulatory-system-guidelines/>
- Sperling, L., & McGuire, S. (2010). Understanding and Strengthening Informal Seed Markets. *Experimental Agriculture*, 46(2), 119-136. <https://doi.org/10.1017/S0014479709991074>
- Teklewold, H. (2012). The impact of shadow prices and farmers' impatience on the allocation of a multipurpose renewable resource in Ethiopia. *Environment and Development Economics*, 17(4), 479-505. <https://doi.org/10.1017/S1355770X1200023X>

- URT - United Republic of Tanzania. (1977). Tropical Pesticides Research Institute Act 1977. [https://www.kilimo.go.tz/uploads/regulations/The\\_Tropical\\_Pesticides\\_Research\\_Institute\\_Act\\_1979.pdf](https://www.kilimo.go.tz/uploads/regulations/The_Tropical_Pesticides_Research_Institute_Act_1979.pdf)
- URT - United Republic of Tanzania. (1999). Local Government Act No.6 of 1999.
- URT - United Republic of Tanzania. (2002). Executive Agencies Act. <https://faolex.fao.org/docs/pdf/tan122467.pdf>
- URT - United Republic of Tanzania. (2007a). The seeds act regulations, Government Printer, Dar es Salaam.
- URT - United Republic of Tanzania. (2007b). The Seeds Act, 2003. [https://pdf.usaid.gov/pdf\\_docs/PA00MR49.pdf](https://pdf.usaid.gov/pdf_docs/PA00MR49.pdf)
- URT - United Republic of Tanzania (2013a). Agricultural Sector Development Strategy 2 (ASDS 2), Draft Report Submitted to Ministry of Agriculture, Food Security and Cooperatives (MAFC), Dar-es-Salaam.
- URT - United Republic of Tanzania. (2013b). National Agricultural Policy (NAP). Dar es Salaam, Tanzania: Ministry of Agriculture, Livestock and Fisheries.
- URT - United Republic of Tanzania. (2016). Tanzania Agricultural Research Institute (TARI) Act No. 10 of 2016. <http://www.tari.go.tz/publications/details/tanzania-agricultural-research-institute-tari-act-no-10-2016>
- URT - United Republic of Tanzania. (2020). Control of Quality Declared Seeds Regulations, 2020. The Gazette of The United Republic of Tanzania No.17. Vol.101 Dated 24th April, 2020.
- USAID. (2013). Seed CLIR Tanzania Pilot Report. [https://agrilinks.org/sites/default/files/resource/files/tanzania\\_seedCLIR.pdf](https://agrilinks.org/sites/default/files/resource/files/tanzania_seedCLIR.pdf)

# Appendices

## Appendix I: Major Crops Grown in Tanzania

Crops grown in Tanzania are for food, cash, or a combination of both. Cereals, pulses, oil crops, roots, tubers, and plantain are important in this regard. An overview of the average production area, production in tons, and yield (tons per ha) of crops in each category are illustrated in Table a. As shown, the most important cereal crops are maize, rice, sorghum, pearl millet, finger millet, and wheat, which have low productivity. For example, the average production of maize is only 1.5 tons/ha against the potential 4.5 tons/ha, and rice 2.3 t/ha against the potential of 5 t/ha. Major pulse crops are common beans, pigeon peas, cowpeas, green grams, and chickpeas. Except for cowpeas, pulses are traded regionally and internationally. Major oil crops are groundnuts, sesame, sunflower, and soybeans. Groundnuts are traded as food crops, sesame as food and cash crops, and sunflower and soybeans as oil crops. Finally, main crops under roots, tubers, and plantain category include cassava, sweet potatoes, potatoes, yams, and bananas.

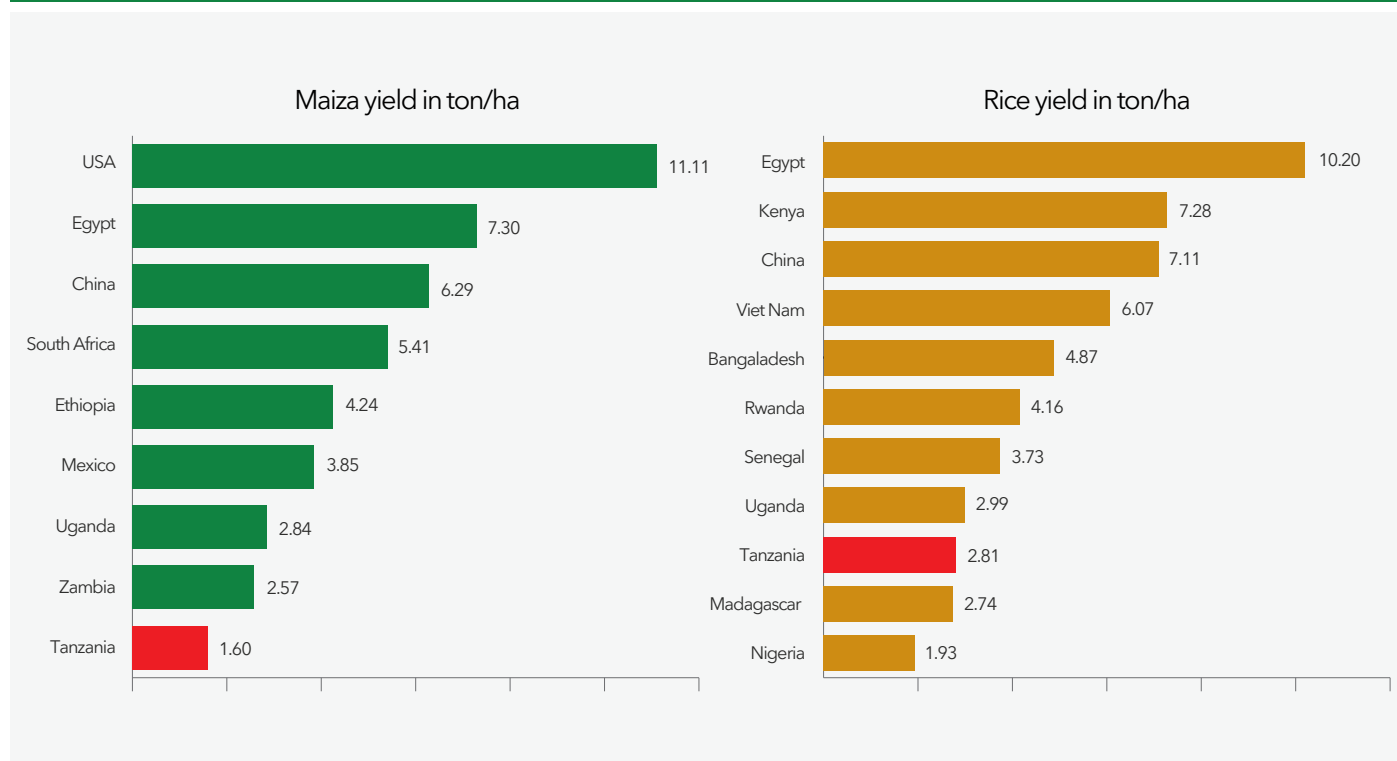
**Table a. Area, Production and Yield of Major Crops in Tanzania**

<b>Cereals</b>	<b>Area (ha)</b>	<b>Production (t)</b>	<b>Yield/ha (t)</b>
Maize	4,931,111	6,504,727	1.5
Rice	1,688,241	3,380,715	2.3
Sorghum	512,888	601,470	1.3
Pearl millet	150,532	148,162	1.1
Finger millet	31,468	32,950	1.2
Wheat	91,659	93,184	1.2
<b>Pulses</b>	<b>Area (ha)</b>	<b>Production (t)</b>	<b>Yield/ha (t)</b>
Common beans	826,685	661,699	0.9
Pigeon peas	258,251	41,922	0.6
Cowpeas	66,101	142,893	2.6
Green grams	91,063	31,551	0.4
<b>Oil crops</b>	<b>Area (ha)</b>	<b>Production (t)</b>	<b>Yield/ha (t)</b>
Groundnuts	528,373	621,697	1.3
Sesame	443,068	128,842	0.3
Sunflower	529,394	504,422	1.0
<b>Roots, tubers and plantain crops</b>	<b>Area (ha)</b>	<b>Production (t)</b>	<b>Yield/ha (t)</b>
Cassava	740,705	1,770,608	7.9
Sweet potatoes	289,917	504,302	2.1
Potatoes	64,429	319,314	6.0
Yam	6,715	6,272	1.5
Bananas	343,766	2,039,433	5.9

Source: National Sample Census of Agriculture 2019/20

The yields of for the main staple crops (rice and maize) are very as shown below. For example, the average productivity of maize is only 1.5 tons per hectare against the potential 4.5 tons per hectare, and rice 2.3 tons per hectare against the potential of 5 tons per hectare. This productivity is very low compared to most countries (Box a).

**Box a: Comparison of maize and rice yield across countries**



## Appendix II: TSSDS Stakeholder Analysis

Impact: To what extent are they impacted by this strategy?	Influence: To what extent can the stakeholder influence this strategy?	How can the stakeholder contribute to the strategy?	How can the stakeholder block the strategy?	Strategies for engaging the stakeholder
<b>1. Farmers (Small, Medium, Large)</b>				
Increased productivity, -higher farm incomes and increased food security	Medium and large-scale farmers may pull along smallholder resource-limited farmers in adoption of recommendations	By adopting several packages from the menu-based farming system	Influential medium and small-scale farmers blocking the smallholders from adopting system relevant content	Encouraging on-farm testing of appropriate extension content by research and extension ground personnel
<b>2. NGOs (Local, National, International)</b>				
	Collaborating with the ground extension staff to accelerate the rate of adoption of the extension content	Providing required resources in the form of improved seeds, fertilizers, and human capital to supplement the resource-constrained public extension system	Working at cross-purposes (with each other) in a way that causes confusion or failure because people are working or talking with different goals or purposes	Regular meetings among NGOs, extension, and research staff
<b>3. Agric. Research Admins (Senior, Junior)</b>				
<i>-They claim credit for their intellectual contribution which can also be counted in their list of successes.</i>	If they are supportive, they will ensure that incentives for good performers and disincentives for mediocre ones are embedded in the system	They will put in place performance monitoring and evaluation system that aims at successful outcomes	Working at cross-purposes	Putting in place mid and end of year reviews where partners are given space to table their issues in a transparent manner
<b>4. Agri. Extension Admins. (Senior, Junior)</b>				
	-If they are supportive, they will ensure that incentives for good performers and disincentives for mediocre ones are embedded in the system	They will provide information to the team on the available extension recommendations and the extent to which each of the recommendation is being adopted	Blockage of the initiative will happen if they do not provide support to the team as it searches for data on existing recommendations and the extent of adoption	Holding meetings to soft land the initiative and co-creating the objectives of the exercise and clearly showing the benefits

Continued >

<b>Impact: To what extent are they impacted by this strategy?</b>	<b>Influence: To what extent can the stakeholder influence this strategy?</b>	<b>How can the stakeholder contribute to the strategy?</b>	<b>How can the stakeholder block the strategy?</b>	<b>Strategies for engaging the stakeholder</b>
<b>5. Agro-dealers (Seed, Fertilizers, Crop protection products, Packaging materials) NB. We cannot isolate “seed” agro-dealers alone because such a thing rarely exist on the ground. Most often, they dealers are multipurpose/multi-functional meaning that they deal with all these inputs at the same time</b>				
This has the potential for positive impact on their businesses - the higher the adoption, the higher the volume of business	In many countries, agro-dealers are becoming good sources of extension content to farmers	At the point of sale of any ag input the agro-dealer can play the role of an extension agent by providing instructions to the buyer/farmer on the usage of the input	Blockage can occur in situations where agro-dealers become unfaithful and start engaging in adulterated inputs	Continues monitoring of agro-dealer activities and holding of seminars to improve performance
<b>6. LGAs, District and Regional Agri. Dev. Officers</b>				
They feel successful when good yield and production are reported in their annual reports and when hunger in their areas is overcome	Provide strategic thinking and direction about what needs to be done to bolster adoption of technologies and other non-technology inputs	Promoting the initiative through playing a coordination role to all parties on the ground	Blockage can occur due to the management refusing to comply with the work plan	Tactfully engage them in conversations that matter—pointing out what the strategy needs to do and expected benefits
<b>7. On-the-ground agricultural researchers and academia</b>				
These interact daily with the farmers, and they know very well why some technologies are being adopted quickly as opposed to those that do not	-Observing, analysing and drawing scientific inferences to show which seeds are performing well, which ones to be discontinued and replaced	These researchers will be providing data and information, sometimes on behalf of the farmers to continuously facilitate an increased understanding of the farmers	If anyone of them decides to differ with the course of the strategy that will cause a big blow to the entire process. There is a dire need to establish a friendly and respectable partnership with this cadre	Establish rapport with them so that they feel we are partners in ag development and encourage them to provide full support to the initiative
<b>8. On -the-ground extension agents (Limited experience, long-term experience)</b>				
The more farmers get attracted to adopting improved seed, the higher the status of the participating farm households	These are the individuals that will convey the extension messages to the farmer by using several methods	These extension agents will provide us with information about seeds being used by farmers the extent to which respective recommendations are adopted. (Improved seed cannot perform alone)	If they do not facilitate the provision of knowledge of improved seed and information about the seed material required, they will derail the initiative, hence making the implementation of the strategy difficult.	Frequent meetings and seminars aimed at ensuring that we are all on the same page

Continued >

<b>Impact: To what extent are they impacted by this strategy?</b>	<b>Influence: To what extent can the stakeholder influence this strategy?</b>	<b>How can the stakeholder contribute to the strategy?</b>	<b>How can the stakeholder block the strategy?</b>	<b>Strategies for engaging the stakeholder</b>
<b>9. EGS (technical and administrative) ASA, TOSCI &lt; Selected Commercial Seed Companies</b>				
<p>These are the mothers of improved seed. They technically and administratively take care of the very early seed material</p>	<p>Through their visioning and strategic thinking, they can guide the country on what steps to undertake to improve the quantity and quality of the seed material in the country</p>	<p>Deliberate and intentional sharing of technical knowledge with relevant stakeholders in the seed value chain. They are the most informed category in terms of seed technical knowledge which they continuously acquire from their partners—regionally and globally. TASTA becomes quite relevant in this group of stakeholders too</p>	<p>If they do not facilitate the provision of knowledge of improved seed and information about the seed material required, they will derail the initiative, hence rendering the implementation of the strategy difficult</p>	<p>Frequent dialogues among them with respective ministries to ensure smooth understanding and information flow among partners. This includes deliberate effort to adequately finance the EGS and to link them up with regional and global authorities on seed matters</p>

## Appendix III: Selected Experts Visited and Discussed with TSSDS by Zone and by Stakeholder Group

Institution	Role	Expertise	Location
TARI-Ilonga	Breeding, production of breeder, pre-basic, basic and certified seed	Public National Research Institution	Ilonga, Kilosa
TARI-Selian	Breeding, production of breeder, pre-basic, basic and certified seeds	Public National Research Institution	Arusha
TARI-Mikocheni	Research in tissue culture and Biotechnology	Public National Research Institution	Dar es Salaam
International Institute of Tropical Agriculture (IITA)	Research for Development covering vegetatively propagated crops	International Research for Development Center belong to CGIAR	Dar es Salaam
World Vegetable Center	Research for Development covering vegetable crops	International Research for Development Center	Tengeru, Arusha
Agricultural Seed Agency (ASA)	Production of basic and certified seed	Public autonomous institution	Mororgoro
Tanzania Official Seed Certification Institute (TOSCI)	Seed certification, release, registration, seed policy and quality assurance	Public autonomous institution	Mororgoro
Tanzania Seed Traders Association (TASTA)	Representation and Advocacy	Seed Traders Association	Arusha

## Appendix IV: Toward Meeting the Government Seed Availability High-level Target

### Preamble:

As previously explained in the initial chapters, the MoA has pronounced priority targets to be attained by 2030 in the seed subsector. These targets are:

- Seed production to increase from 130,000 tons to 250,000
- Farmers using improved seed to increase from one-third to two-thirds of the total number of farmers
- Area planted to improved seed to increase from 3 million to 6 million ha
- Number of agro dealers to increase from 3,000 to 12,000 agro-dealers implying that each village will have at least one agro-dealer

In essence, as the seed transforms from the breeder seed to pre-basic to foundation and finally to certified seed there is multiplication taking place—i.e., increasing the quantity of the seed from very few grams of breeder seed to tons of countless certified seeds ready to be sold for planting. As opposed to ordinary multiplication, this process is taking place under very strict scientific procedures, rules and conditions and all according to globally instituted competent authorities.

Developing a successful seed multiplication system road map involves several considerations and key steps to ensure farmers have access to of high-quality seeds. A structured approach to designing such a system is given:

Several consultations have to be undertaken with a range of experts to build up some critical assumptions. These assumptions must be realistic and those setting them up have to be ready we draw a viable seed multiplication plan.

### Needs Assessment:

- Identified the types of crops that require improved seed multiplication (surely it would not be possible to work with all crops. Thus, crops to include in the pile for meeting the MoA targets are based on their socio-economic importance, their contribution to food security of households and the tradability—regionally and globally. The annual percentage increase will be high if we expect the demand for this specific crop. A key technical consideration to determine the rapidity of multiplication of that particular crop (see Table 1 for multiplication rate of selected crops).
- We decided to use the TOSCI figures as baseline figure in the classes of seeds because it is a reliable scientifically-based institution
- TOSCI includes cotton seed in the count of annual certified seed production. However, we decided to put it aside because there is a separate authority dealing with seed cotton and moreover, there is relatively nothing urgent in the cotton seed
- Multiplication rate is dependent on the grain size (the bigger the size the higher the amount of seed required per hectare and vice versa) and ensuring that each class of generation seed requirement is taken into consideration when considering production of certified seed.

### Selected crops for consideration in generating the targeted seed required by 2030

A total of nine crops have been chosen as follows:

- **Maize:** Among cereals, largest area is under maize, has the highest number of private and public sector active participation, and is given high priority as having a high potential for adoption of improved varieties by farmers. Moreover, the crop is traded in the neighboring countries and demand for improved seed is expected to increase and priority for seed is given a high priority.
- **Rice** is cultivated over a large area and in the last 10 years the area under production increasing and consumption is also on the increase. Export to neighboring countries is also increasing. Factories for processing quality rice for domestic and export markets have been established and thus requiring quality grain are in place. Demand for improved seed is expected to increase and priority for seed is high.

- **Sorghum and millets:** The area under sorghum and millets has overall been constant, and seed supply is low. It is not expected that the area and demand for seed will increase and thus it is estimated demand for improved seed will continue to be low unless there is a push for breweries to increase its usage.
- **Beans:** Among pulses, area under common beans is the largest and consumption is highest and traded both in the domestic and regional markets where demand is increasing. The country has identified trait requirements based on consumer demand and trade. The southern Africa countries have specific trait, Kenyan market have their specific requirements, neighboring countries to the west of Tanzania have also their needs and thus export markets are stratified and large. Demand on seed will continue to increase taking into account preferred traits.
- **Pigeonpea and chickpea:** The two pulse crops are crops are grown for their commercial value. In 2023 and 2024 Tanzania was the venue of Afro World and Agrifood International Conference whose focus was on pulses, which is an indication of the growing importance of the country in pulse production and trade. In both conferences, it was indicated that for the country to remain competitive, quality needs to improve. Availability of improved seed is a major constraint. The focus should be on increasing quality and amount of improved seed to meet the ever-growing demand of grain.
- **Green gram:** Demand of green gram in domestic, regional and international markets are intermediate and variable and number of released varieties are few and seed demand is predicted to be medium.
- **Groundnut:** Among oil crops, area and production under groundnut is highest. It is used as food and traded in both domestic and regional markets and the potential for entering international markets if aflatoxin contamination can be control. The trends indicate that the demand will increase and more focus should be in improved end user preferred seed production.
- **Sunflower:** The country's focus is to be self-sufficient in cooking oil and the focus is on increased production of sunflower for oil. It is expected that area under sunflower will increase substantially and in turn seed requirement will increase.
- **Sesame:** Tanzania is the largest producer and exporter of sesame and there is demand for improved seed will continue to be high. However, due to being small seeded, quantity of seed will continue to be low.

**Table b. Certified Seed Projection in Tanzania**

Crop	Seed class (t/ha)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Maize	Basic		393.00	411.86	431.63	465.00	487.32
	Certified		50,000	52,400	54,915	57,551	62,000
Rice	Basic		573.11	622.95	677.12	736.00	800.00
	Certified		47,454	51,580	56,066	60,941	66,240
Sorghum	Basic		47.96	48.94	49.94	50.96	52.00
	Certified		23,502	23,982	24,471	24,970	25,480
Wheat	Basic		9.22	9.41	9.60	9.80	10.00
	Certified		325	332	339	346	353
Pearl millet	Basic		13.84	14.12	14.41	14.70	15.00
	Certified		6,779	6,918	7,059	7,203	7,350
Finger millet	Basic		2.95	3.01	3.07	3.14	3.20
	Certified		1,446	1,476	1,506	1,537	1,568
Common Beans	Basic		152.88	159.25	165.89	172.80	180.00
	Certified		2,202	2,293	2,389	2,488	2,592
Pigeonpea	Basic		85.97	93.44	101.57	110.40	120.00

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Crop	Seed class (t/ha)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
	Certified		6,854	7,450	8,098	8,803	9,568
<i>Chickpea</i>	Basic		17.26	17.80	18.35	18.92	19.50
	Certified		335	345	356	367	378
<i>Green gram</i>	Basic		28.66	31.15	33.86	36.80	40.00
	Certified		1,055	1,146	1,246	1,354	1,472
<i>Groundnut</i>	Basic		101.92	106.17	110.59	115.20	120.00
	Certified		1,345	1,401	1,460	1,521	1,584
<i>Sunflower</i>	Basic		186.26	202.46	220.06	239.20	260.00
	Certified		17,136	18,626	20,246	22,006	23,920
<i>Sesame</i>	Basic		76.44	79.63	82.94	86.40	90.00
	Certified		12,842	13,377	13,935	14,515	15,120
<b>Total</b>	<b>Basic</b>		<b>1,689</b>	<b>1,800</b>	<b>1,919</b>	<b>2,059</b>	<b>2,197</b>
	<b>Certified</b>		<b>171,276</b>	<b>181,328</b>	<b>192,085</b>	<b>203,602</b>	<b>217,625</b>

NB: Actually, this total of 217 certified seed surpasses the 250000 tons because the latter included seed cotton which we have removed in our estimations.

**Table c. TSSDS: Stakeholders groups participation in the focus group discussions in the three centers**

S/N	Stakeholder category	Arusha	Morogoro	Iringa	Total
1	Agro-dealers	8	8	7	23
2	Seed companies	2	10	7	19
3	Researchers/Academia	1	8	5	14
4	NGOs	4	6	5	15
5	Government/LGAs	2	3	4	9
6	Extension officers	2	1	6	9
7	Farmers	3	3	2	8

# Glossary

accreditation	The process where the national certification agency (NCA) authorizes an entity (private or public enterprise or person) to undertake seed certification or seed testing services, which are otherwise the responsibility of the NCA.
breeders' rights	Intellectual property rights granted to breeders as innovators of new plant varieties to enable them to recoup investment in variety breeding.
compulsory certification	Applies to a group of crops selected as economically vital nationally and whose seed must undergo full certification before being offered for sale.
essentially derived varieties	A variety that has been produced using an initial variety through repeated back-crossing until the new (derived) variety has similar essential characteristics as the initial variety.
first, second, third, fourth, etc, generation	Refers to inspection status of seed crops through the multi-placation cycle. Breeders' seed gives rise to basic seed whose progeny is certified seed. Depending on the crop, certified seed may be classified as C1' which yields C2' which in turn yields C3' etc.
intellectual property right (IPR)	Exclusive rights granted to innovators to exploit their innovations to recoup investment in top research. IPR may be granted as breeders' rights to cover plants, or patents to cover industrial designs of innovations. In some countries, patents may also be granted varieties containing selected genes such as genetically modified crops.
interagency certification	A system where field certification is undertaken in one country by the NCA and bulk seed is moved to another country to complete the certification process.
harmonization	A process where a group countries or economic integration blocs agree to standardize rules, procedures, regulations, standards and even laws that govern seed trade.
national certification agency (NCA)	The national designated authority responsible for under-taking seed-certification services.
national variety list	A list of varieties officially released for commercial production In any one country. It is also called a Nation Office Catalogue.
non-tariff barriers	These are laws, regulations, administrative and technical Requirements other than tariffs imposed by a partner state whose effect is to impede trade.
open-pollinated crop	Crops whose mode of reproduction involves the transfer of pollen either within the same plant or transfer of pollen from other plants of the same or very closely related species. It involves out-crossing.
phytosanitary certificate	A phytosanitary certificate is issued by the exporting country to confirm that the plant material was inspected and found free from pests/diseases of a quarantine nature in the importing country. It is a key requirement for trade in plant material (including seed) across international borders. Regulations governing the issuing of phytosanitary certificates are usually international but may be national.

plant variety protection	These are rights given to a breeder to authorize the sale of a variety she/he has bred. The grant of protection is given by the government for a limited period (usually 15-25 years) during which the breeder is expected to have recouped the investment in developing the variety protected. Only those varieties that are distinct (that is, novel), uniform, and stable (that is, remain the same even after several cycles of reproduction) are eligible for protection.
procedural vs. legal agreement	A procedural agreement refers to an agreement that may be agreement effected by the minister in charge, while with a legal agreement the full legislative process is required before the agreement becomes operational.
quarantine pest	A dangerous disease or pest that is found in one zone and not in another (including country) and whose movement is therefore controlled ('quarantined').
rationalization	Refers to a situation where laws, regulations, procedures and standards may be present in a country, but these are not well coordinated. Rationalizing these will enable these laws, regulations and procedures to be harmonized across countries.
regional variety list	A list of crop varieties officially released for commercial Production in any two of the countries of the block eg. COMESA, EAC, SADC
seed certification	The process of ensuring that seeds offered for sale meet the minimum regulatory standards. Standards checked include field and laboratory standards, processing, labeling and label information. The seed is usually given a 'seal' by the NCA.
seed tag	An official label or mark by the NCA that the packaged seed has undergone the full certification process. It usually has a set of minimum information and has a unique color for each seed class.
self-pollinated crop	A crop whose propagation mode involves transferring pollen within flowers on the same plant. No out-crossing is involved.
tariff	A customs duty imposed on imports and exports.
variety evaluation, release and registration	The process of breeding new crop varieties, selecting the progeny for desirable characteristics and evaluating the selected materials under field, glasshouse or laboratory conditions to confirm that the selected materials contain the characters for which the cross was made and finally testing the best selected materials (or lines) under field conditions in what is called adaptability trials. The best-performing materials are then put through a common evaluation trial (national variety performance trial) before release. Only officially released varieties are registered or put into a national official catalog (also called 'gazette').
voluntary certification	Where certification is requested by the applicant and usually involves testing for laboratory standards only.

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