

Resilient Agriculture for Inclusive and Sustainable Ethiopian food systems - RAISE-FS

Resilient, inclusive and sustainable food systems in Ethiopia

Annexes annual report 2022

RAISE-FS
Resilient Agriculture for Inclusive and Sustainable Ethiopian Food Systems

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List of abbreviations and acronyms

AAU	Addis Ababa University
ACC	Agricultural Commercialisations Clusters
ARARI	Amhara Agricultural Research Institute
ARI	Agricultural Research Institute
ATI	Agricultural Transformation Institute
BDU	Bahir Dar University
BoA	Bureau of Agriculture
BENEFIT	Bilateral Ethiopia–Netherlands Effort for Food, Income and Trade
CAPI	Computer Assisted Personal Interview
CoC	Certificate of Competency
DA	Development Agent
ECA	Economic Commission for Africa
ECX	Ethiopian Commodity Exchange
EIAR	Ethiopian Institute of Agricultural Research
EFBDG	Ethiopian Food Based Dietary Guideline
EFDA	Ethiopian Food and Drug Authority
EGS	Early Generation Seed
EKN	Embassy of the Kingdom of the Netherlands
ENAO	Ethiopian National Accreditation Office
ENGEA	Ethiopian Network Gender Equality in Agriculture (Platform)
EPOSPEA	Ethiopian Pulses, Oilseeds and Spices Processors-Exporters Association
EPPPA	Ethiopian Poultry Producer Processors Association
ESA	Ethiopian Seed Association
ESAHGPA	Ethiopian Spice Aromatic and Herbs Growers and Processors Association
FNS	Food and Nutrition Security
HarU	Haramaya University
HawU	Hawassa University
IFDC	International Fertilizer Development Centre
IPM	Integrated Pest Management
IRM	Innovation Recommendation Mapping
ISFM	Integrated Soil Fertility Management
FAO	Food & Agriculture Organization
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GO	Government Organization
IFPRI	International Food Policy Research Institute
IRM	Innovation Recommendation Mapping
ISFM	Integrated Soil Fertility Management
ME&L	Monitoring, Evaluation & Learning
MSME	Medium Small and Medium Enterprises
MoA	Ministry of Agriculture
MoTRI	Ministry of Trade and Regional Integration
MoU	Memorandum of Understanding
NGO	Non-Government Organization
NSA	Nutrition Sensitive Agriculture
NWEEF	National Women Economic Empowerment Forum
ODK	Open Data-Kit
PTE	Participatory Technology Evaluation
QDS	Quality Declared Seed
R4FST	Research for Food System Transformation
RAISE-FS	Resilient Agriculture for Inclusive and Sustainable Ethiopian food systems
RARI	Regional Agricultural Research Institute
RED & FS	Rural Economic Development and Food Security

RUSACCO	Rural Saving and Credit Cooperative
SARI	Southern Agricultural Research Institute
SNNPR	Southern Nations, Nationalities and People's Region
SWRE	Stichting Wageningen Research Ethiopia
ToT	Training of Trainer
WAD	Ministry of Agriculture Women Affairs Directorate
WCDI	Wageningen Centre for Development Innovation, Wageningen University & Research
WHO	World Health Organization
WUR	Wageningen University & Research

Summary Sheet

Programme title	Resilient Agriculture for Inclusive and Sustainable Ethiopian food systems (RAISE-FS).
Vision	The vision of RAISE-FS is more **resilient, inclusive** and **sustainable food systems** in Ethiopia.
Impact	The overall impact of RAISE-FS is increased productivity, enhanced value chain performance and improved human nutrition for improved food security while minimizing the impact on the environment and ensuring social inclusion.
Goal	Creating evidence for practices that contribute to transformation of the food system by addressing leverage points in relation to productivity, enhanced value chain performance and improved human nutrition for improved food security while minimizing the impact on the environment and ensuring social inclusion.
Country	Ethiopia
Programme duration	4 years (September 2021–December 2025)
Contract holder	Stichting Wageningen Research, Wageningen University & Research P.O. Box 88, 6700 AB Wageningen, The Netherlands
Main implementing parties	Wageningen Research Wageningen University & Research c/o P.O. Box 88 6700 AB Wageningen The Netherlands
Contact Ethiopia	Dr. Dawit Alemu Stichting Wageningen Research Ethiopia E-mail: dawit.alemu@wur.nl Phone: +251 911629149
Contact Netherlands	Dr. Irene Koomen Wageningen Centre for Development Innovation E-mail: irene.koomen@wur.nl Phone: +31 623204301
Budget	Total budget: € 12,000,000

These annexes are a detailed narrative of the activities from September 2021 till 31 December 2022.

Annex 1 Key Activities per outcome

A1.1 Social and economic empowerment of women and youth increased

Outcome statement
Through targeted activities, RAISE-FS will contribute to social and economic empowerment of women and youth in food systems. Some of these activities specifically address this outcome area, but as this area is an enabler for other outcome areas, some activities relevant to this outcome area are included in other outcome areas.

A1.1.1 Increased women's and youth's decision-making in agriculture

Leverage points: (1) to bridge the information gap for women and youth (2) initiate novel and locally acceptable negotiation platforms for women and youth

A scoping study was conducted to map and examine the diversity of good practices that can be applied to the agricultural sector in the areas of gender equality and women and youth empowerment.

Following the completion of the study, a stakeholder consultation workshop was organized to obtain stakeholders' feedback, views and opinions on gender equality related. Stakeholders were invited from different government ministries, knowledge and research organizations, and private sector companies. Some of the issues include the strengthening the evidence base of gender and youth empowerment interventions, measures to ensure sustainability of women and youth livelihood interventions and integrating gender transformative approaches in the agriculture sector and strengthening collaboration among the different development actors in the agriculture sector. Stakeholders reached a consensus on the need to change the fragile coordination of stakeholders in the sector and contribute towards strengthening the existing Ethiopian Network for Gender Equality in Agriculture (ENGEA) platform to contribute for evidence generation and bring all pertinent actors working in the sector on board.



Figure 1 *RAISE-FS consultation workshop participants*

An inventory of existing platforms and organizations with a focus on youth & gender has been made to ensure effective collaboration and alignment as to influence both policy and development objectives. Existing platforms that focus on gender and youth agenda within the agriculture context have been mapped.

At the household level, the project employed an inclusive approach in all its interventions to improve the decision-making role of women. The project implementation involved spouses in all project interventions including trainings, cooking demonstrations, participatory technology evaluations, field days etc. Engaging spouses in such interventions positively contributes to promote cooperation within the household thereby contributing to improved decision-making role in the agriculture sector. Deliberate efforts were made to target women and youth in all project interventions. Women and youth participated as host and learning farmers in all testing and validation activities of the project. On the other hand, in participatory Technology Evaluation (PTE), women were encouraged to select their preferred varieties in a safe space i.e. women only groups, to ensure representation of their voices, and women trait preferences were considered in the selection of preferred varieties and practices.

Efforts have been made to engage with a range of development actors through bilateral dialogues and joining learning and action platforms on gender equality, women and youth empowerment. Two national level platforms, the Ethiopian Network for Gender Equality in Agriculture (ENGEA) and National Women Economic Empowerment forum (NWEE). ENGEA is a national level platform led by the Ministry of Agriculture Women Affairs Directorate (WAD) with the goal of contributing for closing gender gap in Ethiopian agriculture through the exchange of experience and information, partnership and networking, research, advocacy and services. SWR-Ethiopia is now an advisory committee member of this platform, actively contributing for the common goal. NWEE focuses on gender equality and women economic empowerment in the agriculture sector.

Training, capacity-building, and creating spaces for exchange with and between partners is an important cross-cutting pathway in RAISE-FS project. To this end, a workshop in which 35 project and implementing partner staff participated, was organized on gender equality and social inclusion.



Figure 2 *Participants during group discussion and 'power walk' exercise*

In efforts to integrate gender empowerment and social inclusion in all its interventions and projects, a guidance document focusing on gender and social inclusion integration has been developed. The guidance document uses participatory and inclusive methods based on experiential learning that considers the diverse experiences, perspectives and needs of participants. A range of topics including social exclusion and vulnerability, intersectionality, gender analysis tools and techniques, gender equality integration continuum and gender empowerment and social inclusion action planning.

A1.1.2 Increased income for women and youth in the food system

Leverage points: (1) increase access to finance for women and youth (2) create mechanisms for agricultural jobs for women and youth (3) increase access to resources by women and youth

A range of income generating initiatives that make explicit provisions to target and benefit women and young people in rural area were identified. These include group actions on various commodities, self-help approaches to women and youth empowerment and soft and hard skill provisions for women and youth in the agriculture sector.

In Amhara, Angot *woreda*, pilots on poultry and small ruminants (sheep and goat) are underway to create income opportunities for women and youth. Thus far, recruitment and linkage of women and youth with Rural Saving and Credit Cooperatives (RUSACCOs) have been finalized. Additionally, participants have been trained in techniques of poultry production, housing, feeding, and health management. This activity has not yet been finalized due to the security situation in the area. The financial provision is expected to be finalized on the first quarter of the 2023 planning year.

In Oromia, an effort to demonstrate scalable business model, preliminary activities are undergoing to engage women and youth in shallot and carrot seed production as a business model. Following the initial activities, trainings, linkage with financial service providers and development of the business model is planned to be conducted in 2023. Year-round vegetable production is being done in food insecure and high potential food systems. While this activity primarily contributes to the improvement of vegetable consumption, it also serves as a supplementary source of income for women who are able to sell surplus production. In commercial food systems, gender and youth value chain assessments were conducted providing due focus to gender and power relations, women and youth specific opportunities and constraints in the sub-sectors.

Demonstrating scalable inclusive access to finance is aiming at increasing the income of women and youth. Access to finance for women and jobless youth was facilitated for them to engage in income generation activities. In Amhara region Angot Woreda, membership of women and youth in community saving and credit cooperatives was facilitated. Being a member improves the social capital of women and youth.

A living income study as an indicator applicable for rural farm households has been initiated with a pilot in SNPP and Sidama. The concept of living income as an indicator was introduced as an indicator to calculate the living income of rural farm households of all farming systems, from subsistence to commercialized. A living income is defined as sufficient income to afford a decent standard of living for all household members and quantified by considering cost of nutritious diet, decent housing and other non-food costs for health care, education, transport and clothes.

A1.2 Efficient and environmentally sustainable production increased

Outcome statement
Through providing evidence, the combination of improved input supply and finance, improved strategic planning tools, sustainable agricultural practices and a focus on climate resilient agriculture, production is raised to levels that have the potential to secure local and national food security, substitute imports, increase exports and protect the resource base against productivity loss and erosion.

A1.2.1 Efficient and sustainable production system enhanced

Leverage points: (1) improve availability of evidence based sustainable practices (2) design and validate context specific solutions for sustainable production systems

National Ginger revitalization

Ginger is one of the important export crops and grows predominantly in SNNP and Sidama, it is a cash crop for many smallholder farmers. Prior to the outbreak of Ginger Bacterial Wilt, which occurred in 2012 in Ethiopia, the country was earning about 11 to 22 million US dollars annual incomes from its export. A sharp drop in production and supply, however, followed because of a sudden outbreak of a destructive ginger bacterial wilt which caused an estimated incidence of 80-100%, giving rise up to 90-100% crop loss and resulted in a significant reduction of total annual production of the crop from 650,049 tons in 2008 to a negligible level in the subsequent years. Consequently, the socio-economic security of farmers, traders and other members of the societies whose livelihoods was based directly or indirectly on businesses related to ginger production have been seriously affected particularly in Boloso Bombe woreda.

A stakeholder workshop that brought together professionals from research, universities, government offices, private sectors and NGOs identified key leverage points for revitalization of ginger production in the country. Specifically, the workshop outlined two broad strategic pathways:

i. Identified best production practices to mitigate ginger disease and to bring the production of ginger at full scale.
ii. Strategic and policy related bottlenecks that requires creation of good enabling environment for successful revitalization of ginger production.

As key outcome, comprehensive documentation is in progress that clearly indicates the main potential and challenges along with what needs to be done in the short, medium and long term by each of the relevant stakeholders to ensure the revitalization of ginger not only as a domestic cash crop but also as foreign currency generating commodity.

Increase yield and income through Integrated Soil Fertility Management

Integrated Soil Fertility management (ISFM) practices contribute to environmental sustainability of production. Particularly given the growing low level of availability and access to inorganic fertilizer associated inland and global crises that have affected the fertilizer supply chain, ISFM has economic benefit as well. The use of vermicompost as part of ISFM is a business model that contributes to additional income and empowerment.

ISFM practices on groundnut tested in in Babile *Woreda* gave a yield advantage over the farmer's practice (2.7 t ha^{-1} vs 2.3. t ha^{-1}) with gross margin of 41,440 ETB ha-1 compared with 28,980 ETB ha^{-1} from local practice. This implies that production using ISFM has contribution for environmental sustainability as well as income and empowerment. Validation and demonstration of ISFM innovations were conducted for high potential food system typologies across regions. This includes ISFM teff in Yilmana Densa (Amhara region), potato in Kersa (Oromia region), and faba bean in Gumer (South).

ISFM with 50% per hectare recommended inorganic fertilizer and 2 t ha^{-1} of organic fertilizer showed up to 37.6% yield advantage over the farmer's practice on potato (Gudene variety) at Kersa. ISFM through use of vermicompost had a positive effect on teff production. Applications of inorganic and organic nutrient sources either alone or in combination had a significant effect on grain yield and biomass yield of teff.

Increase yield and income through Integrated Pest Management

Validation of productivity gains of disease-free potato tubers was conducted in Yilmana Densa *woreda* shows that the use of early generation seed potato of Belete variety from tissue culture source ensured 40 t ha^{-1} yield compared 21 t ha^{-1} and 24.5 t ha^{-1} from the old generation seed of the same variety, and the local variety, respectively. This shows 90.7% yield advantage over the old generation variety and 63.3% over the local variety. The production following four years of rotation show higher total yield and higher marketable yield with little disease score compared with that was produced without four-year break. Land use planning and use of early generation seed with efficient seed system contributes to the sustainability of increased

production as well as income and empowerment. This implies the need to work on the potato seed system for sustainable supply of disease-free potato tubers.

Climate resilience

Late establishment of various trials caused the coinciding of flowering time to frost period whereas frost was typically severe this year even for perennial crops. This observation, together with the drought risk reported from Sire *woreda* justify the plan of improving IRM to support decisions taking in to account climate related vulnerabilities.

Enhancing sustainable production of commercial crops

Sesame, soya bean, and sunflower are major commercial commodities cultivated. Sesame and soya bean are alternative commercial crops in West Armachiho *woreda* with substantial replacement of the sesame belt by soya bean in recent years. Participatory technology evaluation (PTE) and validation was conducted covering the following technologies of target commodities:

- Sesame (Obsa, Gondar 1, Abasena, Setite 1, HuARC 4 and the local variety called Gondar Doyo) of which Setite-1 was the preferred variety
- Soya bean (Gishama, Afgat, and Pawe 03) varieties with packages of improved agricultural practices including land preparation, seed rate, fertilizer application. Of which Afgat was the preferred variety

Similarly, testing and validation of innovations for commercial crops namely lentil, which has been challenged due to disease incidence and haricot beans has been done:

- Lentil varieties (Derso, Furi and Beredu along with local) with recommended packages for revitalization of lentil production Of which both Beredu and Furi were the preferred varieties
- Validation of innovations for grain legume crops (soya bean and haricot bean) technologies – management practices have been tested and the potential as a poultry feed has been identified

The good performance in terms of yield, farmers' preference, good marginal rate of return coupled with improved seed system (described under improved input supply system intermediate outcome) contribute to the sustainability of production and the business whereas the yield advantage has a good potential for additional marketable yield as well as income. With a good improvement in the value chain and sector performance for these commercial commodities, sustainable and efficient production of the commodities would contribute to the sustainability of the business leading to the empowerment of the various social groups of the community.

Enhancing crop diversification to increase food security

Diversified production through intercropping of cereals with pulses including maize with common bean and sorghum with mung bean contribute to increased availability of nutrient dense food as well as decreasing food gap months in food insecure areas. Validation of common bean Varieties (Gegeba, SER-125 & Hawassa Dume) along with bio-fertilizer (*Rhizobium* spp.), faba bean Varieties (Dosha, Gabalcho & local) and associated packages were tested and rated by farmers preference and grain yield. The improved varieties and practices provide opportunities for nutrition diversity, risk minimization in water stressed areas, and environmental sustainability through the capacity of legumes to improve soil fertility.

Participatory technology evaluation (PTE) of improved food oat technologies in Angot area intend to promote sustainability of production (ability to produce on acid soils) and contributed to the increase in diversity of nutrient dense food as food oats has not been produced yet in the area, and also contributes to reduction of food gap months.

Demonstration of year-round production and consumption of home garden vegetables was implemented at Yilmana Densa, Sire, Haramaya, Kersa, and Babile *woredas* in 2022. The vegetables planted include squash, carrot, head cabbage, beetroot, Swiss chard, broccoli and Maradol papaya. The intervention on year-round production supported the diversification of sources of nutritious food. Even in areas where vegetable production is common, limited number of vegetables are usually produced mostly for local market. This model, however, has the potential to improve temporal distribution of the availability of vegetables for household consumption; and improve efficiency of land and water for sustainability. It also demonstrated the scalability of use of compost & vermicompost for small plots and home gardens while improving the

environmental sustainability. However, host farmers tend to take the produces to market as explained during field days. Therefore, behavioural change need to be promoted to enhance the diversified consumption of nutritious vegetables at household level in high potential areas that is characterized by high productivity but less diversified production system. This model not only has similar contribution for food insecure areas, but also contribute to fill food gap months that is a dominant characteristics of food insecure food system. Gaps identified from the testing and validation are availability of water for irrigation, pest management as pesticide use is high on vegetables and limited availability of vegetable seeds.

A1.2.2 Improved input supply chain systems

Leverage points: (1) improve the integration and functioning of input supply chains (2) increase access to improved inputs and finance

The key activities implemented in relation to improving input supply system were related with (i) enhancing access to early generation seed for target commodities, (ii) enhancing the collaboration of relevant actors engaged in promoting the potato seed system and (iii) identification of key challenges and opportunities for improved inorganic fertilizer supply system in the country.

Enhancing access to Early Generation Seed
One of the challenges to improve productivity of commercial commodities is the seed system, mainly because these commodities are currently not supported by the formal seed system of Ethiopia. To bridge this gap, interventions on Early Generation Seed (EGS) multiplication were implemented in 2022 for sesame, soya bean, sunflower, lentil, faba bean and for potato.

Empowering private farmers to multiply early generation clean seed potato was demonstrated at Adet. The model followed the use of disease free mini-tubers from tissue culture sources multiplied in mini-screen houses owned by private farmers (G2 or second generation), linkage to interested farmers willing to produce G3 (or third generation) disease free potato seed on land that previously was not used for potato production. The modality for 2022 was that Adet dispatched G2 to interested farmers with the agreement that farmers will pay back for the G2 they received in the form of G3 seed potato.

Demonstration of mini-screen house on individual farmers helped to generate evidence on the potential of producing mini tubers of potato at private level following business model which is crucial for sustainability and well-functioning of the seed supply system. This feeds well to the national initiatives on improving clean seed potato supply system. This model of linking the chain of tissue culture sources with private producers of mini-tubers from mini-screen houses and capacitated seed producers along with validations of ware and seed potato storage management enhances increased productivity implying products can be supplied to the market in the high potential food system at times of good price as well as promote season wide availability of potato for food.

Challenges of the potato seed system
Potato has been identified as one of the major commodities most high potential food system and some food insecure food system typologies within RAISE-FS project. Past experiences and recent local level assessments from the baseline survey and the rapid food system appraisal have shown that potato seed system is operating under complex challenges that resulted in low level of productivity and production.

Most problems in the potato seed system are identified to be cross regional in nature concentrating around availability of clean seed tuber for potential potato producing areas, and system level regulatory to ensure quality potato seed both of which require nationally coordinated efforts. With this understanding we have been working to avail innovative clean-potato seed supply system to improve the input supply while acknowledging the extensive efforts made by various national and international actors supporting the potato sector along the value chain, a collaborative engagement to avoid overlaps of efforts. A stakeholder workshop was conducted with representatives from MoA, Holeta research centre (EIAR), Adet research centre (Amhara), Worabe research centre (South), Haramaya University, Ethio-Netherlands Seed partnership, the international Potato Centre (CIP), and SNV. Key challenges, opportunities, innovative

interventions, and areas of potential alignment towards enabling sustainable clean potato seed supply system were identified and clustered into the following general categories (Table 1).

Table 1 *Key challenges of the potato seed system*

Key challenge	Descriptions
Variety development and delivery	• Limited varieties for the diverse agroecology and farming systems • Challenge in variety release system • Gudene is the most dominant for a number of reasons
EGS	• Limited capacity for the production of sufficient EGS • Limited participation of the private sector in EGS • Free delivery of EGS (lack of business model) • Limited knowledge and skills in the new seed potato propagation system • Weak linkage in the seed generation schemes • Weak willingness to pay for quality seed • Bulky seed amount (it discourages farmers to buy)
Seed multiplication and storage	• Unavailability of sufficient EGS • High accumulation of diseases which leads to land shortage (highland areas) • Difficulty to cluster seed production/ poor seed production plan • Lack of seed and ware potato production delineation • Public seed enterprises are not engaged in seed potato production (bulky seed rate, transportation, storage facility, limited experience in marketing) • Limited participation of the private sector (good experience in Uganda) • Poor seed potato demand assessment (two years needed to estimate effective demand). Not guiding seed production • Profitability and feasible business model for seed production (it needs assessment) • Farmers' seed replacement rate • Seed storage system (high cost, power). Smallholders-friendly storage system • Seed tracing information system (including seed extension) • Using ware potato for seed
Quality assurance	• Low attention from a regulatory body (not as strong as cereals) • Limited capacity of the regulatory system (manpower, logistic, facilities) • Limited COC holders • Too much dependency of seed producers on external support (NGOs, research) • Limited law enforcement • Adulteration • Improvement on QDS (it allows up to C5) • Lack of disease load standard (only observation-inspection is enough)
Seed marketing	• Understanding seed and ware potato linkage • No price incentives for certified and ware potato • Selling ware potatoes as seed • Lack of seed potato market information • Lack of standard packaging and handling • Selling standard (weight vs the number of tubers). The weight loss discourages producers • Brokers power (they fix prices and get high price share) • High price fluctuation and recent price soaring (3000 Birr/qt.) • Risk [market,..]

Strategy development to enhance the fertilizer supply chain

A fertilizer supply chain assessment and mapping was conducted through a stakeholder meeting involving participants from multiple institutions involved in supporting the fertilizer sector such as the Ministry of Agriculture, Amhara Regional Agricultural Bureaus, Oromia cooperatives, South cooperatives, Federal Cooperative Commission, Ethiopian Shipping and Logistic Enterprise, Commercial Bank of Ethiopia, Ministry of Finance, Ministry of Transport and Logistic, Ethiopian Maritime Affairs Authority, Ethiopian Standard Agency, and Agricultural Authority.

The stakeholders' workshop (i) mapped the fertilizer supply chain including core processes, main actors and their functions and linkages; the flow of information and products and price change across supply chain;

(ii) identified strategies and coping mechanisms followed by actors in response to global and local crises (iii) identified the leverage points for improving the efficiency of fertilizer supply chain. Stakeholders recognized the need for effective collaboration linkage, consequently, a multi-stakeholder technical core group lead by Ministry of education was established. The technical core group will regularly meet to analyze and provide innovative guidance on specific problems and leverage points.

A1.2.3 Strategic planning for agricultural development improved

Leverage points: (1) strengthen research-education-extension linkages (2) design and validate mechanisms for a well performing agricultural sector

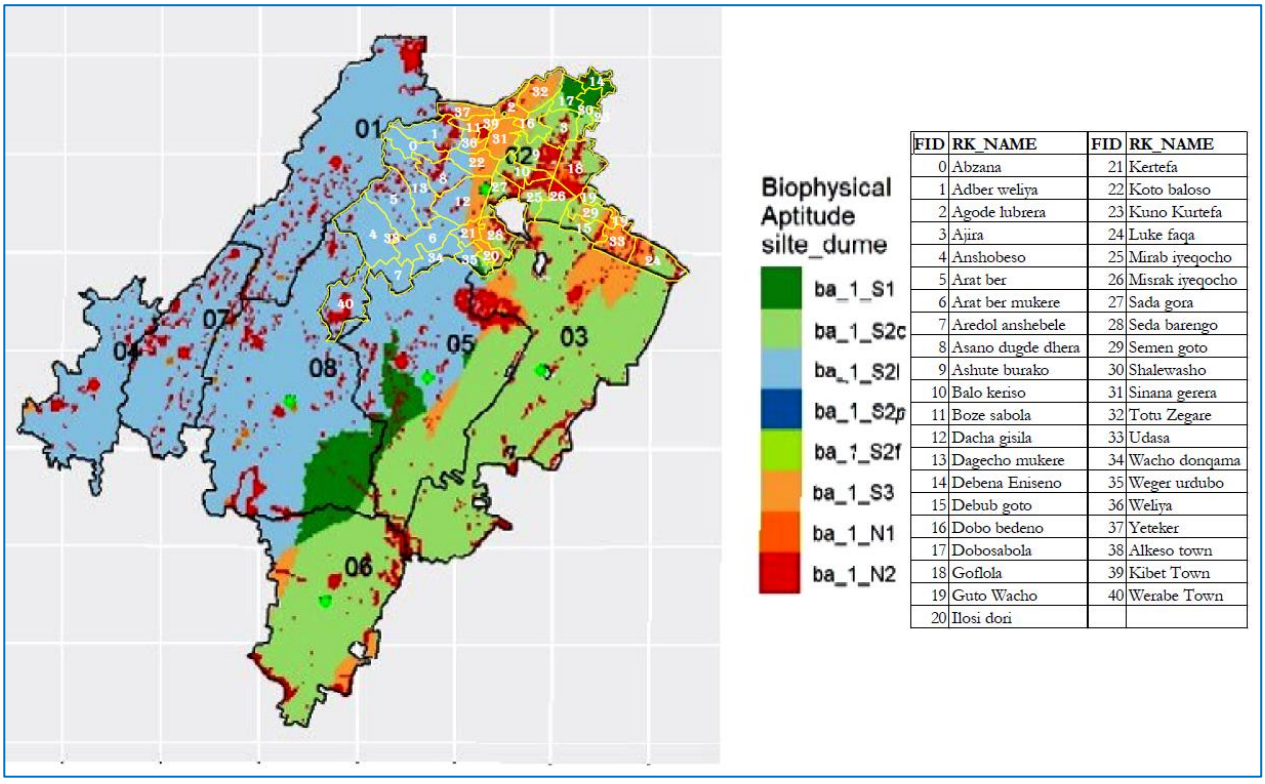
Innovation Recommendation Mapping

Efficient agricultural planning and informed decisions are key elements for effectiveness of scaling as well as sustainability and resilience of agricultural production. Innovation Recommendation Mapping (IRM) is a modelling approach that integrates important biophysical, demographic, economic and infrastructural conditions to enhance participation and guide planning to make informed decisions and enables scaling of innovations to suitable niches.

A one day workshop was conducted with experts form MoA and EIAR to assess local capacity to support IRM and agree on pilots/use cases of further improvement. Key improvement areas have been identified in various use cases taking in to account the technical capacity of local team, data requirement and priorities.

The identified use cases/ improvement areas are:

a. Validate and use the existing IRM tool for scaling of selected innovations. As part of this, IRM map (Figure 3) was generated for ground level piloting of IRM for scaling up of maize-haricot bean intercropping in Silte *woreda*. The potential *kebeles* (Table 2) that fall under the identified suitability class of various level of limiting factors were identified. These *kebeles* will be part of ground level piloting of IRM in 2023.



FID	RK_NAME	FID	RK_NAME
0	Abzana	21	Kertefa
1	Adber weliya	22	Koto baloso
2	Agode lubrera	23	Kuno Kurtefa
3	Ajira	24	Luke faqa
4	Anshobeso	25	Mirab iyeqocho
5	Arat ber	26	Misrak iyeqocho
6	Arat ber mukere	27	Sada gora
7	Aredol anshebele	28	Seda barengo
8	Asano dugde dhera	29	Semen goto
9	Ashute burako	30	Shalewasho
10	Balo keriso	31	Sinana gerera
11	Boze sabola	32	Totu Zegare
12	Dacha gisila	33	Udasa
13	Dagecho mukere	34	Wacho dongama
14	Debena Eniseno	35	Weger urdubo
15	Debub goto	36	Weliya
16	Dobo bedeno	37	Yeteker
17	Dobosabola	38	Alkeso town
18	Goflola	39	Kibet Town
19	Guto Wacho	40	Werabe Town
20	Ilosi dori		

Figure 3 *IRM map to validate maize-haricot bean intercropping in Silte woreda*

Table 2 *Kebeles falling under various suitability classes identified using IRM for Silte woreda*

Class	*kebele*	Description	Remark
S1	14. Debena Eniseno	Most of the area is suitable	full
	17. Dobosabola		Partial
	30. Shalewasho		
S2C	17. Dobosabola	Moderaetly Suitable/ Climate as alimiting factor	partial
	30. Shalewasho		
S2 L	0. Abzana	Moderaetly Suitable/ Landscape as alimiting factor	partial
	1. Adber weliya		
	12. Dacha gisila		
	13. Dagecho mukere		
	8. Asano dugde dhera		
S3	22. Koto baloso	Marginally suitable	partial
	31. Sinana gerera		
	32. Totu Zegare		
	33. Udasa		
N1 & N2	9. Ashute burako	no suitable and permanently not suitable	partial
	18. Goflola		
	25. Mirab iyeqocho		
	26. Misrak iyeqocho		

b. Improve IRM to include socio-economic and climate related vulnerabilities, support bottom-up planning, fertilizer and input distribution, access to agri-finance by blending with top-down e.g. earth observation data, policy directions.
c. A dashboard on selected use cases that would align with *woreda* planning; to make IRM more user friendly and accessible to decision makers and non-expert audiences.

A1.3 Sector performance and value chains enhanced

Outcome statement
In selected agricultural subsectors, RAISE-FS will contribute to the development of a more vibrant private sector by enhancing competitiveness in order to contribute to increased food security. It will realize this in cooperation with the Agricultural Transformation Institute (ATI) in the ACC areas and semi-commercial food systems, through regionalization of activities and with the support feet on-the-ground implementing partners (RARIs and the private sector).

A1.3.1 Improved sector competitiveness

Leverage points: (1) improve sector collaboration and coordination (2) create incentives (3) strengthen private sector facilitation (4)increase the capacity of the public sector to deliver services

Strategy development for the poultry sector
In Oromia poultry is among the priority commodities for the region and at the beginning of 2022 the sub-sector was recovering from a national disease outbreak. As such an assessment of the effects of the 2021 disease outbreak and development of a disease control system was initiated. Even though the nature of the disease was not formally announced the assessment found that it had severe effects on value chain actors and associated stakeholders at social, economic and environmental aspects. The study focused around Bishoftu area as it was the epicentre of the outbreak and interviewed 63 representatives of small, medium and large poultry farms. The main findings were:

- It was observed that pullets and layers seem to have been affected the worst. Farms holding these poultry products experienced 54% and 75% losses of their stock respectively. The loss in income from the direct impact of the outbreak ranged from 23% to 75%.
- The biggest loss experienced by farms was the forced disposal of eggs, chicks and chickens even though the disease was not sensed in the farm. The other side-effect of the outbreak and subsequent blockade

was the drop in demand for poultry products by consumers for prolonged period. This had affected 95% of the farms interviewed.
- the two-third of farms also faced lack of access to inputs- especially day-old-chicks- after the outbreak, presumably caused by the disposal of chicks done by hatchery farms.
- Over 40% of the farms were forced to reduce their employees to cut cost.
- The disposal mechanism used for the dead poultry affected by the disease was burning or disposing in open space, the latter being common among SMEs. High cost of poultry farm insurance.
- Lack of coordination with public actors was raised as an aggravating factor for such outbreaks and poor sub-sector performance as a whole.

A validation workshop attended by the Ministry of Agriculture, Ada'a *Woreda* Office of Agriculture, Bishoftu Urban Agriculture Office, Small, medium and large-scale broiler and Layer farms, Breeding Farms, Feed and supplement suppliers, Debrezeit Agricultural Research Centre, Addis Ababa University and Ethiopian Poultry Producers and Processors Association, formulated the following recommendations:
- development of a farm database;
- awareness creation to farms;
- strengthen the quarantine system;
- continuous dialogue between the private and public sectors;
- implementation of a disease control strategy by Ministry of Agriculture and regional bureaus;
- system development on updating upcoming diseases.

Assessing disease outbreak trend and benchmark management mechanisms and attention should be given on farm waste management systems. In the South, a preliminary assessment was done on the poultry sub-sector in Hawassa Zuria, encompassing Hawassa city. The assessment showed that the sub-sector is dominated by smallholder farmers (91.7%) and micro enterprises (50- 400 chickens). These farms are mainly managed by female farmers (88.3%) holding either local or improved breed chickens.

Challenges in the sesame and soya bean sectors

In the Amhara region an assessment was conducted with the objective of mapping the existing value chain actors of sesame and soya bean, their function, performance, status, strategy/plans, their inter-linkages and governance structure using a gender lens (men, women, youth). The objective was to identify opportunities, constraints, leverage points and mechanisms for improved value chain development. The assessment was done in Norther western part of the regions covering West Armachiho, Jawi, Metema and Quara areas.

The result of the assessment showed that for sesame farmers would like to continue producing sesame as it has high market demand, suitable agroecology for production of the crop, it has long shelf line, it is fast growing, it can be processed for food and they have gotten used to the production mechanism. However, the farmers are faced with challenges such as water logging, high production cost, disease and insects, lack of and high price of inputs (fertilizer, chemicals, improved seeds), lodging due to wind, untimely rain during harvest, shortage and high cost of tractors and labour, declining productivity and crop demanding attention.

In the case of soya producers, the advantages were put as conducive agroecology i.e water logging does not affect soya, lower labour demand for weeding and pesticide use and high productivity especially when compared to the trend in productivity of sesame. The challenges, on the other hand, are shortage and high cost of tractors and threshers, limited access to improved varieties, shortage and high cost of labour, limited access to credit and untimely supply of improved seeds.

While these are issues on the production side, on marketing, smallholders are faced with delay from buyers, local traders setting price instead of competitive pricing of different traders, poor market linkage problem especially for soya, lack of alternative buyers, regulatory challenges sell produce in preferred area and underestimation of quality by buyers for low price. The marketing challenges of medium and large-scale farms are poor market linkages for inputs and outputs, lack of alternative market opportunities, regulation on only selling to buyers in the same kebele, only traders setting price and dropping price for soya bean.

Challenges of the spices, herbs and aromatic crops sectors
A private sector platform meeting was held on spices, herbs and aromatics in collaboration with the Ethiopian Spices Aromatic and Herbs Growers and Processors Association (ESAHGPA). This meeting also served as the general assembly of the association. The leverage points identified by the project for spices validated by participants include 1) production level: low and traditional production and post-harvest handling system, under developed input supply system, low extension coverage and lack of access to finance and technologies 2) processing level: limited value addition/product development, under capacity performance, lack of availability, affordability & quality of some spices/herbs/aromatics and lack of affordable technologies for processing and packaging 3) marketing level: lack of structure (pricing, bulking, contract system….), lack of quality standards, lack of marketing information system and linkage with value chain actors.

Challenges in the pulses and oilseeds sectors
A multi-stakeholder meeting on pulses and oilseeds was held with the objectives to highlight already identified pulses and oilseeds challenges and opportunities and incorporate additional points of entry as well as prioritizing key points to be addresses and the stakeholders to be engaged. The leverage points validated and prioritized by the stakeholders included: low production and productivity along with high cost of production; malfunction in the marketing systems (ECX), an alternative system (contract farming) is planned weak sectoral collaboration and coordination including association; capacity gap in: informed decisions; technology use and marketing; low quality of products caused by poor handling and access to finance (input, machinery, bulking).

A1.3.2 Market linkages created; access to market information improved

Leverage points: (1) increase access to market information (2) design mechanisms for more equal power relationship in value chains

Business model development for the edible oil sector
Business model development for the edible oil sector in Amhara is being conducted. From this, recommendations will be forwarded to the regional government on how to improve the market linkage among supply chain actors. In addition, maximizing youth employment opportunities that would stem from the supply chain and complementary value chains like feed and livestock will be identified. In relation to this, the project has also started work to facilitate market linkages between agri-processors in the region with farmers and primary cooperatives and unions producing soya bean in 2022 and will expect actual trade linkages in 2023.

Supporting contract farming development
The development of the contract farming directive and guideline was facilitated in partnership with the Ministry of Agriculture. Stakeholders from the Ministry of Trade and Regional Integration, Ministry of Industry, Cooperative Commission, private sector and development partners were also involved. The documents are planned to follow the approval of the contract farming policy which is on hold for review by the federal parliament.

A1.3.3 Innovation and technology transfer in subsectors enhanced

Leverage points: (1) increase access to technologies

Profiling of access to finance
An innovation fund was designed with two types of funding alternatives and a fund manual prepared accordingly. The first alternative is for a matching fund of € 25,000 to € 50,000 with a 50% contribution from grantees and € 10,000 to € 25,000 Euro grant with a 25% contribution from grantees. The fund is aimed at boosting private sector participation in piloting sustainable and feasible innovations that can solve challenges in the agricultural sector. These businesses can partner with knowledge institutes, other businesses or organizations for the implementation of the innovative concept. Accordingly, in 2022, a call for application was floated and 57 applications were received. Currently a due diligence visit is being conducted on the shortlisted 15 companies for further short listing. Grant release is due in June of 2023.

Piloting access to finance
An assessment of post-harvest technologies and business model proposition was initiated. In 2022 the ground level situation analysis was done in all three regions. The assessment focused on the priority commodities of the project and what post-harvest practices are done in each, which technologies are there, at what scale and with what drawbacks. The full analysis of what business models can be proposed for the set-ups on the ground will be completed in the first quarter of 2023.

A1.3.4 Access to finance enhanced (inclusive to youth and women)

Leverage points: (1) increase access to finance (2) reduce cost of finance

An assessment on profiling access to finance available for agriculture actors was conducted to highlight which financial organizations provide services and what form of package they have. It covered financial institutions like banks, micro-finance institutes, equity and seed investments and grants and funds from various development organizations.

One activity in progress is a business model on availing financial access that is being piloted in Angot (Amhara region). Micro businesses of ruminant fattening and poultry rearing are being incubated as alternative income sourcing and a partnership with Bisrat Rural Savings and Credit Cooperatives Union (RUSACCO Union) is being fostered. Bisrat RUSACCO will avail a loan set up for these businesses with the arrangement of a revolving the fund once repaid by the current enterprises. The project will deposit a fund amounting to one-third of the required amount for all the businesses and the union would commit the rest two-third and also do the follow up to get the loan paid back. This pilot is expected to give the financial institution the confidence to give out loans to such agricultural businesses at a wider scale while also introducing the approach to the community of the area, especially youth and women.

A1.4 Availability of safe and nutritious foods increased

Outcome statement
At the impact level, the entire RAISE-FS programme seeks to improve nutrition and food security, safety and quality, and thus all project pathways support this goal. However, this section suggests specific activities that are key in demonstrating innovative approaches/practices and policies to increase the availability of, access to and affordability of nutritious foods, and how to best stimulate demand and consumption of these foods and ensure that the focus of RAISE-FS is on increased quality, not only quantity, of foods.

A1.4.1 Increased availability of nutrient-dense food

Leverage points: (1) improve the balance between dietary needs and supply

A scoping study and stakeholder mapping was conducted for the purpose of assessing and documenting the nutrition interventions by various stakeholders, identifying key gaps and informing the nutrition strategy. The findings indicate that various types of Nutrient Sensitive Agriculture (NSA) interventions such as home gardening, promotion of nutrient dense and bio-fortified crops, income generating activities, social behavioural change activities and others were implemented by different organizations. Production and consumption related gaps were identified including sustainability of interventions, often due to challenges in accessing inputs. Based on the mapping, a number of recommendations were developed and were validated with representatives from governmental and non-governmental organization as well as knowledge institutes.

In order for people to consume nutritious food, it must be available either through their own production or locally in the market. To enhance the availability of nutrient dense food, different nutrition sensitive agriculture mechanism were piloted, focusing on both production for own consumption and production for increased incomes, which can be used to improve diets. Agricultural production diversification activities include intercropping nutrient dense crops with cereal crops such as maize-common bean and sorghum with mung bean, demonstration and evaluation of nutrient dense pulse crops such as mung bean, soyabean,

lentil, faba bean as well as validation of iron and zinc biofortified common bean, and validation of nut and oil seeds including sesame and groundnut.

Year-round production and consumption of nutrient dense vegetable home gardening innovation were piloted for household consumption in food insecure and high potential food systems to improve availability of vegetables and fruits (Figure 4). Amaranthus, carrot, Swiss card, head cabbage, Ethiopian kale, beet root, Chinese cabbage, Pak Choi, squash and broccoli are some selected vegetables for home gardening based on agro-ecology and nutritional contribution to the diet. Maradol papaya was also selected in some implementing *woredas*. The preliminary result indicated that host farmers have become familiar with a new food habit, for example including vegetables in their dish which is beneficial to their health.

Additionally, apart for home consumption by adding vegetables and diversifying food, farmers have actually begun selling vegetables and earning income. Approximately 6,000 ETB was generated from the sale of beetroot and carrots and around 3,500 ETB from Swiss chard sales from a garden of 100 m^2 over one year per participating household in Yilmana Densa *woreda*.

According to the nutrition scoping study and stakeholder mapping, access to inputs for home gardening, especially seeds, is a key challenge affecting sustainability of home gardening. To address this challenge shallot and carrot seed production were demonstrated as business models in Haramaya *woreda*. Furthermore, several discussions were conducted with different stakeholders and projects such as the World Vegetable Center.



Figure 4 *Diversified nutrient dense home gardening in Yilmana densa Woreda*

Animal source foods can be important sources of proteins, fats and key micronutrients that are often deficient in diets based mainly on cereals. Availability and affordability are challenges for rural households though. To overcome these challenges, piloting sheep fattening and poultry production as business models were initiated. Effective communication mechanisms for social and behavioural change will be piloted in the coming years to ensure the balance between domestic consumption and sale..

A1.4.2 Increased utilization of safe and nutrient-dense foods

Leverage points: (1) increase access to information and knowledge of a diverse diet (2) enhance knowledge about food handling and sanitation practices

Many agricultural interventions were successful in their ability to increase food production but this does not necessarily lead to improved nutrition, with nutritious crops often sold and nutrient poor crops replacing these. In order to promote the consumption of healthy diet, mixed interpersonal communication and community mobilization approaches were undertaken in areas where home gardening interventions were being promoted. Nutrition education sessions were organized in some *woredas* for host home gardeners (both husbands and wives), DAs, health extension workers and woreda agriculture experts. Furthermore, to

enhance utilization of safe and nutritious food community mobilization activities including field day and cooking demonstration sessions were organized both in the food insecure and high potential food system (Figure 5).



Figure 5 *Cooking demonstration event in Sire woreda*

An effective SBCC approach is based on a comprehensive understanding of the target audiences and the factors that influence specific behaviours – considering barriers and enablers of behaviour change- and using this understanding nutrition SBCC messages, materials and activities were designed and used. Barriers and enablers of soya bean consumption were conducted in the commercial food system in West Armachiho. The result indicated that only 17.9% (N=117) of soybean producers consumed soya bean products and only 12.8% had consumed soya bean in the previous 24 hours. Farmers' perceptions, processing technologies, taste, cooking time, social norms and skills were the key barriers for households' low levels of soybean consumption. FDG findings revealed that soyabeans are considered only as a cash crop, not as a food. One of the respondents reflected: "We produced soybean for sale only, if not sold, it will be wasted". Similarly, "There are farmers of our friends who talk as if it is wild fruit even rats don't want to eat". Provision of training, cooking demonstration, mass media communication and demonstrating processing technologies were recommended to increase soybean consumption.

One of the specific objectives of nutrition scoping study and stakeholder mapping was to identify existing SBCC approaches used by others (e.g., governmental and non-governmental organizations) to increase consumption of a diverse diets. Key channels identified include: Mass media, mobile based communication, advocacy, participatory demonstration and nutrition education through DA and health extension worker. Existing communication materials include the NSA training manual, food recipe compendium, job aids, and pocket guides, which were developed by the MoA. NSA Job aid and pocket guide is prepared in both Amharic and Oromiffa for farmers.

Stakeholder engagement and collaboration include formal and informal collaboration with governmental and non- governmental organization to ensure effective alignment and synergy. Key activities include formal membership and active engagement in the newly established national level nutrition sensitive agriculture forum (NNSAF), this platform will be instrumental to align, synergize efforts and mainstream innovations with relevant stakeholders working on nutrition sensitive agriculture.

To enhance visibility of nutrition and mainstream nutrition implementing partners were provided with a five-day training on NSA (Figure 6) and overview of Ethiopian food based dietary diversity. The training was facilitated jointly with MoA.



Figure 6 *ToT training on NSA and overview of EFBDG*

A1.4.3 The national food safety system is strengthened

Leverage points: (1) increase investment in the food safety regulatory system

To be successful and sustainable, initiatives to improve capacity in national food safety and quality must be based on careful identification, analysis and prioritization of needs. RAISE-FS conducted a food safety system assessment along the five pillars of the food control system (Food control management, Food laws and regulations, Food inspection and certification, Monitoring and surveillance, and Information, Education, Communication and Training) based on FAO/WHO Guidelines. The assessment focused on the priority sub-sectors being poultry, pulses, potato, oil seeds and spices. Key challenges and opportunities for the national food safety system were identified along the five pillars. The study findings were validated with representatives of various stakeholder groups, and recommended actions were suggested as key priorities to address national food safety control system challenges. To further discuss and develop strategies for the national food control system, the attendants have selected a team composed of ten representatives from the various actors present to act as a working group.

An assessment of mycotoxin prevalence and possible risk factors for contamination has been initiated with MSc students from Bahir Dar University, looking at soya bean, red pepper, and sesame value chains. Outcomes of this study can inform the national food safety system by identifying mycotoxin contamination risks and recommending possible risk mitigation mechanisms for future interventions.



Figure 7 *National Food safety system assessment validation and consultative workshop*

A1.5 Enabling environment for system change enhanced

Outcome statement
Through demonstration and providing evidence, enhanced stakeholder collaboration and organizational strengthening, enabling policies are developed and implemented and operational systems are in place for improved performance of selected sectors and cross-cutting issues; thereby, respective food systems are sustainable, inclusive and resilient. This outcome area is an enabler for other outcome areas and key evidence will be generated through the implementation of the different activities in the other outcomes.

A1.5.1 Bottlenecks in policy and its implementation addressed

Leverage points: (1) strengthen operational enabling environment (2) increase linkages between research – producers - consumers

During the reporting periods identification of bottlenecks and selective engagement with the top priority areas was done.

Rapid Food System Appraisal
A Rapid Food System Appraisal (RFSA) is a tool developed by RAISE-FS that provides a diverse and integrated perspective on the current food system situation, key challenges and opportunities in a particular *woreda*. A RFSA is comprised of a sequence of steps that consecutively build on one another (Figure 8). The RSFA was executed in the 9 core woredas (the same as the baseline survey) and carried out by a multidisciplinary team of experts together with the community and relevant stakeholders such as woreda officials, agricultural extension staff (DAs). The gathered insights and information that were documented, processed, analysed and validated by stakeholders both at *kebele* and at *woreda* level. The key product of the RFSA is a woreda food system profile that can be used for addressing the critical issues for food system transformation. The food system profile for Yilmana Densa has been prepared.

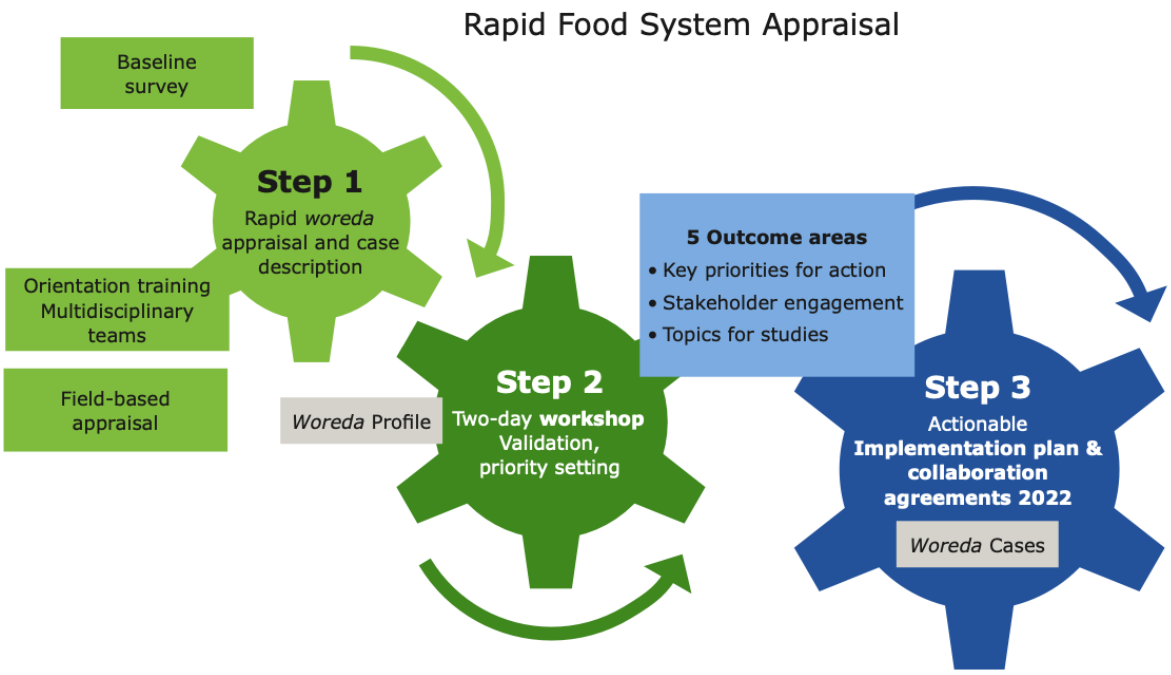


Figure 8 *Overview steps RFSA*

Pluralistic extension
The Ethiopian extension system is characterized as government led and it gives little recognition to other actors which played a critical role in extension service provision. Two staff are members of the national technical committee to prepare a pluralistic extension proclamation and directives. The initiative will open an

enabling environment for the participation of the private sector, NGOs, professional associations, and farmers' organizations in extension service provision.

Seed system

Engagement, together with the Ethio-Netherlands Seed Partnership, in improving the enabling environment for the Ethiopian seed system targeted (i) addressing the seed sector policy issues as lead and member of the National seed advisory group, and (ii) through facilitation of crop specific seed system development. Currently, the policy document on improving the national seed sector coordination has been presented to the MoA and got accepted where there will be a National Seed Sector Steering committee (NSS-SC) and a National Seed Sector-Technical Taskforce (NSS-TTF).

Recognizing the serious challenge facing the potato sector, which is associated with the lack of formal seed system for the potato that can ensure supply of disease-free potato tuber seed, the project initiated stakeholder engagement through a national workshop to discuss the challenges, opportunities, and the way forward. The workshop concluded by agreeing to produce a proceeding and collaborate on key initiatives for clean potato seed production.

One of the neglected commodities in relation to the seed sector development are forage crops that are not covered by the formal seed sector. Accordingly, the project is actively engaged in the national forage seed sector development forum and contributing the policy debates for improvement. In addition, collaboration with the World Vegetable Center is underway to increase the number of cold-season vegetables to be registered in Ethiopia.

Ginger revitalization

Ginger is a game-changer crop in Boloso Bombe. It has played a wider role in the livelihood of farmers, the local economy, and in foreign currency generation. Since the prevalence of the devastating disease ginger bacterial wilt (*Ralstonia solanacearum*) in 2012 the production, productivity, area coverage, export volume, and export earnings from ginger has been decreased significantly. During the first report of the disease complex, many scholars indicated that bacterial wilt disease is the major one, and a control strategy under our farmers' condition wasn't suggested. As a result, farmers were advised to cease the production of ginger until bacterial wilt disease inoculum survival in the soil ends. However, it could not be practical due to the importance of the crop both for producers and other actors in the value chain as means of income. Then farmers continued producing and this condition forced both research and extension to contribute some effort in the control or develop a management strategy for bacterial wilt disease development. Accordingly, many research activities and extension efforts have been conducted by many stakeholders over the last decade. However, the efforts of many stakeholders are not coordinated and remain fragmented. RAISE-FS critically examine the gap and organized a consultative workshop. The workshop maps out the major challenges, existing solutions, and opportunities and develops a joint action plan with the research, bureau of agriculture, NGOs, and private sectors. A core team comprised of members from the research, BoA, NGOs, and the private sector was established to follow up on the joint action plan and to facilitate enabling conditions for ginger revitalization including the following:

- Alignment between different relevant stakeholders,
- Broker knowledge and experience in co-creation,
- Provide leadership,
- Search for resources and mobilize it toward the ginger disease control strategy,
- Finally set policy and strategic issues related to ginger.

Targeting and social inclusion:

A background paper was developed to ensure proper targeting of project participants and promote social inclusion. Given the project's focus on gender and social inclusion, nutrition and healthy diet and food insecure food system self-targeting is not a feasible solution. Therefore, targeting mechanisms that facilitate project accountability, efficiency, and impact are elaborated and ready for implementation.

Contract farming
Together with relevant stakeholders (MoA, ATI), the project has contributed in the design of the draft proclamation on contract farming. As there was a need to develop draft directives that will help in the implementation of the proclamation, the project participated in the drafting the directives.

Bottom-up planning
Piloting of the importance of bottom-up planning was undertaken through development of woreda profiles for the project target woredas. The approach is expected to ensure local level decion making based on clear understanding of local level challenges and opportunities. The methods for woreda profiling will be further refined and developed a tool for scaling.

Ethiopian Food System transformation roadmap
As core team member of Ethiopian food system taskforce, the project has contributed to preparation of Ethiopian food system roadmap (crafted interventions and activities, translated Ethiopian food system roadmap to local language (Amharic)).

A1.5.2 Organizational and institutional capacities strengthened

Leverage points: (1) creation of a functional working group for food system transformation

RAISE-FS organized nutrition-sensitive agriculture and gender and social inclusion training workshops. Participants have gained new knowledge and skills which can help them do activities from the nutrition and social inclusion lenses.

A1.5.3 Collaboration and alignment among stakeholders enhanced

Leverage points: (1) lack of alignment between institutions (2) no intra- and inter sectoral integration

Stakeholder analysis
A stakeholder analysis was conducted to position the RAISE-FS project in the agricultural research for the development landscape of Ethiopia**.** The result indicates that the RAISE-FS project should collaborate with key government line ministries, NGOs, and private sector actors. The two key stakeholders identified for further engagement to ensure project impact and sustainability based on influence and impact include:

a. Implementing partners
The research system actors such as the Ethiopia Institute of Agricultural Research (EIAR) and Regional Agricultural Research Institutes (ARARs) and Higher Learning Institute (HLI) with strong agricultural faculty and research program are rated as the most influential and have strong impact on the project changes and transformation agenda.

b. Collaborating and scaling partners
In this category of stakeholder, the line ministries (MoA, MoTRI, MoWSA, Agriculture Authority, Cooperative Agency, ATI), flagship programs (AGP, PSNP, SLMP, Seqouta Declaration), NGOs (GIZ, SNV, CARE, CGAIR), private sector actors (Regional seed enterprise, EPOSPEA) are identified. Establishing networks and platforms with these stakeholders is critically important to achieve greater impact and ensure sustainability.

The various activities conducted including studies, meetings, validation workshops, and field days, contributed to the collaboration and alignment of stakeholders at different levels. In particular, the annual plan validation workshops, data collection activities, and validation meetings brought together various food system stakeholders at different levels and allowed for discussions.

Collaboration initiative made with two stakeholders in the reporting period. The World Vegetable Center and Selco foundation India partner in Ethiopia called PRECISE. The partnership with WVC grow to an agreement to produce cool-temperature vegetables with a large number of accessions. Selco foundation in India and its partner in Ethiopia (PRECISE) are focused on sustainable energy for inclusive development. They focus on off-grid energy innovation in the agriculture sector with a particular focus on the dairy and poultry sector. We found it relevant for our commercial poultry development in rural areas where power supply is a problem.

Annex 2 Activities per region and food system

A2.1 Amhara

A2.1.1 Food insecure food system – Angot

Overview of activities for 2022 in the food insecure food system and their contribution to the outcomes

Outcome	Potato	Food oat	Poultry & sheep fattening	Year-round vegetable production
Social and economic empowerment			√	√
Sustainable production	√	√	√	√
Sector performance			√	
Safe and nutritious foods	√	√	√	√
Enabling environment				

Participatory technology evaluation of improved potato technologies

Leverage point: to address low productivity, improve agronomic practices, and address the poor-quality local varieties as well as to address food and nutrition insecurity and increasing crop diversity and availability

Farmers (5) to host the demonstration sited were jointly selected with the *woreda* office of agriculture. The farmers' training centre (FTC) also hosted the trial. Agronomic recommendations including fertilizer rate, spacing tillage frequency, etc. were applied equally for each treatment. Farmers planted three improved potato varieties, namely, Belete, Gera, and Shenkola. Research host farmers and development agents were trained in potato production and postharvest handling techniques. The main treatments used were: site selection, land preparation, planting, field management, and follow-up on 10m*10m plots.

Due to frost during the flowering stage the trials were not successful. The lesson here should be that there are mechanisms to avoid these natural hazards, considering farmers' experience, especially in adjusting planting time, and early maturing seed varieties are recommended as possible corrective actions for the upcoming implementation period.

Participatory technology evaluation of improved food oat technologies

Leverage point: there is a lack of improved varieties for food diversity and the area has acidic soil which is considered suitable for the production of food oat in addition to the benefits of crop diversity for food and nutrition security

Participatory technology evaluation (PTE) of improved food oat technologies basic treatments have been done, mainly three newly released food oat varieties (Tena, Hulegeb, Surafeta) were selected and tested, using randomized blocks designed on 6 farmers' plots, and 3 FTC fields; while farmers used as replications. The plot size was 8m x 8m with 40 rows, 0.2m spacing between rows, and 1m between plots. For oat PTE, 100 kg/ha seed rate and recommended fertilizer were used. Nitrogen was applied as split; half of the recommendation at planting and the remaining was during the tailoring stage. Phosphorus fertilizer was applied while planting.

However, other activities such as data recording on days to heading and maturity, 1000 kernels weight (g), plant height (cm), panicle length, dry straw and grain yield (kg ha^{-1}), diseases severity and reaction (rust

and blotch), hectolitre weight (kg hL^{-1}), and results/findings, statistical analyses-report activities have not been carried out due to failure of the PTE-trials due to frost.

The learning from this trial is running the activity by re-scheduling planting time, selecting early mature varieties, and following farmers' calendars, especially for planting time.

Demonstration of poultry and Awassi sheep-fattening business model

Leverage point: to create job opportunities for youths and women, improve access to nutrition and increase access to income for the household

In 2022, it was planned to demonstrate a viable business model for youth and women job creation and diversifying both food and income sources, focusing on two activities- poultry and sheep fattening. The sheep fattening activity involved 12 farmers of which 5 women while the poultry activity involved 20 farmers (3 men and 17 women). These activities started late due to different reasons, the security issue being the main one. The activities designed included the facilitation of access to credit services for the selected farmers.

Thus far some progress has been made. The selected farmers who were not members of saving and credit cooperatives have been linked with the cooperatives and become members so that it will ease the credit process. For the Awassi sheep fattening activity selected farmers have produced and harvested feed oat with technical support from researchers and development agents. The farmers were also trained on husbandry practices and built barns from local materials.

Most farmers selected for the poultry activity constructed poultry houses and have been linked to RUSACOs to be registered as members. They have been trained in techniques of poultry production, housing, feeding, and health management. At present, farmers are waiting for the financial linkage.

Various financial organisations have been approached to facilitate a guarantee fund activity. Bisrat RUSACOs, situated in Woldia town, has a number of primary saving and credit cooperatives in the *kebeles* of the intervention *woreda* and is willing to collaborate.

Both activities have not yet been fully implemented because of the long process to have access to finance and therefore be transferred to be implemented in 2023 using a guarantee fund scheme. At present, a contract agreement has been drafted and it will be signed soon.

Improved year-round vegetable production

Leverage point: to improve nutrition and dietary diversity for households and increase access to income for women

Improved year-round vegetable production has been initiated, vegetable crops including head cabbage, beetroot, carrot, Ethiopian kale (*Ayderkie*), and Swiss chard were selected for demonstration purposes. Thirty women and 10 men farmers were selected and trained on seedling raising, bed making, keyhole gardening, and vegetable production techniques. Farmers were also shown how to use farmyard manure as fertilizer, and low-cost water harvesting mechanisms like the collection of runoffs, rainwater, roof water harvesting, etc.

This activity started a little later than expected. Currently, seedlings for three different types of vegetables have been produced by 20 farmers from two *kebeles* and are prepared for distribution to their home gardens during the upcoming *belg* session, this hopefully avoiding frost.

A2.1.2 High potential food system - Yilmana Densa

Overview of activities for 2022 in the high potential food system and their contribution to the outcomes

Outcome	Soil fertility teff	Disease-free seed potatoes	Ware and seed potato storage	Year-round vegetable production
Social and economic empowerment				√
Sustainable production	√	√	√	√
Sector performance	√	√	√	
Safe and nutritious foods				√
Enabling environment				

Validation of integrated soil fertility management innovations for sustainable teff production

Leverage point: to improve soil nutrition, counterbalance low soil fertility & health and sustainable production of teff

One of the activities is the validation of integrated soil fertility management for sustainable teff production. This activity was initiated because of the depilation of soil health and the difficulty to cope with globally unstable fertilizer supply and cost increment which resulted in the reduction of the productivity of the crop. The specific focus is on assessing the feasibility of vermiculture as a business activity to ensure the sustainable supply of organic vermicompost. The trial has been conducted on three farmers' sites, of which two on nitisols and one on vertosols.

The treatments were: i) control (with no input), ii) 100%R-N + R-phosphorus, iii) 50% Organic (Vermicompost) fertilizer + 50% R-N + R-phosphorus, and iv) 100% Organic (vermicompost) fertilizer + R-phosphorus. The amount of vermicompost was determined based on the equivalence ratio from recommended nitrogen fertilizer. Phosphorus fertilizer was applied uniformly at all treatments except the control treatment. The experimental design was a simple plot design with a plot size of 8m x 10m. Washera teff variety was used as a test crop. Vermicompost, urea, and triple superphosphate were used as a source of nitrogen and phosphorus fertilizers. Nitrogen was applied in split, one half at planting and the other half after 35 days of transplanting. All recommended improved management practices, including weeding and fertilization, were applied as planned.

In the process, a training session was organised for 20 farmers (16 men and 4 women) and attended by staff from the research and *woreda* office of agriculture. Trainees visited demonstration of vermicompost preparation. In the training, all aspects of composting and utilization were addressed. It was also emphasised that organic matter added to the soil through tillage has a positive effect on the physical, chemical and biological properties of the soil, and improves soil structure, increases pore space and increases the water-holding capacity of the soil. A farmer field day was organised to demonstrate the performance of teff through the use of vermicomposting. The field day created an opportunity for farmers to share information observe performance and explain technological attributes.

The result showed that the integrated nutrient application approach had a positive effect on teff production, in contrast to applying nutrients from one source. Applications of inorganic and organic nutrient sources either alone or in combination had a significant effect on grain yield, biomass yield, plant height, and panicle length of teff.

Validation of productivity gains of disease-free seed potatoes for income generation

Leverage point: to increase production of potato through supply of disease free planting material and create economic opportunities through marketing of seed potato and storage

This activity was planned to validate and generate evidence of productivity gains from using clean, disease-free potato planting materials so that farmers would be aware and demand clean seed tubers. The trial was carried out in four farmers' plots, two on disease-free plots and the other two farmers' plots, which were infected by bacterial wilt or one-year crop rotation (at one *kebele*). Seed potatoes used were 1st generation Belete variety, a local variety and Belete variety unknown generation bought from the local market. All agronomic practices were conducted according to research recommendations.

A training, which includes both theoretical and practical aspects of potato production technologies (agronomic practice, bacterial wilt management, late blight control, postharvest management), was organised for 30 farmers of which 10 were women, in Dabal *kebele*.

The result shows that the average yield harvested from clean Belete seed was 40 t/ha, which is 63.3% over the local variety and 90.5% over the locally sourced Belete variety. The local variety yield is 24.5 t/ha while the locally sourced Belete yielded 21 t/ha. The results also show that clean seeds of Belete variety planted at bacterial wilt-infected fields produced higher unmarketable tuber yield than marketable yield. This indicates that planting clean seeds on disease-free or rotated fields can produce higher and quality tuber yield. In addition, planting old or bacterial wilt-infected seeds on disease-free farms/fields produced low quality or 69.5% bacterial wilt-infected and low tuber yield. Farmer's local varieties planted on rotated or disease-free fields showed a low yield (23.45) than the yield (35.98 t/ha) of clean improved Belete variety G1 seed planted. This demonstration of farmers-based improved potato seed production has shown the functioning of an enhanced seed supply chain for high-potential food systems.

In the efforts made to improve the production and productivity of potato by improving the potato seed tuber supply, attempts have been made to empower private potato seed producers in Yilmana Densa *woreda*. To this end, 100 selected farmers have been engaged in clean seed potato production. About 28,000 disease-free seed potatoes were delivered to these farmers and all farmers planted the given tubers. For the effective implementation of this activity, pathologists, agronomists, and breeders from Adet ARC provided intensive training for farmers, development agents, and *woreda* experts in potato seed production technologies. The training focused on site selection, land preparation, soil fertilization, seeding rate, and post-harvest management of potato. Technical advice has been given to the selected farmers. Farmers followed the recommended management practices such as weeding, hoeing, earthling up, fertilization, and chemical spray. It is expected that 100,000 G3 improved seeds can be produced to be used for the next planting season.

This activity though not yet completed familiarized farmers with improved agricultural technologies including improved variety and good agronomic practices. When completed it contributes to the efforts made to address the shortage of improved potato varieties.

The other planned activity which can increase farmers' income through the use of innovations is the demonstration of mini screen houses for disease-free seed potato production. For this activity, the materials for the construction of mini screen houses have been purchased and thus far two mini screen houses (4m x 3m) have already been constructed on two farms, the remaining two still need to be constructed. This activity is still in its initial stage and difficult to talk about the technology transfer and its scalability at this stage.

Validation of ware and seed potato storage management

Leverage point: to overcome post-harvest losses of both seed and ware potatoes

In the efforts made to reduce the post-harvest loss of potato, improving the quality of the product by introducing storage facilities and practices and thereby increase market access for smallholder farmers,

validation of ware and seed potato storage management activity have been carried out. It was planned to construct eight ware and seed potato improved storage but this has yet to be completed. For this year, farmers were advised to store their products using the traditional storage practice, without mixing them with other varieties.

Demonstration of year-round production and consumption of home garden vegetables

Leverage point: to improve nutrition and dietary diversity for households and increase access to income for women

Demonstration of year-round production and consumption of home garden vegetables has been done in two *kebeles*. A total of 20 (11 men and 9 women) farmers have produced vegetables in 10m x 10m plots in their backyards. In the process of implementing this activity, a training session was organised for the 20 farmers and 16 other participants from *woreda* office of agriculture, Adet ARC, and other stakeholders. The training focused on improved vegetable production practices which includes land preparation, seedling raising, water management, pest and disease control, etc. Trainees were also informed about the importance of diversifying their food by consuming vegetables.

Field days have also been organised for a total number of 86 participants of which 40 farmers (31 male and 9 women farmers) and 42 professionals from different stakeholders including the *woreda* office of agriculture, Adet ARC, Woramit Sub-centre, and ARARI. During the field day, participants discussed challenges related to seed, the importance of giving attention to not only production but also to consumption of vegetables, food diversity, vegetable marketing, and scaling of the activity.

Though it is on a small scale, from farmers' reactions it was learned that this activity contributes to the increased availability of nutrient-dense vegetables. In particular, the introduction of Swiss Chard, which can be harvested year-round, increased the availability of vegetables for host farmers throughout the year.

Farmers said they like the activities that they do at their home garden as they have started to earn additional income other than their main agricultural activities. Mr. Aynalem Mekonnen from Adet Zuria *kebele* stated that his wife does almost all the activities in the vegetable garden. "…. I sometimes advise her and support her in activities such as applying compost. She earns some money from the sale of the vegetable produces, which she uses to purchase onions, potato, oil and salt."

Mr. Minibel Alemu and Mrs. Emye Asnakew are a married couple who lives in kililit *kebele* and work together in their home garden. This year, they cultivated carrot, sweet chard, beetroot and cabbage in their garden with the support of horticulturists from Woramit sub-centre. "I found sweet chard very interesting." Mrs Emye said. "We have tested it and we found it to be quite nice. Our kids also enjoyed it. We would like to have access to these seed sources."

Mr. Minibel for his part said they used to grow vegetables in a very conventional way, but they are now experimenting with new vegetable crops, that can be harvested all year round. He added that they had limited experience in consuming them but his family now tried the new vegetables and they found them nice.

A2.1.3 Commercial food system - West Armachiho

Overview of activities for 2022 in the commercial food system and their contribution to the outcomes

Outcome	Sesame & soya bean varieties	Seed supply	Sesame & soya bean VC analysis	Soya bean consumption
Social and economic empowerment			√	√
Sustainable production	√	√	√	
Sector performance	√	√	√	
Safe and nutritious foods				√
Enabling environment		√	√	

Participatory technology evaluation of sesame and soya bean

Leverage point: to address crop productivity and marketability

In order to provide farmers with options for improved sesame and soybean technologies, participatory technology evaluation (PTE) was carried out in three *kebeles*, namely Terefework, Abrhajira and Midregenet. Improved agricultural practices including land preparation, seed rate 4 kg ha^{-1}, row planting (40 cm between rows and 10 cm between plants), fertilizer application (121 kg NPS + 80 kg urea), thinning during the first weeding, four times weeding, harvesting (when the colour of 2/3 of plants changed into yellow) drying on a levelled high spot, not more than two weeks, threshing near the drying site were used.

For sesame PTE six varieties, namely Obsa, Gondar 1, Abasena, Setite 1, HuARC 4 and the local variety called Gondar Doyo were used. A pairwise ranking was applied and the selection criteria selected by farmers weighted disease resistance, early maturity, number of pods per plant, branch and height as the most important parameters for sesame variety selection.

Following this process farmers selected Setit-1 as their first choice and HuARC 4 as the second. The yield data also shows that the Setit 1 variety yielded 881.2 kg ha^{-1}. This shows that the farmers' preference and the biological yield of the varieties were correlated. Setite 1 variety has shown a 28.4% (250 kg ha^{-1}) yield advantage over the other varieties. In conclusion, the demonstration of sesame variety coupled with improved production practices resulted in an increases productivity of Setit-1 variety by 28.4% over the local production system and can be scaled up.

Similarly, the soya bean PTE was conducted in three *kebeles* where three varieties, namely Gishama, Afgat, and Pawe 03 were used with and without the recommended biofertilizer (*Rhizobium* sp.). 500 gram ha^{-1} of SB-12 biofertilizer and 50 kg ha^{-1} of NPS (Nitrogen – Phosphorous – Sulphate) fertilizer were applied for the treatments. This activity was conducted on five farmers' sites, each plot measuring 10m x 10m. All improved agronomic practices such as tillage (2-3 times), seed rate (65 kg ha^{-1}), spacing (60 cm between rows and 10 cm between plants), weeding (1-2 times), and disease and pest management were applied based on the recommendation.

Training was given to participant farmers about soya bean production, crop protection, and crop management practices. Farmer research extension group (FREG) was established and member farmers participated in the evaluation process starting from the planning activities, conducting on-farm trials, evaluating the trials, and providing feedback on the overall process. FREG members evaluated the technologies based on their own selection criteria. The criteria they set were plant height, number of pods per plant, branch number, maturity date, and strength of the stalk.

Based on the performance in the field, FREG members evaluated the varieties, and Afgat and Gishama varieties with biofertilizer scored higher results in Terefework 02 *kebele*, while in Midregenet 02 the same varieties without biofertilizer were given higher scores. Pawe 03 with (1900 kg ha^{-1}) and without biofertilizer (1,584 kg ha^{-1}) gave the lowest yields. The yield data shows that Afgat with biofertilizer gave the highest yield (2,620 kg ha^{-1}) and Afgat without biofertilizer (2,440 kg ha^{-1}) and Gishama with biofertilizer (2,280 kg ha^{-1}) become the second and third, respectively.

Finally, a marginal rate of return (MRR) was made; by dominance analysis Afgat with biofertilizer had 120% MRR, this implies that one ETB increase in the improved technologies (use biofertilizer for Afgat variety), earns an additional 1.20 ETB after paying the input costs. Also, sensitivity analysis was made; it was calculated at 20% input cost increment and output decrement showing that the MMR for Afgat with biofertilizer was 63%. In case the input cost and labour cost increase by 20% and the price of output decreases by 20%, the use of Afgat with biofertilizer technology can still be profitable. In conclusion, Afgat with biofertilizer gives a better yield advantage than other treatments. Even without the application of biofertilizer Afgat gives better yield than the other varieties. The application of biofertilizer and NPS technologies in Afgat variety can be further scaled out for the potential areas of West Armachiho *woredas*. The activity also shows that farmers' participation plays an important role in the research and development process.

Table 3 *Farmer preference of sesame varieties*

Criteria	Variety					
	Obsa	Gondar-1	Abasena	Setit-1	HUARC-4	Local
No of pod/plant	2	3	3	4	4	2
Branch	2	2	3	4	3	2
Height	3	3	3	5	3	1
Earliness	3	3	2	3	3	1
Disease resistance	2	2	3	5	3	1
Mean	2.4	2.6	2.8	4.2	3.2	1.4
Rank				1	2	

The table above shows the farmer preference for sesame improved variety. Based on this the variety Setit-1 is the first variety selected by farmers and the HUARC-4 was selected secondly.

Innovations for quality seed supply system of sesame, soya bean and sunflower

Leverage point: to address crop productivity and marketability

A study has been conducted to facilitate the quality assurance and certification process of Early Generation Seed (EGS), cooperative, and commercial farmer-produced seeds, as well as to maintain and make available high-quality and genetically pure seeds of sesame, soybean, and sunflower for producers.

Field inspections were made following the minimum standard of the Ethiopian Seed Quality Standard Agency (ES, 2016). It was done before planting for checking crop rotation, land suitability, and preparation. At the vegetative stage inspection was made to check isolation distance, uniformity, field performance, disease and weed; at the flowering stage to check the maturity flower colour, uniformity in height, uniformity in maturity, disease and weed, and variety uniformity. The harvesting, threshing and transportation times were inspected by the internal quality control team. The vegetative, flowering, maturity and harvesting stage of the crop was checked by ANRS Agricultural Quality & Safety Authority Gondar Branch as an external quality control. Laboratory inspection will be done as soon as the seed cleaning is completed by both internal and external controlling bodies to examine physical purity, physiological purity, and seed health.

A feasibility study has been conducted on research, seed producers' cooperatives and commercial seed producer farmers' fields to explore the potential and profitability of growing improved seed, assess the existing seed demand forecasting process, and develop a technical road map that details approaches and possible technical ways. Data were collected from 281 households using a questionnaire. All costs and income have been recorded; awareness and perception of farmers in quality seed production have been assessed. The study has not yet been concluded. The next step is to gather additional data using key informant interviews. (KIIs).

The Ethiopian seed system is very poor and the formal seed system is working only on very few crop commodities. In particular, commercial commodities like sesame, soybean, and sunflower have no formal seed system. In order to support and strengthen the informal seed system with the establishment of a community-based quality declared seed system early generation seed (EGS) multiplication of improved varieties of sesame, sunflower and soybean variety was conducted.

Pre basic, basic and certified seeds of recognized improved sesame varieties (Humera1 and Setit 1), soybean varieties (Afgat and Gishama), and sunflower variety (Oissa) were planted at Gondar Agricultural Research Centre's stations in 2022 main cropping season and all agronomic practices were implemented well as the recommendations. The aforementioned varieties were planted on a total of 12 ha of land.

The seeds of all varieties were harvested, threshed, and transported to Gondar ARC and the remaining activities (cleaning, quality testing, packing, levelling, and storing) will be implemented according to the time scheduled. The yield from this activity will be used for the community-based seed business and production of improved seeds with commercial private farms in 2023.

Sesame and soya bean gender responsive value chain analysis

Leverage point: to assess the in/exclusivity of sesame and soya bean value chains

This activity was designed with the objective of mapping oil crops value chain actors, their function, performance, status, strategy/plans, and their inter-linkages and governance structure with the gender lenses (men, women, youth); identify opportunities, constraints; and leverage points/mechanisms for improved value chain development; establishing an innovation platform for engaging stakeholders in addressing identified leverage points.

Primary and secondary data were collected from the various actors of the value chain including main actors, supporters, and enablers. Information from secondary sources is being reviewed so as to understand and generate relevant evidence related to the overall oil crops value chain at regional, national, and international levels. To analyze the data, Porter's Diamond model and gender and youth-focused guiding questions on the FGD and KII tools have been used.

Though the analysis and write-up of the report have not yet been completed the preliminary findings show the opportunities and challenges in the production, marketing, and input supply.

Producers – Opportunities

Sesame	Soya bean
• The environment (the soil, the temperature) is suitable for production • There is a very high market demand • Long shelf-life of the crop unless exposed to moisture • Sesame is fast growing and early maturing (within three months) • Culture of production is there • Sesame can be used for food (ease of processing	• Suitable environmental conditions (the soil is waterlogging and is convenient for producing it) • Convenient climate (adapted to high rainfall conditions than sesame) • High productivity • The crop demands relatively low labour for weeding than others (associated lower labour cost for weeding). • Less cost for pesticide as it is not as sensitive to pest attack unlike sesame • Since sesame productivity is decreasing, it is a substitute crop for sesame

Producers - Challenges

Sesame	Soyabean
• High cost of production • Prone to high rainfall; water-logging • Becoming prone to diseases and insects • Lack of inputs (like fertilizer, improved seed, chemicals) and the high price of inputs • Untimely rainfall (during harvest time) due to climate change • Wind problem • Termites • Shortage and high rental cost of tractor • Shortage and high cost of labour • Needs close care and follow-up • From year to year decrease in productivity	• Shortage and high rental cost of tractors • Shortage and high rental cost of threshing machine "Degaga" • Unavailability of an improved variety of seed • Mix up of seeds of different varieties • Shortage and the high price of fertilizers • High labour demand and shortage of supply of labour and high cost of labour for harvesting and collecting the crop; • Prone to drought • Limited access to credit and also inconvenient time of repayment of the loan (for both) • Limited supply of improved seed and delay in supply (for both)

Marketing - Challenges

Smallholder producers	Medium and large-scale Producers
• Burys are not coming timely (immediately) at the time of production to sell the products so as to repay borrowed money for production • Collusion of traders in price setting (local traders alone decide the market price) • Producers do not have a role in price setting • Poor market linkage problem mainly for soya bean • Low market demand and relatively low price for soya bean • Few numbers of buyers, lack of alternative buyers • Smallholder farmers are not allowed to take and sell their products anywhere they want • Buyers underestimate the quality of produces so as to set low price.	• Poor market linkage for inputs and outputs • Market restriction, lack of alternative market opportunities • Selling to other alternative markets is not possible (forbidden) • Sales are possible only for buyers found in the *kebele* • Traders alone set the price of the product (collusive pricing) • Poor market linkage for inputs and outputs • Poor access to agricultural inputs and low prices of products like soya bean • Poor access to agricultural inputs and low prices of products like soya bean

Major problems faced in input supply for both sesame and soya bean from the input supplier side are low attention given to improved seed production, land shortage for seed production, limited access to credit, limited access to chemicals and seed users' limited awareness

Barriers and enablers for soya bean consumption

In order to identify the barriers and enablers of soybean consumption, a barrier analysis study was conducted in West Armachiho Woreda. A cross-sectional study was conducted in Midregenet 02, Abrrhajira 02, and Terefework 02 *kebeles*. The data for the study was collected using focus group discussions. The analysis of the study was made and the first draft report write-up was completed.

The findings recommended ongoing activities for 2023.

Barrier analysis of soya bean consumption

Responses from the study	Determinant	Bridge to Activity
Farmers don't know about any nutritional advantages and disadvantages of consuming soybean	Perceived consequences	Raise awareness about the nutritional contribution of soybean
Peer farmers discourage consumption of soybean	Perceived social norms	Conduct mass awareness activities via media or using social gathering points
None-convenient taste and longer cooking-time	Perceived self-efficacy	Design and demonstrate processing technologies that would improve flavour and reduce cooking-time
Difficult to mill due to its oily substance	Perceived self-efficacy	Design and demonstrate appropriate technology
Lack of knowledge and skills on how to prepare meals from soybean	Perceived self-efficacy	Raise awareness and conduct cooking demonstrations
Farmers don't know whether they may become malnourished if they don't eat soybean	Perceived susceptibility	Raise awareness about what nutrients (nutritional benefits) soybean contributes to the body
Farmers don't know the seriousness of becoming malnourished	Perceived susceptibility	Raise awareness about how serious is the effect of becoming malnourished to one's health and productive capacity

A2.2 Oromia

A2.2.1 Food insecure food system – Babile, Haramaya & Sire

Overview of activities for 2022 in the food insecure food system and their contribution to the outcomes

	Babile		Haramaya		Sire		Babile, Harmaya, Sire
Outcome	**Groundnut**	**Sorghum – Mung Bean Intercropping**	**Inter- and relay cropping**	**Vegetable seed production**	**Common bean**	**Mung bean**	**Year-round vegetable production**
Social and economic empowerment	√	√	√	√			√
Sustainable production	√	√	√	√	√	√	√
Sector performance				√			
Safe and nutritious foods	√	√	√		√	√	√
Enabling environment	√						

One Qindi' Package of Groundnut Integrated Technology Validation (Babile)

Leverage point: to address land degradation and nutrient depletion, as well as lack of standardized package for smallholders with small land sizes, and little or no fertilizer use for the crop

This trial validated one qindi (one-eighth of a hectare) groundnut production packages (seed rate and fertilizer rates) for Hararghe context specific recommendations so as to ensure the farmers access to improved technologies in small packages including women and youths. This trial was conducted inBishan Babile *kebele* on five farmers (2 men, 2 women and 1 female youth) fields. An improved groundnut variety Werer-961 was used as a test crop and there were two treatments which were consisted of local c.q. farmers' management practices and integrated fertilizer use (OQP; i.e 50% recommended NPS plus 2.5 t ha^{-1} farm yard manure). The gross plot size was 625 m^2 for each treatment.

The result showed that the groundnut variety (Were-961) along with integrated soil fertility management (IFSM) practice showed higher yield over farmers practices. ISFM gave a grain yield up to 28.2% advantage over the farmer's practice (2.7 t ha^{-1} vs 2.3 t ha^{-1}). Besides, the economic analysis showed also a profitability of the tested practice over the local farmers practices (the profit per hectare gained from IFSM and farmer's practice was 41,440 ETB ha^{-1} and 28,980 ETB ha^{-1} respectively based on 300 ETB as farm gate price for a ton of unshelled groundnut. The major selection criteria and traits used by farmers were yield performance, cost-effectiveness, and the potential for soil fertility improvement. Based on the discussions with farmers during technology selection, both man and woman farmers selected the improved practice over the local practice because of its high yield advantage, soil fertility and cost-effectiveness. Therefore, groundnut variety, Werer-962 along with 50% recommended inorganic fertilizer and 2.5 t organic fertilizer ha^{-1} is recommended for scaling up in collaboration with scaling up partners.

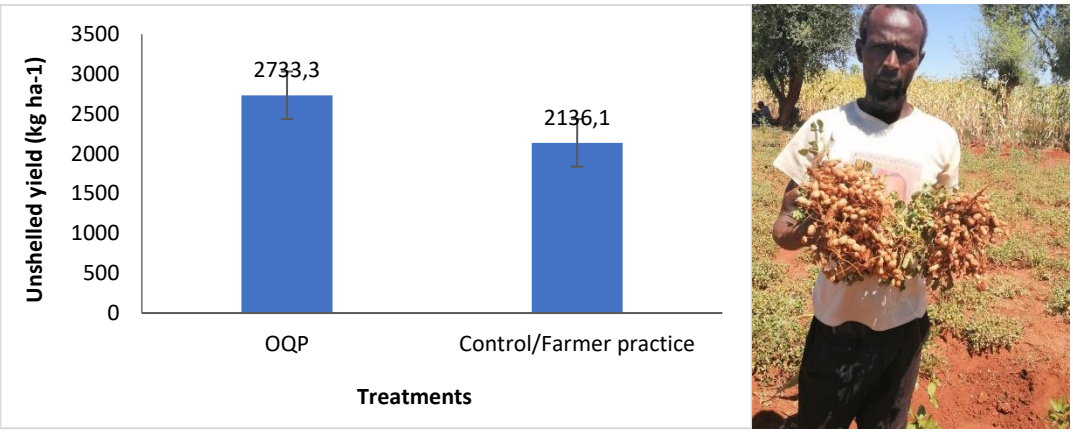


Figure 9 *One Qindi' Package of Groundnut Integrated Technology Validation (Babile)*

Demonstration of mung bean technologies (Sire)

Leverage point: to improve nutrition and dietary diversity for households

Initially, the activity was planned to conduct at two *woredas* viz. Sire and Dodota, however, the experiment at Dodota *woreda* was not satisfactory as the trial faced high drought stress. Relatively, at Sire, this stress was better as compared to Dodota and hence necessary data were collected from some experimental sites. Two improved mung bean varieties (N-26 and NV-L) were demonstrated and evaluated; 4 famers hosted the experiment (three men and one woman farmer). Besides, one experimental site was set up on FTC where many farmers had the opportunity to visit the trial. A field day was not organized as the crop matured and farmers (31 of which 19 were women) participated in training of mung bean production and cooking demonstration of recipes.

Promotion of Sorghum-Mung Bean Intercropping in Sorghum-Based Cropping System (Babile)

Leverage point: to address the food gap, food diversification, overcome striga infestation and increase income

The trial was conducted on farmers' fields in Bishan Babile *kebele*. A total of 20 farmers (14 of which are men and 6 were young men and women) were engaged in the activity. One sorghum variety (Melkam) and one mung-bean variety (N-26) were used. The two treatments were the intercropping of Melkam sorghum variety with N-26 mung bean variety and the farmers' practice i.e sole sorghum production. The plot size of each treatment was 40mx30m.

The result showed that sorghum variety (Melkam) intercropped with mung-bean variety (N-26) gave better yield as compared to the farmers practice. The intercropping of maize with mung bean gave up to 22.3% yield advantage over the farmer's practice (2.5 t ha^{-1} vs 2.1 t ha^{-1}). The mung bean matured quite early (in less than 90 days). The farmers harvested the mung bean and used this for consumption before the data were taken and thus, the yield of mung bean was not considered in this treatment comparison. If the yield of mung bean in the intercropping treatment is considered, the overall advantage of the maize intercropping significantly surpasses that of sole cropping (farmers practices). Besides, the advantage of soil fertility improvement from mung bean intercropping was also one advantage as compared to sole sorghum production even though the soil fertility improvement from mung bean intercropped field has not been quantified. Different research conducted across locations indicated that, practicing intercropping with legumes including mung bean improves the nutrient resources and subsequently improve the growth performance of both companion crops particularly in areas such as Eastern Hararghe zone which is known as low-input farming systems. Thus, it is assumed that, mung bean intercropped with sorghum improve soil fertility and considered as one advantage that can be gained from this intercropping practices/experiment. Besides, farmers appreciated the recipes prepared from the mung bean. Additionally, mung bean is recognized as one of the resilient crops that withstands low moisture stress in areas such as Babile where frequent and recurrent drought is common in the *woreda*.

Overall, the opinion of the farmers on technology preference was collected from participants during technology demonstration. The major criteria & traits used by farmers for sorghum variety evaluation were yield, and early maturity and drought tolerance. Based on the discussion, both men and women farmers selected the improved practice (intercropping) over the local practice or sole planting, because of its high yielding ability, soil fertility (legume component), economic return, early maturity, and reducing risk of crop failure.

The sorghum variety Melkame was highly preferred by the farmers, DAs and *woreda* and zone experts during a field day and hence, this variety is selected for piloting scaling up by 2023 in collaboration with scaling partners.

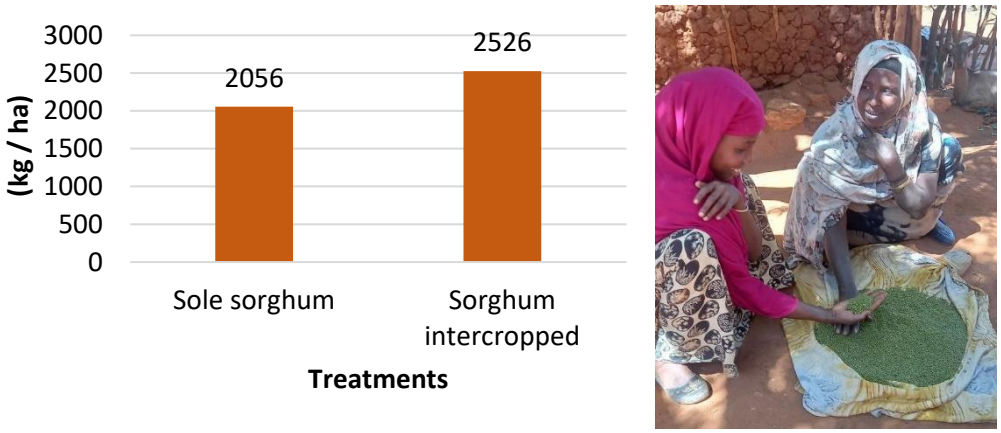


Figure 10 *Yield performance of Sorghum (left) and Grain of mung bean harvested from sorghum mung bean intercropping while observed by women farmers (right)*

Participatory common bean variety evaluation (Sire)

Leverage point: to improve nutrition and dietary diversity

Six improved common bean varieties viz. SER-119, SER-125, SAB-632, KATB-1, Awash 2 and Awash mitin were demonstrated and evaluated on 3 farmers' field, on one FTC and on MARC research station. Each variety was planted on 5mx5 m plot.

Even though the yield potential of varieties were not expressed fully due to the late planting and drought encountered during the growing season, variation among the varieties were visible to make selection among the test varieties under such stress. 14 farmers were invited to participatory variety selection based on their set criteria. These criteria include high pod load, seed color, disease resistance, good stand, grain yield and marketability. There were no selection criteria differences among men and women farmers in this participatory variety selection. It was found that, there were no differences in farmers selection criteria in terms of gender difference. The varieties included were of different colours, seed sizes and market types. Accordingly, speckled type SAB-632 variety was preferred because of its colour, red type SER-119 & SER-125 varieties were also preferred because of pod load and white type Awash-2 variety was preferred for the market.

Intercropping of maize/sorghum with common beans followed by relay cropping of chickpea for food and nutrition security (Haramaya)

Leverage point: to improve production, crop diversification and nutrition

The trial was conducted on 32 farmers' (21 men and 11 women, of which 14 farmers were youth, 10 men and 4 women) fields in Haramaya *woreda* in two *kebeles* (Korke and Kuro Jalala *kebeles*) during the 2022 cropping season. One Maize variety (Melkassa-2) intercropped with three different common bean varieties

(Dursitu, Tinike, and Babile), these treatments were tested against farmer's practice (i.e sole maize cropping) on a plot size of 625 m^2 per farmer.

The farmers evaluated the technology and positively assessed the high potential of maize-bean intercropping for enhancing overall productivity, profitability and nutritional benefits through diet diversification e.g. early harvest of the common bean component, and minimized risks associated with crop failure. Among the three common bean varieties evaluated, variety Babile and Dursitu were preferred by the farmers for intercropping while, variety Tinike (third variety) was rejected as it tends to climb on maize. Moreover, farmers have witnessed that intercropping of compatible crop varieties can be even more advantageous over sole cropping when planted on time (in good rainfall seasons).

Overall, in this experiment, compatible common bean variety that match with Melkassa-2 maize variety for intercropping was identified. The result showed that the yield obtained from maize in maize-common bean intercropping is higher than that of the maize sole cropping. The recurrent drought encountered during the season negatively affected to clearly see the advantage of intercropping as the current yields obtained were below the potential of the crops.

Seed production of improved shallot (Huruta variety) and carrot (Haramaya-1 variety) (Haramaya)

Leverage point: to create income generation opportunities for women and youth, seed production and supply and crop diversification

The activity was started in 2022 and is ongoing in two *kebeles* (Kuro Jalala and Haro Adi) of Haramaya *woreda*. Improved Huruta shallot variety and Haramaya-1 carrot varieties were used.

The first phase (bulb production for shallot and root production for carrot) was completed in this season. Currently, the bulbs were planted for seed production and transplanting of the seedlings for the final phase of seed production is underway. Similarly, for carrot, the roots were planted for seed production and transplanting of the seedlings for the final phase of seed production is underway. The plot size used for both crops was 20 m x 25 m.

The next steps are training the farmers and stakeholders (unions, agriculture experts, and DAs), and facilitate linkage with micro finance and facilitate how they work together on guarantee fund and develop a business model. About 20 farmers are involved as host farmers of which 12 men and 8 women with 7 being youth (5 men, 2 women

Promotion of home garden vegetables for year-round production and consumption of a diverse and nutritious foods (Babile, Haramaya, & Sire)

Leverage point: to improve nutrition and dietary diversity for households and increase access to income for women

This project activity is initiated with objectives to demonstrate integrated home garden technology to enhance year-round production of diversified nutritious vegetables at the household level, and to improve household level nutritional knowledge and utilization of safe diversified and nutrient dense foods. This activity was conducted in four *woredas*.

The participants were selected based on criteria such as availability of water sources, lands, and willingness to participate, also considering inclusiveness of women and youths. Besides, vegetable crops selections are made based on nutritional value, suitability of the vegetable in the agro-ecology, ease of production and management using family resources and availability of seeds/planting materials. This demonstration of home gardening of vegetables is started with a target to promote gender sensitive vegetable production approach where both male and female households were purposely selected.

This activity was commenced late in the season (December, 2022) as such only few activities were implemented so far. These include identification of *kebeles* per *woreda*, identification of host farmers per *kebele* with active engagement of the *kebele* DAs and *woreda* expert, distribution of vegetable seeds ((i.e., squash, carrot, head cabbage, beetroot, Swiss chard, broccoli, Pak Choi) and Maradol papaya seedlings. The host farmers were selected based on criteria such as availability of water sources, land, and willingness to participate, also considering inclusion of women and youth. Besides, vegetable crops selections was made based on nutritional value, suitability of the vegetable in the agro-ecology, ease of production and management using family resources and availability of seeds or planting material. At some of the sites water saving technologies, key hole and bed type gardening with drip and water can irrigation systems were demonstrated.

Practical and theoretical training using prepared training modules was provided for farmers and development agents on vegetable production and its managements. Besides, nutritious food preparation and awareness creation on nutrition security, and gender role in household nutrition was provided for the participating farmers. In addition, *woreda* agricultural office experts and head of the office, health extensionists, and DAs participated in the cooking demonstration.

A2.2.2 High potential food system –Wolmera and Kersa

Overview of activities for 2022 in the high potential food system and their contribution to the outcomes

	Wolmera		Wolmera & Kersa	Kersa
Outcome	**Faba bean**	**Seed potato**	**Year-round vegetable production**	**IFSM potato**
Social and economic empowerment			√	√
Sustainable production	√	√	√	√
Sector performance				
Safe and nutritious foods			√	
Enabling environment		√		

Enhancing improved faba bean seed production system (Wolmera)

Leverage point: to create opportunities for income generation and sustainable production

This activity was implemented in Robi Gebeya *kebele of* Wolmera *woreda.* A total of 3 hectares of land involving 6 farmers (6 men), was planted two improved varieties of faba bean (Tumsa and Dosha) in this year (2022) as initial seed production for next year (2023) start of seed multiplication by a group of farmers through organizing seed producing farmers group in cluster farming approach. The farmers used integrated recommended agronomic packages such as inoculation with *Rhizobium*, fertilizer, pre-emergency herbicide and lime. They produced seed under supervision of the Holeta research team following the seed production practices such as isolation distances, rouging, and other seed production methods and practices. Ten farmers (nine men and one woman) have visited the activities to gain experience during a mini field day.

Enhancing the quality of potato seed tuber delivery through improved regulatory system (Wolmera)

Leverage point: to create opportunities for income generation and sustainable production

A focus group discussion with a farmer seed group cooperative in Wolmera district was conducted as part of a previous project. Key stakeholders, ware potato farmers, previous seed potato producers' coops, extension & support services and seed regulatory participated. The results of the survey were summarized and formulated this follow-up activity. Production status of potato in the district is known, potato is the fourth important commodity in terms of area of production next to teff, wheat and barley. Besides, the dominant potato varieties under production in the district were identified being Gudane, Beleta and Jalenie.

Regarding the source of potato seed in the district about 50% is from local seed growers, 35% from home saved seed and 15% from other sources. This clearly shows that there is shortage of potato seed supply in the district and seed shortage is among the major potato production challenge in the district. Generally, the major challenges of the potato seed system in the district is summarized as follow:

- Late blight is prevalent and major yield limiting biotic factor in potato production. This disease is in fact can managed by using integrated disease control options such as fungicidal sprays and using disease tolerant/resistant potato varieties.
- Bacterial wilt occurs is some fields though the disease has a zero-tolerance standard in seed potato certification.
- Seed producers are not able to detect latent Bacterial Wilt infection in seed both in the field and storage.
- Most FSGC have poor linkages with ware potato farmers and seed marketing depend on agents or brokers.
- Foundation seed from early generation seed producers was inadequate and is a serious seed business limitation.
- Both internal and external seed quality control rules are poorly executed.
- Seed regulatory bodies are inadequately supported resulting in poor quality assurance (ill-equipped, underfunded, few specialists).

In conclusion, there is insufficient institutional capacity for quality control results in distributing disease-infested seed leading to poor potato yields.

Demonstration of integrated soil fertility management for potato (Kersa)

Leverage point: to improve soil nutrition, counterbalance low soil fertility & health and sustainable production of potato

This experiment was conducted in two *kebeles*, Gale Mirga and Handhura Kosum, on sixteen farmers (13 men and 3 women) fields. Farmers' management practice and 50% of the recommended inorganic fertilizer and 2 t organic fertilizer ha^{-1} were compared using one improved potato variety, Gudane. The result showed the Gudane variety along with the integrated soil fertility management practice showed superior result over farmers practices with up to 37.6% yield advantage over the farmer's practice. The farmers mentioned early maturity, disease resistance, high yield and high market preference as the main merits of Gudane over the local varieties available in the area. Besides, the economic analysis showed a profitability of the tested practice over the local farmers practices. Therefore, Gudane improved variety along with 50% per hectare recommended inorganic fertilizer and 2 t organic fertilizer ha^{-1} is recommended for piloting scaling up in collaboration with scaling up partners. A field day was organized which was attended by 40 farmers (27 men and 13 women).

Demonstration of year-round production and utilization of home garden vegetables (Wolmera & Kersa)

Leverage point: to improve nutrition and dietary diversity for households and increase access to income for women

This demonstration of home gardening of vegetables was started to promote gender sensitive approach where both male and female households are engaged. So far, training on topics such as home garden vegetable production, organic fertilizer preparation & uses, how to conserve water & use efficiently for home gardening, and processing & utilization of vegetables were delivered to farmers in two *kebeles* of Wolmera and two *kebeles* in Kersa *woreda*. The participants were selected based on criteria such as availability of water sources, lands, and willingness to participate, also considering inclusiveness of women and youths. Vegetable crops selections was done based on nutritional value, suitability of the vegetable in the agro-ecology, ease of production and management using family resources and availability of seeds/planting materials. In Wolmera the seeds of lettuce and kale were distributed to these trained farmers to plant and the seedling production is underway by each farmer on plot size of 1m*5m. Currently, the seedlings are under production and land with plot size of 10m*10m is under preparation for growing the seedlings after transplantation. In Kersa, seeds of six nutrient-dense vegetable i.e., squash, carrot, head cabbage, beet root, Swiss chard, and broccoli, were distributed to the selected farmers.

A2.2.3 Commercial food system – Ada'a

Overview of activities for 2022 in the commercial food system and their contribution to the outcomes

Outcome	Lentil	Poultry disease
Social and economic empowerment		
Sustainable production	√	√
Sector performance		√
Safe and nutritious foods		
Enabling environment		√

Validation of Lentil technologies for revitalization of production and utilization

Leverage point: to enhance the sustainable production and productivity of lentil, overcome the lentil disease

Three improved lentil varieties (Beredu, Furi and Derso) along with local varieties were evaluated on 8 farmers field (8 men of which 2 youth) along with recommended lentil production packages at two kebeles of Ada'a woreda. For comparison, farmers practice was also included in the trial. Farmers participatory technology evaluation and selection was conducted on the field to collect farmers opinions about the tested lentil technologies. Accordingly, farmers selected two improved lentil varieties (Baredu and Furi) along with the recommended production packages based on their own selection criteria such as disease resistance, seed size, seed colour, number of pods, cotyledon colour and yield. Besides, a farmer field day was organized where number of non-host farmers, scaling partners (*woreda* agricultural office) and RAISE-FS team were participated.



Figure 11 *Lentil technology evaluation at Ada'a woreda*

About 22 farmers (11 men and 11 women) were participated in technology evaluation and training and 57 farmers (47 men and 10 women) were participated in a field day event (Figure 11).

Assess the effect of the new poultry disease and development of disease control system

Leverage point: to improve production and the value chain

An assessment was done to make an inventory of the effects of disease outbreak. Small-scale (50 to 1000 chicken), medium-scale (1001 to 10,000 chicken) and large-scale (above 10,000 chicken) grouping was followed according to poultry farm categorization (ENTAG, 2021). Accordingly, A total of 51 poultry farms were surveyed (22 Small, 23 medium- and 6 large-scale farms). A total of 63 respondents (69.8 male and 30.2 female) were interviewed.

The main activities carried out were:

- Stakeholder dialogue facilitated on already established poultry platform
- Results of the current survey validated in the presence of poultry farm association and relevant government officials
- Disease control mechanisms and early warning system development suggested
- Ways of forward to minimize the risk associated with outbreaks suggested
- Major challenges and bottlenecks in poultry subsector identified
- Biosecurity situations of commercial poultry producers assessed and regulatory measures to be followed suggested
- Social effects of the disease outbreak assessed
- Losses due to the outbreak estimated

About 18 (16 men and two women) poultry farm owners participated in the poultry disease outbreak survey report validation workshop.

A2.3 SNNP and Sidama

A2.3.1 Food insecure food system – Bolose Bombe

Overview of activities for 2022 in the food insecure food system and their contribution to the outcomes

Outcome	Common bean	Faba bean	Ginger
Social and economic empowerment			
Sustainable production	√	√	√
Sector performance			√
Safe and nutritious foods	√	√	
Enabling environment			√

Validation of common bean production technologies

Leverage point: to increase common bean productivity through the introduction of iron and zinc rich varieties with research recommended production technology practices

The *kebele* (Bombe Zuria) was purposely selected for validation activity based on the common bean production experience. Participant farmers were selected, together with *woreda* expert and *kebele* development agent, based on farmers' interest. Three common bean varieties (Hawassa Dume, Gegeba & SER-125), which contains available iron and zinc, with the local landrace were used. The agronomic practices such as spacing, land preparation, weed management (since it is not common to weed pulses in most cases) and common bean specific bio-fertilizer inoculant (*Rhizobium*; HB-429), applied at 500g ha^{-1} as per recommendation. Selected 10 farmers (8 men and 2 women) were used as a replicate. The selected farmers were trained about the production technologies (particularly seed dressing with bio-fertilizer, row seeding & weed management practices) of common bean. The plot size for each variety was 32 m^2 (4m x8m) and a total area of 128m^2 per farmer was used. NPSB (mostly for P_2O_5) fertilizer was applied at the rate of 121 kg ha^{-1} and bio-fertilizer was used as replacement for urea.

From 10 farmers, validation trial on two farmers' fields was poorly managed and was not included in data collection. Agronomic data such as plant height, plant density per plot, seed per pod, seed per plant, yield per plot, 100 seed weight and farmers preferences score were recorded from the remaining eight farmers' fields. The average grain moisture content at harvesting was 11.4%. The average grain yield per ha (converted) is indicated Table 4.

Table 4 *Average grain yield across participating farmers*

Variety	Grain yield ($32m^2$)	Yield (kg ha^{-1})
H/Dume	4	1249.8
Gegeba	3.1	961.4
SER-125	6	1883.1
Local	3.6	1112.7
Average	5.6	1735.7

Farmers' preference was carried out based on selection criteria set by the farmers, which include maturity time, disease reaction, grain yield, local market demand, lodging, seed size and seed colour (Table 5).

Table 5 *Average grain yield across participating farmers*

Criteria	Name of variety			
	SER-125	Gegeba	Hawassa Dume	Local
Time of maturity	3	4	2	2
Disease reaction	4	3	3	2
Grain yield	4	3	3	2
Market demand	4	2	3	2
Lodging scale	4	3	2	2
Seed size	3	4	3	2
Seed color	4	2	3	2
Total score	**26**	**21**	**19**	**14**
Rank	**1**	**2**	**3**	**4**

Note: Scale with 1 is poor & with 4 very good, and a variety with highest total score is the most preferred.



Figure 12 *Participating farmers evaluating the varieties in the presence of agronomist (left)*

From the validation of common bean technologies, variety SER-125 was selected due its high grain yield (69% yield increment over the local variety) and farmers' preferences. Therefore, the SER-125 variety can be further promoted in low-moisture stress areas of Boloso Bombe *woreda* and other similar areas. Accordingly, demonstration activity was designed for 2023 to further demonstrate production, food recipe and storage of common bean grain in PICS bag.

Validation of faba bean production technologies

Leverage point: to increase faba bean productivity through the introduction of high yielding varieties with research recommended production technology practices

Faba bean is a highland cool season crop and the validation trial was conducted in the highland Zaba kebel. Farmers in Zaba *kebele* and around did not get an opportunity of using improved faba bean production practices because of *kebele*'s inaccessibility (poor road) and low attention given by the research and

extension. Farmer selection for the validation trials was carried out based on their interest to participate in the validation activities. Ten farmers (all men) were selected involving *kebele* development agents. Thereafter, discussion was held with the participating farmers and they indicated that low productivity in recent years is the major constraint though the agro-ecology is suitable for faba bean production. Soil samples were taken from the plot of selected farmers suspecting the problem of soil acidity as the area receives high rainfall. However, only one farmer's plot showed low pH that is not suitable for growing faba bean and all other nine farmer's plots never showed acidity problem. For the validation, two varieties (Gabalcho, Tumsa and local cultivar) were grown following recommended agronomic practices including bio-fertilizer inoculant (*Rhizobium;* FB-1018) specific to faba bean at a rate of 500g ha^{-1}. Each variety was sown on a plot of 100m^2 (10m x10m) and NPSB fertilizer (121kg ha^{-1}) was applied at planting. During vegetative stage, the trials in all farmers' field were at good stand. However, at maturity stage, there was a storm that affected many validation plots. Luxurious vegetative growth was observed on Gabalcho variety while local variety (seed purchased from the local market during planting) was not affected much with wind because the mixed nature of plants helped the local variety to tolerate the wind effect. Finally, grain yield of the local variety & Gabalcho was nearly the same as observed in two farmers' field (Table 6).



Figure 13 *A faba bean plot on farmer's field visited during the local level field days after storm attack*

Table 6 *Average grain yield across participating farmers*

Variety	Farmer		Average (kg 100m^2)
	Wajana	Fikre	
Gabalcho	30	20.6	25.3
Tumsa	26	18.33	22.165
Local	30	22	26
Average	28.7	20.31	24.49

In general, during the field day and follow-up discussions with participating farmers Gabalcho variety was preferred over the local and Tumsa varieties due to its field performance and later its large grain size and grain uniformity. The grain from the local variety was not uniform. Faba bean is a cross pollinated crop plant and genetic impurity of seeds is a problem unless produced with necessary procedure for seed purpose. The other issue farmers mentioned was use of bio-fertilizer strain as a good growth promoter, but suspected lodging might be due to its effect.

Therefore, farmers want the variety to be promoted to farmers in the *kebele*. Accordingly, faba bean technologies demonstration activity was initiated for 2023.

Creating Enabling Environment for Ginger Revitalization

Leverage point: to create awareness about ginger production under bacterial wilt challenge and re-establish the ginger production to commercial scale

A workshop was conducted by involving different stakeholders drawn from different institutions including regional and national agricultural research institutes, agricultural extension, coffee and spices authority, Sodo Agriculture College, NGOs (especially FARM-Africa has been dealing with the issue in collaboration with different stakeholders), private business companies and universities (particularly Addis Ababa University) with 26 participants (of which 3 women). The objectives of the workshop was first to discuss and understand about the ginger disease complex, efforts that different institutions have been exerting, and commonly agree on short- and long-term efforts towards solutions.

In the plenary session, participants from SARI, EIAR, Addis Ababa University jointly with one private business compony (Eden Oil) and coffee and spices authority of the regional state presented papers on their experience on control of ginger diseases. Following the plenary presentation, participants were grouped into three and group discussion was held on possible solutions. The technical solutions suggested in consensus were: 1) growing ginger during dry season using irrigation to escape the suitable condition for disease development, which usually occurs in August and September; and 2) use of integrated pest management practices. Following suggestion during group discussion, a core team was established with members drawn from coffee & spices authority, private business company and SWR Ethiopia Hawassa liaison office. Based on the consensus reached during the workshop, technical solutions were suggested to be demonstrated by SARI (Areka Agricultural Research Centre) and further study about the disease was suggested to be done by EIAR and Addis Ababa University. The core team will facilitate and create future platforms involving stakeholders that can contribute towards revitalization of ginger production and marketing.

Dry season planting/ early planting using irrigation and integrated disease management (IDM) demonstration activities were planned for the 2023 RAISE-FS activity implementation. Following the workshop, a working paper is drafted and being under review for publication.

A2.3.2 High potential food system - Gumer

Overview of activities for 2022 in the high potential food system and their contribution to the outcomes

Outcome	Potato	Faba bean
Social and economic empowerment		
Sustainable production	√	√
Sector performance	√	
Safe and nutritious foods		√
Enabling environment		

Assessment of seed potato value chain

Leverage point: to map the seed potato value chain and identify critical stage where the seed system is challenged for further action

Initially, the activity was proposed to conduct the assessment at the *woreda* level, but a national level workshop was organized to identify major challenges of potato seed system and discuss way forward. The major challenges in Gumer *woreda* in particular and in potato growing areas of the south regions were identified and presented at the national level stakeholder workshop organized. Participants from Gumer *woreda* and from Gureage zone critically mentioned seed replacement as a major bottleneck for potato production. Farmers are producing the seed generation that was introduced before nine years and as a result disease pressure became a problem for potato yield reduction. Therefore, Worabe Agricultural Research Centre introduced certified seed of two potato varieties (Gudene and Menagesha) from cooperative union in Oromia and validated on 28 farmers (9 women) fields. Each variety was planted on plot of 100 m^2 and each farmer grew both varieties. Due to security problem in the area and logistics problem, regular field visit was

not conducted during the growing season. From 28 farmers who planted the varieties, 21 of them produced potato tuber for seed purpose for the *belg* season production. The planting in 2022 was undertaken in *meher* (main rainy season) to produce seed tuber for *belg* planting (in 2023). Farmers in the area consider *belg* as suitable season and plant potato in *belg* season. The productivity was low as farmers did not pay attention to field management. From farmers' evaluation and yield data, the two varieties showed similar performance while most of the farmers preferred Gudene over Menagehsa variety because of the previous experience they have with Gudene variety. The average yield of Gudene was 6.9 t ha^{-1} (ranging from 3.2 to 10.1 t ha^{-1}) while that of Menagesha was 6.4 t ha^{-1} (ranging from 3.4 t ha^{-1} to 9.9 t ha^{-1}).

The validation of potato production technologies was proposed for 2023 considering availability of seed tuber from the trials of the two varieties in 2022.

Validation of improved faba bean variety with production technologies

Leverage point: to increase faba bean production and productivity using integrated soil fertility management practices under acidic soil condition

Farmers from three *kebele*s were selected and briefed about the validation of faba bean production technologies planned to implement. A total of 30 farmers (8 women) were selected and four treatment levels (Tumsa variety with bio-fertilizer (*Rhizobium*), Tumsa variety without bio-fertilizer, local variety with bio-fertilizer and local variety without bio-fertilizer) were compared on 100 m^2 plots.

Due to lack of frequent field visit during the growing period, agronomic and yield data were recorded only from 16 farmers' plots from the three *kebele*s (Table 7).

Table 7 *Performance of faba bean varieties with and without rhizobium strain across kebeles*

Treatment	*Kebele* grain yield average (kg ha^{-1})			Average	Average farmers preference score
	Asselecha (n=8)	B-Denber (n=4)	Essenina (n=4)		
Tumsa with strain	3193.8	3337.5	3256.3	3262.5	4.6
Tumsa without	2831.3	3000.0	2981.3	2937.5	4.3
Local with strain	3075.0	3137.5	3087.5	3100.0	2.6
Local without	2743.8	2862.5	2737.5	2781.3	2.3
Average (kg ha^{-1})	2961.0	3084.4	3015.7	3020.3	

In this validation, only slight variation is observed in yield between the local and Tumsa variety (both under strain and without strain). The application of the strain has resulted yield difference for both the improved Tumsa variety (0.32 t ha^{-1}) and local (0.31 t ha^{-1}). The local variety used may be an improved variety introduced few years ago and considered as a local cultivar since this *woreda* has been participating in many crop technology evaluations by different stakeholders (NGO, research institutions, extension, etc). However, farmers preferred Tumsa for uniform grain sizes. Tumsa variety with bio-fertilizer can therefore be promoted integrating with different soil management practices.

A2.3.3 Commercial food system – Hawassa Zuria

Overview of activities for 2022 in the commercial food system and their contribution to the outcomes

Outcome	Poultry	Haricot bean	Soya bean
Social and economic empowerment	√		
Sustainable production	√	√	√
Sector performance	√	√	√
Safe and nutritious foods	√	√	√
Enabling environment			

Introduction of Small-Scale Poultry Commercialization

Leverage point: to assess the current status of poultry production, and the role of gender in the production system improvement of intervention in the poultry sector

In two intervention *kebele*s (Lubo Koromu and Jara Damowa), households who own at least five chickens were identified with the *kebele* development agents and data were collected from 180 households (117 were men headed and 63 were women headed). The questionnaire was developed by the team of researchers and coded in Kobo mobile phone online data collection tool. Enumerators were selected from the district office of livestock and fishery and trained on the contents of the questionnaire and Kobo tool data collection procedures. The collected data were transferred to STATA version 16 and checked & cleaned for data that are missing and outliers. Finally, the collected data was analyzed using descriptive statistics.

The study showed that 54% of the sample household heads involved in formal education, 21.7% can read and write and 23.9% can't read and write. Majority (87.2%) of the household's main income source were mixed crop-livestock production system, and only 8.3% of the HHs started adoption of semi-intensive production system. The main sources for poultry flock in the study area is either through the government extension system or from local markets. Moreover, a significant portion of the sample households' practices home hatching which may be affected by cross-breeding with less productive species. Therefore, it is better to improve access to poultry breeds from certified breeds through either organizing a day-old chicken producers' enterprises or enhancing the capacity of district level livestock and fishery office to supply adequate and quality poultry breeds to producers.

All farmers reported maize/wheat grain as the only sources of feed for their poultry feeding. The survey result also confirms that 89.4% of the households uses wheat bran/ '*frushika*' as a poultry feed. Only 3% of respondents claimed to utilize formulated poultry feeds. Those households who rely on maize/wheat grain feeding uses scavenging as an alternative feed resources. Household food leftovers, forage seeds, and agricultural by-products make up the majority of the typical scavenging feed resources.

Regarding to the gender involvement in poultry management, most management activities are carried by women members of the household. Based on the data, 88.3% women reported that they play key roles in feeding and watering. Nearly 79% of the sale was carried by women. This figure was 10.6% in male-headed households in which the head involves in selling eggs. Male and female children had less roles in management and products selling activities. With respect to poultry production, 51.1% of women reported that they control the income obtained from poultry and its products sell as compared with 37.8% of male in the same category. Based on the customs of the area, male likely involve in both production and marketing of poultry and its products. This may be an opportunity to enhance women participation in the sector for their economic and social empowerments.

Regarding the poultry production challenges, getting formulated poultry feed and access to improved chicken breed are the major barriers to expansion in poultry production (Table 8).

Table 8 *Poultry production and marketing constraints*

Problems related to input access	Frequency	%
Getting chicken breed	43	23.9
Getting formulated poultry feed	126	70.0
Access to poultry vaccine & medicaments	20	11.1
Market for eggs	0	100
Market for live birds	8	4.4

The results show that there is potential for commercialization of poultry in the area and the market demand if one were to engage in chicken production.

It is recommended to increase producers' access to poultry breeds from certified breeds by either setting up day-old chicken production firms or strengthening the ability of the livestock and fishery office at the district level to provide sufficient and high-quality poultry breeds to farmers. To improve access to commercial feeds, it is crucial to increase the availability of feed through the development of rations using locally accessible raw materials. Women plays a key role in a poultry production at the study area. This could be an opportunity for women economic empowerment. Hence, households headed by women should be the main target of the poultry interventions.

Validation of haricot bean production technologies *at Hawassa Zuria woreda*

Leverage point: to increase common bean productivity through the introduction varieties with research recommended production technology practices

Common bean production technologies with different treatment levels were conducted on 8 farmers' (7 men + 1 woman) field on two *kebele*s. The number of farmers were small due to the fact that during site selection almost all farmers covered their land with different crops. The treatment levels were 100kg NPS, Rhizobium strain alone, 50kg NPS + Rhizobium strain & control (without fertilizer and strain), and the common bean variety used was SER-125. Planting of validation was done late due to different reasons and as a result. However, the growing period for the year was more or less suitable for haricot bean. Due to logistics issue researchers were not able to regularly visit the validation activity and as a result some of the designed parameters were not recorded. Based on their observation of field performance and yield (Table 9) of common bean variety, farmers witnessed the benefit of use of rhizobium strains for common bean agronomic performance. Further demonstration of those pulse crops' technologies is suggested for 2023 following appropriate planting / sowing time.

Table 9 *Effect of rhizobium strain on yield of SER-125 common bean variety*

Treatment	100-seed weight (g)	Seed yield (t ha^{-1})	Biomass yield (t ha^{-1})
Control (no fertilizer/ inoculant)	25.70± 2.85	3.19±0.796	4.28± 2.48
100kg NPS	25.85± 1.58	4.023 ±2.29	7.75± 1.52
Rhizobium strain	24.83± 1.59	5.94±1.99	8.32± 0.95
50kg NPS + Rhizobium strain	24.56± 2.07	3.55±0.79	4.72±2.47
LSD $_{(0.05)}$	ns	1.98	2.36
CV (%)	8.64	29.04	34.11



Figure 14 *Beans of SER-125 variety*

Validation of soya bean production technologies

Leverage point: to address crop diversification and promoting filling gaps in soya bean productivity through promoting Rhizobia-inoculated soya bean production to improve its economic contribution to small-scale farmers' livelihoods

Field validation was conducted on eight farmers' fields in Lebu Koromo and Jara Damowa *kebele*s of the Hawassa Zuria district. Farmers were selected purposively based on their willingness to share experiences with other farmers, examining their profiles with the support of development agents. Farmers and development agents received in situ training regarding the nature of the chosen variety in terms of requirements for agronomic management, crop protection, harvesting, and the importance, application, and care necessary during application of the rhizobium inoculant. During the training farmers had prepared their own plan regarding the trial management activities calendar, as per the trainings offered to enable them to implement activities by themselves with periodic supervision of the DAs and RAISE–FS implementing teams for any inquiries for technical support.

The validation trials consisted of one variety of soya bean crop and four N fertilizer sources (0, 100kg NPS), *Rhizobium* strain, and 50kgNPS + *Rhizobium* strain). The plot size for each treatment was 10x10 m^2. In all inoculated treatments, soya bean seeds were treated with a peat-based carrier as per the recommended rate (10 g inoculant per kg of seed) containing 6.5×108 viable bacterial cells g^{-1} peat of *Rhizobium* strain. Water was used to ensure adhesion of the inoculant. Seeds were hand sown with 50cm spacing between rows and 10cm between plants.

Measurements were made on agronomic and yield performance of the soya bean crop, seed yield was calculated by adjusting the seed moisture to 10% and converted into hectare basis.

From the trials, it was found that sole application of *Rhizobium* inoculant significantly influenced number of pods per plant, biomass and seed yield (Table 10). Number of pods per plant ranged from 15 to 30. The highest number of pods per plant was obtained by *Rhizobium* inoculant while the lowest was obtained from control. Application of *Rhizobium* inoculant alone significantly increased seed yield by 100%, 20% and 23% over the control, 100kg NPS and combination of NPS with *Rhizobium*, resp.

The correlation coefficient among traits was positive and highly significant for pods per plant (NPPP), seed yield (SY), biomass yield (BMY) and seeds per pod (NSPP) (Table 10) There was strong correlation in all the above traits, however, the highest correlation was obtained between NPPP, NBPP and BMY (r=0.73). This indicates the impact of rhizobia inoculation on the growth parameters directly contributes for the biomass and seed yield of the soya bean crop.

Table 10 *Effect of rhizobium strain on yield of soya bean variety (cocker-240) performance*

Treatments	Number of pod per plant	100-seed weight (g)	Seed yield (t ha^{-1})	Biomass yield (t ha^{-1})
Control (no treatment)	15.8	13.3	0.8	4.6
100kg NPS alone	23.6	13.6	1.3	7.8
Rhizobium strain alone	30.9	13.4	1.7	9.1
50kg NPS + strain	24.6	13.1	1.3	7.4

Annex 3 Monitoring, evaluation, learning & communication

A3.1 Monitoring, evaluation & learning

A3.1.1 Baseline

The project planned to collect data for objectively measuring its impacts and outcomes and hence it is needed to establish baseline estimates for key indicators of resilient, inclusive and sustainable food system in Ethiopia. The main objective of the baseline was to collect reliable data that help to estimate the current value of the Key Performance Indicators (KPIs) identified for each of the project outcome areas. A clear methodology was designed with supportive tools including questionnaire to collect data electronically from all regions. The survey questionnaire was designed into Computer Assisted Personal Interview (CAPI) mode by using KOBO toolbox which is part of open-source data kit (ODK) software.

Prior to field data collection, all the field teams (data collectors, supervisors and coordinators) were trained on the basics of baseline survey and were extensively exposed to the questionnaires for this baseline survey. Three-day training was given and followed by one day field exercise in the nearby target kebele that already identified for the survey. This helps data collectors and supervisors to internalize the questions and check preciseness (clarity) of the questions for the respondents, besides exercising the application using tablets.

A total of 18 kebeles (two from each food system in each region) from 9 woredas and 926 households were covered to collect data for indicators of social and economic empowerment of women and youth, efficient and environmentally sustainable production, sector performance and value chains, availability and use of safe and nutritious foods, and associated enabling environment. Sample woredas selected for food systems were Angot (food insecure), Yilmana Densa (high potential), and West armacho (commercial) from Amhara, Boloso Bombe (food insecure), Gumer (high potential) and Hawassa zuria (commercial) from SNNPR and Sidama, Babile (food insecure), Wolmera (high potential), and Ada'a (commercial) from Oromia.

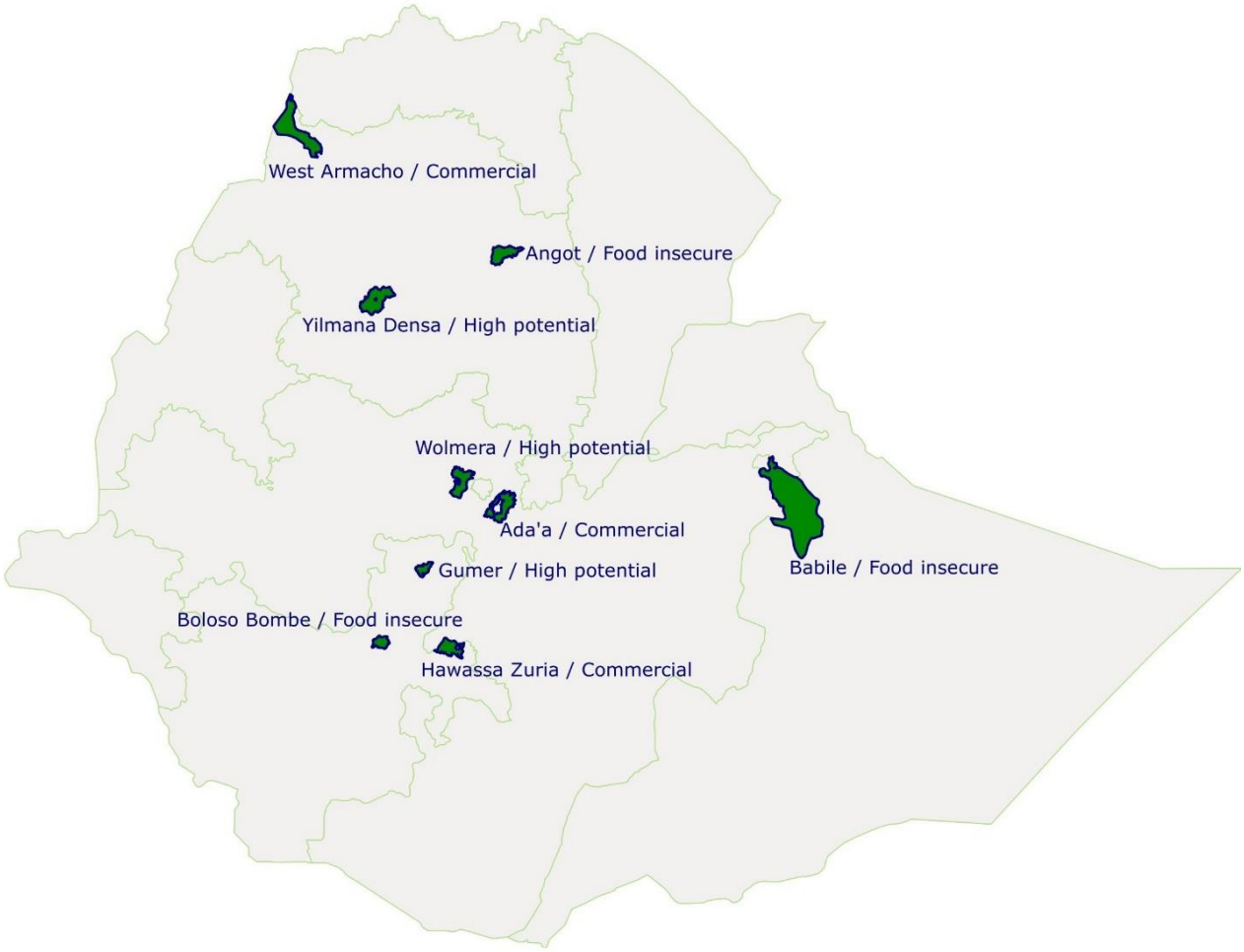


Figure 15 *Location of baseline and RSFA woredas*

A3.1.2 Reach

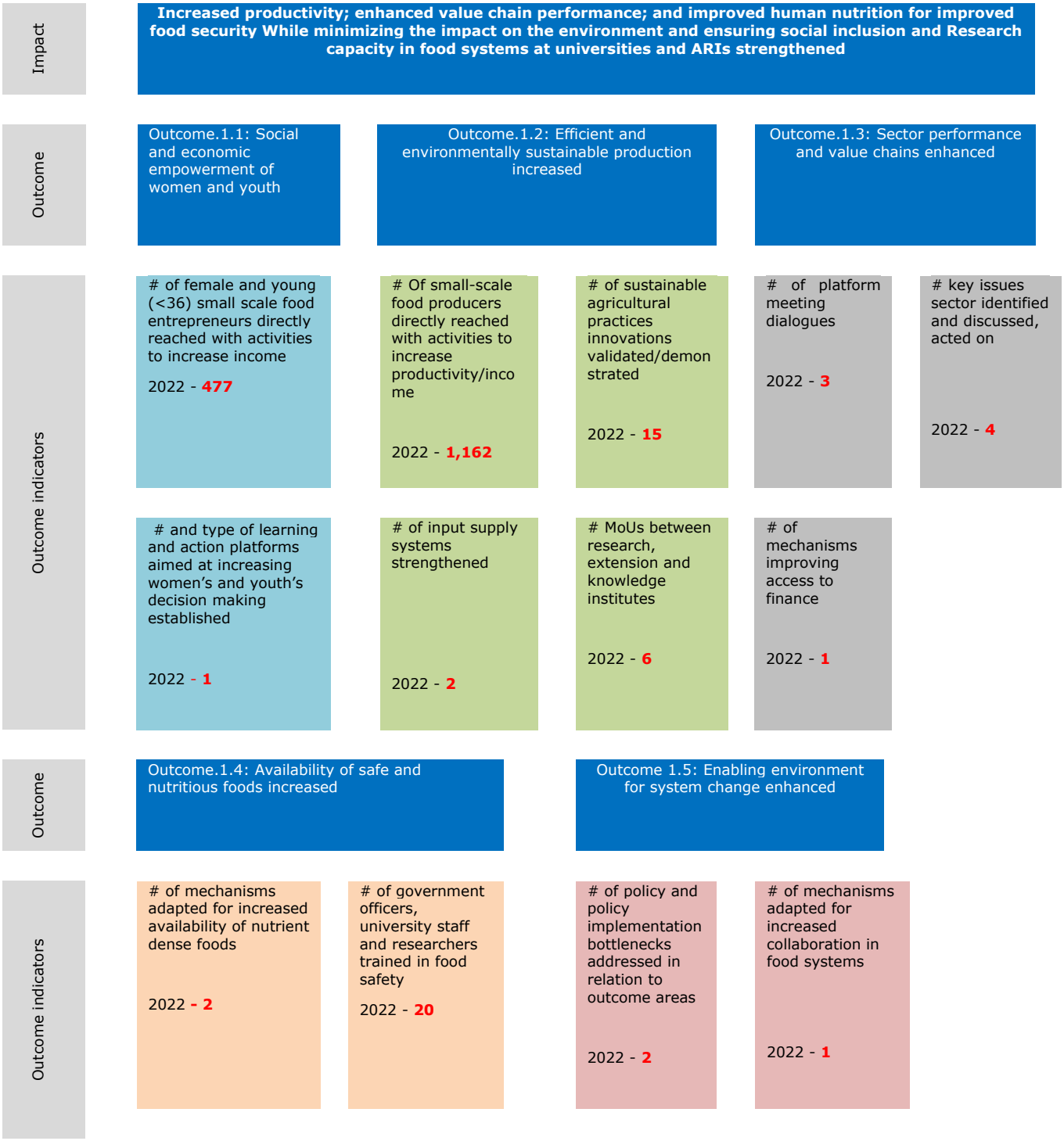


Figure 16 *The key indicators and reach per outcome*

A3.1.3 Stories

Bahir Dar liaison office developed two stories and shared with audiences via the RAISE-FS newsletter and websites. One is a story about women farmers in Yilmana Densa *woreda* who get benefited from vegetable production. The other story is about stinging Nettle (*Urtica simensis*), which is a potential food crop for highlands with food insecurity.

A3.2 Communication

Various communication channels, including a website, a quarterly newsletter, social media, and other written communication outputs, are used to provide information to stakeholders, partners, and the general public. Both printed and electronic copies of information and communication materials were sent to readers. For internal communication WhatsApp, zoom, telegram and email communications were used. RAISE-FS regional teams shared stories, pictures and footages which were shared on our communication channels. In almost all communication channels, an effort was made to concentrate on key RAISE-FS and stakeholder activities, with inputs from RAISE-FS regional liaison offices.

RAISE-FS website and social media
News stories of major activities and documents have been shared via the RAISE-FS website, on Facebook, Twitter and Linkedin accounts. Stakeholders have been informed that electronic copies of all communication materials and project documents are available at the RAISE-FS website.

RAISE-FS Newsletter and other communication outputs
The 1st and 2nd issues of the RAISE-FS newsletter were published and shared to more than 800 electronic copy receivers using MailChimp mailing app. The soft copies of the newsletters were also posted in the RAISE-FS website and social media. 300 copies of each issue published in hard copies and distributed to readers.

Different print communication outputs (broachers, leaflets, banners, paper bags, roller banner, stickers, staff ID, business cards, …) have prepared on different topics. Publication templates and technical reporting templates developed and shared to staffs. Four publications formatted according to the RAISE-FS publication guide and made ready for copy editing and then for publishing.

RAISE-FS Communication strategy document which guide both internal and external communications has been developed. It includes the type of communication methods, channels, targets, information needs, frequency of production …etc.

Publications
Publications are an essential component of any organization, as they serve to share knowledge, promote ideas based on evidence, and inform the public. In the context of RAISE-FS, a project implemented by a research organization, publications are even more important, as they are the primary way in which the project's outcomes can be shared, disseminated and influence policy decisions. RAISE-FS identified potential topics that are in the outcome areas of the project and lead to the production of scientific publication. Eight publication topics identified and draft documents developed. The type of publications proposed are working paper, experience brief, issue brief and policy brief. The publications are being peer reviewed and will be copy-edited for final publication in 2023.

Short videos and footages
A short video has been produced on the most significant change story on soya bean innovation in commercial food system oriented woredas of West Gondar zone. The EKN Addis hired the consultancy EyeOpener Works and organized a visual story telling training in which two RAISE-FS colleagues participated. Following the training, one video story about soybean innovation and one photo story about home gardening for year-round vegetable production were produced. The short film was shown to various stakeholders, including EKN Addis. It was also shared through on RAISE-FS website and other social media accounts.

Documentation
Documentation is an integral part of any project, as it allows for the preservation of key information and provides evidence of the efforts made. Pictures and footages from the events and activities implemented by the project have been documented and archived to provide a historical record of its progress. These documents stored on an external hard drive, so they could be accessed easily when needed in the future.

Visitors to RAISE-FS website and social media

More and more people are visiting the RAISE-FS website. The tab counting software shows that over 30 posts made and 6,883 visits have been made till December 2022. Google analytics indicate visitors have come from different parts of the world. The Google analytics result from January 1, 2022 - December 31, 2022 shows the following: Ethiopia (4,517), Netherlands (589), USA (429), China (146) etc. The website thus reaches a broad international audience. From the RAISE-FS websites different documents have been downloaded by users. The RAISE-FS innovation manual (417 times), RAISE-FS first call newsletter version (491 times), RAISE-FS brief (173 times), RAISE-FS Newsletter (80 times) have been downloaded by users.

From November to December 2022, the LinkedIn page has got more than 200 followers. At present, this page has 210 followers, and more than 1,500 impressions already. The followers of the RAISE-FS Twitter page are also increasing.

Annex 4 Indicators & targets

#	Indicator description	Reach 2021/22	End of project target
	FNS indicators		
1	# of small-scale food producers directly reached with activities to increase productivity/income	1162	105,000
	of which women	338	31,500
	of which youth (<35 years of age)	422	42,000
2	# of small-scale food producers that adopted new knowledge and/or technologies	872	90,000
	of which women	254	27,000
	of which youth (<35 years of age)	317	36,000
3	# of FNS- relevant knowledge institutions that perform better	6	9
	Social and economic empowerment of women and youth in food systems		
4	# and type of learning and action platforms aimed at increasing women's and youth's decision making established	1	3
5	# of female and youth (<36) small scale food entrepreneurs directly reached with activities to increase income	477	25,000
	of which women	281	15,000
	of which youth (<35 years of age)	287	18,750
	Efficient and environmentally sustainable production		
6	# of sustainable agricultural practices innovations validated	1	4
7	# of input supply systems strengthened	2	8
8	# MoUs between research, extension and knowledge institutes (national, regional, zonal level)	6	8
9	# of woreda's which are supported in scenario planning through recommendation mapping		40
	Sector performance and value chains		
10	# of platform meeting dialogues	3	3 per sector/year
11	# key issues sector identified and discussed, acted on	2	2 per sector
12	# of market linkages materialized		40
13	# market opportunity report updates developed;	2	8
14	# of innovations for improved productivity & quality	3	3 per sector
15	# innovation proposals approved and implemented;		30
16	# of mechanisms improving access to finance		3
17	# of direct beneficiaries with improved access to finance		1,000
	of which women		500
	of which youth (<35 years of age)		500
	Availability of safe and nutritious foods		
18	# of mechanisms adapted for increased availability of nutrient dense foods	2	5
19	# of trainings for food handlers piloted		10
20	# of government officers, university staff and researchers trained in food safety	20	50
21	# of food safety mechanisms developed and/or strengthened		4
	Enabling environment for systems change		
22	# of policy and policy implementation bottlenecks addressed in relation to women's and youth empowerment, sustainable production, sector and value chain performance and safe and nutritious food	2	4
23	# of sustainable mechanism for collaboration and alignment among stakeholders established	1	2
24	# of mechanisms adapted for increased collaboration in food systems	1	3

Wageningen Centre for Development Innovation
Wageningen University & Research
P.O. Box 88
6700 AB Wageningen
The Netherlands
T +31 (0)317 48 68 00
wur.eu/wcdi

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