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SUSTAINABLE SEED SUPPLY SYSTEMS FOR KULIMA

A Concept Developed by CGIAR and Partners



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ACRONYMS

CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
DARS	Department of Agricultural Research Services
DLRC	Department of Land Resources Conservation
DTM	Drought-tolerant maize
EGS	Early generation seed
FAO	Food and Agricultural Organization of the United Nations
FFS	Farmers field school
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICRAF	International Centre for Research in Agroforestry (World Agroforestry)
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IITA	International Institute for Tropical Agriculture
KULIMA	<i>Kutukula Ulimi Mmalawi</i> (“Promoting Farming in Malawi”)
MTs	Master trainers
NDM	Nutrient-dense maize
QDS	Quality declared seed
RTC	Residential training center
SAH	Semi-autotrophic hydroponics
SHA	Self Help Africa
SSU	Seed Service Unit
STAM	Seed Traders Association of Malawi
WFC	World Fish Center

SUMMARY

This integrated sustainable seed supply system concept paper is developed to combine strategies used by different CGIAR centers to meet the anticipated increase in demand for improved seed, planting materials, and other inputs through the farmers field school approach established under the KULIMA program. On the basis of the type of crops and technologies that the CGIAR centers are introducing in the program, five different seed supply systems are presented: legumes, cereals, root and tubers, agroforestry trees, and fish. This concept paper also presents the proposed action plans to guide implementation of the sustainable seed supply system for each of the five commodities.

1. INTRODUCTION

KULIMA (*Kutukula Ulimi Mmalawi*, or “Promoting Farming in Malawi”) is a program in Malawi funded by the European Union. It is being implemented by the government of Malawi, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the Food and Agricultural Organization of the United Nations (FAO), and a consortium of NGOs led by Self Help Africa (SHA). The goal of the program is to promote sustainable agricultural growth to increase incomes, employment, and food security in Malawi in the context of a changing climate.

Under the GIZ component of the KULIMA program, the International Potato Center (CIP) is coordinating the activities of seven CGIAR centers (including CIP) in collaboration with the Department of Agricultural Research Services (DARS), Department of Land Resources Conservation (DLRC), and Department of Fisheries to provide a wide range of science-based agricultural production technologies, training, and access to inputs and technical advice. The entry point for interventions at household level is the farmers field schools (FFS) approach. The agricultural development divisions and FAO are leading the training of FFS master trainers (MTs) at three residential training centers (RTCs) in Mzuzu, Kasungu, and Mulanje districts. After graduating from the 13-week MT course, the MTs move back to their respective Extension Planning Areas across the 10 KULIMA districts (Chitipa, Karonga, Nkhatabay, Mzimba, Nkhatakota, Kasungu, Salima, Chiradzulu, Thyolo, and Mulanje) to facilitate trainings of community-based facilitators (CBFs). These CBFs will then, with backstopping from the NGO consortium and district government extension staff, facilitate the learning in FFS. The CGIAR centers and their government counterparts contribute to building the technical capacity of MTs at the three RTCs, who will pass on the knowledge to CBFs that will eventually support, through FFS, more than 400,000 productive farming households to improve their productivity, diversification, and income generation.

Through the FFS approach, we anticipate that demand for seed of improved varieties and quality planting materials and other inputs will increase. It is in this context that the GIZ/CGIAR/DARS program component was tasked to develop a concept for a sustainable supply system for production and distribution of quality seed and planting materials for producers and other inputs within KULIMA. In this concept paper different value chain commodities are grouped into five distinct seed systems:

- Legume crops, including beans, soybeans, cowpeas, groundnuts, and pigeon peas
- Cereals, including maize, sorghum, and millet
- Agroforestry tree germplasm (seeds and seedlings)
- Root and tuber crops, including potato, sweetpotato, and cassava
- Fish seed systems

Strategies to enhance household seed security differ by the type of value chains but should generally consider seed availability, seed access, varietal preference and suitability, seed quality, and resilience of the seed system. Involvement of agro-dealers will enhance access to seeds and other inputs. This concept explains how CGIAR will make high-quality inputs available in the KULIMA program.

1.1 OVERVIEW OF THE SEED SECTOR IN MALAWI

The seed industry in Malawi began in 1993 with the creation of the National Seed Policy Act, which was amended in 1996. The amendment was designed to (1) promote and stimulate the development of a competitive seed industry; (2) regulate and control the registration and release of varieties; (3) protect farmers from the sale of poor quality seeds; (4) facilitate the production and marketing of high-

quality seeds; (5) and provide legal support for official testing, certification, sales, importation, exportation, and use of seed. In 2017 the 1996 Seed Act was reviewed to make seed trade business fully liberalized and to incorporate harmonized regional seed certification standards. In the Seed Policy Act, the Seed Services Unit (SSU) of DARS, under the Ministry of Agriculture, Irrigation and Water Development, is mandated to regulate seed quality control and certification through seed crop registration, inspections, seed sampling, laboratory seed testing, seed monitoring, and farmer training.

The seed sector in Malawi comprises formal and informal seed systems alike. The informal system involves farmers' seed production system, where various farmer associations are engaged in the production and exchange of seed at community levels. In the formal seed sector both public and private sectors are involved in the production and distribution of seed. The public sector is composed of public institutions and international agricultural research centers (i.e., CGIAR centers) who are engaged in variety development and production of early generation seed (EGS) of crop varieties. The private sector is made up of both national and multinational seed companies who are also involved in breeding, seed production, multiplication, processing, and distribution of seed.

Several players are involved in the production and distribution of seeds of various crops. Notable among the key players is the Seed Trade Association of Malawi (STAM), which established in 2004 as part of the harmonization process between the private and public seed sector. STAM's goals are to promote competitive seed business environment and to ensure that seeds sold to Malawian farmers are of good quality.

Currently, about 24 private seed companies are engaged in seed production and marketing through Malawi's Farm Input Subsidy Programme and through independent agro-dealer networks. However, the formal sector accounts for less than 20% of seed requirements in the country. Aside from the seed of tobacco and maize that are produced and marketed by private seed companies, the seed of other crops is rarely available in the markets. Hence, smallholder farmers often must rely on seed that they saved on-farm or exchanged with other farmers.

2. LEGUMES SEED SUPPLY SYSTEMS

2.1 INTRODUCTION TO LEGUME SEED SYSTEMS

The legume crops that are included in the seed supply systems include soybean, cowpea, common bean, pigeon pea, and groundnut. The legume seed supply system will be facilitated by the International Crop Research Institute for Semi-Arid Tropics (ICRISAT), the International Center for Tropical Agriculture (CIAT), and the International Institute for Tropical Agriculture (IITA) in collaboration with DARS.

Legume production in Malawi is characterized by a wide gap between yield potential of released varieties and the on-farm yields. This yield gap is partly caused by limited use of good quality seed of improved varieties. Seed producers perceive the legume seed business to be less lucrative due to inconsistent demand for certified legume seed as farmers tend to sow farm-saved seeds. On the other hand, farmers bemoan inadequate supply of seed of the varieties of their choice. Meanwhile, legume markets tend to be informal and fragmented. This does not convince farmers to invest in quality seed and other inputs for better returns. Under these circumstances, informal seed systems have been the dominant source of planting material for legumes. While formal seed systems have not been competitive for legumes, it is equally important to highlight the weaknesses of informal seed systems

such as quality concerns, localized coverage, and lack of access to new varieties. This implies that there is no single system that can satisfy the seed needs of smallholder legume producers in Malawi. There is a need to strengthen both formal and informal systems and allow them to operate in an integrated approach while creating demand for quality seed. This involves strengthening the commercial distribution network for quality seed, complementary inputs, and crop output markets.

The overall success of the legume seed system will depend on close partnerships between research organizations, producers, and marketers of certified and quality declared seed (QDS). Quality control agencies, farmers, and traders will share the roles and responsibilities to facilitate sustainable availability of improved legume seed in the KULIMA sites (Fig. 1). Closing the gap in availability of seed requires strategies that facilitate demand-led production of EGS and the subsequent classes to avoid bottlenecks along the value chains; the demand side should pull production of preceding classes of seed. Meanwhile, quality assurance should be key along the value chain. The important activities include production and maintenance of EGS, multiplication of certified seed, and commercialization.

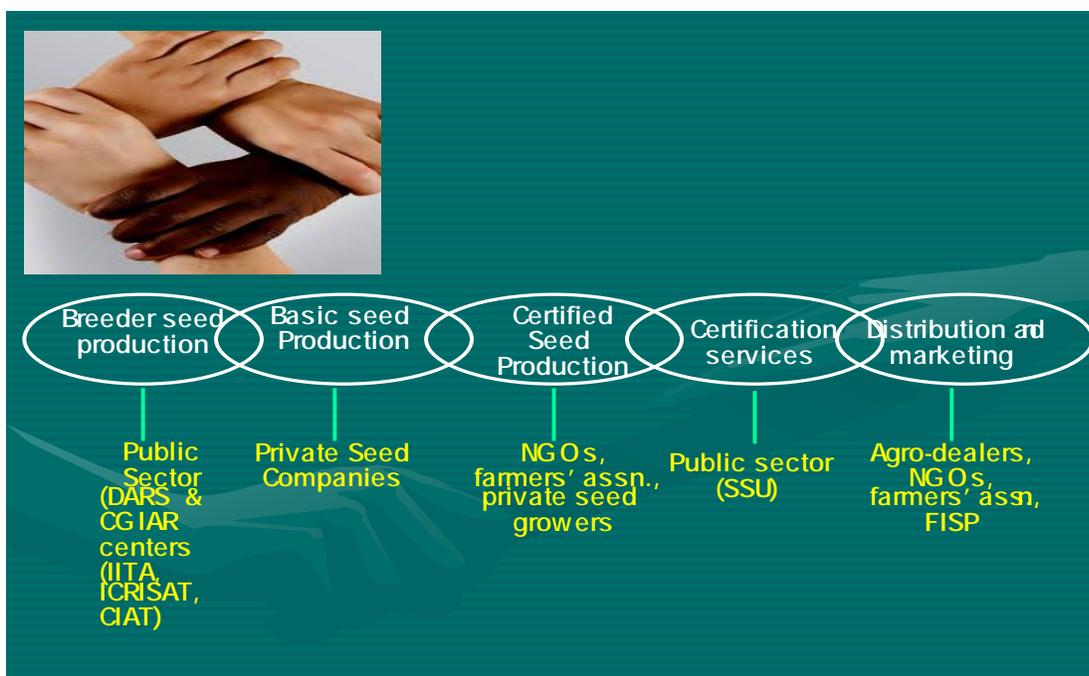


Figure 1. Seed production and delivery arrangement. (Adopted from IITA.)

2.2 ACTIVITIES IN THE LEGUME SEED SYSTEMS

The following activities will be implemented to ensure improved availability of legume seed in the KULIMA districts.

2.2.1 Production and maintenance of EGS

The research organizations IITA, ICRISAT, and CIAT, in partnership with DARS, will be responsible for production, multiplication, and maintenance of EGS: breeders' and pre-basic seed of improved legume varieties. Production of breeders' and pre-basic seed will be informed by demand registered from basic seed producers and/or other known factors. This will maintain continuous availability and accessibility of EGS of improved legume crop varieties. This will also ensure genetic purity on the cost-sharing model.

2.2.2 Multiplication of basic seed by seed companies and individuals

The CGIAR centers and DARS will also work with capable and willing seed companies and contract growers in the form of individuals and smallholder farmer clubs to engage in basic seed production for onward production of certified seed and sales to other certified seed producers.

2.2.3 Certified seed multiplication

Capable certified seed producers will be identified in partnership with the NGO consortium to engage in multiplication of the certified seed, under close supervision of CGIAR and DARS and quality assurance by the SSU. The certified multipliers will be linked to the NGO consortium, seed companies, and agro-dealers, but they can also do their own marketing of the certified seed.

2.2.4 Community-based seed multiplication

Community seed production schemes will be used mostly to introduce already released improved varieties that have not been popularized by the private sector. Community seed production provides an opportunity for farmers to have access to their own seed to produce QDS. Training of community seed producers will be a key activity to ensure quality seed production in field and proper postharvest seed handling.

2.3 PARTNERSHIPS FOR LEGUMES SEED SUPPLY SYSTEM

To ensure production and distribution of seed of improved legume varieties, SSU will be critical in enforcing quality assurance. Seed producers at all levels such as large-scale seed companies, commercial farmers, cooperatives, associations, and individual smallholder farmers will be engaged in the production and multiplication of basic and certified seeds. Seed producers will need to be trained in legume seed production and marketing. Such training will need to draw on expertise from CGIAR centers involved, NGOs, SSU, and STAM. STAM can support the producers with its affiliated network of agro-dealers to distribute seed in various locations. We anticipate that the NGO consortium will facilitate demand creation for improved seed varieties by creating awareness on the importance of using quality seed. Seed is only a means—not the ultimate product—for the farmer who needs to produce a high yield of quality grain. This demands establishment of a sustainable and profitable output market for legumes crops to increase demand for seed. This can be achieved in two ways: linking farmers to existing markets or creating new markets through community-based processing (value addition or cottage industry). Either way, improved marketing requires the involvement of major grain traders such as Agricultural Commodity Exchange, Auction Holdings, Export Trading Group, and Agrocomm. Since grain marketing to create a demand for seed is not CGIAR's mandate in KULIMA, we anticipate that CGIAR will mainly respond to the demand for seed created by other partners, with special emphasis on the FFS groups supported by the NGO consortium. Table 1 summarizes the proposed partners and their roles in the legume seed systems.

Table 1. Partners in the legume seed supply system

Partners	Roles
ICRISAT, IITA, CIAT, DARS	Lead the maintenance and multiplication of EGS Train producers in legume seed production
SSU	Quality control
STAM	Link small-scale producers to markets/agro-dealers
NGO consortium partners	Conduct trainings on marketing and creating awareness Support community seed schemes as part of transition from relief to development
Seed producers (cooperatives, seed companies, commercial farmers, associations)	Produce basic and certified seed
Agricultural Commodity Exchange	Create demand for and market the produce
Extension staff (Department of Agricultural Extension Services)	Promote, identify potential multipliers, and provide trainings and technical backstopping to community seed schemes

2.4 TYPES OF INPUTS REQUIRED FOR THE LEGUME SEED SYSTEMS

Besides EGS, the production of legume seed requires several other inputs (Table 2). These inputs will also be covered in the training of agro-dealers, as explained in section 7 below.

Table 2. List of inputs required for the legume seed system

Inputs	Purpose
Inoculants	To boost nitrogen fixation as a low-cost option to enhance productivity of legumes
Pesticides and seed-dressers	To control pests in synergy with other integrated pest management strategies to manage pests and diseases. (KULIMA will not procure the chemicals.)
Basic seed	To produce certified seed from starter seed
Packaging and storage materials	To reduce seed damage and infection

2.5 ACTION PLANS FOR THE LEGUME SEED SUPPLY SYSTEM

The action plans for IITA (soybean and cowpea), CIAT (beans), and ICRISAT (groundnuts and pigeon peas) are presented in Appendix 1.

IITA is leading the work on soybean and cowpea seed systems in partnership with DARS, SSU, NGOs, and government extension workers. The target is to engage 60 seed multipliers across the 10 districts. Identification of the multipliers was finalized in the first phase of KULIMA and was followed by profiling and training of the multipliers, verifying production sites, providing inputs, and establishing fields. From December 2019 to the end of the program, partners will conduct market linkages through seed field days, market information systems, and match-making between seed multipliers and seed buyers.

CIAT leads the implementation of bean seed systems, working with the NGO consortium partners with the objective of building farmers' capacity to produce and disseminate high-quality certified seed of several common bean varieties to farmers in the KULIMA districts. The target is to engage 30 seed multipliers across the 10 districts. The main activities in phase 1 include identification and selection of farmers/multipliers by NGOs with guidelines from CIAT, assessment of site suitability, registration and training of the multipliers, and delivery of seed to multiplication sites. In phase 2 the activities will also

include monitoring, training on harvesting and postharvest management, and demand creation and marketing.

ICRISAT leads the implementation of groundnuts and pigeon pea seed systems in partnership with DARS, SSU, DAES, and the NGO consortium. The objective is to ensure that the FFS in the districts have access to good quality planting material; the target is to recruit an average of five FFS per district. However, the actual number of FFS to be engaged was not consistent across the 10 districts. The main activities include identification of seed multipliers, training of seed multipliers on production of certified seed, registration of multipliers, procuring and distributing start-up basic seed, periodic monitoring, field inspection, and supporting farmers with marketing of seed.

3. CEREAL SEED SUPPLY SYSTEMS

3.1 INTRODUCTION TO CEREAL SEED SYSTEMS

The focus crops in the cereals seed supply systems are maize, sorghum, and millet. And although maize has a well-developed formal seed system with several commercial seed companies involved, many farmers still use informal systems to access maize seed by saving and sharing seed informally. Sorghum and millet seed systems are more like legumes. They are characterized by a low and inconsistent demand for certified seed, and which makes them less lucrative. The cereals seed supply system is led by CIMMYT and ICRISAT in partnership DARS. The approach for the cereals seed system involves supporting the seed value chain (Fig. 2). The success of the seed system depends on close partnerships between research organizations, producers, and marketers of certified and quality control agencies. CGIAR and DARS are responsible for maintenance and multiplication of the EGS, and large seed companies and individual multipliers are involved in the multiplication of basic and certified seed. Agro-dealers are also very influential as para-extension agents because they are in close contact with farmers and influence farmers' decision-making regarding choice of the most suitable variety. Therefore, agro-dealers play a key role in diffusion of new varieties into new areas.

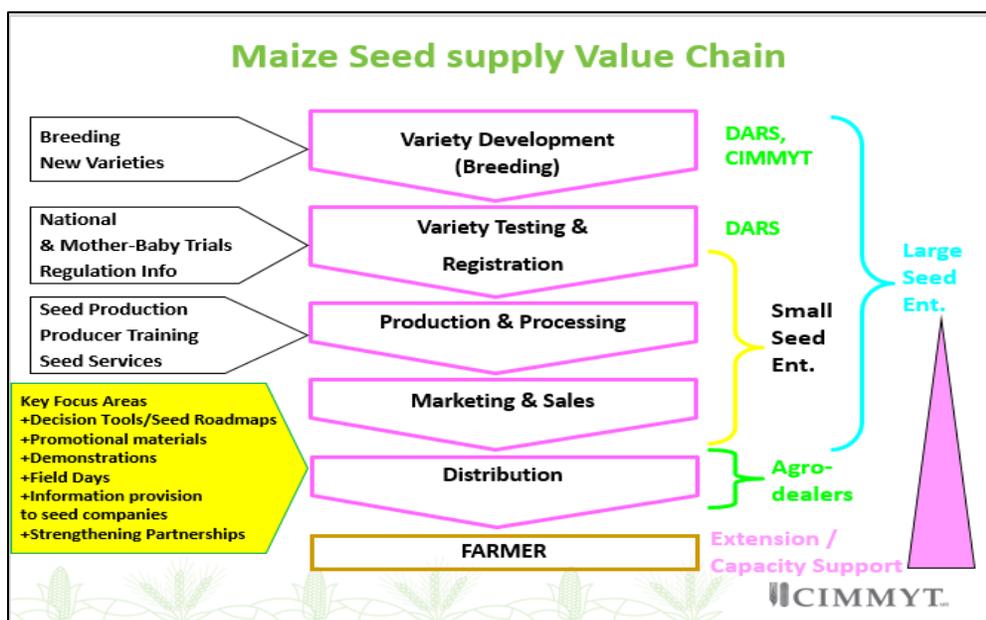


Figure 2. Maize seed supply value chain.

Quality assurance and quality control are key in deploying certified high-quality seed, which is an important factor for increasing yields in farmers' fields. The efficiency of other agricultural inputs will depend largely on the quality of seeds planted. High-quality seeds are genetically and physically pure, properly mature, free from insects–pests and pathogens, and uniform in size. They have high germination potential and optimum moisture content and are viable and vigorous. Farmers will depend on SSU to ensure that the seed they buy meets these standards.

3.2 ACTIVITIES IN THE CEREAL SEED SYSTEMS

The following activities will be implemented to ensure improved availability of cereal seed in the KULIMA districts.

3.2.1 Production and maintenance of EGS

The research organizations CIMMYT and ICRISAT, in partnership with DARS, will be responsible for production, multiplication, and maintenance of initial EGS. Once the EGS is given to seed companies, they will also be responsible for production and multiplication. Beside production and multiplication of EGS, seed companies will be expected to ensure that they maintain quality control and quality assurance of seed to ensure that the seed remains genetically pure.

3.2.2 Multiplication of basic seed by seed companies and individuals

These two CGIAR centers and DARS will work with capable and willing seed companies and individuals to engage in basic seed production for onward production of certified seed and sales to other certified seed producers. CGIAR will provide the initial EGS for seed companies

3.2.3 Certified seed multiplication

Once varieties are released and registered for production, the CGIAR centers will provide technical support to seed companies in seed production and quality control issues. SSU will monitor the production of certified seed production to ensure that seed is produced according to the national standards.

3.2.4 Demand creation and marketing

Agro-dealers will be involved in creating awareness and demand by advising the farmers of the existing improved varieties and their characteristics. The NGO consortium will provide training to agro-dealers in seed marketing and also link them to the various seed companies in the country.

3.3 PARTNERSHIPS NEEDED FOR THE CEREAL SEED SYSTEMS

Stakeholders across the whole value chain will provide support or contribute to the production and distribution of quality seed to reach the target farmers. There will be a need to strengthen the relationship and facilitate flow of information about improved cereals varieties from CGIAR and DARS to seed companies and agro dealers. The agro-dealers will play an important role in demand creation and distribution of cereal seeds of improved varieties. In addition, the NGOs will facilitate demand creation as they provide direct support to the FFS groups in the districts.

3.4 TYPES OF INPUTS REQUIRED FOR THE CEREAL SEED SYSTEMS

To support the production and multiplication of the cereals seeds the following inputs will be vital: compost manure, EGS from seed companies, and fertilizer to support community-based seed production for sorghum and millet.

3.5 ACTION PLANS FOR THE CEREAL SEED SYSTEMS

CIMMYT will lead the implementation of drought-tolerant maize (DTM) and nutrient-dense maize (NDM) (quality protein maize and pro-vitamin A) seed systems in partnerships with DARS, seed companies, NGO consortium partners, and various agro-dealers. The target is to involve and train 150 agro-dealers and establish 50 demo plots across all 10 KULIMA districts. The demos will be useful for farmers to learn the current varieties that are on the market for demand creation. The seed companies will then be able to know the varieties that are in demand by farmers. As outlined in the action plan (Appendix 1), CIMMYT and other partners will also promote DTM and NDM varieties through winter demo plots. NGO partners and agro-dealers will be trained on attributes and characteristics of DTM and NDM varieties and seed quality (storage, handling, and transport) among other activities.

The action plan for sorghum and millet seed systems led by ICRISAT resembles that of legumes (Appendix 1). The target is to support two farmers per district in seed multiplication. The main activities include identification of seed multipliers, training of seed multipliers on production of EGS, registration of multipliers, procurement and distribution of start-up seed, periodic monitoring, field inspection, and support to farmers in the marketing of seed.

4. AGROFORESTRY TREE SEED SYSTEMS

4.1 INTRODUCTION TO TREE SEED SYSTEMS

There are several challenges associated with the supply of tree germplasm (seeds and seedlings) in Malawi. Lack of high-quality tree planting material is a major constraint to the successful establishment of productive agroforestry production systems. National institutions such as the Land Resource Center (LRC) that supply tree seeds face challenges to reach many farmers due in part to the LRC's central location. Furthermore, most poor farmers cannot afford to pay for the tree germplasm. Low seed replacement rate for trees and the small-seed requirements of smallholders are additional challenges for development of viable tree germplasm enterprises.

Agroforestry tree seed systems activities, led by ICRAF, are broadly categorized into leguminous trees and shrubs for soil fertility improvement (i.e., Tephrosia, pigeon pea, Sesbania, Gliricidia, Faidherbia); fruits (i.e., mango, guava, oranges, avocado pears, citrus); and legume fodder (Calliandria, Sesbania, Leucaena, Angustissima). A functioning tree seed supply system (Fig. 3) ensures an efficient flow of the seed and seedling to ensure availability and access of the quality planting materials. There should also be an efficient flow of information about the knowledge about the market and other enabling factors in supplying of the quality planting materials.

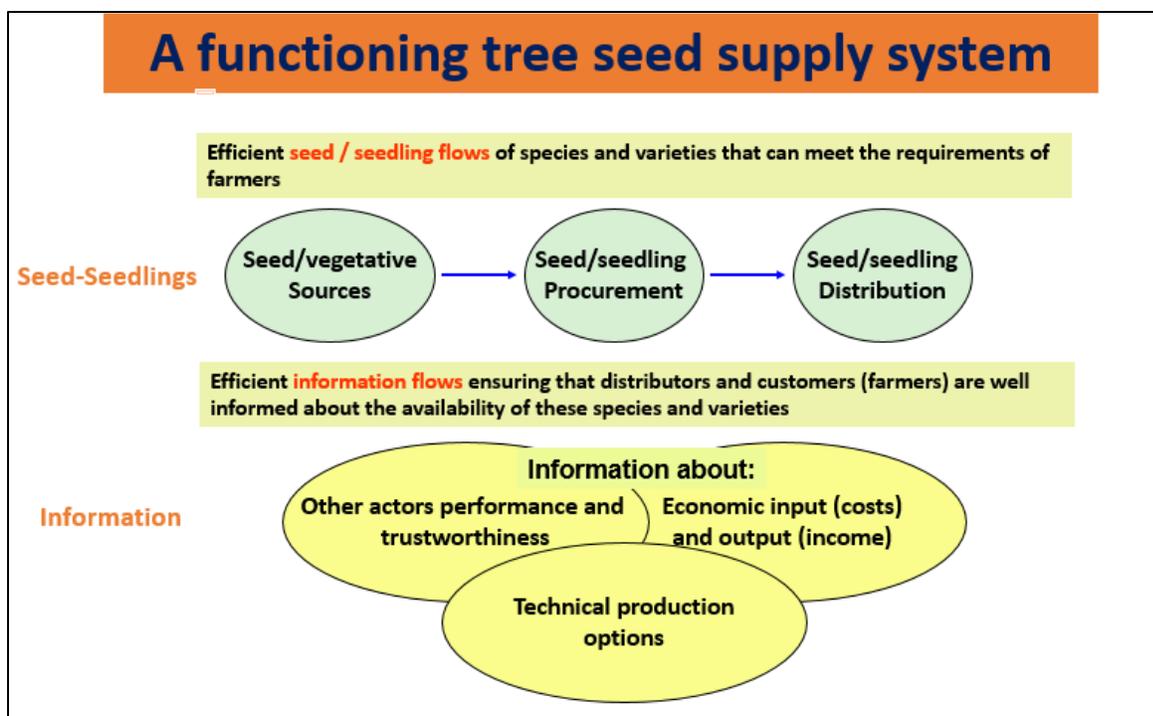


Figure 3. Detailed information of a functioning tree supply system.

4.2 ACTIVITIES IN THE AGROFORESTRY TREE SEED/SEEDLING SYSTEMS

The following activities will be implemented to ensure improved availability of tree seed/seedlings in the KULIMA districts.

4.2.1 Decentralizing the supply of improved fruit germplasm through village mother blocks

The establishment of decentralized fruit mother blocks will be critical to ensure availability of scion and buds for grafting/budding to nursery operators. Currently, these fruit mother blocks are only found at government research stations, which are a considerable distance for many nursery entrepreneurs.

4.2.2 Training and establishment of nursery operators

Establishing effective, low-cost, sustainable, and community-based germplasm production and distribution systems is an appropriate solution to the challenges of limited access to planting material. The training of nursery operators will target groups and individual farmer nurseries and private entrepreneurs. Farmers will be trained on critical practices such as raising quality seedlings, potting media, grafting and budding, and care of grafts.

4.2.3 Local sales through the program

There will also be promotion of the local sales of the tree seedlings to NGOs and other organizations to improve demand for the seedlings.

4.2.4 Own (group and individual farmer nurseries) production and use

Owing to the market challenges associated with tree germplasm, more emphasis will be on self-sustaining production and less emphasis on markets.

4.3 PARTNERSHIPS FOR AGROFORESTRY TREE SEED/SEEDLING SUPPLY SYSTEM

Partnerships will be formed with the CGIAR centers that promote other crops included in the agroforestry seed supply system. This includes ICRISAT on pigeon pea. LRC, an autonomous trust under the DLRC, will be a strategic partner to ensure a sustainable supply of selected agroforestry tree seeds. Partnerships will also be forged with existing nursery entrepreneurs to explore opportunities for sourcing supply from smaller nursery operators.

4.4 INPUTS REQUIRED FOR THE AGROFORESTRY TREE SEED/SEEDLING SUPPLY SYSTEMS

The inputs required to establish agroforestry seed supply systems include mother blocks (fruit trees), seed orchards, planting tubes, potting media, fertilizer, planting pots grafting tools (knife, grafting tap), 50% shade net, and labor.

4.5 ACTION PLAN FOR AGROFORESTRY TREE SEED/SEEDLING SYSTEMS

The action plan proposed to guide implementation of the agroforestry seed system is summarized in Appendix 1. For fruit trees, improved germplasm (scions and buds) will be sourced from ICRAF and DARS mother blocks to establish village mother blocks. Farmers will be trained on nursery practices including grafting and budding. Sale of seed and seedlings to NGOs and other organizations will be promoted through linkages with community agroforestry tree seed banks, though much emphasis will be on self-sustaining production. The agroforestry seed supply system for pigeon pea will be developed in partnerships with ICRISAT, and LRC will be engaged as a partner to ensure market supply of true tree seeds. There will be joint trainings on the agroforestry tree seed management.

5. ROOT AND TUBER CROPS SEED SUPPLY SYSTEM

5.1 INTRODUCTION TO ROOT AND TUBER CROPS SEED SYSTEMS

Seed systems for roots and tuber crops receive relatively little attention from commercial seed sector actors, despite their importance for food security, nutrition, and rural livelihoods. The crops of focus in the KULIMA seed systems are cassava, potato, and sweetpotato and which are all vegetatively propagated. Vegetative multiplication means that they can be multiplied “true to type” through stem cuttings (cassava), minitubers (potato), or vine cuttings (sweetpotato). Vegetative propagation makes these crops susceptible to the build-up of viruses and other pathogens, however. Their bulkiness, low multiplication rate, and perishability have implications for their storability and transport. Hence the resulting seed systems are characterized by being farmer dominated, only partially commoditized, dependent on public sector research efforts, and less formally regulated. It is only recently that private sector interest to engage in roots and tuber crops seed systems is growing. Currently, common approaches to developing such seed systems promoted by development partners favor decentralized multiplication models to make quality seed available closer to smallholder farmers. The revised seed policy launched in 2018 includes vegetatively propagated crops. In addition, there have been recent efforts to develop certification standards. Increased quality control by the SSU is a visible result of the efforts by public research organizations (DARS, CIP, IITA) in promoting availability of quality planting materials. The roots and tuber crops seed supply systems will further build on this progress. It is led by CIP and IITA in partnership with DARS.

5.2 ACTIVITIES IN THE ROOTS AND TUBER CROPS SEED SYSTEMS

CGIAR and DARS will continue with variety development and maintenance and supply of early generation (pre-basic) startup planting materials. Some specific work is discussed below.

5.2.1 Maintenance and multiplication of the early generation seed (EGS)

This activity aims at production of clean planting materials, usually in a controlled environment, using tissue culture techniques and multiplication of early generation and pre-basic planting materials by CGIAR and DARS. Note that this stage of the seed value chain will mainly be supported by projects other than KULIMA.

5.2.2 Multiplication of the basic planting materials

Commercial multipliers will be engaged to support availability of the quality basic seed for roots and tuber crops. The seed can be sold to other (decentralized) multipliers for multiplication of certified seed.

5.2.3 Decentralized multiplication of certified or quality declared seed

CGIAR will collaborate with the NGO consortium to engage multipliers across the 10 KULIMA districts and can include FFS groups that can multiply for sharing in the community. They can also be registered with SSU to engage in more commercial seed multiplication and sales of planting material. This would benefit both local communities as well as NGOs seeking to procure clean planting material. MTs will also be trained in rapid multiplication of planting materials for cassava and sweetpotato. Training on positive selection (selection of disease-free plants as a source of seed potato) of potato seed in the field will ensure that farmers save only quality seeds from their existing fields.

5.3 PARTNERSHIPS FOR ROOTS AND TUBER CROPS SEED SUPPLY SYSTEM

The potato seed supply system work will be implemented by CIP, DARS, DAES, SSU, and the NGO consortium. An additional partner in the sweetpotato seed system is the World Fish Center (WFC), which will support year-round rapid vine multiplication around the fish ponds. IITA, DARS, SSU, the NGO consortium, and DAES will partner on the cassava seed supply system. For all three crops, multipliers will be identified and supported in partnership with the NGO consortium. Demand creation led by the NGOs will be crucial for the sustainability of the supply of the roots and tuber planting materials.

5.4 INPUTS REQUIRED FOR THE ROOTS AND TUBER CROPS SEED SUPPLY SYSTEMS

Inputs that will be required for potato are EGS, fertilizer, and pesticides. To ensure that seed potatoes sprout after harvest, a growth hormone (gibberellic acid) may need to be applied to the seed. Inputs required for cassava are early generation of clean stems of improved varieties, fertilizer, and pesticides to control termites. Inputs for sweetpotato are early generation vine cuttings of improved varieties, compost manure, fertilizer, and pesticides to control insects that transmit viruses.

5.5 ACTION PLANS FOR ROOTS AND TUBER CROPS SEED SUPPLY SYSTEMS

The action plans for CIP and IITA are presented in Appendix 1. CIP and partners support at least two multipliers for sweetpotato and two for potato per district. However, a few districts along the lakeshore are not suitable for potato; these districts will only have sweetpotato multipliers. All multipliers have been trained in phase 1, received start-up planting material, and were registered with SSU and inspected. The multipliers will be further supported in phase 1 with follow-up training and marketing. To ensure sustainability we will discourage free provision of inputs and registration on behalf of multipliers in phase 2.

IITA will lead activities on cassava seed systems in partnership with DARS, SSU, the NGO consortium, and government extension workers. The target is to engage 60 seed multipliers across the 10 districts. Specific activities will include applying a three-tier system (1^o, 2^o, 3^o nurseries) by government institutions, NGOs, and farmers using disease-free (symptomless) planting materials. IITA will support the use of semi-autotrophic hydroponics (SAH) to produce clean materials. SAH facilitates rapid multiplication of virus-free, true-to-type tissue culture plantlets that result in cassava plantlets that withstand being planted directly in the fields. IITA and partners will build capacity of partners and multipliers on good agricultural practices for seed production and inspection.

6. FISH SEED SUPPLY SYSTEM

6.1 INTRODUCTION TO SUSTAINABLE FISH SEED SUPPLY SYSTEMS

The objective of a sustainable fish seed supply system is to establish a cost-effective model that ensures adequate, timely production and provision of fingerlings to small and medium-sized farmers. The system should ensure that such farmers in all the KULIMA target districts have access to quality and affordable fingerlings, accompanied by proper information on fish production and marketing (Fig. 4). Fish species to be included in the supply system are tilapia *Rendalli (chilunguni)*, *Oreochromis shiranus (makuamba)*, *Oreochromis karongae (chambo)*, and *Clarias gariepinus (mlamba)*.

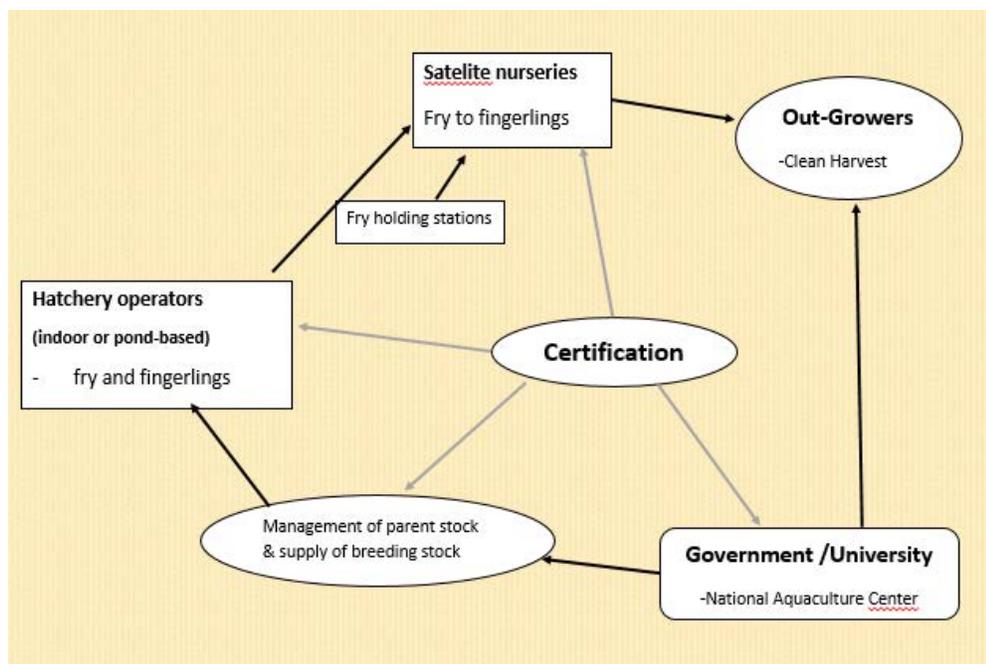


Figure 4. Seed supply system for fish.

6.2 ACTIVITIES IN THE FISH SEED SYSTEMS

Some key activities in the fish seed system include:

- Management of the genebank (parent stock) by public research institutions such as WFC and universities
- Distribution of primary broodstock to commercial or semi-commercial farms
- Mass production of fry and/or fingerlings by hatchery operators

An important activity is “fry sex manipulation” that ensures all male production. The fry is then distributed to holding stations and/or nursery operators in selected aquaculture development zones. This system reduces both losses during transfer and costs as fry are transported in large quantities. Finally, it shortens the distance travelled by outgrowers to access fingerlings.

6.2.1 Quality control

Public research will play an important a role in management of parent stock, certification, and development and updates of biosecurity guidelines. Hatchery operators are responsible for management of broodstock and fingerlings (nursing) as well as general sanitation. They should also adhere to the production guidelines.

6.2.2 Distribution of fingerlings to farmers

Clustering of farmers for uniform stocking and harvesting will result in economies of scale in accessing input and output markets. This approach will require zoning of fish-farming areas and also identifying lead farmers in each of the clusters. Assessment of the farmer’s situation, including existing production capacities and potential for development, is an important aspect. Designing harvesting plans and linking farmers to lucrative markets and analysis of different transport options for fingerlings, fry, and table fish are other areas of work to ensure a sustainable supply system.

6.3 PARTNERSHIPS FOR THE FISH SUPPLY SYSTEM

The fish seed system activities require strong partnerships between WFC, the National Aquaculture Center, Department of Fisheries, hatchery operators, nurseries, and outgrowers. An additional partnership is with several other CGIAR centers (i.e., CIP, CIAT, ICRISAT, and IITA) to plant crops around the fish ponds that are part of the seed supply system.

6.4 TYPES OF INPUTS REQUIRED FOR THE FISH SUPPLY SYSTEM

The materials and inputs that will be required for the fish seed supply system are shown in Table 3.

Table 3. Inputs required for the fish seed/fingerling supply system

Types of Inputs	Source	Justification
Pond rehabilitation equipment (hose, wheelbarrows, pipes, etc.)	Local dealers	For pond renovations
Pond liners	Internal and external sources	Seepage control mechanism
Broodstock	Natural water bodies/research stations	For gene purity and production of fingerlings
Fish feed and ingredients (soya, sunflower cake, minerals, vitamin premix, bran, etc.)	Local dealers and external sources	Provision of essential nutrients for good fish growth
Hapas	External	Fingerling production and nursing
Netting materials	Local dealers	For fish sampling and harvesting
Fish handling materials (e.g., buckets, oxygen, plastic bags, scales)	Local dealers	Fish handling and transportation

6.5 ACTION PLANS FOR THE FISH SEED SUPPLY SYSTEM

The plan agreed for fish seed supply system is presented in Appendix 1. The approach includes management of the genebank (parent stock) by public research institutions such as WFC and universities, distribution of primary broodstock to commercial or semi-commercial farms, and mass production of fry and/or fingerlings by hatchery operators. Specific activities include a project kick-off

meeting with DARS and Department of Fisheries, preparation of training materials, identification of hatchery and nursery operators, setting up of parent management centers at Domasi and Mzuzu, pond rehabilitation, recruitment of broodstock, fry and fingerling production, distribution of brooders to hatchery operators, and fingerling production.

7. SUPPORT TO AGRO-DEALERS IN THE KULIMA DISTRICTS

With the anticipated increased demand for inputs or seed of improved varieties through the FFS approach, there is need to ensure sustainable supply of quality inputs and seeds in the 10 districts. One of the ways to achieve this is to work with agro-dealers, who play a very critical role in distribution and the seed supply chain. Agro-dealers are already established in the seed system and are present in all the districts in Malawi. With this background, CGIAR centers working in the KULIMA program are training agro-dealers so as to familiarize them with the value chain commodities that the centers are promoting. It is expected that through these trainings agro-dealers will start stocking seeds of improved varieties and other inputs necessary for the adoption of technologies that are being promoted.

The support to agro-dealers is led by CIMMYT in partnership with all other CGIAR centers. In phase 1 of KULIMA, 120 agro-dealers were trained with sessions facilitated by all centers. The objectives were to train agro-dealers in their role in the seed industry and to familiarize them with the value chains and associated inputs that the centers are promoting in the KULIMA program. CIMMYT leadership is strategic due to the working relationship that is already there beyond KULIMA with the agro-dealers through STAM and seed companies in the promotion of improved maize varieties.

Agro-dealers are supported in all the 10 KULIMA districts. Apart from the agro-dealers, officials from the agricultural development divisions, crops officers from the district agricultural offices, and NGO representatives are included in the capacity-building initiatives for agro-dealers.

In phase 2 an assessment of the effectiveness of the agro-dealer trainings should be conducted. This will identify the need for refresher trainings, more in-depth training in some topics, or need for training in additional subjects related to CGIAR-promoted technologies.

APPENDIX 1. SUMMARY OF ACTION PLANS AND PARTNERSHIPS BY CENTER TO MAKE SEED, PLANTING MATERIAL, AND INPUTS AVAILABLE IN THE 10 KULIMA DISTRICTS

Table 1.1 CIP: Potato and sweetpotato seed systems

Activity	CIP Responsibilities	NGO Responsibilities
Select multipliers of planting material (3 for sweetpotato and 4 for potato per district)	Provide selection criteria	Select suitable multipliers
Train all selected multipliers in sweetpotato vine multiplication and seed potato production	Organize, facilitate, and cover costs for the training	Assist with the invitations and venue organization
Monitor preparation of nursery beds (1 visit/multiplier)		To visit multipliers
Procure and deliver clean start-up material to multipliers (for 0.2 ha of potato production, or 3–5 bundles of sweetpotato vines)	Procurement and delivery	
Register all multipliers with SSU	Register all multipliers	
Visits all multipliers with seed inspectors from SSU	Support inspection of the multipliers	
Train all multipliers on harvest, postharvest handling, and storage of vines and seed potato	Conduct trainings	
Support multipliers with marketing of planting material		Provide marketing support
Conduct refresher trainings for multipliers	Conduct trainings	

Table 1.2 ICRISAT: Groundnut, pigeon pea, sorghum, finger millet and pearl millet seed systems

Activity	ICRISAT Responsibilities	NGO Responsibilities
Identify seed multipliers (2 producer groups per district)	Provide selection criteria and register the seed multipliers	Select the seed multipliers
Train all seed multipliers on production of certified seed	Organize, facilitate, and cover cost of training	Mobilize training participants
Register all seed multipliers	Support registration of seed producers with SSU	
Procure and distribute good quality start-up EGS to producers (20 kg/farmer/season for groundnut and 5 kg for pigeonpea and sorghum)	Distribute the EGS for all proposed varieties	Check if all seed multipliers are served with the recommended variety
Monitor periodically seed fields to ascertain compliance to field management for a successful seed crop	Provide technical advice to farmers	Routine monitoring to ensure good field management
Carry out field inspections	Support SSU to inspect fields	
Support farmers with marketing of seed		Link farmers to markets

Table 1.3 IITA: Soybean, cowpea and cassava seed systems

Activity	IITA Responsibilities	NGO Responsibilities
Sensitize, identify, and select 60 seed/stems multipliers across the 10 districts	Define criteria for selection	In collaboration with government extension workers sensitize and identify multipliers based on the defined criteria for selection
Profile and register 60 seed/stem multipliers across 10 districts	With other partners (e.g., DARS and extension workers) organize engagement meetings with all the identified seed/stem multipliers for profiling and registration	
Train registered seed/stem multipliers in quality seed production, internal quality control, rapid cassava multiplication techniques, and record keeping	With SSU develop the training curriculum and deliver the training	With government extension workers mobilize and facilitate the invitation of selected seed multipliers for the training
Verify production sites and other facilities designated for seed/stem production	Backstop partners in site verification and assess the suitability of land and facilities designated for seed production	
Procure and deliver parent seed and other inputs to the selected multipliers	In collaboration with NGOs and extension workers participate in seeds quality evaluation and distribution of parent seed and other inputs required for seed production to the seed multipliers	In collaboration with IITA and extension workers participate in seeds quality evaluation and distribution of parent seed and other inputs required for seed production to the seed multipliers
Register and inspect seed farms for certification	With SSU facilitate the registration and inspection of seed farms for seed multipliers	Work with SSU to facilitate farm registration and inspection
Establish 1ha of EGS production at Lisasadzi RTC	Establish 1 ha of EGS production farm at Lisasadzi RTC	Backstop IITA in the management of the seed farm
Establish seed/stem farms at various districts	With other partners (e.g., extension workers) provide technical guidance to seed/stem multipliers during the establishment of seed farms	Backstop seed multipliers to ensure proper establishment of seed farms
Create market linkages through seed field days, market information systems, and matchmaking between seed multipliers and seed buyers		With other partners create market linkages for the multipliers through seed field days, seed fair, market information systems, and match-making between seed multipliers and seed companies/ agro-dealers
Train multipliers in improved postharvest management and storage and marketing	With SSU develop the training curriculum and deliver the training	With government extension workers mobilize and facilitate the invitation of selected multipliers for the training
Demonstrate soybean thresher-cleaner among seed and grain producing farmers	Collaborate with NGOs and government extension workers to demonstrate soybean thresher –cleaners among seed multipliers and grain producers	Create awareness among farmers and mobilize them for the thresher demonstration

Table 1.4 ICRAF: Tree germplasm systems

Activity	ICRAF Responsibilities	NGO Responsibilities
Sensitize, identify, and select agroforestry tree seed producers (2 farmers/district) for the market and seed producers for own use (20 farmers/ district)	Provide selection criteria	Select agroforestry tree seed producers based on criteria
Train selected agroforestry tree seed producers on tree field establishment, management, seed harvest, processing, storage, and germination tests	Organize, facilitate, and cover costs for a 1-day training in tree seed production for sale and own use	Assist with the invitations of the selected agroforestry tree producers
Make available start-up seed/seedlings of Tephrosia, Gliricidia, Calliandra, 2 mango and orange cultivars, and 1 avocado and tangerine cultivar (10 seedlings/cultivar)	Source, procure, and facilitate distribution of high-quality tree seed/seedlings of the cultivars	Pay for the costs of the planting material sourced from private suppliers
Train private fruit tree nursery operators on production of high-quality fruit trees and seedlings (1 private nursery operator per KULIMA-implementing district)	Organize, facilitate, and cover costs for a 1-day training with the help of SSU and Department of Crops (for the developed standards)	Assist with identification of the fruit tree seedling nursery operators

Table 1.5 CIAT: Beans seed system

Activity	CIAT Responsibilities	NGO Responsibilities
Identify and select 30 seed multipliers	Provide guidelines for selection for seed multipliers	Select multipliers following the guidelines from CIAT
Assess site suitability for bean seed multiplication on 30 sites	Georeference production sites; collect and analyze soil samples	
Register 30 seed multipliers with SSU	<ul style="list-style-type: none"> Facilitate the registration process with SSU Provide seed production application forms to partner NGOs 	Collect information from multipliers as specified on seed production application form provided by CIAT
Train seed multipliers in common bean seed production	<ul style="list-style-type: none"> Facilitate training Cover all training costs Provide manuals on bean agronomy to all participants 	Schedule trainings in the districts and invite participants to the training
Deliver seed to multiplication sites	Deliver seed to partner NGOs	Distribute seed to multipliers
Conduct monitoring visit to seed production sites	<ul style="list-style-type: none"> Collect monitoring data Advise on pest and disease management 	
Train multipliers on harvesting and post-harvest management	Facilitate training and cover all training costs	Schedule trainings in the districts and invite participants to the training
Promote demand creation	Invite private seed companies and commodity off-takers to field days	Organize field days
Provide marketing support	Facilitate seed business training	Schedule trainings in the districts and invite participants to the training

Table 1.6 CIMMYT: Maize seed systems and agro-dealer trainings

Activity	CGIAR Responsibilities	NGO Responsibilities
Promote varieties of DTM and nutrient-dense maize through 360 winter demos in 10 districts	Provide promotional seed packs and data collection forms	Identify beneficiary farmers, collect beneficiary data
Train 5 NGO partners in 10 districts on varietal attributes of DTM and nutrient-dense maize, including data collection	Provided training material development and actual training	Provide staff to be trained
Provide refresher training to 121 agro-dealers based on demand in 10 districts on seed/input quality (storage, handling, & transportation) and ability to source and stock CG-promoted technologies' related inputs	Identify and train agro-dealers in collaboration with STAM, SSU, and other CGIAR centers	To be determined
Conduct at least 1 field day/district on winter fields/demos	Provide backstopping support on demand	Facilitate the field days
Assess seed requirements for the promoted DTM varieties	Link with seed companies and agro-dealers on seed requirement	Assess and report on quantity and varieties demanded by farmers
Audit agro-dealers in 10 districts to check adherence to code of conduct for maintaining quality seeds	Conduct assessments in collaboration with STAM & SSU	To be determined
Establish study plots on DTM and nutrient-dense maize (include DTM varieties in the existing FFS study plots)	Provide information for suppliers (seed companies) of DTM varieties	Procure inputs (DTM seed & other inputs) for study plots
Protocol training for NGOs & CBFs (Includes data collection & facilitation of participatory variety selection)	Develop study plot layout protocol in collaboration with NGOs; facilitate protocol training	To be determined
Facilitate field days to evaluate DTM and nutrient-dense maize varieties with farmers	Provide evaluation methodology	Facilitate the field days
Collect data on the DTM and nutrient-dense maize variety field demos	Provide data collection forms/ booklets	Data collection

Table 1.7 World Fish Center: Fish supply system

Activity	CGIAR Responsibilities	NGO Responsibilities
Establish rice-fish integration study plots in potential outreach stations	Develop layout protocol together with MTs	Identify suitable sites
Scale out aquaculture-agriculture integrated systems in outreach stations	<ul style="list-style-type: none"> • Conduct scaling out meeting with NGO field staff • Monitor setting up of study plots 	<ul style="list-style-type: none"> • Select farmers • Procure inputs and other items to establish integrated agriculture aquaculture
Train hatchery and nursery operators	<ul style="list-style-type: none"> • Develop training curriculum • Conduct training 	<ul style="list-style-type: none"> • Identify and invite trainees • Provide financial resources for the training
Support seed multiplication and/or availability in the KULIMA Action districts in a more sustainable manner	<ul style="list-style-type: none"> • Register all seed multipliers • Assess demand for fish seed 	<ul style="list-style-type: none"> • Register all multipliers • Assess • Conduct monitoring visits
Train farmers on location-specific fish feed diets using local ingredients	<ul style="list-style-type: none"> • Conduct assessment of availability of local fish feed ingredients • Conduct farmer trainings 	Organize training

Activity	CGIAR Responsibilities	NGO Responsibilities
Operationalize seed inspection and certification process	<ul style="list-style-type: none"> • Hold final technical review of the seed supply system protocol with Department of Fisheries experts • Reorient NGOs on the new fish seed production and supply system • Facilitate fish seed inspection 	Invite trainees
Conduct monitoring and technical backstopping	In liaison with NGOs conduct monitoring visits as can be agreed	Conduct agreed monitoring visits
Facilitate field days to evaluate integrated agriculture aquaculture with farmers	<ul style="list-style-type: none"> • Orient MTs and CBFs on evaluation protocol • Analyze findings from monitoring data together with NGOs 	<ul style="list-style-type: none"> • Conduct evaluation meetings • Collect monitoring data