OROMIA AGRICULTURAL RESEARCH INSTITUTE

BAKO AGRICULTURAL RESEARCH CENTER

ANNUAL REPORT FROM

JULY 2022 to JUNE 2023

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1. INTRODUCTION (Overview of the Center)

Bako Agricultural Research Center (BARC) is the widest and well organized multi-disciplinary research center contributing to a demand driven technologies and has a significant role in food self-sufficiency of the Western Oromia. The center was fouded by Ethio-German agreement as Ethio-German Experimental Station in 1962. The Center is operating under Oromia Agricultural Research Institute (OARI) as a full-flaged research center with the objective of generating improved Agricultural technologies and information on Crop, Crop protection, Livestock, Natural resource, Coffe and tea, Irrigation, socio-economics and extension-research. In this budget year, BARC has been conducting various research and Center development activities with budget sources from the Government and non-governemetal Supporters. These activities have been carried out by the center under the backings of six (6) Core research processes, which are sub divided into twenty (20) research teams, one supporting work process, and four (4) supporting teams. In total, the Center planned about 240 research activities and has been undertaking majority of them on station and at different research sub-sites. Out of these activities about 181 are Government/IQQO funded where as about 58 research activities are funded by Non-IQQOs (partnership works). Pre-extension demonstration, demonstration and scale ups of technologies have been conducted in farmers' field and FTC in Zones in Western Oromia.

This report includes summary of completed research activities, status of ongoing, technology multiplication and center development activities plus different trainings, human resource development and ethical advancement activities. The report also covers work on cross-cutting issues, strengthening implementation and research capacity building, none-IQQO research activities, Budget utilization, and other features. In General, the report covers the performance from July 2022 to June 2023 and includes the activities planned and carried out during this fiscal year.

1.1.Vision

Bako Agricultural Research center (BARC) aspires to be the center of excellence in research findings and technology transfer in the Country and also improve the living standards of farming communities in Western Oromia.

1.2.Mission

To Alleviating poverty through increased Agricultural productivity, restore and maintain the natural resource base of the region.

1.3.Mandate and the Services that BARC provides

Generating/developing, adapting and demonstrating improved agricultural technologies

Giving training on agricultural technologies utilization and provide advisory services for studnts and different organizations

Prepare different Agricultural users manuals and guidelines

Backing other research centers with different materials and trained man power

2. Performance of the Center

2.1 Leadership Activities

BARC has planned to convene about four (4) management committee meetings throughout the year to evaluate how the planned activities were carried out, bid support, and monitor the different teams toward the center's and Institute's goals. All of the management meetings that were scheduled to be undertaken were actually held with additional argust meeting, and some how the meeting were successful in carrying out their objectives intended since the meeting helped us to make different decisions to address some shortcomings and encouraged best practices to be followed by all workers of the center. The leadership also had a significant role in stherngething the Anti-Corruption Prevention Council, which met every two months with the aim of supporting the administration of property in various areas where weaknesses are seen and to carry out monitoring and evaluation of the work. Directions were given to focus on upcoming events in front of members of the management committee. In adition, the staff received consciousness training on professionalism and work ethics twiceand also one time on service delivery standards. Group discussions among the various team members have been held once a month. As a result, every employee is now familiar with the responsibilities of their jobs and has developed their own monthly, quarterly and annual work plans in compliance with the minimal service delivery standard. The employees' performance this year was assessed twice every six months in addition to making preparations for the evaluation procedure for the next year.

The horizontal operation of all research and other operations is a result of discussions with team leaders and the entire staff to prevent work interruptions caused by the shortage of budget and in some case by the current insecurity in our reagion which made special in case our center.

Figure 1. Photo taken during mangemet and wokers Meeting

2.2. Center Development Activities

Bako Agricultural research center is one of the oldest research center in IQQO. Therefore, all available office, residential houses, farm machinery and other facilities need maintainance. To

this effect this year BARC has pland to maintain some of this facilities turn by turn. Some of the maintaince made this year were as indicated on the picture

Figure 2. Photo of Some maintained offices

3. Summary of Completed activities, Status of ongoing activities of this year by Research process

3.1. Crop Research Process

SUMMARY OF HUMAN RESOURCE UNDER CROP RESEARCH PROCESS

Table 1: Human resource status of crop research process

№	Qualification	Profession			Total
		Breeder	Agronomist	Pathologist	
1	Ph.D.	1	–	–	1
2	M.Sc.	9 (2*)	7 (1*)	-	16 (3*)
3	B.Sc.	3(3*)	-	-	3*
4	Diploma				8
5	Others				12
Grand total					40

(*)= Study leave.

SUMMARY OF ACTIVITIES UNDER CROP RESEARCH PROCESS

Table 1: summary of crop research process activities

Team	**Status of activities**				
	Completed	Discontinued/suspended	extended	Ongoing	**Total**
Cereal	32(13*)	0	1	6	39
Pulse and oil	22(7*)	1	5	6	34
Horticulture	7(6*)	4	1	4	16
Grand total	**61(26*)**	**5**	**7**	**16**	**89**

*** Completed activities** are including breeder seed maintenance and pre-basic seed multiplication activities per crop.

I. CEREAL CROPS TECHNOLOGY GENERATION RESEARCH TEAM

1.1 SORGHUM

COMPLETED ACTIVITIES

Thematic area/Component: Breeding and Genetic

PROJECT TITLE: DEVELOPMENT OF SORGHUM TECHNOLOGIES TO ENHANCE PRODUCTIVITY OF SMALL-SCALE FARMERS IN WESTERN OROMIA

Activity 1: Sorghum preliminary yield trial

Twenty (20) sorghum genotypes including standard checks Bonsa and Marara were evaluated under preliminary yield trial at Bako and Gute site in 2022 using RCBD. The result of combined

analysis revealed that significant variability was observed among the tested genotypes (Table 2). Therefore, depending on yield and yield related parameters and disease reaction 16 best performing genotypes including the two standard checks were promoted to regional variety trial.

Activity 2: Evaluation of F2 Sorghum crosses

A total of 69 F_2 sorghum crosses were planted at Bako in the 2022 main cropping season with the objectives to assess sorghum genotypes for disease resistant or further breeding program. From F_2 generation; best head plants were selected with better in anthracnose disease resistance and agronomic traits were selected and tagged to advance for F_3 generation. As a result 80 heads were selected to be evaluated in the coming main cropping season (F_3 segregation).

Activity 3: Evaluation of F_5 Sorghum segregants generations

During the 2022 main cropping season a total of 64 F_5 sorghum crosses were planted at Bako on station with the objective to evaluate and advance F_5 segregants' with better anthracnose resistance and agronomic traits. From F_5 generation; best head plants were selected with better in anthracnose disease resistance and agronomic traits were selected and tagged to advance for F_6 generation. As a result 50 heads were selected and to be evaluated in the 2023 season as F_6 segregation.

Activity 4: Evaluation of micro-dosing fertilizer application on sorghum yield and Yield components at western Region of Oromia, Ethiopia

Current status of the activity

The experiment was carried out in according to the work plan (as stated in the centers and regional review) and no any variance of implementation form original work plan was made during the process of experimentation. A composite soil sample before planting and from each plots after harvesting from the experimental area were also collected and sent to Nekemte Soil research center for the Physico-chemical property analysis of the soil. Thus, the remaining full write up will be compiled after the soil sample analysis completed.

Activity 5: Sorghum Breeder Seed Maintenance

Six released sorghum varieties (Jaba, Marara, Chemeda,Gemadi,Lalo and Dano) were maintained /multiplied at Gute and Bako on station with the objective to maintain breeder seed with true to type/ up hold seed purity and guarantee seed supply to maintain breeder seed for future use. To this a total of 11.2 qt of seeds were obtained.

EXTENDED ACTIVITIES

Activity 1: Sorghum Variety Verification Trial

The Center has proposed to evaluate sorghum candidates' varieties under variety verification trial in the 2022 cropping season. However, due to security issue the trial was not planted as planned. Therefore, the Center decided to extend the candidate varieties evaluation in 2023 season.

Current status of the activity: The activity was planted as planned and field managements and data collections are under way.

ON-GOING ACTIVITIES

Activity 1: Sorghum Regional Variety Trial

Eighteen (18) genotypes including standard checks Bonsa and Marara were evaluated under Regional variety trial at Bako, Gute and Bilo Boshe site during 2022 using RCB design. The result of combined analysis revealed that there is significant variability was observed among the tested genotypes. The experiment will be repeated at the same locations with similar fashion to fulfill the criteria for RVT and also have the reliable data.

Current status of the activity: The activity was planted as planned and field managements and data collections are under way.

Activity 2: Effect of inorganic fertilizer and Farmyard manure on yield and yield component of Sorghum (Sorghum bicholor L) at western Region of Oromiya, Ethiopia.

This experiment was initiated in 2022 using Marara sorghum variety as a test crops for the execution of the experiments. Four recommended fertilizer NPS and N (25%, 50%, 75%, and 100% the recommended rates) and four FYM levels (0, 3, 6 and 9 t ha^{-1}) were arranged in factorial RCBD. The recommended NPS is 125 kg ha^{-1} with the elemental composition (47.5 P_2O_5, 23.75 N, 8.75 S kg ha^{-1}) and 46 kg ha^{-1} Nitrogen rate. This experiment was carried out in 2022 according to the work plan (as stated in the centers and regional review) and no any variance of implementation form original work plan was made during the process of experimentation. To get precise information, the experiment will be repeated in 2023 cropping season.

Current status of the activity: The activity was planted as per planned and field managements and data collections are under way.

1.2 .BARLEY

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF BARLEY FOR WESTERN OROMIA, ETHIOPIA

COMPLETED ACTIVITIES

Activity 1: Food barley Preliminary Yield Trial

About 36 genotypes including standard check Robera and Abdane were evaluated at Gedo in 2022 using 6x6 Triple lattice design with the objective to identify superior genotypes in terms of yield and disease resistance/tolerant and other agronomic characters and 20 best performed genotypes were promoted to RVT.

Activity 2: Malt barley Preliminary Yield Trial

About 36 genotypes including standard check Moata and Singitan were evaluated at Gedo in 2022 using 6x6 Triple lattice design with the objective to identify superior genotypes in terms of yield and disease resistance/tolerant and other agronomic characters and promote to the next breeding stage. From 36 genotypes 20 genotypes were promoted to RVT.

Activity 3: Food barley RVT

About 16 genotypes including Standard check Robera were evaluated at Gedo and Shambu in 2020, 2021 and 2022 using RCBD with the objective to select diseases resistance and superior genotypes for yield and 2 stable and high yielder genotypes were promoted to VVT

Activity 4: Evaluation of grain yield, yield traits, and protein content of malt barley variety under different application levels of NPSB and N fertilizers in Western Oromia, Ethiopia

The experiment was conducted in Shembu and Gedo sub sites for two consecutive years (2021 and 2022/23). The experiment was laid out in a randomized complete block design with factorial arrangement in three replications. The plot size was 2m x 3m. The treatments consisted of five NPSB levels (0, 25, 50, 75 and 100 kg NPSB ha^{-1}) and four levels of N (0, 19, 35 and 47 kg N ha^{-1}). All the NPSB and half N were applied at the time of planting, and half the remaining N was applied at the tillering stage. N fertilizer in the form of Urea was applied at different rates as constituted in the treatments. One malt barley variety (Holker) which was recommended for the area by BARC was used as a test crop for the execution of experiment. The trial was planted with inter-row of 20 cm with drilling sowing method. Plant height, biomass yield, grain yield, harvest index, thousand kernel weight and other relevant agronomic traits were recorded at appropriate growth stages. A composite soil sample before planting, and from each plots after harvesting from the experimental area were also collected and sent to Nekemte soil research for

the Physico-Chemical property of the soil. The grain sample was also sent to Sinana agricultural research center for grain quality (protein content) analysis. Thus, the full write up will be compiled after soil sample and grain quality analysis completed.

Activity 5: Food barley (Hordeum vulgare L.) yield and yield components influenced by integrated cattle manure and inorganic fertilizer at parts of the Western Oromia, Ethiopia

The experiment was conducted at Shambu, Gedo and Arjo for two cropping seasons 2021 and 2022 to assess the effect of cattle manure combined with inorganic fertilizer on yields and yield components of food barley and on soil fertility (Hordeum vulgare L.). Five levels of inorganic fertilizer rate (NPS) (0, 25%, 50%. 75%, and 100%) of recommendation was combined with four rate of decomposed cattle manure 0, 3tone, 6tone and 9tone per hectare. The experimental Design used was RCBD in factorial arrangement with Plot size 3mx3m.

The analysis of variance reveled that there was highly significant difference among treatments at 5%. Grain yield of 3992 kg ha^{-1} was recorded from the plot treated with 100% of the recommendation of in organic fertilizer that area and 6 t ha^{-1} followed by 100% recommendation and 3 t ha^{-1} and 75% recommendation and 6 t ha^{-1} which gave 3712 kg ha^{-1}.

Activity 6: Barley Breeder Seed Maintenance

One adapted variety, HB-1307 and the released hulless 'Jalqabne' variety were maintained and multiplied at Shambu and Gedo sub-site with the objective to maintain a quality seed for future use. To this a total of 23 kg of seeds were obtained/harvested.

Activity 7: Food Barley Pre-Basic Seed Multiplication

Early generation seed (EGS) production constitute the regular multiplication and supply of high quality pre-basic seeds. Therefore, to the supply of quality seeds of these varieties; multiplication is mandatory. Accordingly, one adapted variety, HB-1307 was multiplied at Shambu sub-site and the production obtained was 5.0 qt.

ON-GOING ACTIVITIES

Activity 1: Malt barley Variety Adaptation Trial

About 9 varieties including standard check were evaluated with objective to identify adaptable variety/ies and resistant/tolerant to disease and insect pest at Shambu & Gedo in the 2021 and 2022 season. The results of two year showed that there was significant difference among the evaluated varieties at both locations. To get precision data and to fulfill the criteria for the adaptation trial, the experiment will be repeated at the same locations with similar fashion.

Current status of the activity: The activity was planted as per planned and field managements and data collections are under way.

BREAD WHEAT

Project Title: Development and Promotion of bread wheat Technologies to enhance productivity of Small scale farmers in Western Oromia

COMPLETED ACTIVITIES

Activity 1: Bread wheat variety verification trial -2022

Two bread wheat genotypes (ETBW9413 and ETBW9606) were assessed against one standard check (Balch) at Shambu, Gedo and Harato, and on two farmers' field at each sites on a 10m × 10 m plot size. The candidate varieties were evaluated by the variety release technical committee, and one variety was released as a new bread wheat variety.

Activity 2: Bread wheat Regional yield Trial-2020

Under the regional variety trial, about 20 bread genotypes were examined against Liben standard checks across locations and years. According to the combined mean analysis, there was significant variation in grain yield and other relevant variables. Based on the results of the evaluation, two genotypes (1601 and 1185) performed well and provided a grain yield advantage above the standard check. Furthermore, GGE biplot analysis revealed that the selected candidates had consistent adaptation across places and years. As a result, the genotypes chosen were promoted to the variety verification trail for the upcoming cropping season.

Activity 3: Bread wheat Preliminary Yield Trial-2022

Thirty (30) genotypes were assessed across locations using the Laku standard check. Grain yield and associated characteristics varied significantly among genotypes, according to an analysis of variance. The performance of 15 genotypes was good, and they produced more grain than the standard check. Hence, in the upcoming cropping season, these genotypes will be elevated to regional variety trail.

Activity 4: Bread Wheat Observation Nursery Trial-2022

185 bread wheat genotypes, including four standard checks (Liben, Laku, Boru and Galan), were planted in an observation nursery trial at Gedo during the main cropping season of 2022. SAS was applied to all significant agronomic and yield-related data. A significant variation between genotypes for grain yield was revealed by the analytical variance (Table 1). Hence, the

analysis's findings showed that 15 genotypes would be advanced to a preliminary variety trial since they outperformed the checks.

Activity 5: Breeder seed maintenance of bread wheat

Bako Agricultural Research Center developed two bread wheat types (Liben and Laku). As a result, the varieties were maintained at the Gedo and Shambu sites with the goal of preserving quality seed for future use. Each cultivar was grown on 100 m^2 using a head-to-row planting technique and 40 kg of seed were harvested.

Activity 6: Breeder seed maintenance of Triticale

Bako Agricultural Research Center recently released three triticale varieties (Kombolcha, Abdissa, and Moti). As a result, the varieties were maintained at the Gedo and Shambu sites with the aim of maintaining quality seed for future use. Each cultivar was grown on 100 m^2 using a head-to-row planting system and 20 kg of seed were harvested.

Activity 7: Pre-basic seed multiplication of bread wheat

Bread wheat varieties (Liben and Laku) were released by BARC for small scale farmers in western Oromia. As a result, the varieties were multiplied at the Gedo and Shambu sites with the aim of supplying quality seed. On 0.25 and 0.2 hectare, respectively, and a total of 5.6 qt seed were obtained.

Activity 8: Pre-basic seed multiplication of Triticale

Triticale varieties (Kombolcha and Moti) were released by Bako Agricultural Research Center. As a result, the varieties were multiplied on 0.065 and 0.025 hectare, respectively at the Gedo and Shambu sites with the aim of supplying quality seed for farmers in western Oromia. To this a total of 50 kg of seed were harvested.

ON-GOING ACTIVITIES

Activity 1: Bread wheat Regional variety Trial-2021

Twenty (25) genotypes, including standard checks (Laku), were tested in a regional variety trial at Shambu and Gedo sub sites in 2022 using an Alpha latice design. All data were collected for the 2022 season. To obtain precision results and fulfill the criteria for regional variety trial, the experiment will be repeated in 2023 season at the same locations.

Current status of the activity: The activity was planted as per planned and field managements and data collections are under way.

Activity 2: Bread Wheat Regional Variety Trial-2022

Twenty (20) genotypes, including standard checks (Laku), were tested in a regional variety trial at Shambu and Gedo sub sites in 2022 using an RCB design. All data collected for the 2022 season. To obtain precision results and fulfill the criteria for regional variety trial, the experiment will be repeated in 2023 season at the same locations.

Current status of the activity: The activity was planted as per planned and field managements and data collections are under way.

RICE

Project title: Development of rice technologies to enhance productivity of Small scale farmers in western Oromia

COMPLETED ACTIVITIES

Activity 1: Upland Rice Regional Variety Trial –Year-3

Twelve (12) upland rice genotypes were examined against Chewaka variety as a standard check at Bako and Chewaka experimental sites. Based on the combined mean analysis, two genotypes (ART35-200 and ART16-17-7) performed well and provided a grain yield advantage above the standard check. Furthermore, GGE biplot analysis revealed that the selected candidates had consistent adaptation across places and years. As a result, these genotypes were promoted to the variety verification trail.

Activity 2: Breeder seed maintenance of Rice

Chewaka variety was released through Bako Agriculture Research Center. Therefore, the varieties were maintained /multiplied at Bako site with the objective to maintain a quality seed for future use. Chewaka variety was maintained on 100 m^2 based on head to row planting system and 50 kg of seeds were obtained.

Activity 3: Pre-Basic Seed Multiplication of Rice

Rice variety (Chewaka) was released by Bako Agriculture Research Center for small scale farmers of western Oromia. The variety was multiplied at Bako on 0.5 ha site with the objective to provide a quality seed for small scale farmers of western Oromia. To this a total of 18.5 qt seeds were obtained.

ONGOING ACTIVITIES

Activity 1: Upland Rice regional Yield Trial-2022

About 12 genotypes were evaluated against chewaka variety as a standard check at chewaka and Bako sites under regional variety trial during 2022 cropping season. Analysis of variance

indicated there was significant variation in grain yield and related parameters among genotypes. To obtain precision results and fulfill the criteria for regional variety trial, the experiment will be repeated in 2023 season at the same locations.

Current status of the activity: The activity was planted as per planned and field managements and data collections are under way.

TEFF

COMPLETED ACTIVITIES

Activity 1: Tef Variety Verification Trial (White seeded)

White seeded tef variety verification trial was undertaken with the objective to verify tef candidate variety for possible release. One candidate variety (BK-01-1817) with standard and local checks was planted at Shambu, Gedo and Arjo including on farmers field. All necessary agronomic management was applied accordingly and trial was evaluated by technical committee & the candidate variety was approved & released as a new tef variety.

Activity 2: Tef Variety Verification Trial (Brown seeded)

Two brown seeded *tef* candidate varieties (BK-01-5317 & BK-01-6617) were planted at Shambu, Gedo and Arjo including on farmer's field. All necessary agronomic management was applied accordingly and trial was evaluated by technical committee & the candidate variety was approved & released as a new tef variety.

Activity 3: Tef preliminary Yield trial

A total of 36 genotypes including standard & local checks were tested at Shambu sub-site using simple lattice experimental design during 2022/23. All necessary management practices were applied and agronomic and phonological data was collected. The collected data was subjected to SAS software and sixteen genotypes showed best agronomic performance were promoted to regional variety trial 2023/24 cropping season.

Activity 4: Tef varieties breeder maintenance

Early generation seed (EGS) production constitute the maintenance breeding of improved varieties of tef. Five improved tef varieties namely Dursi, Jitu, Jarso, Kena and Guduru were released from Bako Agricultural Research Center during last two decayed and are under production. Therefore, to secure the quality seeds of these varieties; maintenance is mandatory and maintained at Gedo and Arjo sub-sites. To this, a total of 20 kg true to type and pure seed was harvested.

Activity 5: Tef pre-basic seed Multiplication

Early generation seed (EGS) production constitute the regular multiplication and supply of high quality pre-basic seeds. Therefore, to the supply of quality seeds of these varieties (Dursi, Jitu, Jarso, Kena and Guduru); multiplication is mandatory. Accordingly, these varieties were multiplied at Gedo and Arjo sub-site, and a total of 4 qt seed was obtained.

FINGER MILLET

PROJECT TITLE: DEVELOPMENT OF FINGER MILLET TECHNOLOGIES TO ENHANCE PRODUCTION AND PRODUCTIVITY OF SMALL-SCALE FARMERS IN WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Finger millet Preliminary Yield Trial

Twenty-five finger millet Genotypes along with standard checks was tested in PYT at Bako site using Simple Lattice Design during 2022/23 on a plot size (experimental unit) of 1.6m x5m ($8m^2$) and with 0.4m of row spacing. Other agronomic practices were applied uniformly as required. All necessary data was collected and subjected to statistical analysis using R-software. Finally 16 best performed genotypes were promoted to regional Variety trial.

Activity 2: Finger millet breeder seed maintenance

Bako Agricultural research Center has been mandated to maintain the released finger millet varieties (eleven varieties) to secure the quality seeds of varieties. Thus the varieties was maintained at Bako each varieties on $100m^2$ area and a total of 22 kg of seed were obtained.

Activity 3: Finger millet breeder seed maintenance and multiplication

The Center has been multiplied the released finger millet varieties to supply to seed growers and for agricultural offices for demonstration activities engaged in technology demonstrations. A total of 3.98 qt of seeds were obtained.

Activity 4: Effect of integrated use of cattle manure and blended (NPSB) inorganic fertilizer on growth, yield and yield components of finger millet (Eleusine coracana (L) gaertn.) at Bako, Gute and B/Boshe

The experiment was carried out at Bako, Gute and Billo Boshe in cropping season of 2020 and 2022 with the objectives to identify the optimum and economically feasible integrated cattle manure and in-organic fertilizer for finger millet production in the study area. Five levels (0, 25%, 50%, 75% and 100%) NPSB/Urea was used as one factor and three levels of decomposed

cattle manure (0, 3tone, 6tone and 9) tons per hectare was used as a second factor. Data was measured from 4 harvestable rows and some important data was collected and recorded as usual from two locations Bako and B/Boshe and one year data from Gute. Data from Gute in 2023 harvesting season was not included for the reason of poor performance of the crop. All-important soil and agronomic data were collected and analyzed using Gen-Stat soft ware

Based on the analyzed results statistically significant difference between treatments tested on grain yield at 5% level of significance. The highest grain yield mean of 2546 kg ha^{-1} was harvested from the plot treated with 9 t ha^{-1} and 100% NPSB/Urea followed by the plot treated by 6 t ha^{-1} and 75% NPSB/Urea from which **2195** kg harvested.

II. PULSE AND OILS CROP RESEARCH TEAM

COMMON BEAN

COMPLETED ACTIVITIES

Project Title: Development and Promotion of Improved Technologies of Common Bean for Western Oromia

Activity 1: Common Bean PYT (Bush Type)

Sixty four common bean genotypes including check Hora were evaluated in simple lattice design with two replications at Bako location in 2022 cropping season. After all necessary agronomic recommendations carried out and data collected, analyzed and interpreted, the tested genotypes were not promisable to go further evaluating. Therefore, we concluded to stop the trial at this level.

Activity 2: Effect of Blended NPSB fertilizer and common bean varieties on yield components and yield of common bean at Bako, western Oromia Ethiopia

The experiment was conducted during 2021 and 2022 cropping season with the objectives to identify the optimum NPSB fertilizer and varieties on common bean yield and yield components. There were significant yield among treatments tested. Based on the results of analysis of variance and partial budget analysis, the highest grain yield was recorded at 150NPSB applied on Nassir common bean varieties followed 100kg N ha^{-1} NPSB applied on Nassir variety at Bako. All-important parameters were collected, summarized and the full write up of the activity will be presented on completed activity review forum.

Activity 3: Breeder Seed Maintenance of Common Bean Varieties

Seven common bean varieties (Nasir, Anger, Loko, Gabisa, Tibe, Dandessu and Wajju) were multiplied at Bako on station during 2022 cropping season, and 1.9 qt of seed were harvested.

EXTENDED ACTIVITIES

Activity 1: Common Bean VVT (Bush Type)

One candidate variety and two standard checks were planted at Bako, Uke and Billo Boshe in 2022 cropping season. We invited timely technical committee through MoA. But, MoA has not got the voluntarily technical Committee to evaluate the trial due to security issue. Therefore, the activity will be extended for the next season if the environment is secured.

Current status of the activity: The activity was planted as per planned and field managements and data collections are under way.

Activity 2: Common Bean VVT (Climber Type)

One candidate variety and two standard checks varieties were proposed to plant at Bako, B/Boshe and Uke in the 2022. Since the nature of the crop needs stack, we unable to take the materials to the required locations, because the center vehicle not traveled to the West direction due to security problems. Therefore, the activity will be extended for the next season if the security problem solved.

Current status of the activity: The activity was planted as per planned and field managements and data collections are under way.

SOYBEAN

PROOJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF SOYBEAN IN PARTS OF WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Late set soybean variety verification trial

Two late set soybean candidate genotypes were evaluated against standard check Gute and SC1 at Uke, Billo and Bako location in the 2022 main cropping season. The trail is planted on the main station and on-farm on a 10 m x 10 m plot area both on-station and on-farm at all locations. The trial planted 0.6 m and 0.1 m inter and intra row spacing. The trial was evaluated by the national variety releasing technical committee and released as new variety.

Activity 2: Medium Set Soybean Preliminary Yield Trial

Twenty five medium set soybean genotypes were evaluated against standard check Billo using simple lattice design with three replications at BARC in 2022 main cropping season. All required

yield, yield related and disease data were collected and analyzed. Out of the tested medium set soybean genotypes 15 genotypes including check were promoted to the next breeding stage regional variety trial.

Activity 3: Late Set Soybean Preliminary Yield Trial

Twenty five late set soybean genotypes were evaluated against standard check Gute using simple lattice design with three replications at BARC in 2022 main cropping season. All required yield, yield related and disease data were collected, and analyzed. Out of the tested late set soybean genotypes 13 genotypes including standard check were promoted to the next breeding stage regional variety trial.

Activity 4: F5 Soybean Sergeant Generation

With the objective of improving the crop through hybridization, about 122 F5 soybean segregating population were evaluated at Bako Agricultural Research Center in 2022 main cropping season. Each line planted in two rows spaced in 0.6 meter having 5 meter plot length. All recommended agronomic recommendations were applied per recommendation. Regular field follow up and inspection was made as per planned to identify sergeant soybean generation. From evaluated F5 Segregating populations 96 lines have been screened and promoted to the next screening stage F6.

Activity 5: Soybean Observation Nursery

About 108 soybean genotypes were brought from Jimma Agricultural Research Center and evaluated against standard check Billo (medium) and Gute (late) at Bako main experimental station in the 2022 main cropping season. Phenology data, yield and yield related data were collected side by side field observation. Disease data were recorded in (1-9) scale two times at early flowering stage and maturity stage. Based on this scenario, 36 including standard checks lines were screened and grouped as medium and late maturity class respectively.

Activity 6: Breeder Seed Maintenance of Soybean Varieties

Nine soybean varieties were multiplied at Bako on station and Billo sub-sites during 2022 cropping season. A total of 6.71 qt of seed were harvested.

ON-GOING ACTIVITIES

Activity 1: Effect of Row Spacing and NPSB fertilizer rate on Growth, Yield and Yield Component of Soybean under Irrigation at Bako, Western Ethiopia

The activity was proposed to determinate the optimum level of NPSB and appropriate row spacing for soybean under irrigation. Currently the activity was planted according to schedule.

DISCONTINUED ACTIVITIES

Activity 1: Medium set soybean variety verification trial

Two medium set soybean candidate genotypes were screened and planned to evaluate under VVT trial in 2022 main cropping season. Even though the trial was planned to manage under VVT trials in 2022 main cropping season, the selected candidate genotype was already released by another center (JARC). Hence, the Ministry of Agriculture decided to drop the document in order to avoid redundancy of varieties once released.

PIGEON PEA

PROOJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF PIGEON PEA IN PARTS OF WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Medium Set Pigeon Pea Varity verification trial

Two medium set pigeon pea candidate genotypes were evaluated against standard check at Gute, Billo and Bako location in the 2022 main cropping season. The trail is planted on the main station and on-farm on a 10 m x 10 m plot area both on-station and on-farm at all locations. The trial planted 0.6 m and 0.4 m inter and intra row spacing. The trial was evaluated by the national variety releasing committee and one candidate variety was released as a new variety.

Activity 2: Late Set Pigeon Pea Varity verification trial

Two late set pigeon pea candidate genotypes were evaluated against standard check Uke, Billo, chewaka, Gute and Bako location in the 2022 main cropping season. The trail is planted on the main station and on-farm on a 10 m x 10 m plot area both on-station and on-farm at all locations. The trial planted 0.5 m and 0.4 m inter and intra row spacing. The trial was evaluated by the national variety releasing committee and one candidate variety was released as a new variety.

FIELD PEA

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF FIELD PEA FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Breeder Seed Maintenance of Field pea Varieties

Five field pea varieties (Jidha, Lammiif, Gedo-1, Bariso, Arjo-1, Kuullee and Jirraa) were multiplied at Shambu, Gedo and Arjo sub-sites during 2020 cropping season and a total of 0.91 qt seed was harvested.

ON-GOING ACTIVITIES

Activity 1: Field Pea RVT (Shiro Type)

Nineteen field pea including standard check, KUULLEE were evaluated at Shambu and Gedo in RCBD with three replications. But, no data was harvested from Gedo site; due to hail damage at flowering stage. The trial will be repeated with extra locations next year.

Activity 2: Effect of Soil Amendment in Legume-wheat Based Rotations Systems on Yields and Chemical properties of the Rhizosphere Soil in West Oromia

The study was conducted at Shambu subsites. Currently, farmers have been using mono-cropping systems i.e. rotation of cereal with cereals in western Oromia. Therefore, the activity was initiated with the objectives to compare the long-term impact of legume species on soil properties, yield and yield components in legume- wheat rotation systems, to identify the best precursor legume/oil crops for rotation purposes in wheat production systems in the study area that are economic feasibility of different soil amendment in the legume-wheat rotation systems. The highest legume yield was obtained from faba bean applied with vermin-compost plus recommended fertilizer rate which followed by field pea applied with vermin-compost plus RFD.

FABA BEAN

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF FABA BEAN FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Fababean Preliminary Observation Nurseries

One hundred thirty (130) Faba bean genotypes were evaluated with three standard checks (Gora, Numan and Degega) at Gedo for one year (2022) in augmented design to identify superior faba bean genotypes in terms of their desirable traits. Accordingly, all necessary data were taken and

the trial were well good and performed. From 130 genotypes 49 genotypes were promoted to the next breeding stage (PYT).

Activity 2: Response of Faba bean (*Vicia faba* L.) to *Rhizobium* Inoculation and Blended NPSB Fertilizer on lime treated soil at Western Oromiya, Ethiopia

The activity was conducted at Gedo and Shambu location for two consecutive years (2021-2022) with the objective of to determine blended fertilizer (NPSB) rates and Rhizobium strain inoculation and their interaction on nodulation and grain yield of faba bean. The heist grain yield was obtained at the application of 125 kg of NPS.

Activity 3: Breeder Seed Maintenance of Field pea Varieties

Two faba bean varieties (dagaga and Hacalu) were multiplied at Shambuand and Gedo sub-sites during 2022 cropping season. The harvested amount was 45 kg and 39 kg of seed for Dagaga and Hachalu respectively.

LINSEED

PROOJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF LINSEED IN PARTS OF WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Linseed Regional Variety Trial

Sixteen (16) linseed genotypes were evaluated against standard check at Gedo and Arjo in 2021 and 2022 main cropping season. All penology, yield and yield related data were collected as planned. The collected data were analyzed. From the tested genotypes genotype, three genotypes (Acc.10054, Acc.13620 and Acc.10114) showed high yielder uniform and stable across environment and year. Hence, these genotypes were selected and promoted to the next breeding stage VVT.

Activity 2: Breeder Seed Maintenance of Field pea Varieties

Two linseed varieties (kulumsa and Arjo) were multiplied at Gedo and Arjo sub-sites during 2023 cropping season. The harvested amount of each variety was 11 kg and 8 kg respectively.

SESAME

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF SESAME FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Breeder Seed Maintenance of Sesame Varieties

Seven sesame varieties were multiplied at Uke and Bako sub-sites during 2022 cropping season. However from Uke site due to security problem and from Bako site due to high rain fall and disease all maintained varieties were not harvested.

EXTENDED ACTIVITIES

Activity 1: Sesame Regional Variety Trial (RVT 2020)

The trial was proposed to complete within six environments to evaluate the performance and yield stability of the tested genotypes over locations. However in the 2020 the data was collected only from one location and in 2021 the data were collected from three locations which are not sufficient for evaluation. In this season the trial were planted in two locations at Bako on station and Cheweka sub site to get the reliable data to estimate stability and yield performance of the genotypes in tested agro ecologies. Hence, from Cheweka site the trial was not harvested due to stability problems at that time so to complete the experiment it required additional year in the coming cropping season.

Current status of the activity: The activity was planted as planned and field managements and data collections are under way.

Activity 2: Sesame Variety Verification Trial (VVT 2022)

About two best performing candidate genotypes will be selected from RVT-IIIB during previous cropping season with standard checks (Walin and Hachalu) across each location verify and release the best stable and high yielding variety. However due to security problem at all tested location we couldn't planted. Hence, it should be extended for this year if the security problem became solved.

Current status of the activity: The activity was planted as planned and field managements and data collections are under way.

ON-GOINING ACTIVITIES

Activity 1: Sesame Regional Variety Trial (RVT 2022)

Twelve sesame genotypes including standard checks (Yale and Hachalu) were evaluated using RCBD with three replications under Regional variety trial at Bako and Cheweka during 2022 main cropping season. All necessary data were collected and analyzed from Bako but from Cheweka site the trial was collapsed due to security issue at harvesting time. Thus, to get reliable

result, the activity will be continuing in next year with the same objectives within the same methodologies.

Current status of the activity: The activity was planted as planned and field managements and data collections are under way.

Activity 2: Effect of N Fertilizer Rates and Row spacing on Growth, Yield and Oil Content of Sesame (*Sesamum indicum* L.) Under Irrigation at Bako, Western Oromia

The activity was proposed to determine the optimum rate of N and Row spacing for sesame production under irrigation. Currently the trial was planted as seclude using following proposed methodology at Bako research center under irrigation

GROUNDNUT

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF GROUNDNUT FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Ground nut Preliminary Yield Trial

Due to the absence of the materials, only 34 genotypes were brought from HU to evaluate at nursery stage in 2021. However, the performance of the materials at nursery stage was not satisfactory. Sixteen ground nut genotypes were evaluated in Simple Lattice Design with two replications on plot size of = 4.8m2 (2m length x 0.6m space x 4 rows) at Bako. All agronomic packages were applied, all necessary data was collected, analyzed and interpreted. The performance of the evaluated materials at PYT stage was also poor. Therefore, it is decided the activity is terminated at this stage.

Activity 2: Breeder Seed Maintenance of Groundnut Varieties

Three groundnut varieties, Seenaaf, Bulki, and Shulamith were multiplied at Bako during 2022 cropping season. The overall amount of grain yield harvested was 58 kg.

ON-GOING ACTIVITIES

Activity 1: Effect of NPSB Fertilizer and Earthing up Frequency on Yield and Yield Components of Groundnut (*Arachis hypogaea* L.) in Western Oromia, Ethiopia

The activity was proposed with the objectives of; to determinate the optimum level of NPSB fertilizer and earthing up. The activity was planted at two locations (Bako and Uke) but the data collected only from Bako site only. From Uke site, all data were not collected due to security

problem. Thus, to get reliable data the experiment is repeated in 2023 season following the same procedures of last year.

Current status of the activity: The activity was planted as planned and field managements and data collections are under way.

SUN FLOWER

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED TECHNOLOGIES OF SUNFLOWER FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Sunflower Regional Variety trial for midland areas

Thirteen (13) sunflower genotypes were evaluated with one standard check at Bako, Bilo and Gute in 2021 and 2022 main cropping season by using RCBD with three replications. Hence, at Gute 2022 the trial was not performed well due to soil fertility problem on the site. Based on yield performance at least two sunflower genotypes was identified and promoted for VVT. The sample of selected candidate genotypes was sent to IQQO Food science for oil quality analysis.

Activity 2: Sunflower Preliminary Yield trials for mid land areas

Twenty five (25) sunflower genotypes were evaluated including check at Bako in 2022 using Simple lattice design. The trial was well performed and all necessary data were collected and analyzed. There was highly significant difference for most studied traits across tested genotypes. Hence, 14 sunflower genotypes were promoted to RVT based on their yield and yield related traits performance for stability analysis.

EXTENDED ACTIVITIES

Activity 1: Sunflower Regional Variety Trial for High land areas

Sixteen (16) sunflower genotypes were evaluated under RVT in 2021 and 2022 main cropping season by using RCBD within three replications. The trial was planted at two locations (Shambu and Gedo) but not planted at Arjo due to security problems. All data were collected in 2022 cropping season from Shambu and Gedo and it was very good in performance and we have data only from three environments. Hence, to get reliable result the trial should be repeated over three locations in the next cropping season

III. HORTICULTURE TECHNOLOGY RESEARCH TEAM

POTATO

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF POTATO VARIETIES FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Potato Preliminary Yield Trial

Thirty six (36) potato genotypes were evaluated by 6x6 simple lattice designs at Shambu in 2022. The analysis showed significant difference among genotypes. Eighteen (18) Genotypes with high yield performance and yield advantage greater than 10% including standard check were promoted to regional variety trial.

ON-GOING ACTIVITY

Activity 1: Potato Regional Variety Trial (Set-I)

For two years, the trial was held in two locations. The outcomes of two locations and two years were encouraging. For this trial, eight elite potato genotypes were tested. The trial will resume in 2023 to get reliable data following the last year methods. Data to be collected: a number of parameters were considered: stem length, stem number, tuber numbers, tuber size categories, total yield, marketable yield, dry matter content and specific gravity.

Current status of the activity: The activity was planted as planned and field managements and data collections are under way.

ANCHOTE

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF ANCHOTE TECHONOLOGIES IN WESTERN OROMIA

COMPLETED ACTIVITY

Activity 1: Anchote parent seed maintenance and multiplication

Anchote germplasm were maintained at Bako in the 2022 for seed ource for the next breeding activities

EXTENDED ACTIVITIES

Activity 1: Anchote Regional variety Trial

Sixteen (16) genotypes were planted at Bako, Gute, and Bilo during the 2022 cropping season. Two locations Bilo and Gute were poorly managed because of security instability and the data from two locations were poor. So the team decided to extend for one extra year toget precision data.

Current status of the activity: The activity was not planted as planned due to shortage of enough tubers for all locations. The team decided to multiply the tuber for next year and the multiplication tuber is under way.

HOT PEPPER

PROJECT TITLE: DEVELOPMENT OF IMPROVED HOT PEPPER TECHNOLOGIES FOR HIGH LAND AND MID-ALTITUDE AREAS OF WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Hot Pepper varieties breeder seed maintenance

Seven hot pepper varieties (Mareko Fana, Bako local, Oda Gibe, Oda Haro, Kume, Dinsire and Dame) were maintained at Bako Agricultural Research centre on station to use as a source of seed for the next year. From the maintained varieties, about eleven kg of seeds were collected.

ON-GOING ACTIVITIES

Activity 1: Small Pod Hot pepper Regional Variety Trial

In 2022, eight small pod hot peppers were assessed utilizing RCBD at two places (Billo and Bako). The overall product is unappealing. The entire Bilo site was mishandled, and no results were obtained. Thus, to get reliable data the trial will be repeated in the 2023 using the same procedures to last year at the same locations.

DISCONTINUED ACTIVITIES

Activity 1: Hot Pepper Variety Verification Trial for Green Pod Purpose

Reason for termination

The reason for the termination is that there is a five-year gap between RVT and VVT, and there is insufficient information. Even the candidates do not meet the requirements. The initial thought was that hot pepper genotypes that have a good appearance during green but shrink when used for dry pods would be good candidates for green pod trials. However, the researchers failed to recognize this issue and dropped those candidates, resulting in unsuitable materials for the variety release. Apart from that, because of the disability, the time for verification has been extended more than three times, and if we have to continue, it may be the fourth time, which may be illegal. As a result, it is preferable to discontinue this activity.

TOMATO

DEVELOPMENT OF IMPROVED TOMATO TECHNOLOGIES FOR OF WESTERN OROMIA

COMPLETED ACTIVITY

Activity 1: Tomato breeder Seed maintenance

Three tomato varieties that were released by Bako Agricultural Research Center were maintained at Bako under irrigation and 1.14 kg of seed were harvested.

PUMPKIN

DEVELOPMENT OF IMPROVED PUMPKIN TECHNOLOGIES FOR WESTERN OROMIA

SUSPENDED ACTIVITIES

Activity 1: Lowland Pumpkin Variety Verification Trial

Reason for suspension

The RVT was done in two locations (Uke and Chewka). The field was not maintained due to a security issue, and no data was gathered. Again, due to a security concern, repeating and validating the trial is not now allowed. As a result, it is better to suspend and restart when the condition is secure.

Activity 2: Midland Pumpkin Variety Verification Trial

Reason for suspension

The RVT was done in two locations (Bako and Billo). The field was not maintained due to a security issue, and no data was gathered. Again, due to a security concern, repeating and validating the trial is not now allowed. As a result, it is better to suspend and restart when the condition is secure.

HEAD CABBAGE

DEVELOPMENT OF IMPROVED HEAD CABBAGE TECHNOLOGIES FOR WESTERN OROMIA

ONGOING ACTIVITIES

Activity 1: Determination Of Nitrogen, NPS Fertilizer Rates and Intra-row Spacing On Growth and Yield of Head Cabbage (Brassica Oleracea L.) Under Irrigation At Bako, West Oromiya, Ethiopia

The investigation lasted two years. The second year trial is underway. Data collection was completed this year

BANANA

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED BANANA TECHNOLOGIES FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Banana Variety Breeder Seed Maintenance

Six banana varieties were maintained at Bako on-station to use as a source of planting materials (suckers) for the surrounding communities

Number	Variety	Distributed (number suckers)
1	Poyo	160
2	Butuzia	110
3	Giant Cavendish	167
4	Dwarf Cavendish	54
5	Williamis	90
6	Grand nine	89
	Total	670

NB: About 430 suckers were given to Adami Tulu Agricultural Research center (ATARC) for multiplication of Banana suckers using Biotechnology(tissue culture)

AVOCADO

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF IMPROVED AVOCADO TECHNOLOGIES FOR WESTERN OROMIA

COMPLETED ACTIVITIES

Activity 1: Avocado Breeder seed maintenance

Three avocado varieties (Fruthe, Hass and Etinger) were adapted to the area so far. These varieties were maintained at BARC to use as a source of planting materials for the surrounding communities. Therefore the varieties were maintained under breeders close supervision and management. The varieties were maintained on an area of 0.5 ha.

MANGO

PROJECT TITLE: DEVELOPMENT AND PROMOTION OF MANGO VARIETIES IN WESTERN OROMIYA

COMPLETED ACTIVITIES

Activity 1: Mango Varieties breeder seed Care

Five adapted mango varieties were maintained at Bako to provide scion to nearby community and other stakeholders.

PAPAYA

PROJECT TITLE: ADAPTATION OF IMPROVED PAPAYA TECHNOLOGIES IN MID LAND AREAS OF WESTERN OROMIYA

ON-GOING ACTIVITY

Activity 1: Papaya Adaptation Trial

The first year's data was collected. The collection of data for the second year (2022/23) is still on-going. It will be handed over this year. Fruit attack by wildlife and security body is high.

GARLIC

DEVELOPMENT OF IMPROVED GARLIC TECHNOLOGIES FOR WESTERN OROMIA

GARLIC

SUSPENDED ACTIVITIES

Activity 1: Effect of different planting time of bulb to seed bolting of Onion on quality seed production, growth, yield and components

Reason for Suspension

The activity was decided to be suspended due to shortage of seed and man power (Agronomist); the researchers handled the activity was left the center.

3.2 Crop Protection Research Process

3.2.1 Pathology Research Team

1. Completed Activities

Activity 1: Screening of small white common bean genotypes for Resistance to major disease of common bean in Bako area.

Abstract

Common bean (Phaseolus vulgaris L.) is an important crop worldwide, comprising of both dry beans and snap (green) beans. The experiment initiated with the objective of, to screen small white common bean major diseases under field condition. The study was conducted for one year in (2022) cropping season at Bako Agricultural research center. A total of 64 genotypes were evaluated and simple lattice design a plot size of 3m length and with a recommended spacing of 10 cm x 40 cm between plant and row respectively were used. Among all,34 genotypes moderately resistance and good yield performance. These genotypes seem to have some significant different against for major diseases of common bean and moderate resistance of infection with common bean disease. Those genotypes promoted to breeder for next breeding program.

Keyword: major diseases, severity, resistance

Table 1: Mean disease incidence and severity of common bean Angular leaf spot against common bean genotypes during 2022 main cropping season.

Genotypes	INC.	Sev.	Genotypes	INC.	Sev.
CB1	35.3	17.7	CB33	31.3	17.3
CB1.2	34	19	CB34	57.3	44
CB10	21.3	8	CB35	53	22
CB10.1	24.7	8.3	CB35.1	47.7	24
CB11	28.7	22	CB36	37	17.7
CB12	36	22.7	CB36.1	23.7	9.7
CB13	33.3	23.7	CB37	34	20
CB14	26.3	7.7	CB38	67.7	56
CB15	18.3	13	CB38.1	38	19
CB16	28.3	15.3	CB39	33.3	12.7
CB16.1	24	10	CB39.1	21.7	8.7
CB17	23.7	11.3	CB39.2	33.3	14.3
CB18	34.3	27.3	CB39.3	32	18.3
CB19	51.3	14.7	CB4	63	57.7
CB19.1	28.7	18.3	CB4.2	47	18.3
CB2	26.7	17	CB4.4	69	52.7
CB20	45.3	17	CB41	23.3	14
CB20.1	31	12.7	CB42	38.7	7.3
CB21	20.7	9.7	CB42.2	30	12.7
CB23	20.7	8	CB42.3	24	10
CB23.1	49.7	14.7	CB42.5	22	8.7
CB24	30.3	19.7	CB43.1	49.7	26.3
CB25	41.7	24.3	CB43.2	52.3	21
CB26	33	13.7	CB44	64.7	31.3
CB27	23	13.7	CB5	59	20
CB27.1	26	13.7	CB6	39.7	11
CB28.5	34.7	16	CB7	24	9.3
CB28.6	25	15.3	CB8	34	16
CB29	31	15	CB9	26.3	17.3
CB3	30	8.7	Wajju	20	14.3

CB3.2	18.3	9.3	Mean	34.8	18
CB30	29.3	18.3	CV	16.1	22.6
CB32	27.7	14.7	LSD (p<0.05%)	9.028	6.574**
CB32.1	38.3	21			

- ✓ 12 genotypes immune/resistant (1-10% severity)
- ✓ 35 genotypes Moderate Resistant (10,1-20% Severity)
- ✓ 12 genotypes Moderately susceptible (20.1-50% severity)
- ✓ 3 genotypes Susceptible (50.1 -75% severity)
- ✓ 7.7-57.6% disease severity of Angular leaf spot was recorded.

Table 2: Growth parameters, Yield and yield components of common bean genotypes during 2022 main cropping season.

Genotypes	FD	PSD	MD	PH	PPP	SPP	HSW	G. Yield kg/ha
CB1	46.0	57.3	99.3	51.1	11.8	54.2	12.3	2167.0
CB1.2	44.0	62.0	90.7	56.3	11.3	51.4	17.0	2534.0
CB10	44.0	60.7	93.0	74.3	11.1	52.3	19.0	2522.0
CB10.1	42.7	62.0	95.0	74.4	12.2	46.1	16.0	2119.0
CB11	40.0	60.7	83.0	26.7	6.1	25.7	21.7	1942.0
CB12	48.7	67.3	97.0	68.2	9.3	28.1	13.9	1418.0
CB13	44.0	62.3	98.0	70.5	18.1	43.5	17.1	1881.0
CB14	46.7	65.3	97.0	62.5	9.3	43.3	15.9	2304.0
CB15	44.0	55.7	99.7	63.1	12.3	52.8	14.2	1630.0
CB16	52.7	61.7	94.0	97.9	4.2	20.0	21.1	1282.0
CB16.1	47.7	59.0	96.0	82.6	7.6	40.5	16.6	1147.0
CB17	41.0	56.7	81.0	68.3	9.5	46.5	15.5	1489.0
CB18	47.3	57.0	94.3	73.2	11.8	42.8	15.1	1520.0
CB19	43.3	56.0	97.7	58.4	18.7	39.6	20.4	1791.0
CB19.1	41.7	57.7	99.3	58.7	5.1	21.1	19.3	1883.0
CB2	47.3	65.3	92.3	69.6	16.7	67.5	14.0	2539.0
CB20	49.3	64.0	92.3	59.1	7.0	37.9	18.3	1750.0
CB20.1	43.3	55.3	93.3	64.1	9.7	45.2	16.8	1980.0
CB21	46.3	59.7	82.3	55.1	5.7	23.3	19.8	1586.0
CB23	43.7	56.7	93.3	62.3	9.9	51.5	19.6	1927.0
CB23.1	49.0	59.0	88.3	65.1	12.5	51.5	20.4	2330.0
CB24	44.7	62.0	91.0	32.1	6.5	19.9	21.9	1875.0
CB25	45.0	62.0	90.3	52.9	4.7	15.5	20.4	1423.0
CB26	42.0	53.3	98.7	82.1	7.1	29.1	22.6	1739.0
CB27	39.0	51.7	86.7	58.9	16.7	31.3	16.1	1762.0
CB27.1	46.3	62.7	97.0	57.9	16.2	70.5	16.9	2072.0

CB28.5	39.3	52.7	89.7	60.6	10.7	53.0	19.9	1849.0
CB28.6	39.3	53.0	89.0	73.3	8.4	38.0	22.2	1541.0
CB29	40.3	52.7	92.0	72.1	13.8	74.9	16.5	2133.0
CB3	39.7	49.7	92.0	42.7	21.9	71.6	16.2	2665.0
CB3.2	45.0	57.7	92.0	52.6	9.6	50.3	15.4	1991.0
CB30	43.3	53.7	77.0	71.5	5.9	24.0	22.9	1650.0
CB32	46.7	57.0	91.7	62.5	6.7	44.5	11.1	1345.0
CB32.1	43.3	54.0	82.0	47.8	6.3	24.1	14.9	1603.0
CB33	56.3	64.7	104.0	60.7	8.5	30.7	11.8	1358.0
CB34	45.7	59.7	89.0	65.1	7.1	25.9	15.2	1376.0
CB35	38.3	49.3	82.0	51.8	9.2	32.5	15.6	1528.0
CB35.1	47.0	58.3	82.0	67.5	13.0	52.1	14.6	1817.0
CB36	48.0	62.0	96.0	74.0	8.7	43.2	14.5	1577.0
CB36.1	47.3	60.3	97.7	79.9	13.3	66.2	14.5	1970.0
CB37	39.3	50.0	81.0	48.3	5.1	17.8	22.0	1586.0
CB38	38.7	51.7	77.3	66.2	4.9	24.5	14.4	1285.0
CB38.1	47.7	58.7	89.3	60.1	5.9	20.4	14.6	1239.0
CB39	39.7	48.3	93.3	84.3	16.1	59.3	19.3	2370.0
CB39.1	47.0	60.7	92.3	76.7	8.5	35.7	18.2	2265.0
CB39.2	45.7	61.7	94.7	58.5	7.2	33.3	18.8	1685.0
CB39.3	40.3	50.7	92.0	78.1	12.7	63.2	16.4	2246.0
CB4	39.7	53.3	73.7	54.7	10.4	38.5	15.0	1562.0
CB4.2	41.7	54.3	89.7	39.9	8.1	31.7	14.9	1437.0
CB4.4	48.7	61.3	87.7	37.0	10.3	32.4	15.2	1325.0
CB41	47.3	58.7	93.3	80.4	12.8	61.7	14.9	2094.0
CB42	44.3	58.3	93.7	53.5	12.0	51.8	13.3	2274.0
CB42.2	49.3	60.7	101.7	51.5	12.1	47.8	16.7	2273.0
CB42.3	48.7	57.0	89.0	47.9	17.7	41.4	18.5	2580.0
CB42.5	50.3	62.0	99.0	61.2	11.7	44.3	17.8	1966.0
CB43.1	38.0	50.7	81.3	50.9	10.2	40.8	21.4	1963.0
CB43.2	38.0	50.0	80.7	49.3	9.1	35.5	21.2	2230.0
CB44	46.3	64.3	94.7	86.1	7.7	35.6	15.6	1517.0
CB5	43.3	54.0	86.7	64.6	7.2	22.8	12.3	1285.0
CB6	41.0	55.0	87.0	53.8	9.8	38.7	12.5	1449.0
CB7	54.7	66.7	92.3	69.4	9.3	33.0	13.3	1601.0
CB8	45.7	61.3	98.3	72.7	9.2	49.5	16.1	2496.0
CB9	43.0	53.7	69.7	34.1	7.5	30.8	21.5	1388.0
Wajju	50.0	60.7	94.7	73.1	10.3	45.8	23.3	1841.0
Mean	44.7	57.8	90.8	62.2	10.2	40.9	17.1	1827.7
CV	11.8	11.5	10.3	14.4	25.4	16.1	7.4	15.2
LSD (p<0.05%)	8.52*	10.75*	12.17**	14.42**	4.17**	10.65**	2.03	449.16**

Activity 2: Evaluation of Field pea Genotypes for Resistance to Powdery mildew and Ascochyta blight.

Abstract

Field pea ((Pisum sativum L.)) is an important crop worldwide, comprising of both dry beans and snap (green) beans. The experiment initiated with the objective of, to identify resistance or moderately resistance Field Pea genotypes to Powdery mildew and Ascochyta blight disease in the area. The study was conducted for one year in (2022) cropping season at Shambu sub-site. A total of 81 genotypes were evaluated and simple lattice design a plot size of 3m length and with a recommended spacing of 10 cm x 20 cm between plant and row respectively were used. Among all,53 genotypes moderately resistance and good yield performance. These genotypes seem to have some significant different against for Powdery mildew and Ascochyta blight of field pea and moderate resistance of infection with common bean disease. Those genotypes promoted to breeder for next breeding program.

Keyword: major diseases, severity, resistance

Table 1: Growth parameters, Yield and yield components and ascochyta blight of field pea during 2022 main cropping season.

Genotypes	FD	PSD	MD	PH	PPP	SPP	SEV.	HSW	G. Yield Kg/Ha
FG1	62.7	78.7	129.0	140.4	10.7	5.3	40.3	15.5	1222
FG104	64.7	74.3	140.7	188.3	11.9	5.3	16.3	13.7	2587
FG105	66.3	78.0	133.0	163.4	10.8	4.8	9.0	14.6	2251
FG107	71.3	83.7	144.0	194.9	11.5	5.2	12.0	16.6	3723
FG108	62.0	75.0	123.3	180.2	7.3	5.3	14.7	15.2	1794
FG109	59.0	71.0	134.7	186.2	10.9	4.7	20.0	16.1	2491
FG111	64.7	77.7	137.7	200.1	9.8	5.4	8.7	14.7	3163
FG114	65.3	77.7	133.0	185.4	9.5	5.7	26.3	13.7	2129
FG115	67.7	81.7	132.0	189.6	10.7	4.9	19.3	14.9	2193
FG116	65.7	72.3	136.7	198.7	10.0	4.6	31.7	14.2	2031
FG117	59.3	71.0	124.7	213.6	11.4	5.7	6.7	15.4	3445
FG120	59.0	70.7	120.7	135.3	8.5	3.6	40.3	14.2	1247
FG121	62.3	76.0	124.3	183.3	12.0	4.6	9.3	16.7	3578
FG122	62.7	74.0	131.7	204.0	10.8	6.0	12.7	15.3	2537
FG124	62.3	76.0	122.0	147.9	11.3	5.3	26.3	13.9	2808
FG126	72.0	83.7	149.7	185.7	13.7	4.8	14.7	15.5	3223
FG127	63.0	78.7	125.3	178.5	10.6	5.5	19.0	14.4	1724
FG128	64.0	76.0	133.3	137.2	9.4	4.4	41.3	11.8	1272
FG130	62.0	74.0	122.0	175.2	10.0	5.3	8.0	14.1	3395
FG131	64.3	79.3	138.7	168.9	13.3	4.8	25.7	13.2	2400
FG132	63.7	79.3	131.7	153.8	11.8	5.1	17.3	13.3	3392
FG134	71.0	84.7	145.3	173.2	10.0	4.3	16.7	14.9	3316
FG138	62.3	75.0	123.0	167.1	10.5	4.6	33.0	13.7	1792
FG141	60.0	73.3	130.7	169.2	9.6	4.8	16.3	15.3	1299
FG142	59.3	72.0	123.7	140.1	10.6	4.8	16.7	17.0	2940
FG143	63.0	76.3	131.3	168.2	12.3	5.6	14.0	14.6	3897
FG144	56.0	71.0	122.7	176.2	9.1	4.4	33.7	13.3	2184

FG148	64.0	76.3	135.7	171.7	10.9	5.3	9.3	16.0	3321
FG16	66.0	80.3	132.7	159.6	11.6	4.8	17.3	14.8	3084
FG17	67.0	81.0	142.3	139.4	12.6	4.8	10.0	15.4	3417
FG2	63.3	75.7	120.0	184.6	10.1	5.3	22.7	14.6	2830
FG20	66.3	78.7	136.3	135.3	7.9	4.7	15.0	12.7	2418
FG24	67.0	80.7	134.0	182.1	8.8	4.8	15.3	15.9	2644
FG28	64.0	75.0	122.0	139.7	9.8	4.3	44.7	12.9	1237
FG3	59.7	72.7	121.7	165.4	12.3	4.9	17.7	15.4	3295
FG30	59.3	73.3	118.7	166.7	9.9	5.1	30.7	15.4	2164
FG31	62.7	74.7	124.7	141.2	10.3	5.3	21.3	14.6	3194
FG32	67.0	74.0	140.0	193.6	11.3	5.0	13.7	14.3	2984
FG35	61.7	76.0	129.0	182.9	10.4	6.1	15.0	15.9	3052
FG38	64.0	76.7	135.7	174.0	10.0	5.3	17.7	15.7	3178
FG39	64.3	77.3	131.3	176.4	9.3	4.7	34.0	14.7	2956
FG41	65.0	78.0	124.0	164.0	12.2	4.7	15.7	15.9	2814
FG42	64.7	77.3	137.7	178.9	11.7	4.8	20.7	15.3	2723
FG43	64.7	76.0	127.7	177.9	12.4	5.9	9.3	15.2	2799
FG44	61.0	75.0	117.3	146.3	10.5	5.3	12.7	15.5	3158
FG45	66.0	77.7	132.3	169.7	11.1	4.7	22.0	16.3	2860
FG48	63.0	75.3	123.3	167.2	9.4	5.8	9.7	14.7	3023
FG5	68.0	78.7	138.0	170.8	9.8	4.6	21.0	16.9	2274
FG50	64.0	78.0	117.3	165.0	9.8	5.2	30.7	17.1	1492
FG51	64.3	77.0	119.7	154.2	8.8	4.7	43.0	20.7	2108
FG53	61.0	73.7	135.7	201.7	11.3	4.9	17.3	14.4	1861
FG58	64.7	77.0	125.0	131.7	10.8	5.0	22.7	15.4	2510
FG59	65.0	78.3	136.3	164.2	10.3	5.9	23.3	15.9	2612
FG60	60.0	77.3	132.0	176.5	10.1	5.9	12.3	14.8	3241
FG61	63.7	75.0	138.0	179.6	9.6	5.0	11.0	13.9	3317
FG64	61.0	74.3	128.7	182.4	12.4	5.3	16.3	13.8	1613
FG66	63.3	76.0	140.3	171.5	11.4	5.2	28.3	12.9	2364
FG68	68.7	81.0	128.0	168.3	10.5	5.4	37.3	15.6	1875
FG69	64.3	73.0	124.7	190.8	11.1	5.6	25.3	15.0	3113
FG70	62.0	78.0	120.3	155.8	10.3	6.1	19.7	14.7	2907
FG72	69.0	80.7	132.7	170.0	11.8	6.2	16.0	13.8	1687
FG73	65.3	81.0	127.0	153.7	9.5	5.5	17.0	14.1	2470
FG76	61.7	72.7	132.7	191.9	10.7	5.4	17.0	16.7	3282
FG77	57.3	70.3	121.0	198.1	10.1	4.8	14.3	15.7	3144
FG79	62.7	77.7	139.3	157.3	11.4	5.3	15.0	14.3	3474
FG80	62.3	80.3	124.3	156.2	10.6	5.7	8.7	15.7	3170
FG81	62.7	73.0	142.3	193.8	11.3	4.3	18.7	14.0	2822
FG82	64.0	78.3	123.7	193.9	10.9	5.0	17.3	12.9	2799
FG83	65.0	80.7	134.0	151.8	11.9	5.3	21.7	14.1	2191
FG85	64.7	76.3	131.0	146.1	10.3	4.5	15.7	15.2	3459
FG87	66.7	79.0	136.7	174.4	9.9	3.8	16.7	14.2	2393
FG88	61.7	77.3	141.7	171.9	13.0	4.8	15.7	15.7	3487
FG90	65.7	78.0	126.0	160.0	10.6	4.8	37.3	14.6	2082
FG91	64.7	79.0	123.3	155.2	8.2	5.7	22.3	15.2	2380
FG93	60.7	72.3	118.3	167.1	11.1	5.0	26.7	14.5	1947
FG94	63.3	81.0	133.0	182.9	10.4	4.5	28.0	14.2	1740

FG95	63.7	76.3	145.0	137.2	8.8	5.6	29.7	13.6	2451
FG97	63.3	78.0	129.3	174.2	10.8	5.1	37.3	15.0	1671
FG98	59.0	73.3	137.3	172.5	10.0	5.3	16.0	15.2	3181
FG99	63.3	81.7	127.7	189.7	12.0	5.4	34.3	14.5	1773
Lamif	65.3	74.3	135.3	188.8	10.7	5.3	20.7	21.0	2855
Mean	63.7	76.7	130.6	170.6	10.6	5.1	20.7	15.0	2604
LSD(P<0.05%)	NS	NS	15.603**	27.46**	2.8*	NS	7.095**	2.36**	561.87**
CV	11.1	10.4	7.4	10.0	16.4	17.3	21.2	10.8	13.4

- ✓ 10 genotypes resistant (1-10% severity)
- ✓ 39 genotypes moderately resistant (11.1-20% severity)
- ✓ 27 genotypes moderately susceptible (20.1- 50% severity)
- ✓ 5 genotypes susceptible (50.1- 75% severity)
- ✓ 6.7 -61% disease severity of ascochyta blight recorded

Activity 3: Efficacy of different Fungicides on Barley leaf rust and other Barley Leaf diseases at shambu

Brief Status: Completed

- Year started: 2020
- Year of completion: 2022

The experiment was conducted at Shambu and Gedo sub-sites for two seasons. In 2021 cropping season it was repeated at both locations. Data was collected from Gedo sub-site as planned, however, from Shambu Gitilo sub-site data was not collected due to security problem. It was repeated in 2022 at Shambu sub-site

- Data were under processing
- Therefore, it will be reported soon by combing each location and years data

Table 1. Mean of yield and diseases as influenced by fungicide type and frequencies at Shambu in 2020

Treatments	Yield	Scald	BLS	LR	Netbloch
Control	25.021	**8.68**	**3.33**	**60**	**5**
Jeba1	24.341	6.33	4	35	4
Jeba2	34.181	3	3.67	20	4
Jeba3	31.839	3.67	3.67	15	4.33
Manco1	25.489	7.33	3.33	50	4.67
Manco2	27.104	5.68	3	25	5
Manco3	20.937	7	3.33	30	4
Nativo1	24.004	5	3.33	31.67	4
Nativo2	28.803	3	3.33	5	3.67
Nativo3	32.136	3	3.66	5	3.67
Natura1	27.104	6	3.33	35	4.67

Natura2	29.542	3.3	3.33	5	3.33
Natura3	31.839	3	3.33	5	3.67
F test	**	**	NS	**	**
LSD	**4.806**	**1.597**		**18.613**	**1.0036**
CV%	**10.23**	**19**	**20.33**	**40**	**14.34**

Table 2. Mean of yield and diseases as influenced by fungicide type and frequencies at Gedo in 2020

Treatments	Grain yield	Scald	BLS	LR	Netbloch
Control	**15.082**	**3.33**	**4**	**25**	**4**
Jeba1	17.427	1.67	3	5	3.33
Jeba2	19.037	2.33	3	5	2.67
Jeba3	20.948	2.67	3	5	3.67
Manco1	17.220	3.33	3	5	3.33
Manco2	16.323	2.67	3.33	4	3.33
Manco3	13.484	2	2.67	8	2.67
Nativo1	16.452	2.33	3	1	3.33
Nativo2	21.037	2.67	3	1	3
Nativo3	19.203	3	3	1	3.33
Natura1	17.122	3	3	1	2
Natura2	22.970	1.67	2.33	5	3.33
Natura3	22.320	2	3.33	5	3
F test	*	**	*	**	NS
LSD	**5.3074**	**1.2415**	**0.6746**	**10**	
CV%	**17.16**	**29.3**	**13.12**	**42**	**23**

Table 3. Mean diseases severity as influenced by fungicide type and frequencies at Gedo 2021

Treatment	**Scald**	**Leaf rust**	**Spot blotch**	**Net blotch**
Control	1.33 a	23.33 ab	2.33 ab	4.00 a
Jaba1	1.67 a	23.33 ab	2.33 ab	4.33 a
Jaba2	1.00 a	20.00 ab	3.00 a	4.33 a
Jaba3	1.00 a	30.00 ab	2.33 ab	3.67 a
Manco1	1.00 a	26.67 ab	2.33 ab	4.00 a
Manco2	1.67 a	40.00 a	2.00 b	3.67 a
Manco3	1.67 a	23.33 ab	2.67 ab	4.33 a
Nativo1	1.00 a	20.00 ab	2.00 b	3.67 a
Nativo2	1.33 a	16.67 b	2.00 b	3.00 a
Nativo3	1.33 a	23.33 ab	2.33 ab	4.00 a
Natura1	1.00 a	20.00 ab	2.00 b	4.00 a

Natura2	1.33 a	20.00 ab	2.33 ab	4.33 a
Natura3	1.00 a	26.67 ab	2.00 b	3.67 a
mean	1.256	49.49	22.46	27.2
lsd	0.99	20.1	0.86	1.8
CV	46.83	24.1	2.28	3.92

Table 4. Mean yield and yield relates as influenced by fungicide type and frequencies at Gedo 2021

Treatments	**Yield per plot**	**1000 seed wt**	**No. tillers**	**Yield qt/ha**
control	1017.63bcd	47.33a	7.60a	24.19bc
Jeba1	952.40bcd	42.67a	7.33a	23.81bc
Jeba2	**1321.13ab**	43.67a	8.53a	32.20ab
Jeba3	**1249.17abc**	44.33a	7.60a	32.06ab
Mancozeb1	821.43d	45.33a	9.07a	20.54c
Mancozeb2	764.20d	54.00a	7.13a	21.61c
Mancozeb3	1038.56abcd	47.67a	8.07a	25.96bc
Nativo1	862.43cd	48.67a	7.07a	21.56c
Nativo2	759.63d	48.67a	6.53a	20.66c
Nativo3	862.23cd	48.00a	7.20a	21.5gc
Natura1	1032.97abcd	50.33a	8.73a	25.82bc
Natura2	1424.00a	47.67a	6.53a	23.52c
Natura3	941.00bcd	45.00a	8.87a	35.60a
Mean	1003.60	47.18	7.71	25.31
P value	<0.00002	0.089	0.652	<0.00002
CV	10.93	7.83	25.73	10.93

Activity 4: Screening of Bread Wheat Germplasms Resistance to Major Wheat Diseases at Gedo

Brief Status

- Year started: 2022
- Year of completion: 2022

It was planted at Gedo-sub site and diseases, agronomic yield data were recorded

Diseases and other traits data were collected with collaboration of breeder

Accordingly, some promising and disease-free genotypes will be promoted to breeding program

All data collected analysis on the way

2. Extended Activities

Activity 1: Assessment of Major Diseases affecting Major Fruits Produced in western Oromia

Brief Status

- Year started: 2020
- Year of completion: 2021

It was planned for two years

One 2020 assessment survey was conducted

Due to security problem the experiment was not done Last year (2021). But one year the assessment was conducted on **Mango, Banana and Avocado fruits.**

Totally **82** fruit farms were assessed from 10 districts of western Oromia. However, because of security problem to overtake the survey the activity was extended for the coming season. The intermediate result was indicated blow.

- ❖ The coming season the activity will be performed according to the plan
- ❖ The activity will be done during **offseason** as it planned.

Table 1: Percentage Prevalence, Incidence and Severity of fruit disease in West Shoa

Zones	Districts	Crop	Diseases	Prevalence	Incidence	Severity
West Shoa	Bako Tibe	Banana	Sigatoka	100	40	15
			Fusarium	50	7.5	5
			Cordana	0	0	0
		Mango	Powdery mildew (leaf)	33.33	13.33	1.67
			Powdery mildew (flower)	33.33	33.33	6.67
			Anthracnose (fruit)	0	0	0
			Anthracnose (leaf)	100	37.33	9
			Black banded	0	0	0
		Avocado	Algal leaf spot	100	60	35
			scab	100	8.5	6
			Anthracnose	0	0	0
	Elu Gelan	Banana	Sigatoka	100	25	10.6
			Fusarium	33.33	5.00	2.67
			Cordana	0	0	0
		Mango	Powdery mildew (leaf)	66.67	35	2.33
			Powdery mildew (flower)	66.67	36.67	40
			Anthracnose (fruit)	33.33	1.67	13.33
			Anthracnose (leaf)	100	50.67	15.67
			Black banded	33.33	1.67	1.67
		Avocado	Algal leaf spot	50	1	0.5

			scab	0	0	0
			Anthracnose	0	0	0

Table 2. Percentage Prevalence, Incidence and Severity of fruit disease **Buno Bedelle**

Zones	Districts	Crop	Diseases	Prevalence	Incidence	Severity
Buno Bedelle	Chewaka	Banana	Sigatoka	66.67	5.33	6.17
			Fusarium	100.00	15.00	9.50
			Cordana	16.67	4.17	0.83
		Mango	Powdery mildew (leaf)	0	0	0
			Powdery mildew (flower)	0	0	0
			Anthracnose (fruit)	100	2.83	8.67
			Anthracnose (leaf)	16.67	8.33	8.33
			Black banded	66.67	22.00	6.00

Table 3. Percentage Prevalence, Incidence and Severity of fruit disease East Wollega zone

Zone	**Districts**	**Crop**	**Diseases**	**Prevalence**	**Incidence**	**severity**
East Wollega	Gobu Sayo	Banana	Sigatoka	66.67	3.33	5.00
			Fusarium	100.00	25.00	20.00
			Cordana	100.00	37.33	5.67
		Mango	Powdery mildew (leaf)	0	0	0
			Powdery mildew (flower)	66.67	66.67	53.33
			Anthracnose (fruit)	66.67	30.00	40.00
			Anthracnose (leaf)	100.00	9.00	4.00
			Black banded	100.00	29.00	9.00
		Avocado	Algal leaf spot	100.00	5.00	5.00
			Anthracnose	100.00	6.00	11.00
	Sibu Sire	Banana	Sigatoka	100.00	12.33	10.00
			Fusarium	66.67	3.33	15.00
			Cordana	100.00	5.00	6.67
		Mango	Powdery mildew (leaf)	25	2.5	1.25
			Powdery mildew (flower)	50	35	37.5
			Anthracnose (fruit)	25	7.5	7.5
			Anthracnose (leaf)	100	13.5	2.5
			Black banded	25	2.5	1.25
		Avocado	Algal leaf spot	100	5	15
			scab	0	0	0
			Anthracnose	0	0	0

Activity 2: Management of Bacterial blight (*Pseudomonas syringae* pv. *Glycinea* (Psg)) disease of soybean in western Oromia

Brief Status

- Year started: 2021
- Year of completion: 2022

- Due to security problem the experiment was not done Last year in Uke sub-site (2022). But one year one-year data have done on Bako.

The experiment will be sown in Bako on station and Gute sub-site as it planned for 2023 cropping season.

Everything well prepared and waiting sow time.

Activity 3: Screening of Sesame (*Sesamum indicum* L.) Genotypes against major diseases of sesame at Bako and East Wollega Zone

Status of Activity

Year of started 2022

Year of completed 2022

Due to heavy rain fall at emerging time the activity was devastated last year (2022).

The activity has sown at Bako on station as its proposed.

The emerging data already recorded and the activity well on going

Every data will be recorded as it has proposed.

3. Ongoing Activities

Activity 1: Evaluation of faba bean Genotypes for Resistance to faba bean Chocolate spot and Ascochyta blight Diseases.

Breif Status of Activity

- Year of started 2022
- Year completed 2023

- ✓ The activity has been done at Shambu and Purified last year. Since the genotypes introduced from EIB were obtened through mass collection.
- ✓ Every input ready for sowing
- ✓ The land also well prepared and read.

Activity 2: Evaluation of fungicides for the managements of groundnut (Arachis hypogaea) early leaf spot and late leaf spot diseases in East wollega.

Status of activity

- Year started 2022
- Year of completed 2023

✓ The activity was sown at Uke and Chawaka sub-site as it proposed

✓ The emerging data already recorded and the activity well on going

✓ Every data will be recorded as it has proposed.

Activity 3: The Status of pesticides use in Western Oromia, with special emphasis on Tomato production system

Status of activity

✓ Year started: 2022

✓ Year of completion: 2023

✓ The activity was planned to be performed in western Oromia to evaluate pesticides status. However, due to security problem in Western Oromia the survey was not performed last year.

✓ Hence, it will be planned for this cropping season and everything is ready to assess as it has planned

4. Modified Activity

Activity 1: Management of Finger millet blast and brown spot disease through host resistance and fungicide application at western Oromia

Status of Activity

Year of started 2022

Year of completed 2024

✓ Reason of modified: some treatment arrangement is important and to manage figure millet blast and brown spot disease, it is better to add number of chemicals and frequencies application.

The activity has sown at Bako on station as its proposed.

The emerging data already recorded and the activity well ongoing

Every data will be recorded as it has proposed.

3.2.2 Weed Science Research Team

1. Completed Activities

Activity 1: Effect of Post-emergence Herbicides and Their Combination with handweeding on Yield and Yield components of Teff [Eragrostis tef (Zucc.) Trotter] at Gedo and Shambu, Western Oromia

Abstract

*The weed effect is one of the important limiting factors for crop growth and productivity in agricultural crop production. Then;there should be a little information on the Effect of Post-emergence Herbicides and Their Combination with Hand weeding on Yield and Yield components of Teff. Hence, this study was conducted at Shambu and Gedo BARC's sub site; Western Oromia to evaluate effectiveness of some post-emergence herbicides and their combination with hand weeding against weeds and to identify optimum weed management option (s) in teff [*Eragrostis tef *(Zucc.) at Gedo and Shambo, Western Oromia. It was conducted during main cropping season of 2021/22 &2022/23. The experiment was carried out in randomized completely block design (RCBD) with three replications. A total of ten weed control treatments were evaluated. The two years data (2021 and 2022) were noticed highly significant difference across locations on the assessed parameters of weed, Yield and yield components.*

Key Words*; weed, Weed control, yield, Post-emergence, Herbicide*

1. Effect of Post-emergence Herbicides and Their Combination with Hand weeding on Yield and Yield components of Teff at Shambu and Gedo

The growth measurements of teff such as plant height, No. Of effective tillers, panicle length and Stand count at harvest in the experiment indicated the highly significant at both locations including grain yield. The results were indicated that weed management practices highly significantly increased the yield over weedy check (unweeded control) at both locations. So, the grain yield of teff was highly significantly influenced by the weed management practices .The highest teff grain yield were recorded from 2XHW@30 AND45DAS at and Pallas OD45@0.5Lha-1 weed management practices treatments (1572.5 kg $ha^{-1}$and 1451.25kg ha^{-1}) at Shambu and Gedo respectively .The lowest grain yield were recorded from Weedy check(440kg ha1 and 605.05kgha-1) at both location; Shambu and Gedo; respectively (Table 1 and 2) .

Table 1. Teff yield and yield components at Shambu

	Yield and Yield Component Means										
	PH		PL		ETPP		SC		Yield		
Treatment Description	2021	20222	2021	20222	2021	20222	2021	20222	2021	20222	Pooled Yield
Fala 1Lha-1	107.8a	107.67a	37.4a	36b	1.133b	1.667a	43.5bcd	34.33bcd	754b	1261d	1007.5
Power860 SL 1Lha-1	109.8a	99a	37.73a	34ab	1.067b	3.767ef	48.33d	23.33a	862c	899c	880.5
Pallas Super 320WG@0.3Lha-1	108.5a	100.33a	39.47a	34.67ab	1.067b	4.067f	44.5cd	40.5cde	1528e	1291d	1409.5
Pallas OD45@0.5Lha-1	107.2a	98a	39.2a	36b	1.667c	3bcd	37bc	30abc	884c	1052c	968
Fala 1Lha-1+1XHW@45DAS	103a	91.67a	35.73a	31.67ab	1.2b	3.733def	40bc	50.33ef	1025d	716b	870.5
Power860 SL 1Lha1+1XHW@45DAS	112.4a	106a	37.8a	35.33ab	1.333bc	2.933bc	36b	73.33g	755b	1532f	1143.5
Pallas Super320WG@0.3Lha1+1XHW@45DAS	113a	101.33a	41.4a	36b	1.2b	2.267ab	64.17e	59.67f	1499e	1310de	1404.5
Pallas OD45@0.5Lha1+1XHW@45DAS	103.6a	93a	39.13a	32.67ab	1.267bc	2.867bc	50.17d	75.67g	1482e	1262d	1372
2XHW@30 AND45DAS	104.6a	93a	40.07a	32.33ab	1.133b	3.133cde	37.5bc	41.67de	1664f	1481ef	1572.5
Weedy Check	114.7a	103.33a	36.5a	30.33a	0a	1.733a	27.67a	26.33ab	431a	449a	440
Pr	0.821	0.729	0.664	0.36	<.001	<.001	<.001	<.001	<.001	<.001	
G/Mean	108.5	99.3	38.44	33.9	1.107	2.917	42.88	45.5	1088	1125	
LSD	16.26	20.15	5.912	5.57	0.4414	0.7572	8.215	10.59	100.6	182.3	
CV	8.7	11.8	9	9.6	23.3	15.1	11.2	13.6	5.4	9.4	

Table 2. Gedo teff yield and yield component data

	Yield and Yield Component Means										
	PH		PL		ETPP		SC		Yield		
Treatment Description	2021	20222	2021	20222	2021	20222	2021	20222	2021	20222	
Fala 1Lha-1	119b	107.2bc	49.4b	43.67c	1.87abc	1.53b	41.5a	52.33ab	1419b	781.2b	1100.1
Power860 SL 1Lha-1	115.7b	110c	42.67a	44.73c	1.8abc	1.4b	54.67bc	44a	1348b	977c	1162.5
Pallas Super 320WG@0.3Lha-1	112.6ab	105.9abc	43.87ab	42.33abc	1.8abc	1.13b	50.67abc	46a	1625cd	988c	1306.5
Pallas OD45@0.5Lha-1	117.7b	106.5abc	48.8b	39.27ab	1.73ab	1.33b	48.17ab	56.33ab	1844e	1058.5cd	1451.25
Fala 1Lha-1+1XHW@45DAS	117.5b	106.3abc	44.8ab	41abc	2.67cd	0a	54.33bc	52ab	1295b	901.1bc	1098.05

Power860 SL 1Lha1+1XHW@45DAS	110.7ab	104.4abc	45.87ab	41.8abc	2.47bcd	1.33b	45.67ab	54.33ab	1366b	1302.8ef	1334.4
Pallas Super320WG@0.3Lha1+1XHW@45DAS	113.9ab	101.1ab	41.93a	39.2ab	2.07abc	1.4b	44.5a	53.67ab	1793de	912.3bc	1352.65
Pallas OD45@0.5Lha1+1XHW@45DAS	104.7a	99.8a	46.33ab	42.53bc	1.4a	1.27b	59.5c	47.33a	1630cd	1207.6de	1418.8
2XHW@30 AND45DAS	118.8b	108.1c	44.73ab	38.33a	3.13d	1.33b	47.17ab	60.67b	1472bc	1367.3f	1419.65
Weedy Check	115.5b	110.9c	42.87a	41.67abc	1.33a	1.53b	44.17a	64.33b	832a	378.1a	605.05
Pr	0.221	0.065	0.155	0.071	0.014	<.001	0.023	0.069	<.001	<.001	
G/Mean	114.6	106.02	45.13	41.45	2.027	1.23	49	53.1	1462	987	
LSD	10.69	6.89	5.692	4.069	0.9269	0.5567	9.73	12.61	192.7	158.5	
CV	5.4	3.8	7.4	5.7	26.7	26.5	11.6	13.8	7.7	9.4	

2. Effect of Post-emergence Herbicides and Their Combination with Hand weeding on Weed density at Shambu and Gedo

The effects of weed management practices on weed density (both broad &grass leaf weeds) were highly significant at each location; Shambu and Gedo. All the herbicide treatments significantly reduced the weed density compared to the weedy control .Among the weed management practices the maximum total weed density were recorded in Weedy check(3.42 m^2) and (2.26 m^2) at Shambu and Gedo respectively;& minimum total weed density were recorded in Fala 1Lha^{-1}+1X HW@45DAS and PallasOD45 @0.5 Lha^{-1}+1X HW@45DAS at Shambu and Gedo (Table 3 and 4).

Table 3. Teff, Weed Density data at Shambu

	Weed Density (No/m2)					
	BLWD		GLWD		TWD	
Treatment Description	**2021**	**2022**	2021	20222	2021	20222
Fala 1Lha-1	1.33bc(1.34cd)	5.667cd(2.476)cd	3.33b(1.96b)	5.667bc(2.481)c	4.67d(2.27d)	11.33ef(3.44)e
Power860 SL 1Lha-1	1.83c(1.53d)	6cd(2.544)cd	3.17b(1.91b)	6.333cd(2.607)cd	5d(2.34d)	12.33f(3.58)e
Pallas Super 320WG@0.3Lha-1	1.17bc(1.29bcd)	6.833de(2.704)de	3.33b(1.95b)	0a(0.707)a	4.5d(2.23d)	6.83c(2.70)c
Pallas OD45@0.5Lha-1	0.67ab(1.05abc)	5.5cd(2.448)cd	3.5b(1.99bc)	4.333b(2.196)b	4.17cd(2.16cd)	9.83de(3.21)de
Fala 1Lha-1+1XHW@45DAS	0a(0.71a)	0a(0.707)a	3.23b(1.93b)	0a(0.707)a	3.23bc(1.93c)	0a(0.71)a
Power860 SL 1Lha1+1XHW@45DAS	0.5ab(0.98ab)	0a(0.707)a	3.83bc(2.08bc)	0a(0.707)a	4.33cd(2.20cd)	0a(0.71)a
Pallas Super320WG@0.3Lha1 + 1XHW@45DAS	0a(0.71a)	2.833b(1.782)b	3.17b(1.91b)	0a(0.707)a	3.17bc(1.91c)	2.83b(1.78)b
Pallas OD45@0.5Lha1 + 1XHW@45DAS	0.17a(0.81a)	0a(0.707)a	1a(1.21a)	8e(2.906)e	1.17a(1.29a)	8cd(2.91)cd
2XHW@30 AND45DAS	0.67ab(0.99abc)	4.833c(2.309)c	1.5a(1.41a)	7.333de(2.79)de	2.17ab(1.60b)	12.17f(3.55)e
Weedy Check	3.17d(1.91e)	8e(2.912)e	4.33c(2.19c)	7.667de(2.857)de	7.5e(2.82e)	15.67g(4.02)f
Pr	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)
G/Mean	0.95(1.13)	3.97(1.93)	3.04(1.86)	3.93(1.867)	3.99(2.08)	7.9(2.66)
LSD	0.84(0.35)	1.51(0.3521)	0.79(0.23)	1.404(0.2543)	1.23(0.30)	2.17(0.41)
CV	51.5(18.1)	22.2(10.6)	15.1(7.2)	20.8(7.9)	17.9(8.30	16(9)

Table 4. Weed Density in teff at Gedo

Treatment Description	Weed Density (No/m2)

	BLWD		GLWD		TWD	
	2021	20222	2021	20222	2021	20222
Fala 1Lha-1	2.5cd(1.72bcd)	0.67(1.07)b	2.33b(1.68b)	0.93(1.20)c	4.83c(2.30bc)	1.6(1.45)c
Power860 SL 1Lha-1	2.33bcd(2.05d)	0.93(1.20)c	4.83d(2.52d)	0.67(1.07)b	7.167d(2.77de)	1.6(1.45)c
Pallas Super 320WG@0.3Lha-1	3.33de(1.95d)	0.97(1.21)c	0a(0.71a)	0.5(1)b	3.33b(1.95b)	1.47(1.40)c
Pallas OD45@0.5Lha-1	1.33abc(1.34abc)	0.57(1.03)b	0a(0.71a)	0.5(1)b	1.33a(1.34a)	1.07(1.25)b
Fala 1Lha-1+1XHW@45DAS	3.17d(1.91cd)	0(0.71)a	0a(0.71a)	0(0.71)a	3.17b(1.91b)	0(0.71)a
Power860 SL 1Lha1+1XHW@45DAS	1.17abc(1.23ab)	0(0.71)a	0a(0.71a)	0(0.71)a	1.17a(1.23a)	0(0.71)a
Pallas Super320WG@0.3Lha1+1XHW@45DAS	1ab(1.171ab)	0(0.71)a	2.23b(1.65b)	0(0.71)a	3.23b(1.92b)	0(0.71)a
Pallas OD45@0.5Lha1+1XHW@45DAS	0.67a(0.99a)	0(0.71)a	0a(0.71a)	0(0.71)a	0.67a(0.99a)	0(0.71)a
2XHW@30 AND45DAS	3.33de(1.95d)	0(0.71)a	2.33b(1.68b)	0(0.71)a	5.67c(2.48cd)	0(0.71)a
Weedy Check	4.67e(2.27d)	0.93(1.2)c	4.23c(2.18c)	0.67(1.08)b	8.90e(3.07e)	1.6(1.45)c
Pr	<.001(0.002)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)
G/Mean	2.35(1.66)	0.41(0.92)	1.60(1.32)	0.33(0.89)	3.95(1.99)	0.73(1.05)
LSD	1.45(0.59)	0.20(0.09)	0.53(0.09)	0.21(0.10)	1.33(0.45)	0.34(0.12)
CV	36(20.6)	28.9(5.7)	19.5(3.8)	38(6.3)	19.6(13.2)	26.8(6.4)

3. Effect of Post-emergence Herbicides and Their Combination with Hand weeding on Weed biomass at Shambu and Gedo.

The effects of weed management practices on Total Weed Biomass (both broad &grass leaf weeds) were highly significant at each location; Shambu and Gedo. The maximum (11.66 gm/m^2 and 11.68gm/m^2) total weed biomass were recorded in weedy check at both location ; Shambu and Gedo ;and minimum Total Weed Biomass(0.71gm/m^2 were recorded in PallasSuper320WG@0.3Lha1+1XHW@45DAS(1.99gm/m^2 and 0.62gm/m^2 at both location; Shambu and Gedo respectively(Table 5 and 6).

Table 5. Teff, Weed Biomass data at Shambu

	Weed Biomass(gm/m2)					
	BLWB		GLWB		TWB	
Treatment Description	2021	20222	2021	20222	2021	20222
Fala 1Lha-1	20.57(4.51)c	20.33abc(4.561)c	29.37(5.44)ef	6.2c(2.584)c	49.93(7.05)de	26.53b(5.198)c
Power860 SL 1Lha-1	48.53(6.89)d	38.73c(5.842)c	21.7(4.71)cd	11.267e(3.428)e	70.23(8.34)f	50c(6.834)d
Pallas Super 320WG@0.3Lha-1	4.47(2.14)ab	22.87bc(4.83)c	24.63(5.01)de	0a(0.707)a	29.1(5.43)bc	22.87b(4.83)c
Pallas OD45@0.5Lha-1	12.93(3.16)bc	19.33abc(4.425)bc	46.67(6.87)h	5.633bc(2.474)c	59.6(7.72)ef	24.97b(5.026)c
Fala 1Lha-1+1XHW@45DAS	0(0.71)a	0a(0.707)a	40.9(6.42)gh	0a(0.707)a	40.9(6.42)cd	0a(0.707)a
Power860 SL 1Lha1+1XHW@45DAS	10.73(2.78)ab	0a(0.707)a	33.3(5.80)fg	0a(0.707)a	44.03(6.65)cde	0a(0.707)a
Pallas Super320WG@0.3Lha1+1XHW@45DAS	0(0.71)a	0a(0.707)a	10.3(3.28)a	0a(0.707)a	10.3(3.28)a	0a(0.707)a
Pallas OD45@0.5Lha1+1XHW@45DAS	4(1.65)ab	0a(0.707)a	16.27(4.09)bc	8.633d(3.012)d	20.27(4.52)ab	8.63ab(3.012)b
2XHW@30 AND45DAS	6.5(1.96)ab	8.33ab(2.959)b	23.9(4.93)de	6c(2.548)c	30.4(5.53)bc	14.33ab(3.844)bc
Weedy Check	201.27(14.2)e	68.6d(8.299)d	15.8(4.02)b	4.4b(2.214)b	217.07(14.76)g	73d(8.56)e
Pr	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)
G/Mean	30.9(3.9)	17.8(3.37)	26.28(5.06)	4.21(1.909)	57.2(6.97)	22(3.94)
LSD	18.38(2.34)	21.14(1.591)	6.77(0.65)	1.24(0.2139)	18.61(1.26))	20.73(1.39)

CV	34.7(35.2)	69.2(27.5)	15(7.5)	17.2(6.5)	19(10.5)	54.8(20.6)

Table 6. Weed Biomass in teff at Gedo

	Weed Biomass(gm/m2)					
	BLWB		**GLWB**		**TWB**	
Treatment Description	2021	20222	2021	20222	2021	20222
Fala 1Lha-1	37.8(5.82)cd	74.5cd(8.65cd)	5.73(2.48)bc	55.27c(7.46c)	43.53(6.38)cd	129.77e(11.41e)
Power860 SL 1Lha-1	42.43(6.22)cd	59.67b(7.76b)	15.53(3.99)d	31.5b(5.63b)	57.97(7.42)d	91.17b(9.57b)
Pallas Super 320WG@ 0.3Lha-1	20.37(4.548)bc	84.07e(9.19e)	0(0.71)a	28.9b(5.42b)	20.37(4.55)bc	112.97d(10.65d)
Pallas OD45@0.5Lha-1	9.13(2.81)ab	72.43c(8.54c)	0(0.71)a	27.47b(5.29b)	9.13(2.81)ab	99.9c(10.02c)
Fala 1Lha-1+1X HW @ 45DAS	11.07 (3.40)abc	0a (0.71a)	0 (0.71)a	0a (0.71a)	11.07 (3.40)ab	0a (0.71a)
Power860 SL 1Lha1+1 XHW@45DAS	9.07(2.67)ab	0a(0.71a)	0(0.71)a	0a(0.71a)	9.07(2.67)ab	0a(0.71a)
Pallas Super320WG@0.3Lha1+ 1XHW@45DAS	1.93(1.42)a	0a(0.71a)	4.2(2.17)b	0a(0.71a)	6.13(2.54)ab	0a(0.71a)
Pallas OD45 @ 0.5Lha^{1} +1X HW@45DAS	1.57(1.23)a	0a(0.71a)	0(0.71)a	0a(0.71a)	1.57(1.23)a	0a(0.71a)
2XHW @ 30 and 45 DAS	16.57(3.922)abc	0a(0.71a)	8.47(2.98)c	0a(0.71a)	25.03(4.96)bc	0a(0.71a)
Weedy Check	59.83(7.524)d	81de(9.03de)	58.03(7.63)e	75.5d(8.71d)	117.87(10.83)e	156.5f(12.53f)
Pr	0.005(0.002)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)	<.001(<.001)
G/Mean	21(3.96)	37.17(4.67)	9.2(2.28)	21.86(3.61)	30.2(4.68)	59.03(5.77)
LSD	28.31(2.827)	6.84(0.39)	5.66(0.51)	5.03(0.39)	27.61(2.43)	7.24(0.36)
CV	78.7(41.6)	10.7(4.9)	35.9(13.0)	13.4(6.3)	53.3(30.2)	7.2(3.6)

4. Effect of Post-emergence Herbicides and Their Combination with Handweeding on Weed control efficiency, Weed Index and herbicide efficiency Index at Shambu and Gedo

The magnitude of weed reduction caused by the weed control treatment (Weed Control Efficiency) Was done. In general; the weed control efficiency results show that all eight herbicide treatments could reduce weed infestation at the two locations (Shambu and Gedo). Of

weed control treatment practices, PallasSuper320WG@0.3Lha1+1XHW@45DAS shown high weed control efficiency(82.89 %) than the rest practices at Shambu whereas Pallas OD45@0.5Lha1+1XHW@45DAS(91.70%) at Gedo. The minimum weed control efficiency observed from weedy check treatments at each location (Shambu and Gedo). The highest &e weed index (WI) or relative yield loss was recorded (72.02 and 57.38) from Weedy check and the at Shambu and Gedo respectively; and the minimum (0.00) from two times HW@30 AND 45DAS at both locations. Comparing the weed management indices of post herbicides, significantly, the highest (97.13 and 72.45) weed killing potential (Herbicide Efficiency Index) was obtained from 2XHW@30 AND45DAS and Pallas OD45@0.5Lha-1 weed management practices at Shambu and Gedo respectively. And the lowest Herbicide Efficiency Index (0.00) obtained from Weedy Check at each location; Shambu and Gedo (Table 7)

Table 7; WCE, WI and HEI at Shambu and Gedo in teff

	TWB		YIELD		WCE(%)		WI(%)		HEI	
Trt	SHAMBU	GEDO	SHAMBU	GEDO	SHAMBU	GEDO	SHAMBU	GEDO	SHAMBU	GEDO
Fala 1Lha-1	6.13	8.89	1007.50	1100.1	47.47	23.84	35.93	22.51	48.67	42.38
Power860 SL 1Lha-1	7.59	8.49	880.50	1162.5	34.95	27.27	44.01	18.11	37.78	47.73
Pallas Super 320WG@0.3Lha-1	5.13	7.60	1409.50	1306.5	56.00	34.93	10.37	7.97	83.15	60.06
Pallas OD45@0.5Lha-1	6.38	6.42	968.00	1451.25	45.33	45.08	38.44	-2.23	45.28	72.45
Fala 1Lha-1+1XHW@45DAS	3.57	2.06	870.50	1098.05	69.43	82.41	44.64	22.65	36.92	42.21
Power860 SL 1Lha1+1XHW@45DAS	3.68	1.69	1143.50	1334.4	68.44	85.53	27.28	6.01	60.33	62.44
PallasSuper320WG@0.3Lha1+1XHW@45DAS	2.00	1.63	1404.50	1352.65	82.89	86.09	10.68	4.72	82.72	64.01
Pallas OD45 @ 0.5Lha1 +1XHW@45DAS	3.77	0.97	1372.00	1418.8	67.71	91.70	12.75	0.06	79.93	69.67
2XHW@30 AND45DAS	4.69	2.84	1572.50	1419.65	59.82	75.73	0.00	0.00	97.13	69.74
Weedy Check	11.66	11.68	440.00	605.05	0.00	0.00	72.02	57.38	0.00	0.00

Activity 2: Evaluation of Post-emergence Herbicides against Weeds in Wheat (*Triticum aestivum* L.) at Gedo and Shambo, Western Oromia

Abstract

*The weed effect is one of the important limiting factors for crop growth and productivity in agricultural crop production. Then; there should be a little information on the Evaluation of Post-emergence Herbicides against Weeds in Wheat (*Triticum aestivum *L.) at Gedo and Shambo, Western Oromia. Hence, this study was conducted at Shambu and Gedo BARC's sub site; Western Oromia to evaluate effectiveness of selected post-emergence herbicides, their application rates and herbicides combinations for optimum weed management in wheat and to identify and recommend effective herbicidal weed control treatment (s) in wheat at Gedo and Shambo, Western Oromia .It was conducted during main cropping season of 2021/22 &2022/23 .The experiment was carried out in randomized completely block design (RCBD) with three replications. A total of eight weed control treatments were evaluated. The pooled two years data (2021 and 2022) were noticed highly significant difference across locations on the assessed parameters of weed, Yield and yield components.*

***Key Words**; weed, Weed control, yield, Post-emergence, Herbicide*

1. Effects of Post-emergence Herbicides on yield and yield components of wheat at Gedo and Shambu

The growth measurements of teff such as plant height, No. Of effective tillers, panicle length, un-effective tillers /plant and Stand count at harvest in the experiment indicated the highly significant differences including grain yield (Table 1). The results was indicated that weed management practices highly significantly increased the yield over weedy check (unweeded control) .So, the grain yield of wheat was highly significantly influenced by the weed management practices .The highest wheat grain yield were recorded from 2XHW@30 AND45DAS at and followed by Husar Active OD411@1Lha^{-1} weed management practices treatments (1948.02 kg ha^{-1}and 1919.83 kg ha^{-1}) respectively (Table 1) .The lowest grain yield were recorded from Weedy check(974.7kgha-1) (Table 1) .

Table 1. Wheat Yield and yield Components Result

Weed Management Practices	***Yield and yield components***						
	plant Hieght (cm)	***PanicleLength(cm)***	***Effective TIllers /plant (No)***	***Un-effective Tillers /Plant (No)***	***Stand Count/plot(No)***	***Above Ground Biomass (kg/plot)***	***Yield(kg/ha-1)***
Husar Active OD411@1Lha^{-1}	83.13a	7.82ab	1.87a	0.37d	22.44bc	8.50cd	1919.83a
Fala@1Lha^{-1}+Topik@1Lha^{-1}	79ab	7.67abc	2.04a	0.47d	19.78bcd	9.83a	1833.79abc
Power860@1Lha^{-1}+ Topik@1Lha^{-1}	78.07b	7.62abc	1.51b	0.42d	19.22cd	9.00bc	1911.07a
Pallas Super320WG@0.3Lha^{-1}	78.4b	7.40bc	1.40b	0.09e	22.72bc	8.00d	1749.63bc
Fala@1Lha^{-1} +Rubah @1Lha^{-1}	77.42b	7.58abc	1.24b	0.09e	20.11bcd	8.80bcd	1881.39ab

Power 860@1Lha^{-1} +Rubah@1Lha^{-1}	77.89b	8.04a	1.83a	0.67c	23.72ab	8.43cd	1690.06c
2xHW@30 &45DAS	77.44b	7.51abc	1.97a	1.00b	27.28a	6.63e	1948.02a
Weedy check	83.02a	7.09c	0.64c	2.49a	17.78d	9.33ab	974.7d
Pr	0.06	0.006	<.0001	<.0001	<.0001	<.0001	<.0001
G/Mean	79.30	7.59	1.56	0.70	21.63	8.57	1738.56
CV	5.72	7.79	20.58	29.41	18.28	9.40	8.99

2. Effects of Post-emergence Herbicides on weed density and weed biomass at Gedo and Shambu

The effects of weed management practices on weed density(both broad &grass leaf weeds)were shown highly significant differences (Table 2 .All the herbicide treatments significantly reduced the weed density compared to the weedy control .Among the weed management practices; the maximum total weed density were recorded in Weedy check(3.14m^2);& minimum total weed density were recorded in 2xHW@30 &45DAS(1.91m2)(table 2) .The effects of weed management practices on Total Weed Biomass(both broad &grass leaf weeds)were shown highly significant differences .The maximum(12.05gm/m^2) total weed biomass were recorded in weedy check ;and minimum Total Weed Biomass(6.96gm/m^2 were recorded in 2xHW@30 &45DAS weed management practices(Table 2).

Table 2. Wheat Weed Data

	Weed Density(No/m2)			***Weed Biomass(gm/m2)***		
Weed Management Practices	***BLWD***	***GLWD***	***TWD***	***BLWB***	***GLWB***	***TWB***
Husar Active OD411@1Lha^{-1}	3.73bc(1.98b)	3.78ab(1.77abc)	7.51b(2.61ab)	63.27e(7.51c)	12.97c(3.08c)	76.24e(8.16cd)
Fala@1Lha^{-1}+Topik@1Lha^{-1}	1.5d(1.34d)	3.17ab(1.63abc)	4.67bc(1.99c)	57.82e(5.61d)	39.73a(5.36a)	97.56cd(7.86d)
Power860@1Lha^{-1}+ Topik@1Lha^{-1}	3.08bc(1.84cd)	3.39ab(1.76abc)	6.47bc(2.50bc)	96.09b(8.55b)	13.2c(3.20c)	109.29bc(9.63b)
Pallas Super320WG@0.3Lha^{-1}	3.78b(2.00b)	1.83b(1.30bc)	5.61bc(2.30bc)	81.52cd(7.94bc)	9.69c(2.82c)	91.21d(8.82bc)
Fala@1Lha^{-1} +Rubah @1Lha^{-1}	2.72bcd(1.76bc)	4.33a(1.81ab)	7.06b(2.51bc)	91.83bc(8.57b)	10.18c(2.87c)	102.01bcd(9.41b)
Power 860@1Lha^{-1} +Rubah@1Lha-^{1}	2.63bcd(1.74bc)	4.5a(2.02a)	7.13b(2.62ab)	79.04d(7.84bc)	32.62b(5.48a)	111.67b(9.63b)
2xHW@30 &45DAS	2.22cd(1.57cd)	1.5b(1.24c)	3.72c(1.91c)	46.61f(5.62d)	31.64b(3.90b)	78.24e(6.96e)
Weedy check	5.81a(2.45a)	4.72a(2.07a)	10.53a(3.14a)	136.98a(10.89a)	29.49b(5.18a)	166.47a(12.05a)
Pr	<.0001(<.0001)	<.0001(<.0001)	<.0001(<.0001)	<.0001(<.0001)	<.0001(<.0001)	<.0001(<.0001)

G/Mean	3.19(1.84)	3.40(1.70)	6.59(2.45)	81.65(7.82)	22.44(3.99)	104.09(9.07)
CV	45.29(19.91)	65.51(30.82)	43.34(23.57)	14.41(9.51)	15.83(11.93)	11.38(8.83)

3. Effect of Post-emergence Herbicides on Weed control efficiency, Weed Index and herbicide efficiency Index at Shambu and Gedo

The magnitude of weed reduction caused by the weed control treatment (Weed Control Efficiency) Was done. In general; the weed control efficiency results show that all six herbicide treatments could reduce weed infestation at the two locations (Shambu and Gedo). Of herbicide weed control treatment practices, Fala@1Lha^{-1}+Topik@1Lha^{-1} shown high weed control efficiency (34.77 %) than the rest practices. The maximum and minimum weed control efficiency (42.2 and 0.00) observed from two times Hand Weeding @30 &45DAS and weedy check treatments respectively. The highest weed index (WI) or relative yield loss was recorded (49.96) from Weedy check; and the minimum (0.00) from two times Hand Weeding @30 AND 45DAS weed management practices. Comparing the weed management indices of post herbicides, significantly, the highest (80.77) weed killing potential (Herbicide Efficiency Index) was obtained from two times hand weeding@30 & 45DAS and the lowest Herbicide Efficiency Index (0.00) obtained from Weedy Check weed management practices (Table 3)

Table 3; WCE, WI and HEI

Weed Management Practices	TWB(g m/m2)	YIELD(kg/ha-1)	WCE (%)	WI(%)	HEI
Husar Active OD411@1Lha^{-1}	8.16	1919.83	32.28	1.45	78.43
Fala@1Lha^{-1}+Topik@1Lha^{-1}	7.86	1833.79	34.77	5.86	71.29
Power860@1Lha^{-1}+ Topik@1Lha^{-1}	9.63	1911.07	20.08	1.90	77.71
Pallas Super320WG@0.3Lha^{-1}	8.82	1749.63	26.80	10.18	64.31
Fala@1Lha^{-1} +Rubah @1Lha^{-1}	9.41	1881.39	21.91	3.42	75.24
Power 860@1Lha^{-1} +Rubah@1Lha-^{1}	9.63	1690.06	20.08	13.24	59.37
2xHW@30 &45DAS	6.96	1948.02	42.24	0.00	80.77
Weedy check	12.05	974.7	0.00	49.96	0.00

Activity 3: Effects of Integrated Weed Management on Soybean (*Glycine max*), Crop in Western Oromia

Abstract

The weed effect is one of the important limiting factors for crop growth and productivity in agricultural crop production. Then; there should be a little information on the Effects of Integrated Weed Management on Soybean (*Glycine max*), Crop in Western Oromia *Hence, this study was proposed to be conducted at BARC and Uke BARC's sub site; Western Oromia to* evaluate pre-emergence herbicides and/or their combination with hand weeding for weed management in soybean and to determine effective weed control practice (s) in soybean at Bako and Chewaka Western Oromia. *It was conducted during main cropping season of 2021/22 &2022/23. The experiment was carried out in randomized completely block design (RCBD) with three replications. A total of sixteen (16) weed control treatments were evaluated. The data was noticed highly significant difference on the assessed parameters of weed Yield and yield components.*
***Key Words**; weed, Weed control, yield, Post-emergence, Herbicide*

1. Effects of Integrated Weed Management on yield and yield components of Soybean

The growth measurements of teff such as plant height ,*Pod Per Plant*, *Seed Per Pod* ,*Stand Count and Yield (kg/ha^{-1})* in the experiment indicated the highly significant differences including grain yield (Table 1).The results was indicated that weed management practices highly significantly increased the yield over weedy check (unweeded control) .So, the grain yield of soybean was highly significantly influenced by the weed management practices and the two soybean varieties (Boshe and Keta) had statistical differences to each other . The highest soybean grain yield was recorded from Boshe+1XHW @ 21DAS and Keta +weed free weed management practices treatments (1655.52kg ha^{-1}and 3187.96 kg ha^{-1}) for Boshe and Keta varieties respectively (Table 1). There were no statistical differences to each other; but numerical differences. The lowest soybean grain yield were recorded from Weedy check of the two soybean varieties (495.65kgha-1 and 502.99kg ha^{-1}) from Boshe and Keta varieties respectively (Table 1).

Table 1. Yield and Yield components of soybean

Treatments Description	***plant Hieght(cm)***	***PPP***	***SPP***	***SC***	***HSW***	***Yield(kg/ha-1)***
Boshe+pendametaln @ 1.25kg/ha	43.913ef	16.967gh	1.85ef	30.333gh	12.833b	585.57i
Boshe+pendamethalin1.25kg/ha+1XHW@45DAS	40.387f	30.317bc	1.95ef	33.333gh	13.683b	1430.98ef
Boshe+s-methalochlor1.5 kg/ ha	45.633ef	24def	2.1333cde	68.333de	12.833b	813.81h
Boshe +s-metaloclorat 1.5kg/ha + 1XHW @ 45DAS	47.9de	35.233a	2.5ab	98b	14.383b	1633.11cde

Boshe +1XHW @ 21DAS	48.873de	25.233d-f	2.1667b-e	77.167cd	14.317b	1655.52cd
Boshe+2X HW @ 21 and 45DAS	51de	28.4cde	2.0333def	82.5c	14.517b	1493.02de
Boshe +weed free	48.4de	27.833c-e	1.9667ef	108.167a	14.467b	1637.9cde
Boshe Weedy	47.04def	16.633h	1.7667f	61.833ef	13.533b	495.65j
Keta+pendametaln @1.25kg/ha	54.35cd	16.45h	2.0667def	40g	17.933a	582.89i
Keta +pendamethalin1.25kg/ha+1XHW@ 45DAS	48.635de	34.608ab	2.1667bcde	27.5h	15.967b	1249.65fg
Keta+s-methalocor1.5 kg/ ha	66.033a	23.333ef	2.3333abcd	53.667f	15.233b	1186.11g
Keta +s-metaloclorat 1.5kg/ha + 1X HW@ 45DAS	61.54ab	29.2c	2.5333a	86.333c	17b	2730.12b
Keta +1XHW@ 21DAS	58.02bc	21.667fg	1.9333ef	77cd	15.317b	1788.36c
Keta+2 XHW @ 21 and 45DAS	62.223ab	28.867cd	2.4667abc	86.667c	16.85b	3073.8a
Keta +weed free	66.283a	25.567c-f	2.2abcde	83.333c	16.95b	3187.96a
Keta Weedy	64.053ab	17.7gh	2.2abcde	69.833de	14.783b	502.99i
Pr	<.0001	<.0001	0.0003	<.0001	0.4348	<.0001
G/Mean	53.39281	25.12552	2.141667	67.75	15.6625	1484.214
CV	10.81621	15.56164	12.02708	12.85493	23.33648	11.32637

2. Effects of Integrated Weed Management on weed density

The effects of weed management practices on weed density(both broad &grass leaf weeds)were shown highly significant differences (Table 2 .All the herbicide treatments significantly reduced the weed density compared to the weedy control .Among the weed management practices; the maximum total weed density were recorded in Weedy check(3.58m^{2} and 4.47) in both soybean varieties (Boshe and Keta) respectively ;& minimum total weed density were recorded in Boshe+2X HW @ 21 and 45DAS, Boshe + weed free (0.71m2) and Keta + 2 X HW @ 21 and 45 DAS ,Boshe + weed free (0.71 m^{2}) weed management practices (table 2) .

Table 2. Weed Density

Weed Density (No/m2)			
Treatments Description	***BLWD***	***GLWD***	***TWD***
Boshe+pendametaln @ 1.25kg/ha	7.33f(2.80f)	1.67c(1.46c)	9.00d(3.07c)
Boshe+pendamethalin1.25kg/ha+1XHW@45DAS	5.83g(2.52g)	0.83d(1.14d)	6.67f(2.63e)
Boshe+s-methalochlor1.5 kg/ ha	7.50ef(2.83ef)	1.33cd(1.34c)	8.83d(3.05c)

Boshe +s-metaloclorat1.5kg/ha+1XHW @ 45DAS	7.00f(2.74f)	0.00e(0.71e)	7.00ef(2.70de)
Boshe +1XHW @ 21DAS	7.33f(2.80f)	2.33b(1.68b)	9.67d(3.17c)
Boshe+2X HW @ 21 and 45DAS	0.00i(0.71i)	0.00e(0.71e)	0.00g(0.71f)
Boshe +weed free	0.00i(0.71i)	0.00e(0.71e)	0.00g(0.71f)
Boshe Weedy	10.00c(3.23c)	2.50b(1.73b)	12.50b(3.58b)
Keta+pendametaln @1.25kg/ha	11.50b(3.46b)	0e(0.71e)	11.50c(3.45b)
Keta +pendamethalin1.25kg/ha+1XHW@ 45DAS	7.67ef(2.86ef)	0e(0.71e)	7.67e(2.83d)
Keta+s-methalocor1.5 kg/ ha	8.67de(3.02de)	0e(0.71e)	8.67d(3.00c)
Keta +s-metaloclorat1.5kg/ha +1X HW@ 45DAS	3.00h(1.86h)	6a(2.55a)	9.00d(3.08c)
Keta +1XHW@ 21DAS	9.33cd(3.13cd)	0e(0.71e)	9.33d(3.13c)
Keta+2 XHW @ 21 and 45DAS	0.00i(0.71i)	0e(0.71e)	0.00g(0.71f)
Keta +weed free	0.00i(0.71i)	0e(0.71e)	0.00g(0.71f)
Keta Weedy	17a(4.18a)	2.67b(1.74b)	19.67a(4.47a)
Pr	<.0001(<.0001)	<.0001(<.0001)	<.0001(<.0001)
G/Mean	6.39(2.39)	1.08(1.13)	7.47(2.56)
CV	15.34(6.79)	48.48(13.92)	10.65(5.01)

3. Effects of Integrated Weed Management on weed biomass

The effects of weed management practices on Total Weed Biomass (both broad & grass leaf weeds) were shown highly significant differences .The maximum (11.84gm/m^2 and 15.64gm/m^2) total weed biomass were recorded in weedy check weed management practice in both soybean varieties (Boshe and Keta) respectively ; and minimum Total Weed Biomass ((0.71gm/m^2 were recorded in Boshe + 2X HW @ 21 and 45 DAS, Boshe + weed free & Keta + 2X HW @ 21 and 45 DAS, Boshe + weed free weed management practices (Table 3).

Table 3. Weed Biomass

	Weed Biomass(gm/m2)		
Treatments Description	***BLWB***	***GLWB***	***TWB***
Boshe+pendametaln @ 1.25kg/ha	122.73bc(11.10bc)	5.23c(2.36c)	127.97bc(11.33bc)
Boshe+pendamethalin1.25kg/ha+1XHW@45DAS	51.93cde(7.12de)	5.20c(2.35c)	57.13cde(7.51de)
Boshe+s-methalochlor1.5 kg/ ha	115.4bc(10.61bc)	8.47b(2.92b)	123.87bc(10.99bc)
Boshe +s-metaloclorat1.5kg/ha+1XHW @ 45DAS	110.87bc(10.21bc)	0.00d(0.71d)	110.87bc(10.21bcd)
Boshe +1XHW @ 21DAS	87.63bcd(9.35cd)	9.8ab(3.21ab)	97.43bcd(9.86cd)
Boshe+2X HW @ 21 and 45DAS	0.00e(0.71f)	0.00d(0.71d)	0.00e(0.71f)

Boshe +weed free	0.00e(0.71f)	0.00d(0.71d)	0.00e(0.71f)
Boshe Weedy	133.07bc(11.47bc)	10.67ab(3.31ab)	140.9bc(11.84bc)
Keta+pendametaln @1.25kg/ha	104.53bcd(9.64bcd)	0.00d(0.71d)	104.53bcd(9.64cd)
Keta +pendamethalin1.25kg/ha+1XHW@ 45DAS	24.27de(4.96e)	0.00d(0.71d)	24.27ed(4.96e)
Keta+s-methalocor1.5 kg/ ha	167.6b(12.66ab)	0.00d(0.71d)	167.6b(12.66bc)
Keta +s-metaloclorat1.5kg/ha +1X HW@ 45DAS	160.77b(12.67ab)	12.67a(3.59a)	173.43b(13.17ab)
Keta +1XHW@ 21DAS	122.53bc(11.073bc)	0.00d(0.71d)	122.53bc(11.07bc)
Keta+2 XHW @ 21 and 45DAS	0.00e(0.71f)	0.00d(0.71d)	0.00e(0.71f)
Keta +weed free	0.00e(0.71f)	0.00d(0.71d)	0.00e(0.71f)
Keta Weedy	260.7a(15.32a)	9.00b(3.01b)	269.7a(15.64a)
Pr	<.0001(<.0001)	<.0001(<.0001)	<.0001(<.0001)
G/Mean	91.38(8.06)	3.81(1.69)	95.01(8.23)
CV	70.88(30.32)	63.37(23.34)	68.26(29.20)

4. Effect of Post-emergence Herbicides on Weed control efficiency, Weed Index and herbicide efficiex

The magnitude of weed reduction caused by the weed control treatment (Weed Control Efficiency) Was done. In general; the weed control efficiency results show that all two types herbicide treatments could reduce weed infestation at Bako. The maximum weed control efficiencies (94 and 95.46) were recorded from weed free of Boshe and Keta soybean varieties respectively and minimum weed control efficiency (0.00) observed from weedy check treatments. The highest weed index (WI) or relative yield loss was recorded (69.74 &84.22) from Weedy check of the two soybean varieties; Boshe and Keta respectively; and the minimum (0.00) from weed free check weed management practices. Comparing the weed management indices of post herbicides, significantly, the highest (97.96 &171.67) weed killing potential (Herbicide Efficiency Index) was obtained from Boshe +1XHW @ 21DASand Keta +weed free respectively. The lowest herbicide Efficiency Index (0.00) obtained from Weedy Check of weed management practices in each variety (Table 4)

Table 4. WCE, WI & HEI

Treatments Description	TWB(gm/m2)	YIELD(kgha-1)	WCE(%)	WI(%)	HEI
Boshe+pendametaln @ 1.25kg/ha	11.33	585.57	4.31	64.25	7.59
Boshe+pendamethalin1.25kg/ha+1XHW@45DAS	7.51	1430.98	36.57	12.63	79.00

Boshe+s-methalochlor1.5 kg/ ha	10.99	813.81	7.18	50.31	26.87
Boshe +s-metaloclorat1.5kg/ha+1XHW @ 45DAS	10.21	1633.11	13.77	0.29	96.07
Boshe +1XHW @ 21DAS	9.86	1655.52	16.72	-1.08	97.96
Boshe+2X HW @ 21 and 45DAS	0.71	1493.02	94.00	8.85	84.24
Boshe +weed free	0.71	1637.9	94.00	0.00	96.47
Boshe Weedy	11.84	495.65	0.00	69.74	0.00
Keta+pendametaln @1.25kg/ha	9.64	582.89	38.36	81.72	5.11
Keta +pendamethalin1.25kg/ha+1XHW@ 45DAS	4.96	1249.65	68.29	60.80	47.74
Keta+s-methalocor1.5 kg/ ha	12.66	1186.11	19.05	62.79	43.68
Keta +s-metaloclorat1.5kg/ha +1X HW@ 45DAS	13.17	2730.12	15.79	14.36	142.40
Keta +1XHW@ 21DAS	11.07	1788.36	29.22	43.90	82.18
Keta+2 XHW @ 21 and 45DAS	0.71	3073.8	95.46	3.58	164.37
Keta +weed free	0.71	3187.96	95.46	0.00	171.67
Keta Weedy	15.64	502.99	0.00	84.22	0.00

2. Ongoing Activities

Activity 1: Effects of Different Weed Management Practices in Common Bean (Phaseolus vulgaris L.) at Bako and Uke; Western Oromia

Brief Status

Year started: 2022
Expected year of completion: 2023/2024
It was conducted both at Bako and Uke (sub-site),

- A totally 11 weed control treatments were evaluated including weed free and weedy checks
- Because of the security problem both the crop and weed data were not collected from Uke site but it was recorded from Bako site.
- In 2022/23; both the crop & weed data were collected from Bako site and analyzed. Weed density and weed biomass were indicated highly significance differences (Table 2 & 3)
- Some the assessed crop parameters were shown significant differences including grain yield (Table 1)
- It will repeat for one year to capture year effect

Table 1; Yield & Yield components of Haricot bean as affected by treatments at Bako , 2022/23

Treatment Description	**Yield & Yield Components**

	Plant Height (cm)	Pod Per Plant (No)	Seed/ Plant (No)	Stand Count (No)	Yield (kg/ha-1)	100SW (gm)
MET 1 Kgha-1	63.07de	6.267ab	26.07abc	34bc	1082.1c	**19.3(a)**
pen 1 Kgha-1	39bc	4.933a	23.6abc	24.67ab	545.2b	20.43(ab)
MET 1Kgha-1 +1XHW @4WACE	72.2ef	6.667ab	25.47abc	42.33cd	1000c	21.33(ab)
pen 1 Kgha-1+1XHW @4WACE	54.73cd	6.133ab	25.8abc	47.67d	**1531.7**e	20.57(ab)
MET 0.75 Kgha-1	51.73bcd	7.067ab	31.87abc	34.67bcd	583.5b	20.43(ab)
MET 0.75Kgha-1+1XHW @4WACE	64.6de	8.933b	36.83c	43cd	1217.5d	21.8(b)
pen 0.75 Kgha-1	62.73de	4.933a	13.47a	18.67a	247.6a	19.97(ab)
pen 0.75Kgha-11XHW @4WACE	81.47f	7.867ab	32.8bc	37bcd	1104.3cd	21.2(ab)
1Xhand weeding @4 WACE	66def	7.067ab	33.27c	23.67ab	579.2b	**21.67(ab)**
Weed Free Check	37.13ab	5.667ab	14.67ab	42cd	1219.7d	21.2(ab)
Weedy Checky	22.33a	4.733a	19.73abc	17a	**183.3a**	20.33(ab)
F pr.	<.001	0.378	0.214	<.001	<.001	0.604
Grand mean	55.9	6.39	25.8	33.2	845.0	20.75
L.S.D	16.33	3.614	18.42	13.52	134.9	2.465
cv%	17.1	33.2	42	24	9.4	7.0

Table 2: weed Density as affected by treatments at Bako, 2022/23

Treatment Description	WEED DENSITY(No/m2)		
	BLWD	GLWD	TWD
MET 1 Kgha-1	1.33(1.35)ab	2(1.58)c	3.33(1.95)bcd
pen 1 Kgha-1	4.17(2.12)c	1.17(1.22)bc	5.33(2.39)de
MET 1Kgha-1 +1XHW @4WACE	5.5(2.38)c	0.17(0.81)a	5.67(2.41)de
pen 1 Kgha-1+1XHW @4WACE	2.67(1.77)bc	1.17(1.27)bc	3.83(2.06)cde
MET 0.75 Kgha-1	4.17(2.11)c	0.17(0.81)a	4.33(2.15)cde
MET 0.75Kgha-1+1XHW @4WACE	1.5(1.41)b	0(0.71)a	1.5(1.41)b
pen 0.75 Kgha-1	4.67(2.25)c	1.33(1.35)bc	6(2.53)de
pen 0.75Kgha-11XHW @4WACE	1.5(1.41)b	0.67(1.04)ab	2.17(1.63)bc
1Xhand weeding @4WACE	4.5(2.23)c	1.83(1.53)c	**6.33(2.61)e**

Weed Free Check	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**
Weedy Checky	4(2.11)c	1.17(1.23)bc	5.17(2.37)de
F pr.	<.001	<.001	<.001
Grand mean	1.804	1.113	2.02
L.S.D	0.6473	0.3735	0.6092
cv%	21.1	19.7	17.7

Table 3; Weed Biomass as affected by treatments at Bako, 2022/23

Treatment Description	**WEED BIOMASS (gm/m2)**		
	BLWB	**GLWB**	**TWB**
MET 1 Kgha^{-1}	75.4(8.7)f	6.27(2.60)cd	**81.67(9.05)f**
Pen 1 Kgha^{-1}	67.02(8.21)ef	1.97(1.32)ab	68.98(8.33)ef
MET 1Kgha^{-1}+1XHW @4WACE	9.03(3.06)b	1.35(1.18)ab	10.38(3.28)b
Pen 1 Kgha^{-1}+1XHW @4WACE	26.07(5.04)d	10.57(3.31)d	36.63(5.99)cd
MET 0.75 Kgha^{-1}	55.35(7.39)ef	0.45(0.93)a	55.8(7.43)e
MET 0.75Kgha-1+1XHW @4WACE	10.67(3.33)bc	0(0.71)a	10.67(3.33)b
pen 0.75 Kgha-1	67.7(8.26)ef	4.3(2.19)bcd	72(8.51)ef
pen 0.75Kgha-11XHW @4WACE	23.97(4.94)cd	2.92(1.84)abc	26.88(5.23)c
1Xhand weeding @4 WACE	6.88(2.70)b	23.28(4.87)e	30.17(5.53)c
Weed Free Check	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**
Weedy Checky	49.95(6.87)e	4.32(1.81)abc	54.27(7.29)de
F pr.	<.001	<.001	<.001
Grand mean	5.38	1.95	5.88
L.S.D	1.625	1.152	1.411
cv%	17.7	34.7	14.1

Activity 2: Determination of Critical Period for Weed Control in Sesame (Sesamum indicum L.) in Western Oromia; Bako and Chewaka

Brief Status

Year started: 2022

Expected year of completion: 2023/2024

- It was conducted both at Bako and Chawaka (sub-site), and shown a good performance
- A totally of 12 weed control treatments were evaluated including weedy and weed free checks
- In 2022/23; both the crop & weed data were collected from Bako site and analyzed
- Yield and yield component data were shown significant differences (Table 1)

- Weed density and its biomass data were indicated significant differences (Table 2)
- Because of the security problem; both the crop and weed data were not yet collected from Chawaka site
- It will repeat for one year to capture year effects

Table 1; Yield & Yield components of Sesame as affected by treatments at Bako 2022/23

Treatments (WACE)	Yield and yield components			
	Plant Height(cm)	**Capsule Per Plant (No)**	**Branch Number Per Plant (No)**	**Yield (kg/ha-1)**
category-I: Weed free treatments				
WF2	89.07abc	13.87)a	2.2)a	62.9a
WF4	93.27bcd	25.53)ac	3.533)bc	527.3ef
WF6	92.93bcd	26.6)bc	4.067)c	577.9ef
WF8	99.47cde	35.33)cd	4.333)c	573.5ef
WF10	100cde	26.13)bc	3.667)bc	502.7de
WI0	**95.13bcd**	**29.87)bcd**	**3.467)bc**	**581.9ef**
category-II: Weed interference treatments				
WI2	108.53e	27.73)bcd	4.133)c	304.4c
WI4	102.73de	36.93)d	4.533)c	655.4f
WI6	94.67bcd	25.33)bc	3.467)bc	364cd
WI8	83.33ab	25.23)b	2.6)ab	239bc
WI10	85.73ab	9.2)a	1.8)a	126.5ab
WFO	**79.87ab**	**13.07)a**	**2.667)ab**	**112.7ab**
F pr.	0.002	<.001	<.001	<.001
Grand mean	93.7	24.57	3.37	386
L.S.D(<0.05)	11.8	10.09	0.527	149.8
cv%	7.4	24.3	19.1	22.9

Table 2: Weed Density & Weed Biomass as affected by treatments at Bako, 2022/23

Trt(WACE)	Weed Density (m2)			Weed Biomass (gm/m2)		
	BLWD	**GLWD**	**TWD**	**BLWB**	**GLWB**	**TWB**
Category-I: Weed free treatments						
WF2	6.33(2.60)d	1.67(1.44)bcd	8(4.04)d	2(1.43)ab	1.4(1.36)bc	3.4(1.86)b
WF4	6(2.53)d	1.33(1.29)bc	7.33(3.82)cd	8.5(2.95)ef	1.47(1.33)bc	9.97(3.17)d
WF6	4.5(2.23)bcd	1.67(1.46)cd	6.33(3.73)cd	6.35(2.59)def	1.53(1.42)bc	7.88(2.87)cd
WF8	4.33(2.20)bcd	1.67(1.46)cd	6(3.66)cd	5.23(2.39)cde	2.9(1.77)c	8.13(2.93)cd

WF10	6.67(2.62)d	2(1.56)cd	8.67(4.18)d	1.3(1.34)ab	1.43(1.38)bc	2.73(1.8)b
WI0	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**
Category-II: Weed interference treatments						
WI2	2.67(1.74)b	0.33(0.88)ab	3(2.62)b	2.9(1.75)bc	0.43(0.92)ab	3.33(1.91)b
WI4	5.33(2.39)cd	2.33(1.64)cd	7.67(4.03)d	1.75(1.49)ab	2.43(1.71)c	4.18(2.16)bc
WI6	6(2.52)d	1(1.17)abc	7(3.69)cd	3.9(2.08)bcd	1.1(1.21)abc	5(2.34)bc
WI8	4.67(2.22)bcd	2(1.56)cd	6.67(3.78)cd	3.57(1.98)bcd	1.7(1.46)bc	5.27(2.38)bc
WI10	2.67(1.77)bc	1.33(1.34)bc	4(3.12)bc	2.57(1.73)bc	2(1.56)c	4.57(2.25)bc
WFO	**4.67(2.26)bcd**	**3.33(1.95)d**	**8(4.22)d**	**10.7(3.28)f**	**5.87(2.52)d**	**16.57(4.1)e**
F pr.	<.001	0.014	<.001	<.001	<.001	<.001
mean	2.149	1.373	3.525	1.977	1.446	2.372
L.S.D	0.6135	0.5678	0.7808	0.8253	0.5944	0.777
cv%	16.9	24.4	13.1	24.6	24.3	19.3

WF=Weed Free; WI=Weed Interfrence

Activity 3. Evaluation of Post-emergence Herbicides and Their Combination with Hand weeding against Weeds in Finger Millet (Elusina Corocana (L.) Gaertn) at Bako and Gute, Western Oromia

Brief Status

Year started: 2022

Expected year of completion: 2023/2024

- It was conducted both at Bako and Gute (sub-site), and shown a good performance at Gute, but not at Bako
- A totally of 10 weed control treatments were evaluated
- In 2022/23; both the crop &weed data were collected and analyzed from Bako & Gute
- Significant differences were indicated from both crop &weed data at Bako (Table 1,2 &3)
- Except yield; other yield component data shown non-Significant differences at Gute (Table 6)
- All weed data were indicated Significant differences at Gute except grass leaf weed density (Table 4 &5)
- It will repeat for one year to capture year effect

Table 1: weed Density as affected by treatments in Finger Millet at Bako,2022/23

Treatment Descriptions	**Weed Density (No/m2)**		
	BLWD	**GLWD**	**TWD**
Zumara@ 1Lha-1	3.83(2.08)cd	0(0.71)a	3.83(2.08)bc

Power860SL@ 1Lha-1	2.17(1.60)b	0.83(1.12)bc	3(1.87)b
Zumara@ 0.75Lha-1	2.67(1.76)bc	2(1.56)d	**4.67(2.27)c**
Power860SL@ 0.75Lha-1	4.33(2.19)d	0(0.71)a	4.33(2.19)c
Zumara@ 1Lha-1 + 1XHW at 45DAS	3.67(2.04)cd	0.67(1.05)abc	4.33(2.2)c
Power860SL@ 1Lha-1 + 1XHW at 45 DAS	4.17(2.15)cd	0(0.71)a	4.17(2.15)bc
Zumara@ 0.75Lha-1 +1XHW at 45DAS	3(1.87)bcd	0(0.71)a	3(1.87)b
Power860SL@ 0.75Lha-1 +1XHW at 45DAS	3.43(1.97)bcd	1.17(1.29)cd	4.6(2.25)c
Two times hand weeding @ 30& 45 DAS	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**
Weedy chech	3.67(2.03)bcd	0.33(0.89)ab	4(2.12)bc
F pr.	<.001	<.001	<.001
Grand mean	1.839	0.943	1.97
L.S.D	0.4249	0.3717	0.2896
cv%	13.5	23	8.6

Table 2; Weed Biomass as affected by treatments in finger Millet at Bako,2022/23

	Weed Biomass(gm?m2)		
Treatment Descriptions	**BLWB**	**GLWB**	**TWB**
Zumara@ 1Lha-1	65.17(7.81)d	0(0.71)a	65.17(7.81)a
Power860SL@ 1Lha-1	53.58(7.14)cd	0.33(0.88)a	22.48(4.72)b
Zumara@ 0.75Lha-1	107.85(10.4)e	4.23(2.15)b	32.02(5.70)bc
Power860SL@ 0.75Lha-1	58.73(7.54)cd	0(0.71)a	33.47(5.78)bc
Zumara@ 1Lha-1 + 1XHW at 45DAS	27.4(5.25)bc	6.07(2.27)b	38.97(6.28)bc
Power860SL@ 1Lha-1 + 1XHW at 45 DAS	22.48(4.72)b	0(0.71)a	53.92(7.18)c
Zumara@ 0.75Lha-1 +1XHW at 45DAS	38.97(6.28)bcd	0(0.71)a	57.95(7.54)c
Power860SL@ 0.75Lha-1 +1XHW at 45DAS	29.62(5.48)bc	2.4(1.57)ab	58.73(7.64)c
Two times hand weeding @ 30& 45 DAS	**0(0.71)a**	**0(0.71)a**	**0(0.71)a**
Weedy chech	56.58(7.54)cd	1.37(1.19)ab	**112.08(10.60)d**
F pr.	<.001	0.028	<.001
Grand mean	6.29	1.16	6.4
L.S.D	2.304	1.091	2.287
cv%	21.4	54.9	20.8

Table 3; Yield & Yield components of Finger Millet as affected by treatments at Bako, 2022/23

Treatment Descriptions	**Yield and Yield Components**

	Plant Height(cm)	Finger No Per Plant (NO)	Finger Length (cm)	Effective Tillers/Plant (NO)	Non Effective Tillers/Plant (NO)	Yield (Kg/ha)
Zumara@ 1Lha-1	29.6b	2.97abc	3.57ab	1.33a	0a	**42.1a**
Power860SL@ 1Lha-1	44.07cd	2.6a	3.1a	1.47a	0.67abc	33.8a
Zumara@ 0.75Lha-1	29.63a	3.07a-d	3.13a	1.4a	0.67abc	71.8ab
Power860SL@ 0.75Lha-1	32.43bcd	3.07a-d	3.67ab	1.4a	0.67abc	126.4ab
Zumara@ 1Lha-1+1XHW@45DAS	35.8bcd	3.8b-e	3.87abc	2.63bc	0.47ab	207.4c
Power860SL@1Lha-1+1XHW@ 45DAS	45.8d	4.13de	4.6c	3.37c	1.33c	**827.8f**
Zumara@ 0.75Lha1+1XHW@45DAS	40.73bcd	4.07cde	4.4bc	3.07c	1.43c	721.3e
Power860SL@0.75Lha1+1XHW@45 DAS	38.47bcd	4.2e	4.13bc	2.83bc	0.77abc	820.8f
2XHW@ 30& 45 DAS	31.07bc	2.93ab	3.87abc	2.77bc	1.13bc	493.1d
Weedy chech	38.23bcd	3abc	3.6ab	2ab	1.1bc	62a
F pr.	0.003	0.043	0.026	<.001	0.036	<.001
Grand mean	34.6	3.38	3.793	2.23	0.823	340.6
L.S.D	14.29	1.108	0.8561	0.956	0.7862	62.64
cv%	24.1	19.1	13.2	25	55.7	10.7

Table 4: weed Density as affected by treatments in Finger Millet at Gute, 2022/23

Treatment Descriptions	Weed Density(no/m2)		
	BLWD	GLWD	TWD
Zumara@ 1Lha-1	2.67(1.77)ab	2.33(1.67)b	5(2.33)abc
Power860SL@ 1Lha-1	6(2.54)c	1.17(1.27)ab	**7.17(2.77)c**
Zumara@ 0.75Lha-1	3.83(2.08)ab	1.33(1.34)ab	5.17(2.38)bc
Power860SL@ 0.75Lha-1	2.83(1.81)ab	2.33(1.67)b	5.17(2.38)bc
Zumara@ 1Lha-1 + 1XHW at 45DAS	3.57(2.02)ab	0.33(0.90)a	3.9(2.09)ab
Power860SL@ 1Lha-1 + 1XHW at 45 DAS	3.7(2.04)ab	1.33(1.32)ab	5.03(2.35)abc
Zumara@ 0.75Lha-1 +1XHW at 45DAS	2.67(1.73)a	0.67(0.99)a	**3.33(1.90)a**
Power860SL@ 0.75Lha-1 +1XHW at 45DAS	3.17(1.89)ab	1(1.18)ab	4.17(2.16)ab
Two times hand weeding @ 30& 45 DAS	2.67(1.74)ab	0.67(0.99)a	3.33(1.92)ab
Weedy chech	4(2.12)b	0.5(0.98)a	4.5(2.23)ab
F pr.	0.01	0.125	0.039
Grand mean	1.976	1.232	2.25

L.S.D	0.3873	0.602	0.4666
cv%	11.4	28.5	12.1

Table 5; Weed Biomass as affected by treatments in Finger Millet at Gute, 2022/23

Treatment Descriptions	**Weed biomass(gm/m2)**		
	BLWB	**GLWB**	**TWB**
Zumara@ 1Lha-1	4.38(2.12)a	8.93(3.02)c	13.32(3.72)ab
Power860SL@ 1Lha-1	28.67(5.37)d	10.17(3.06)c	**38.83(6.23)d**
Zumara@ 0.75Lha-1	18.5(4.35)bcd	9.3(3.11)c	27.8(5.30)cd
Power860SL@ 0.75Lha-1	20.2(4.30)bcd	3.83(2.08)abc	24.03(4.78)bc
Zumara@ 1Lha-1 + 1XHW at 45DAS	9.67(3.19)ab	4.57(2.11)abc	14.23(3.80)ab
Power860SL@ 1Lha-1 + 1XHW at 45 DAS	11.4(3.45)abc	2.87(1.80)abc	14.27(3.84)ab
Zumara@ 0.75Lha-1 +1XHW at 45DAS	7.67(2.85)a	0.67(0.99)a	**8.33(2.97)a**
Power860SL@ 0.75Lha-1 +1XHW at 45DAS	7.4(2.8)a	7.87(2.46)bc	15.27(3.86)ab
Two times hand weeding @ 30& 45 DAS	10(3.16)ab	0.53(0.95)a	10.53(3.22)a
Weedy chech	22.23(4.66)cd	2.7(1.57)ab	**24.93(4.89)bcd**
F pr.	0.004	0.031	0.002
Grand mean	3.62	2.11	4.26
L.S.D	1.434	1.43	1.34
cv%	23.1	39.4	18.3

Table 6; Yield & Yield components of Finger Millet as affected by treatments at Gute, 2022/23

Treatment Descriptions	Yield and Yield components				
	Plant Height (cm)	**Panicle/Finger / length (cm)**	**Finger number per plant (No)**	**Effective Tillers Per Plant (No)**	**Yield (kg/ha)**
Zumara@ 1Lha-1	**44a**	**5a**	**3.47a**	**2.73a**	**619a**
Power860SL@ 1Lha-1	44.6a	5.4a	4.4c	3.67ab	896b
Zumara@ 0.75Lha-1	47.73a	4.87a	4.27bc	3.47ab	1619d
Power860SL@ 0.75Lha-1	45.4a	5.27a	3.47a	3.2a	1082c
Zumara@ 1Lha-1 + 1XHW at 45DAS	42.73a	5.27a	3.93abc	4.33b	1078c
Power860SL@ 1Lha-1 + 1XHW at 45 DAS	44.87a	5.33a	3.8abc	3.4ab	1152c
Zumara@ 0.75Lha-1 +1XHW at 45DAS	45.2a	5.2a	3.8abc	3.2a	623a
Power860SL@ 0.75Lha-1 +1XHW at 45DAS	43.27a	5.6a	3.53ab	3.27a	1623d
Two times hand weeding @ 30& 45 DAS	45.6a	5.27a	4.07abc	3.53ab	**1706d**
Weedy chech	46.6a	4.93a	3.6ab	3.07a	879b
F pr.	0.674	0.814	0.165	0.255	<.001
Grand mean	45	5.213	3.833	3.39	1128
L.S.D	5.157	0.8915	0.7583	1.06	128.1
cv%	6.7	10	11.5	18.2	6.6

3.2.3 Agricultural Entomology Research Team

1. Completed activity

Activity 1: Evaluation of Resistance in Bread Wheat Varieties and Advanced genotypes to the Rice Weevil, Sitophilus Oryzae (L)(Coleoptera:Curculionidae) under Laboratory Condition

Abstract

An experiment was conducted using forty different bread wheat varieties and genotypes to determine their resistance to Sitophilus oryzae (L.) at Bako agricultural research center during the year 2022. The experiment was laid out in Completely Randomized Design (CRD) with three replications. A sample of 100 gm of wheat grains were kept in a plastic jar of 240 gm capacity. Twenty pairs of both sexes newly emerged adults of S. oryzae of uniform age from laboratory stocked culture were released in each jar. The consumption of wheat is increasing with increasing food diversity in our country. Despite its multiple importance's, Sitophilus oryzae is the most important storage pest of wheat. This study aimed and evaluated the resistance in thirteen commonly used bread wheat varieties along with twentyseven advanced genotypes against the rice weevil in laboratory. The level of resistance in varieties were classified based on the dobie index of susceptibility. The result of the study indicated that eleven improved varieties, "Balcha, Danda'a, Deka, Gelan, Hibist, Kekeba, Lakku, Liban, Oborra, Ogolcho and shorima as well as twenty four Advanced genotypes such ACC#1676, ACC#2190, ACC#2489, ACC#3023, ACC#3343, ACC#3490, ACC#3596, ACC#3699, ACC#3788, ACC#4276, ACC#4978, Bwic335, ETW17-114, ETW17-174, ETW17-175, ETW17-176, ETW17-189, ETW17-193, ETW17-198, ETW17-220, ETW17-224, ETW17-251, ETW17-320, ETW17-414" had the lowest index of susceptibility and grouped as Moderately resistant. Weevils reared on these moderately resistant varieties and genotypes produced relatively few numbers of progeny, had a long, shorter developmental period and, low seed damage percentage and seed weight loss. Genotypes, Acc#3187, Bwic-139, ETW17-225 and variety such as Sofumar and Wane were grouped Susceptible. Percent seed damage, weight loss and the number of progenies emerged were positively correlated with susceptibility index but they are negatively associated with seed germination and median developmental period. Among the moderately resistant varieties and genotypes ETW17-251(4.6) and ETW17-220(4.9) had the least Susceptibility Index so the use of these genotypes for future breading purpose will be cost effective and environmentally friendly to reduce grain damage by Sitophilus oryzae

Keywords: *Wheat, Sitophilus oryzae (L.), weight loss, grains damaged, adult population, susceptibility index*

1. Result and Discussion

1.1 Number of weevil Emergence

The data presented in table indicated that the emergence of adult was significantly affected in wheat varieties tested. Genotype ETW17-225 (91.6) had the highest number of weevil which emerged followed by ACC#3187 (90) and DEKA Variety (82). The lowest number of weevil

were recorded in ETW17-220 (47.3) Followed by ETW17-251 (51) and ETW17-198 (53.3). (Table-1). The mean number of weevils emerged ranged from 47.3 to 91.6. This lowest weevil emerged in Genotype ETW17-220 (47.3) could be due to small surface area of that seed (Russell, 1996) Salunke and Jadhav (1982) observed a positive correlation between oviposition and seed surface as Sitophilus orizae prefer large seed for oviposition.

The Moderately resistant genotypes and varieties had low progeny emerging from them while the susceptible genotypes had high number of F1 progeny emergence. Resistance characteristic might be due to genetic and intrinsic factors. This result is in agreement with the findings of (Santos *et al.*, 2006 and Abebe *et al.*, 2006).

Adult emergence, showed positive relationship with kernel damage, thousand seed weight, weight loss and susceptibility index where as it was negatively correlated with median development period and percent germination (Table -3). As the same positive correlation has been reported between pest population increase, grain weight loss and grain damage by (Syed et al., 2001; Khan et al. 2005)

1.2 Grain Weight Loss

There was highly significant ($p<0.01$) difference on wheat grain weight losses among the Experimental varieties and genotypes. ACC#2489(8.4) recorded the highest weight loss followed by OGOCHO (8.3) and ACC#3187 (7.65) whereas ETW17-176 (1.5) and ETW17-220 (2.9) had the lowest weight loss (Table-1). The mean weight loss ranged from 1.5 to 8.4 (Table 1). The lowest weight loss in ETW17-176 (1.5) could be due to resistance mechanism in or on the grain which reduced weevil attack whereas the highest weight loss in ACC#2489, was due to large number of newly emerged insect population. The present findings are in conformity with that of Jayakumar and Jeyaraj (1995), who reported that some varieties of wheat are more susceptible, while the other are least susceptible to the attack of Sitophilus oryzae. High weight loss was due to high carbohydrate and low protein. Weight loss were positively correlated with adult emergence, kernel damage, thousand seed weight and susceptibility index where as it was negatively correlated with percent germination and median development period. The result observed here in agree with Abebe et al, (2009) who studied the resistance of wheat varieties/genotypes to *sitophilus orizae* (L).

1.3. Kernel Damage

There were highly significant ($p<0.01$) differences on wheat kernel damage among the experimental varieties and genotypes. Genotype ETW17-414 (31.3) recorded the highest kernel

damage followed by ACC#2190 (29.2) and ACC#2489 (27.4). The lowest kernel damage was recorded in ETW17-176 (3.7). This lowest of kernel damage in Genotype ETW17-251 could be due to small surface area of that seed. (Russell, 1996). Salunke and Jadhav (1982) observed a positive correlation between oviposition and seed surface. Sitophilus orizae prefer large seed for oviposition, large seeds were more likely to be paratisized or contain more than one egg than smaller seed (Stejskel and Kuserova. (1996). The mean kernel damage was ranged from 3.7 to 31.3. Grain damage were positively correlated with adult emergence, thousand seed weight, weight loss and susceptibility index whereas it was negatively correlated with germination percentage. The result is in conformity with the previous findings of Ahmedani *et al.* (2012) and Bergvinson (2001) who reported that various physical characteristics such as kernel hardness and pericarp trait were identified as mechanism of kernel resistance against the rice weevil.

1.4. Percent Germination

Highly significant ($p<0.01$) differences were observed among the treatments. Percentage germination after weevil attack was highest in genotype ETW17-251 (86.3) followed by ETW17-189 (85.7) and Ogolcho (85.7). While Deka variety (63.3) had the least percentage germination. Mean germination percentage ranged from 63.3% to 86.3%. Seed germination percentage was positively correlated with median development period and percent weevil mortality where as it was negatively correlated with kernel damage, adult emergence, weight loss and susceptibility index, however no relationship was observed between percent germination and thousand seed weight.

Genotype ETW17-251 (86.3), Ogolcho (85.7) and ETW17-189 (85.7), had the highest mean germination percentage indicating high ability to germinate after exposure to rice weevil

Storage pests consume the endosperm and embryo thereby causing a noticeable reduction in seed viability.

1.5. Median Development Period

The average number of days taken to complete the developmental period of *S. oryzae* varied significantly on different wheat varieties. The highest median development time were recorded in ETW17-251 which is (36.6) days followed by Deka variety (35.3) and ETW17-220 which had a mean developmental period of 34.3 days. The least median developmental period was recorded in ETW17-225 which is 23.7 days. The median developmental period ranged from 23.7 days to 36.6 were recorded. Patel (2006), Yadav and Bhargava (2008) and Arve *et al*. (2008) reported

significant differences in developmental period of *S. oryzae* reared on different varieties of wheat, which is in conformity with the present findings. Median development period was positively correlated with percent germination where as it was negatively correlated with progeny emergence, susceptibility index, kernel damage, thousand seed weight and weight loss.

1.6. Thousand Seed weight

Highest 1000sw were recorded in ETW17-251(52.6) followed by Deka (52) and sofumar (50.3) whereas the lowest thousand kernel weight were recorded in ETW17-251(32.2) and ETW17-220 (33.3). Thousand kernel weight varies from 32.2 in genotype ETW17-251 to 52.6 in genotype ETW17-225

Thousand kernel weight was positively correlated with Adult emergence, susceptibility index, kernel damage and weight loss where as it was negatively correlated with median developmental period and Germination percentage (Table-3)

. The result showed that this character is not clear cut associated with resistance of wheat kernel against weevil. But percent of Kernel damage, susceptibility index, weight loss and adult weevil emergence increases with increase in thousand kernel weight. A lower thousand kernel weight is indicative of smaller size which could discourage weevils from laying eggs inside the kernels. This positive association between kernel diameter, grain weight loss and insect damaged kernels could be attributed to the fact that larger surface area of kernels favored more number of visits by ovipositing weevils (Campbell, 2002).

This result was supported by the findings of (Irshad *et al.1988*; Campbell, 2002), (Tiwari and Sharma, 2002).

1.7. Index of susceptibility (SI)

Highly significant differences were observed among the treatments on the index of Susceptibility (Table 2). The highest index of Susceptibility was recorded in genotype ETW17-225 (8.3) followed by ACC#3187 (8.2) and Sofumar variety (7.7). The least index of Susceptibility was recorded in ETW17-251 which is 4.6 followed by ETW17-220 (4.9) and Deka variety (5.5). The index of Susceptibility ranged from 4.6 to 8.3 were recorded. Index of Susceptibility was positively correlated with Adult emergence, seed damage, thousand seed weight and weight loss where as it was negatively correlated with median development period and percent germination.

1.8. Mortality of F1 progeny (%)

The highest percent of F1 progeny mortality were recorded in genotype ETW17-251 (36.3%) followed by genotype ETW17-220 (32.6%) and genotype BWIC-335 (32%) whereas the lowest percent F1 progeny mortality were recorded in genotype ACC#3187 (5.3%) followed by

genotype BWIC-139 (5.6%) and genotype ETW17-225 (6%). Percent F1 progeny mortality varies from 5.3% in ACC#3187 to 36.3% in ETW17-251. Percent F1 Progeny mortality was positively correlated with percent germination and median developmental period where as it was negatively correlated with F1 progeny emergence, kernel damage, weight loss, thousand seed weight and susceptibility Index. It can be recapitulated that if resistant or moderately resistant wheat varieties extend the developmental period of stophilus oryzae, the postharvest loss incurred during storage of farm produce will be minimized to a larger extent.

Table 1. Wheat genotypes and extent of kernel damage, Median development period, weight loss, Progeny emergence (*Sitophilus oryzae*) and Percent Germination.

Trt. No	Genotypes (Varieties)	F1 Progeny Emergence	Median Developmental Period	Kernel damage (%)	Weight loss (%)	Index of susceptibility
1	ACC#1676	65.3(1.81)	26.3(1.42)	7.3(0.19)	4.9(0.59)	6.9
2	ACC#2190	61.7(1.79)	28.3(1.45)	15.4(0.42)	5.3(0.64)	6.4
3	ACC#2489	61(1.78)	24.3(1.39)	11.6(0.31)	5(0.60)	7.4
4	ACC#3023	62.3(1.79)	27(1.43)	15.1(0.41)	4.5(0.53)	6.7
5	ACC#3187	90(1.95)	24(1.38)	18.8(0.53)	8.1(1.19)	8.2
6	ACC#3343	63.3(1.80)	25.3(1.40)	14.6(0.40)	4.4(0.53)	7.2
7	ACC#3490	61.3(1.79)	27.3(1.44)	23.2(0.67)	5(0.61)	6.5
8	ACC#3596	57.3(1.76)	28(1.44)	10.6(0.28)	5.5(0.68)	6.4
9	ACC#3699	67(1.82)	26.7(1.43)	11.3(0.30)	6.4(0.82)	6.8
10	ACC#3788	57.7(1.75)	24.3(1.39)	14.6(0.40)	5(0.60)	7.2
11	ACC#4276	71.7(1.85)	25(1.40)	10.3(0.28)	4.7(0.56)	7.4
12	ACC#4978	64.3(1.81)	32(1.51)	12.2(0.32)	6.9(0.61)	5.6
13	BALCHA	72.3(1.86)	25.3(1.40)	19.6(0.55)	6.3(0.91)	7.3
14	BWIC-139	70(1.84)	24.3(1.38)	22.8(0.65)	6.3(0.79)	7.7
15	BWIC-335	58.3(1.75)	31(1.49)	16.3(0.45)	3.7(0.42)	5.7
16	DANDA'A	72.3(1.86)	25.3(1.40)	7(0.18)	4.3(0.50)	7.4
17	DEKA	82(1.91)	35.3(1.55)	27.4(0.83)	8.4(1.29)	5.5
18	ETW17-114	61.3(1.77)	28(1.45)	4.9(0.13)	4.7(0.57)	6.3
19	ETW17-174	77(1.89)	26(1.42)	6.2(0.16)	4.2(0.5)	7.3
20	ETW17-175	59.7(1.77)	26.7(1.41)	4.2(0.11)	5(0.60)	6.9
21	ETW17-176	61.6(1.79)	27.3(1.44)	16(0.44)	5.5(0.67)	6.6
22	ETW17-189	58(1.76)	25.3(1.40)	4.4(0.11)	4.7(0.56)	7.0
23	ETW17-193	65(1.81)	29(1.46)	13.7(0.37)	4.4(0.52)	6.3
24	ETW17-198	53.3(1.71)	29.3(1.47)	18.4(0.51)	5.6(1.32)	7.3
25	ETW17-220	47.3(1.66)	34.3(1.53)	5.3(0.14)	3(0.34)	4.9
26	ETW17-224	58.3(1.76)	26(1.42)	6.5(0.17)	4.5(0.53)	6.8
26	ETW17-225	91.6(1.96)	23.7(1.37)	8.8(0.23)	4(0.46)	8.3
28	ETW17-251	51(1.70)	36.7(1.56)	3.7(0.09)	1.5(0.16)	4.6
29	ETW17-320	62.7(1.79)	30(1.48)	5(0.13)	6.7(0.86)	6.1
30	ETW17-414	64.3(1.80)	28.3(1.45)	9.8(0.26)	5(0.60)	6.4
31	GELAN	64.7(1.81)	27.3(1.44)	12.6(0.34)	8.3(0.69)	6.6
32	HIBIST	58.7(1.76)	29(1.46)	25.8(0.77)	4.6(0.55)	6.1
33	KEKEBA	72(1.86)	28(1.45)	13.1(0.35)	4.2(0.49)	6.6
34	LAKKU	62(1.79)	27.7(1.44)	11.1(0.30)	6.1(0.77)	6.5
35	LIBAN	67(1.82)	29.7(1.47)	13.1(0.36)	6(0.75)	6.2
36	OBORRA	67.7(1.83)	27(1.43)	31.3(1.11)	7.5(1.03)	6.8

37	OGOLCHO	71.3(1.85)	26(1.41)	4.4(0.11)	4.9(0.59)	5.9
38	SHORIMA	70.3(1.85)	28.3(1.45)	20.8(0.59)	4(0.47)	6.5
39	SOFUMAR	67.7(1.82)	23.7(1.37)	29.2(0.91)	7.5(1.02)	7.7
40	WANE	77(1.89)	25.3(1.40)	23.7(0.69)	7.4(1.02)	7.6
	Mean	**1.81**	**1.44**	**0.39**	**0.68**	
	CV (%)	**4.4**	**3.1**	**22.2**	**9.2**	
	F-pv	**	**	**	**	
	Lsd(P<0.05)	**0.128**	**0.073**	**0.142**	**0.102**	

Number in the bracket are Arcsine transformed values for percentage data and log base 10 transformed for count data. Note: ** = significant at 1% level of significance.

Table 2. Wheat genotypes, percent mortality of *sitophilus oryzae*, Thousand Seed Weight, Susceptibility Index and Susceptibility Class

Trt. No	**Genotypes (Varieties)**	**% Sitophilus Oryzae Mortality**	**Germination %**	**Thousand Seed weight (gm)**	**Susceptibility Class**
1	ACC#1676	22.3(0.65)	70.3(0.90)	37.7	MR
2	ACC#2190	25(0.75)	77.7(1.05)	35.5	MR
3	ACC#2489	7.7(0.20)	62.3(0.77)	47.46	MR
4	ACC#3023	26(0.78)	81.3(1.13)	37.2	MR
5	ACC#3187	5.3(0.14)	76(1.03)	50.1	S
6	ACC#3343	7.3(0.20)	76.3(1.04)	37.1	MR
7	ACC#3490	22.6(0.66)	80(1.10)	37.4	MR
8	ACC#3596	23.3(0.69)	77.3(1.04)	35.8	MR
9	ACC#3699	23(0.68)	83.6(1.21)	37.3	MR
10	ACC#3788	7.3(0.20)	77.6(1.04)	46.6	MR
11	ACC#4276	8.3(0.22)	84.3(1.23)	48.2	MR
12	ACC#4978	30.3(0.98)	80.3(1.11)	33.7	MR
13	BALCHA	7.3(0.19)	72(0.95)	38.46	MR
14	BWIC-139	5.7(0.15)	71.7(0.95)	40	S
15	BWIC-335	32(1.07)	76(1.04)	34.8	MR
16	DANDA'A	10.3(0.28)	83.3(1.2)	37	MR
17	DEKA	29(0.91)	63.3(0.79)	52	MR
18	ETW17-114	25(0.75)	84.3(1.23)	38.46	MR
19	ETW17-174	12.7(0.34)	83(1.2)	36.6	MR
20	ETW17-175	21.3(0.61)	84(1.22)	38.2	MR
21	ETW17-176	20.3(0.58)	77.3(1.04)	38	MR
22	ETW17-189	9.3(0.25)	85.7(1.27)	39.3	MR
23	ETW17-193	23.7(0.70)	77.7(0.98)	37.9	MR
24	ETW17-198	9.7(0.26)	71.7(0.93)	36.9	MR
25	ETW17-220	32(1.07)	81.7(1.25)	33.3	MR
26	ETW17-224	23(0.68)	81.7(1.15)	38.5	MR
26	ETW17-225	6(0.16)	78.3(1.16)	52.6	S
28	ETW17-251	36.3(1.57)	86.3(1.30)	32.2	MR
29	ETW17-320	21(0.61)	84.3(1.23)	37	MR
30	ETW17-414	22.7(0.66)	77.3(1.04)	36.6	MR
31	GELAN	25(0.74)	80.3(1.11)	38.7	MR
32	HIBIST	22.3(0.65)	68.7(0.92)	37.3	MR
33	KEKEBA	22.7(0.73)	78.7(1.08)	38.1	MR
34	LAKKU	22(0.64)	78(1.07)	38	MR
35	LIBAN	23.7(0.70)	79(1.17)	36.2	MR
36	OBORRA	21(0.61)	66.3(0.87)	37.3	MR

37	OGOLCHO	32(1.07)	85.7(1.27)	35.3	MR
38	SHORIMA	23.7(0.70)	73(0.97)	34.8	MR
39	SOFUMAR	6.7(0.18)	78.7(0.88)	50.3	S
40	WANE	6.7(0.18)	80.7(0.91)	50.04	S
	Mean	**0.58**	**1.08**		
	CV (%)	**7.2**	**15.3**		
	F –test	**0.068**	**0.268**		
	Lsd (p<0.05)	**0.58**	**1.08**		

Numbers in the bracket are Arcsine transformed values for percentage data.

Table 3. Correlation Matrix for thirteen bread wheat varieties and twenty-seven bread wheat genotypes**.**

Trait	**F1PE**	**KD%**	**WL%**	**MDP**	**GER%**	**SI**	**1000sw**	**MOR%**
F1PE	1							
KD%	0.232	1						
WL%	0.173	0.398	1					
MDP	-0.309	-0.101	-0.414	1				
GER%	-0.167	-0.512	-0.174	0.204	1			
SI	0.569	0.145	0.390	-0.949	0.226	1		
1000SW	0.519	0.188	0.278	-0.695	0.053	0.771	1	
MOR%	-0.268	-0.203	-0.351	0.560	0.136	-0.564	-0.236	1

where F1 PE- F1 Progeny Emergence, KD-Kernel Damage, WL- Weight Loss, MDP-Median Development Period, GER-Germination, SI-Susceptibility Index, 1000SW-Thousand seed weight, Mor%-Mortality percent

2. Conclusion and recommendations

Out of forty treatments (Thirteen bread wheat varieties and twenty seven advanced bread wheat genotypes, Eleven bread wheat varieties (Balcha, Danda'a, Deka, Gelan, Hibist, Kekeba, Lakku, Liban, Oborra, Ogolcho, shorima) and twenty four advanced genotypes(ACC#1676, ACC#2190, ACC#2489, ACC#3023, ACC#3343, ACC#3490, ACC#3596, ACC#3699, ACC#3788, ACC#4276, ACC#4978, Bwic335, ETW17-114, ETW17-174, ETW17-175, ETW17-176, ETW17-189, ETW17-193, ETW17-198, ETW17-220, ETW17-224, ETW17-251, ETW17-320, ETW17-414) were regarded as moderately Resistant, whereas Three advanced genotypes (ACC#3187, BWIC-139, ETW17-225) and two varieties(Sofumar and Wane) were grouped as

Susceptible. Even if the above listed varieties and advanced genotypes were categorized under moderately resistant class, two genotypes (ETW17-251, ETW17-220) and one released variety (Deka) had the least Susceptibility Index. Therefore, this two genotypes (ETW17-251, ETW17-220) and one Released variety (Deka) can be utilized as an environmental friendly way to reduce damage by S. *Orizae* under traditional storage conditions and can also reduce the cost of weevil's management. Thus, the materials identified in this study may also use as a source of resistance in breeding programs in the future to diversify the basis of resistance to other pest.

2. ONGOING ACTIVITY

Activity Title: Assessment of the status of major cereal crops' field insect pests in West Shoa, Horro Guduru and East Wollega Zones.

Brief summary of the activity

Activity duration- 2 years

Year of initiation- 2022GC

Expected Year of completion- 2023GC

Initiator/s-Abbay G.,Dejene H.,Yohannes K.

Current status of the activity

No data were collected till now due to the security problem existed around the pre-selected three zones where we planned to conduct this survey

The assessment of this survey will be started this cropping calendar (2023/2024 GC) if the security problem of our survey area will be solved

3.3 Livestock Research Process

Livestock Annual Technical Report

Introduction

The Livestock Research Process of Bako Agricultural Research Center is tasked with developing and implementing livestock technologies that will enhance the living conditions of livestock producers and thereby contribute to the growth and development of our nation in general and ATO plan of the Oromia Regional State in particular. To do this, the process has been organized in different teams namely, dairy, meat, animal feed resource and range land management, poultry, and apiculture. Each of these research teams consists of a number of researchers from various fields who collaborate in a multidisciplinary manner to produce comprehensive technical packages. These research teams have carried out 8 completed, 16 ongoing, 3 extended and 12 new research activities in the fiscal year. The research process comprises 31 total activities passing to the next fiscal year (July 2015 to June 2016 EC). Furthermore, 3 initiative activities and one project (ICARD) were effective in collaboration with regional and international organizations, respectively (table 2). In general, brief description of research activities of

livestock research process conducted in the current budget year was presented in this annual report.

2. Status of research activities in livestock process for 2015 & New for 20156 E.C.

Table 1. Summary of research activities in the livestock process funded by IQQO

No	Team	Completed/to be completed	Ongoing	Extended	Total passing to 2016 EC.	New or 2016 EC.	Total for 2016 EC.
1	Dairy	0	2	1	3	1	4
2	Meat	2	3	0	3	5	8
3	Feed	4	7	2	9	4	13
4	Apiculture	0	1	0	1	1	2
5	Poultry	2	3	0	3	1	4
	Total	**8**	**16**	**3**	**19**	**12**	**31**

Table 2. Summary of activities in the Livestock Processes funded by other organizations

No	Team	Completed	Ongoing	Total passing to 2016 EC.	New for 2016 EC.	Total for 2016 EC.
1	Dairy	0	0	0	0	0
2	Meat	0	2	2	0	2
3	Feed Resource	0	0	0	0	0
4	Apiculture	0	0	0	0	0
5	Poultry	0	1	1	0	1
	Total	**0**	**3**	**3**	**0**	**3**

3. Achievements in conducting research activities in Livestock process team by team.

In the current budget year, out of the planned 26 research activities as per GIT, 24 (92.31%) were achieved (table 2).

Table 3. Research activities achievements of livestock process funded by OARI

No	Team	Year plan for 2015		Achievement	% of achievement from actual plan	Remark
		As GTP	Actual			
1	Dairy	5	2	2	100	.
2	Meat	5	6	6	100	
3	Feed resource & RLM	9	10	10	100	
4	Poultry	4	5	5	100	
5	Apiculture	3	1	1	100	
Overall		**26**	**24**	**24**		

3.1. Details achievements of activities under each research team and activity by activity

3.3.1 Dairy Research Team

Ongoing Research Activities (2)

Activity 1: Selection of Horro Cattle for Dual Purpose through Open Nucleus Breeding Scheme at Bako Agricultural Research Center

Current Status

Maintenance of the existed barn and construction of new modern barn were made to accommodate the expected cattle population for the selection program. Farmers were trained and 47 typical Horro Cattle heifers have been purchased in this budgeting year. However, we couldn't achieve the selection program according to our work plan due to security. Future direction: Selection of Horro cattle for dual purpose through open nucleus breeding scheme program should be given an attention and needed an exceptional implementation work. Therefore, the animal should be purchased to attain the expected base population in a short period of time as well as expert should be hired like AI technicians and animal breeder.

Activity 2. Evaluation and managing of conception rate in Dairy through establishments of AI services station in Strategic Locations

Current status

Site selection was made (Gobu Sayo, Bako Tibe & Guto Gida) and the experiment has been started in Bako Tibe and in Gobu Sayo districrs where as in Guto Gida do not started due to security case. In Bako Tibe and Gobu Sayo districts farmers were recruited based on the criteria seated and training was given. About 70 farmers (50 male and 20 female) and 5 experts have been participated on the training, eventually cattle selection and synchronization (25) was made and AI service (19) has been done, accordingly.

Extended Activities (1)

Project title: Improving Productivity of Dairy Cattle through Health Management System in Western Oromia

Activity 1. Study on Bovine Trypanosomiasis and Identification of Fly Density in Tsetse Belt Areas of Western Oromia

Current status

Sites were selected (Bako Tibe, Ilu Gelan, Guto Gida and Chewaka) and sample collection materials likes (slide, cover slip, and capillary tube, lancet) were purchased. Questioner survey and data collection sheet were prepared. However, we are not able to collect field data according to our work plan due to security issues of the area, therefore, the activity has been extended in to 2024 budgeting year. Future direction: Preparation of imputes like Clothes that used for preparation of Traps and target (sewing the purchased clothes), an agreement was made with Bedele Tsetse fly & Trypanosomosis Controlling and Eradication center.

Ongoing Research Activity (1)

Activity 1. Study on Major Reproductive Problems of Dairy Cattle with Specific Emphasize of Bovine Brucellosis in Selected Districts of Western Oromia, Ethiopia

Current status

- Questionnaire and sample collection format preparation underway

Human resource development (Researchers)

- Two dairy research team researchers were participate on Annual Regional Research project Review meeting for six days at Batu/Zuwa

- One researcher was participated on the dairy ration formulation at IQQO

Constraints

- Lack of training of recently employed researchers on data management and statistical analysis
- Inadequate man power in the dairy research team like AI technician and Technical assistant
- Barn maintenance problem (Isolation barn) and
- Security problems
- Absence of transparence in the research center

3.3.2 Meat Research Team

IQQO funded completed activity (2

Activity 1. The effects of Maize and Napier Grass ensiled with Different Proportion of Dolichos Lablab on Ensiling Quality, Growth Performance, Carcass Traits and Meat Quality of Horro Lambs

Brief status of the activity

- In feeding trail all data regarding growth parameters and carcass characterization was completed. Feed and faecal samples were summited to Holota Agricultural research center for lab analysis and full write up is on progress.

Activity 2. Prevalence and Economic Significance of Hydatidosis in Sheep Slaughtered in Hotels and Restaurants of Bako and Shambu Towns

Brief status of the activity

- All data were collected from Bako, Shambu and Nekemte towns. Cyst characterization was conducted in BARC animal health lab. Collected data was interred to the computer and full write up is on progress

IQQO funded on-going research activities (3)

Activity 1. Establishing Community Based Breeding Programs of small ruminants in Oromia

Current status

A total of eight (**8**) CBBP Cooperatives were established during 2020 to 2023 G.C. and two of them had got legal entity. Presently about 695 sheep keepers were grouped under cooperatives and to be benefitted from CBBP program. During the flock registration campaign **4954** flock were tagged. Based on the population of registered flock **130** improved breeding rams were purchased and disseminated for respective established cooperatives. More than 2500 born lambs has been registered. To encourage and motivate established CBBP cooperatives their animals was dewormed against commonly known parasites in the area. About ten thousand (10000) bolus was distributed. Training was delivered for all with respective coop committee and members, village, districts and zonal animal science and cooperative expert, leaders at Diga, Chalia and Horro districts. Accordingly, seven (7) zonal experts, thirteen (13) district experts, ten (10) village experts, seven (7) enumerators and one hundred fifty nine (159) farmers those participate on community based breeding program.

Photo taken during training and awerness creation regarding community Based breeding with stakeholder at East wollega (Diga district and west shoa (Chalia) in 2023.

Activity 2. Evaluation of Veterinary Drugs Usage and Residues in Meat of Large and Small Ruminants in Selected Districts of Western Oromia

Current status of the activity:

- Site selection was done from Arjo Gudetu, Nekemte and Shambu towns. Semi-structured questionnaire was prepared. Chemicals and sample collection equipment were purchased. The activity was not commenced due to security problem and the team was intended to conduct the activity in next fiscal budget year

Activity 3: Effects of Feeding Different Diets on Feed Intake, Growth Performance and Meat Quality of Horro Sheep

Brief status of the activity

- All forages, cereal crop (maize and sorghum) and soybean were sown on 1 hector of land for hay production and grain feed. The planted forage were under good management condition and then feeding trial will be started in next fiscal year

Non-IQQO funded ongoing activity

Activity 1. Community based breeding program of Horro sheep at Horro district

Brief status of the activity

- The activity was conducted in Horro district at three villages namely Gitlo, Laku and Abedongoro. The activity is conducting for a long time. The intermediate result was indicated mean age at first lambing of Horro sheep under Community Based Breeding Program over the period of the study were 358.38±3.17 days. The overall mean lambing interval of Horro sheep under CBBP were 288.55±1.19 days. The twinning percentage obtained in this study was 32.72% and male to female ratio of lambs is (0.91:1). In this budget year (2023 GC) about twenty (20) rams were distributed for cooperatives. About five thousand different bolus of drug were distributed for deworm the flock and training and discussion was held with stakeholders at Shambu town with three (3) zonal experts, seven (7) district experts, three (3) enumerators and thirty (30) committee and members from three cooperatives.

IQQO funded Reinitiated Activity (1)

Project title: Improving productivity of Horro Sheep through Genetic Improvement, Feeding and Health Management System in Western Oromia

Activity 1: Genetic selection of Horro sheep for Growth through open nucleus breeding

Brief status of the activity:

Reason of reinitiated

- We have been working for obtaining mandatory breeding ewes (500 ewes) as a base population via purchasing and breeding of existing ewes from starting year to January 2022. Unfortunately, we had lost almost all the breeding ewes and rams due to security problem at January 2022 only seven ewes was left. Even though, the activity was suspended during regional review forum due to real cause in 2022 G.C, the team had been purchased some ewes and rams. Now we have about forty ewes (40) and ten rams (10) and twenty five (25) lambs. Totally about 75 healthy sheep in our farm. Most of ewes are pregnant hence we have hope to get additional lamb after some months. Currently, the team is managing flock without any budget. Therefore, reinitiating the activity in coming budget year help us to restock the flock and back the activity to actual plane. The reinitiated activity will be implemented as per planned.

Photo of sheep flock in BARC livestock farm currently

IQQO funded new Activities (4)

Activity 1: Effect Substitution of Cowpea with Noug Seed Cake on Growth Performance and Meat Quality of Horro Sheep

Current status of the activity

- Land for cowpea production was selected and well prepared and on about 0.75 ha late maturing "**Morka"** variety of cowpea was planted at on station (BARC). Agronomic management and guarding for the sown forage variety is undergoing. Pen for rams fattening was secured and other necessarily job will be planed accordingly.

Activity 2. **Systematic investigation on Horro Sheep Lamb Mortality across Different Breeding seasons in BARC**

Current status of the activity

- ✓ The experiment was conducting on exist flock in BARC. Currently the number of flock are not enough to commence the trail due to animals lost in last year. However, flock multiplication are smoothly ongoing in BARC and the team have planned to buy some ewes to fill randomize the mandatory parity.

Activity 3: **In-vitro evaluation of the antimicrobial activity of selected ethno-veterinary medicinal plants against selected animal diseases**

Current status:

- Site selection and requesting of necessary materials for purchase were executed for next year. The activity will be started when the budget is released.

Activity 4. Sero-prevalence and associated risk factors of ovine Brucellosis in selected Districts of Western Oromia

Current status:

- Site selection and preparation of semi-structured questionnaire were made to collect information about risk factors. Purchase of necessary materials (vacuutainere tubes, crio vials and others) were requested for the next year to commence the work.

3.3.3 Animal Feed Resources and Range Land Management Team

To be completed activities (4):

Activity 1: Stover yield, nutrient composition and in-vitro digestibility characteristics of forage type (Stay green) sorghum varieties: Implication for selecting food-feed varieties

Brief summary:

Five stay-green sorghum varieties were tested to evaluate their stover yield and nutritive value. Chemeda variety generated the most stover, while the Adukara and Asosa had the highest leaf to stem ratios. In terms of qualitative characteristics, ash and a few fibre components (NDF, ADF, and cellulose) did not differ among the varieties. The lowest crude protein content was obtained from Merera when compared to the other varieties, which had greater and equivalent CP values. Asosa1 and Adukara varieties performed better in terms of dry matter content, metabolizable energy, and in-vitro OM and DM digestibility. Generally speaking, due to their larger leaf to stem ratio, metabolizable energy, and in-vitro digestibility characteristics, Asosa1 and Adukara varieties are advised for wider cultivation.

Activity 2: **Comparative feeding value of *Cajanus Cajan* and *Lablab purpureus* over conventional protein supplements in supporting growth, feed utilization, carcass yield and net return of Horro Sheep based on basal diet of fodder Oat**

Current status:

The purpose of the feeding trial was to determine the effects of supplementing *Lablab purpureus* and *Cajanus cajan* varieties on the growth and carcass yield performance of Horro sheep fed fodder oat as a basal diet. The experimental lambs and concentration feed have already been purchased, and the feeding trial has been operating for the past 90 days. Data on lamb growth and carcass yield, as well as in vivo digestibility studies, were also fully collected. The remaining tasks are data summarization, analysis, and report authoring.

Activity 3: **Adaptation Trial of Alfalfa (*Medicago sativa L.*) Cultivars in Highland Areas of Western Oromia**

Current status:

For the past three croping seasons, an adaptation trial involving nine alfalfa cultivars has been conducted at two sites (Gedo and Shambu sub-sites). The cultivars' adaptability, as well as forage yield and other agronomic variables, were assessed. Except for the quality features of alfalfa, for which samples have already been submitted for chemical analysis and are awaiting laboratory results, no parameters were left.

Activity 4: **Vetch (*Vicia sativa L.)* Regional Variety Trial (RVT)**

Current status:
Ten genotypes of vetch were tested regionally across three cropping seasons at the Shambu and Gedo sub-sites. Across the testing sites, the genotypes were assessed for their forage yield and nutritional value. Based on forage yield and yield-related parameters, two genotypes (Acc. # 10106 and Acc. # 8316) were selected and promoted for verification against the standard check (Lelisa).

On-going activities (7)

Activity 1: Evaluation of straw dry matter yield and nutritive value of finger millet *(Eleusine coracana)* varieties grown under sub-humid climatic conditions of Western Oromia.

Work done so far:
Planting of eleven finger millet varieties was completed in early June at two testing locations (Bako and Gute sub-sites), and the varieties are currently well sprouted at both sites. Data collection and activity management will proceed as scheduled.

Activity 2: Evaluation of intercropping *Lablab purpureus* at different seeding rate and planting time with Napier grass for dry matter yield, agronomic performance and nutrient composition at Bako

Work done so far:
Planting of Napier grass and Lablab purpureas began in early June according to the trial seed rate and planting time. Following their different sowing periods, the following round's planting, yield and related yield traits data gathering for both types of forage will take place as planned.

Activity 3: Centrosema Preliminary Variety Trial (PVT)
Work done so far:
The 16 selected centrosema genotypes were sowed in mid-June, and all have germinated successfully so far. There will also be trial follow-up and observation for insect and/or pest infestation. The collection of agronomic data will proceed as planned.

Activity 4: Stylosantheses Preliminary Variety Trial (PVT)

Work done so far:
The 16 selected **stylosantheses** genotypes were sowed in mid-June, and all have germinated successfully so far. There will also be trial follow-up and observation for insect and/or pest infestation. The collection of agronomic data will proceed as planned.

Activity 5: Adaptation atrial of Sweet Lupines (*Lupinus angustifolius L.*) under sub-humid mid altitude agro-ecologies of western Oromia, Ethiopia

Work done so far:
Three sweet lupine varieties were planted in mid-June at each of the three locations (Bako, Gute, and Billo sub-sites). The varieties that were seeded have exhibited strong germination. As per the specified data collection time, field follow-up and agronomic data collecting will continue.

Activity 6: Adaptation atrial of Desho Grass Varieties at mid-altitude of Bako, Western Oromia, Ethiopia

Work done so far:
Given that Desho is a perennial grass that does not require planting every season, the normal agronomic practices for the previously established varieties have been carefully applied. The required parameters' data will be collected as per its time table scheduled.

Activity 7: Adaptation atrial of Brachiaria Cultivars at mid-altitude of Bako, Western Oromia Component: Breeding

Work done so far:
Given that Brachria is a perennial grass that does not require planting every year, the implementation of the standard agronomic practices for the cultivars that are already established has been done with care. Data were not obtained last year due to the poor performance of the cultivars. Data collection of the required parameters will follow as planned.

Extended activities (2)

Activity 1: **Coffee pulp Nutritional Quality Enhancement after treating with Different Reagents for Livestock feed**

Work done so far:
Due to the ongoing security issues that have hampered coffee pulp and molasses collection, the only tasks completed thus far have been the identification of regions where coffee pulp typically comes from (west Wollega and Buno Bedele) and the availability of molasses from the Finchaa sugar factory. The purchase of inputs (storage area, plastic bags silo, etc.) required for ensiling and experimental material collection (coffee pulp and molasses) and ensiling will take place as planned.

Activity 2. **Ecological study on invasive plant species of different land use type at some districts of West Shewa Zone of Oromia, Ethiopia**

Work done so far:
Although samples of forage biomass, soil, and invasive weeds were taken from the various agro-ecologies in the three study districts (Horro, Chelia, and Dano), this activity was unable to proceed according to schedule due to security concerns that were present there. Quick observations were made to designate study sites across the three districts, and so actual assessments for the expected invasive weeds and soil samples will proceed as scheduled.

Ongoing activities (4)

Activity 1. Effect of Planting Time and Inter and Intra Row Spacing on nutritive value, Seed and Forage dry matter Yield of Dolichos Lablab Variety Grown under Bako Condition.

Current status:

The first round (period) of Lablab variety plantation has already been carried out in accordance with the treatment arrangement. The cultivar has currently displayed a promising germination condition. The following round's planting/sowing, trial administration and data gathering all will proceed in accordance with its schedule.

Activity 2. Effect of Planting Time and Inter and Intra Row Spacing of Cow pea Variety on Seed and Forage DM Yields and nutrient composition at Bako.

Current status:

The first round (period) of cowpea variety plantation has already been carried out in accordance with the treatment arrangement. The cultivar has currently displayed a promising germination condition. The following round's planting/sowing, trial administration and data gathering all will continue in accordance with its schedule

Activity 3: Evaluation of Alfalfa (*Medico sativa L.*) Varieties for dry matter yield, yield components and proximate composition grown under supplementary irrigation condition at BARC.

Current status:

A trial site with irrigation capabilities had previously been chosen, and experimental land preparation is and plantation of the cultivars are on progress. Management of the experimental location and data gathering will proceed as scheduled.

Activity 4: Vetch (*Vicia villosa L*) Variety Verification Trial (VVT)

Current status:

In order to verify the candidate genotypes, site selection both at farmers filed and sub-sites had already been completed. Planation of the genotypes is on the way at this reporting time. Field follow-up, variety release committee invitation, and varietal evaluation will all take place as anticipated.

3.3.4 Poultry Research Team

To be completed activities

Activity 1.Onfarm evaluation of dual Purpose chicken Production Performances in selected Districts of East Wollega, Oromia

Abstract

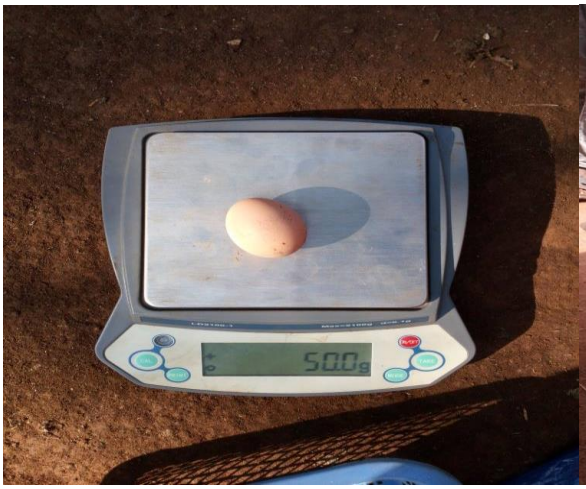
The study was conducted in four selected districts of East wollega zone. Two rural villages and 20 farmers were selected from each districts .The training was given regarding on feeding, housing, sanitation and data recording for farmers and development agents. Individual 10 farmers from each villages received 10 pullets to see adaptation and production evaluation of the chicken. About 2400 pullets were disseminated for four FRG groups at selected districts to evaluate their survivability at farmers' management performances. Age at first laying, eggs weight, body weight and feeding data collection were completed as planned .The mean of body weight at 20 weeks age of pullets was 2.45±0.56 recorded at farmers' households. The survivability mean of distributed of chicken was 8.34±1.23 at individual farmers'. The mean of age at first laying eggs was 156.30±4.32 days. The mean of eggs weight at 5% production 56.60±0.48. The major feed resources utilize are, maize grain/ground/, wheat, finger millet in the study areas. Distribution of Pullets for selected farmers across districts were completed. Therefore, data analyzing and full paper write up are the remaining tasks to finish this activity upcoming two months.

Farmers training at village

During Farmers Receiving Pullets

Growing pullets on station

Pullets transporting to farmer village



Egg Weighing

Body weight recording

Activity2.Evaluation of Cobb/Hubbard Broilers chicken for their adaptability and productivity at BARC

Summary

This activity was conducted on feeding trial of broilers chicken by compering commercial feeds and local available feeds ingredients at on station. The experiments was categorized into two group on feeding trials that adaptation taken 15 days' before actual experiment is started. The broiler day old chicks were brought from Mojo to implement this activity. Daily, Weekly, Monthly weight gain, feed offered, feed refused, carcass data and mortality data were collected sequentially. Currently, this activity data collection and data entry were completed. The remaining parts are data analyzing, interpreting and full paper write up is under way.

Broiler day old chicks

Heat supplying for day old chicks

Fig: Local Feeds Supplied Broiler Trial

Fig; Carcass Data

Ongoing Activities

Activity 1. Evaluation of growth traits and short term laying performance of commercial Chicken, the improved Horro chicken and their random bred progenies on station

Summary

Reproductive performance and production data collection was conducted based on their breeds' profile. The breeding database were collected and documented to begin crossing vigorous strains. Major poultry equipment like hatchery and incubator were arrived on poultry farm to perform this activity accordingly. Generator and transformer were promised to begin this activity. Then, producing day old chicks will be begin as soon as indispensable facilities fulfilled at BARC.

Fig: DZ-White Feather Breed

Fig: Koekoek Breed

Activity 2. Evaluation of growth and egg production performance of DZ-white and Improved Horro chicken breeds at BARC

Summary

Two breeds were requested to evaluate their performance at BARC. Farmers who have indigenous chicken were identified to bring either eggs or pullets as parental stock on station for selection purpose. Potential areas for indigenous chicken selection were identified in some zones. Training was given for the experts'. Therefore, the experiments will be started according to its plan next season

Activity 3. Improving the productivity of indigenous chicken population through selection for sustainable breeding program

Summary

Farmers who have indigenous chicken were identified to bring either eggs or pullets as parental stock on station for selection purpose. Four zones and sixteen districts were identified to undertake this activity as first phase procedure. Training was given for zonal and districts livestock experts' the aim indigenous chicken selection and how to be conducted this project with their integration. House maintenances and hatcher equipment preparation were commenced to implement this activity as its plan. Therefore, selection steps and techniques will be continued to until the desired traits gained at future.

Ongoing Activity (1)

Activity 1. Inclusion of Leucaena Leaf Meals as alternative protein feed ingredients implication on growth, egg production and egg qualities of Dual-Purpose Chicken at BARC

Summary

The day old chicks were requested to get from their production farm in upcoming time. Leucaena leaf meals will be collected and dried to make chicken ration across the treatments. House and local feed ingredients will be prepared to accomplish this task according to its plan.

3.3.5 Apiculture

Ongoing activity

Activity title: Assessment of Bolale Forest Honey Production Potential and Honeybee colonies Carrying Capacity

The breeding status of the honeybee in the Bolale forest area was known. It was identified as enough bee flora were existed in the forest from the district experts. Therefore, the experiment will be continued according to its plan next season.

New activity:

Activity title: Evaluation of off-season alternative sugar supplementary feeding of honeybees (*apis mellifera bandasi*) on brood development and honey production.

- **New activity: It will be started according to its schedule**

Constraints

Table 4: Problem encountered and measurement taken in the livestock research process

No	Problems encountered	Measures taken	Solution suggested
1	Herd lost from farm by terrorist	Purchased some heifers, ewes and rams.	Allocate budget for animal purchase to restock the flock
2	Lack of laboratory (Ethiono-botany Lab, nutrition lab and etc.)	We communicate with EARI centers for collaboration	IQQO should capacitate the lab or make agreement with other institution those fully equipped
3	Inadequate human power in the process like: researchers (Api and poultry), AI technician and Technical assistants in dairy	Assigning researchers and TA that have some experience on AI so far. via borrowing researchers from other team	IQQO should be hired professionals
3	House for sheep. Before the flock has been lost house is a critical problem (overcrowded). To feed the flock indoor competition with wild animals is headache	We maintained by locally available materials (Use Bamboo)	IQQO should allocate budget to maintained /construct the house before fully restock
4	Security problem	The government force/Army was keeping our	Government should be secured the working environment
5	Lack of budget (Feed cost, wage, lab cost)	We have forced to limit our self's to the allocated budget any ways.	IQQO should be reconsider the budget allocation
6	Lack of short term training for researchers and technical assistants	Experience sharing from senior researchers for the junior one is good practice in among our researchers.	IQQO should be qualified the young researchers.
7	Very narrow for long term training (esp. PhD)	No measurements were taken	IQQO should be consider this one
8	Feed cost (particularly for protein source)	We collected and feed lucuenea and other protein source	Consider during budget allocation

3.4 Coffee and Tea Research Process

Summary

Oromia agricultural research institute has established coffee and tea research directorate at head office level and the research process and research teams under six agricultural research centers before few years. Among these, at Bako Agricultural Research center, coffee and tea research process with 2 research team was established with the objective to develop technologies which enhances coffee and tea production and productivity at Western Oromia and similar agro-ecology. These teams started conducting research activities with different areas (disciplines) including technology adaptation and generation at different mandate areas. Currently, at research process level there are to be completed activities, ongoing research activities, extended and new project under both coffee and tea improvement and under coffee and tea management and protection team. These research activities contain coffee and tea breeding, genetics, management (agronomy), pathology and weed science. As the

recommendation, in order to make full package technology, coffee and tea quality research case team should be established in our center with short period as much as possible

.

Project 1: Development of coffee technologies for western Oromia coffee growers

3.4.1 Coffee and tea improvement research

1.1. Arabica coffee variety adaptation trail

- Component: Breeding
- Started year: 2019
- Expected year of completion: 2025
- Status: Ongoing
- Sites: Bako, Gute, Dano and Sasiga
- Number of genotypes: 10
- Number of plants per each genotype: 6
- Spacing: 2m*2m
- Design: RCBD with three replications

Major work done so far,

- The experiments on the Bako onstation and the Gute subsite are well managed, whereas the experiments planted on the Dano and Sasiga sites are not being addressed as planned this season due to security concerns.
- First year data collected and analyzed
- Field management was conducted for Gute and Bako site experiments for the last one year

Major challenges

- Security problem on Dano and Sasigaonfarm experiments

Action made

- We've been in touch with trail managers in phone especially Dano and Sasiga site

Ways forward

We are hopeful that the condition will be resolved, and we are in contact to manage and collect data as planned. If note we intend to continue as we are using know

1.2. Establishment of maintenance block for Western Oromia coffee landraces

- Component: Breeding
- Started year: 2020
- Expected year of completion: 2026
- Site: collections at Bako
- Status: Ongoing
- Sites: Bako on station
- Number of genotypes: 56
- Number of plants per each genotype: 6
- Spacing: 2m*2m
- Design: Augmented

Jobs done so far,

- We have maintained all of the collected landraces on Bako onstation, and they are all well managed in all conditions. Characterization and some data (disease, pest and maturity) collections are under way

1.3. Evaluation and characterization of lowland coffee landraces for CLR, yield and yield components (1000-1550masl) I

- Started year: 2021
- Expected year of completion: 2027
- Status: Ongoing
- Sites: Diga (Jirmaa)
- Number of genotypes: 24
- Number of plants per each genotype: 5
- Spacing: 2m*2m
- Design: Augmented
- Checks: Dessu and 7454

Jobs done so far,

- The experiment was planted on a Diga (Jirmaa) subsite and was well-managed.

Major challenges:

- fence and security

Action made

- We are using public transport for management and inspection

Ways forward

- We are hopeful that the condition will be resolved, and we are in contact to manage and collect data as planned. If note we are planned to continue as we are using know

1.4. Evaluation and characterization of midland coffee landraces for yield and yield components (1550-1850masl) I

- Component: Coffee improvement
  - Started year: 2021
  - Expected year of completion: 2027
  - Status: Ongoing
  - Sites: Sire (Jarso wama)
  - Number of genotypes: 18
  - Number of plants per each genotype: 5
  - Spacing: 2m*2m
  - Checks: 74110 and 74140

Works done so far,

- The experiment was planted on a Sibu sire (JarsoWama) sub site and was well-managed.
- The experiment was managed in good manner, shade management also done

Major challenges:

- fence and security
- security problem

Action made

- We are using public transport for managements, data collections and inspection

Ways forward

- We are hopeful that the condition will be resolved, and we are in contact to manage and collect data as planned. If note we are planned to continue as we doing currently

1.5. Evaluation and characterization of highland coffee landraces for yield and yield components (above 1850masl) I

Component: coffee improvement

- Started year: 2020
- Expected year of completion: 2026
- Status: Ongoing
- Sites: AbaboGuduru (CaalaaFooqaa)
- Number of genotypes: 32
- Number of plants per each genotype: 5
- Spacing: 2m*2m
- Checks: Bunowasho and Yachi
- Design: augmented

Works done so far,

- The experiment was planted on a AbaboGuduru (CaalaaFooqaa) subsite and was well-managed.
- According to gourd report from the site, the experiment is under good managements and performance
- Flay cropping is loading…

Major challenges:

- Security

Action made

- We are using public transport for managements, data collections and inspection

Ways forward

- We are hopeful that the condition will be resolved, and we are in contact to manage and collect data as planned. If note we are planned to continue as we doing currently

1.6. Establishment of maintenance block for 2020 coffee landrace collections at Bako, Western Oromia II

- Component: coffee improvement
  - Started year: 2021
  - Expected year of completion: 2027
  - Status: Ongoing
  - Sites: Bako onstation
  - Number of genotypes: 128
  - Number of plants per each genotype: 5
  - Spacing: 2m*2m
  - Design: augmented

Jobs done so far,

- We have maintained all of the collected landraces on Bako onstation, and they are all well managed in all conditions. Characterization and some data (disease, pest and maturity) collections are under way

Date: 28/07/2022, Bako on station

1.7. Evaluation and characterization of highland coffee landraces for yield and yield components 2020 collections (above 1850masl) II

Component: coffee improvement

- Started year: 2021
- Expected year of completion: 2027
- Status: Ongoing
- Sites: AbaboGuduru (CaalaaFooqaa)
- Number of genotypes: 24
- Number of plants per each genotype: 5
- Spacing: 2m*2m
- Checks: Buno washo and Yachi
- Design: augmented

Works done so far,

- The experiment was planted on a AbaboGuduru (CaalaaFooqaa) subsite and was well-managed.
- According to the guard report from the site, the performance of the trail is very good and under good management

Major challenges:

- Security

Action made

- We are monitoring by phone

Ways forward

- We are hopeful that the condition will be resolved, and we are in contact to manage and collect data as planned. If note we are planned to continue as we doing currently

1.8. Evaluation and characterization of midland coffee landraces for yield and yield components 2020 collections (1550-1850masl) II

- Component: Coffee improvement
  - Started year: 2021
  - Expected year of completion: 2027
  - Status: Ongoing
  - Sites: Sire (JarsoWama)
  - Number of genotypes: 48
  - Number of plants per each genotype: 5
  - Spacing: 2m*2m
  - Checks: 74110 and 74140

Works done so far,

- The experiment was planted on a Sibu sire (JarsoWama) subsite and was well-managed.
- The experiment is under good management and frequent supervision by public transport
- First round application of fertilizer was conducterd on time
- Weeding and shade management was conducted for the trial

Major challenges:

- fence and security

Action made

- We are using public transport for managements, data collections and inspection

Ways forward

- We are hopeful that the condition will be resolved, and we are in contact to manage and collect data as planned. If note we are planned to continue as we doing currently

1.9. Molecular characterization of '*Laage'* Arabic Coffee landraces using simple sequence repeat marker

- Component: Genetics
- Status: ongoing
- Started year: 2021
- Expected year of completion: 2023
- Site: field experiment on Bako, Lab work on HNBRC

Work done so far

- DNA extraction was conducted for all samples by using KIT procedure
- PCR and gel electrophoresis was conducted for 15 primers
- Data scoring also conducted for 15 primers
- Data clearing and analysis is under way

Future plan

- Data clearing and analysis will be conducted near future with collaboration of NBRC researchers the result will be presented on review forum

1.10. Evaluation of coffee varieties under supplementary Irrigation at Bako and Abe Dongoro Western Oromia

- Component: Breeding
- Started year: 2022
- Expected year of completion: 2028
- Status: Ongoing
- Sites: Bako and Diga (Jirmaa)
- Number of genotypes: 10
- Number of plants per each genotype: 6

- Spacing: 2m*2m
- Design: RCBD with three replications

Major work done,

- The experiment was planted on Bako onstation and going to be replicated on Diga (Arjo) subsite
- Both site experiments are under good management as per recommendation

Major challenge

- Site fence and security on Diga (Jirmaa)

Action made

- We are using public transport for management and inspection

Ways forward

- We are hopeful that the condition will be resolved, and we are in contact to manage and collect data as planned. If note we are planned to continue as we are using know

1.11. Maintenance of released coffee varieties

Component: Breeding

- Started year: 2019
- Expected year of completion: 2027
- Status: Ongoing
- Sites: Bako
- Number of genotypes: 10
- Number of plants per each genotype: 30
- Spacing: 2m*2m
- Area: 120m^2

Major work done

- All of the coffee varieties planted before a year were well-managed.
- All maintained varieties yield and on good performance

3.4.2 Coffee and tea management and protection research team

2.1. Coffee and Tea to be completed research activities

2.1.1. The effect of different organic matters combination for germination and growth of coffee seedling at nursery level

- Year started: 2020

- Expected year of completion: 2023
- Code: BARC/CT/CMP (1)-2019

Brief status of the activity

- The trial was laid down using CRD with three replication
- Treatment samples (compost, vermin-compost, top soil, dairy manure and shoat dang) were submitted to soil lab and analyzed under BARC soil Lab.
- First and second year data was taken and analyzed using R-software and the intermediate result has presented in below tables (1) and table (2), respectively.
- The result revealed that, the combination of 40% top soil +35% sand +25% compost media was gave better result when compared to the else treatments.

Table 1. Analyzed composited media/soil sample during 2021

Media type	pH	% OC	% OM	% TN	Ava P
Dairy manure	6.5	2.74	4.72	0.24	8.3
Top soil	5.76	2.32	4.00	0.20	7.98
Shoat manure	8.16	3.00	5.18	0.26	9.74
Vermin compost	8.24	3.06	5.28	0.26	9.92
Compost	7.3	2.93	5.04	0.25	9.98

Table 2. The effect of different ratio combinations of organic matter on germination and growth of coffee seedlings during nursery age

Treatments	DE	PH	LNo.	Girth	RL	NN	INL
50% top soil + 30% sand +20% compost	71.67a	10.63bc	8.80ac	0.28bd	16.86ab	4.86a	1.28abc
40% top soil +35% sand +25% compost	62.33a	12.26a	9.86ab	0.27bd	17.08a	5.00a	1.51a
30% top soil+ 40% sand + 30% compost	67a	10.46bc	9.66ab	0.22ce	16.31ac	4.80ab	1.44ab
50% top soil+30% sand + 20% dairy manure	64.67a	9.56cd	9.20ac	0.17e	13.68ce	4.60ac	1.33ac
40% top soil + 35% sand +25% dairy manure	67a	10.70bc	8.60bd	0.25 be	13.36e	4.40ac	1.45ab
30% top soil + 40% sand + 30% dairy manure	64.67a	10.43bc	9.00ac	0.23ce	14.43be	4.53ac	1.22ad
50% top soil+30% sand+ 20% vermin compost	62.33a	10.76bc	9.92ab	0.26be	15.66ae	4.80ab	1.36ab
40% top soil+35% sand+ 25% vermin compost	67a	9.73bd	9.73ab	0.21ce	16.80ab	4.20bd	1.03ce
30% top soil+40% sand+ 30% vermin compost	67a	10.23bc	9.46ab	0.33ab	13.41de	4.66ab	0.96de
50% top soil+30% sand + 20% shoat	71.67a	10.89ac	9.40ab	0.37a	16.04ad	4.73ab	1.20bd
40% top soil + 35% sand + 25% shoat	64.67a	8.36d	7.46d	0.30ac	14.01ce	3.73d	0.82e
30% top soil + 40% sand +30% shoat	67a	10.03bc	8.00cd	0.21de	17.83a	4.00cd	0.97de
40% top soil+40% sand+20%dairy manure(ch)	64.67a	11.16ab	9.93a	0.24be	17.05ab	4.86a	1.33ac
Means	66.28	10.4	9.16	0.26	15.58	4.55	1.22
LSD	9.62	1.49	1.33	0.09	2.63	0.63	0.30
CV	8.78	8.68	8.77	20.58	10.22	8.33	14.88

Note: PH-plan height, LNo.-leaf number, RL-root length, NN-node number, INL-inter node length

Table 3. Effect of different combination of organic matter on germination and coffee seedling at nursery during 2022

Treatments	PH	LNo.	RL	INL	NN	Girth	FWL	DW
50% top soil + 30% sand +20% compost	8.66b	7.33b	16.99a	1.90a	5.11a	2.66a	2.07a	0.93a
40% top soil +35% sand +25% compost	7.51b-e	5.700bc	13.21b-d	1.27cd	3.33b	2.76a	1.12d	0.86ab
30% top soil+ 40% sand + 30% compost	6.32e	6.17bc	11.37de	1.15cd	3.67b	2.42a	1.68a-c	0.45b
50% top soil+30% sand + 20% dairy manure	8.58b	7.11bc	14.50b	0.97d	4.33ab	2.60a	1.63a-d	0.60ab
40% top soil + 35% sand +25% dairy manure	7.06c-e	6.00bc	12.78b-d	1.23cd	4.22ab	2.64a	2.05ab	0.69ab
30% top soil + 40% sand + 30% dairy manure	5.00f	5.45c	14.12b	1.13cd	2.00c	1.50b	1.47cd	0.70ab
50% top soil+30% sand+ 20% vermin compost	7.80bcd	6.33bc	12.01c-e	0.94d	4.11b	2.45a	1.86a-c	0.56ab
40% top soil+35% sand+ 25% vermin compost	6.33e	6.78bc	14.11b	1.48c-c	4.22ab	2.80a	1.73a-c	0.67ab
30% top soil+40% sand+ 30% vermin compost	8.40bc	6.44bc	9.23f	1.23cd	4.22ab	2.53a	1.34cd	0.77ab
50% top soil+30% sand + 20% shoat	10.16a	8.83a	16.59a	1.78ab	3.78b	2.47a	1.43cd	0.57ab
40% top soil + 35% sand + 25% shoat	7.57b-e	6.61bc	9.00f	1.39b-d	3.83b	2.46a	1.76a-c	0.78ab
30% top soil + 40% sand +30% shoat	5.00f	5.89bc	10.61ef	1.49a-c	3.66b	2.12ab	1.81a-c	0.94a
40% top soil+40% sand+20%dairy manure(ch)	6.47de	6.44bc	13.80bc	1.00cd	3.33b	2.46a	1.51b-d	0.57ab
Mean	7.30	6.55	12.95	1.31	3.86	2.45	1.65	0.69
LSD (0.05)	***	*	**	**	***	ns	*	*
CV	10.05	13.21	8.11	19.50	13.46	16.07	16.99	22.23

Future prospective

- Usual efforts should be given for the success of trial

2.1. 2. Land suitability analysis for coffee (*Coffea arabica* L.) production using GIS at Western and Central Oromia

- Year started: 2021
- Expected year of completion: 2023
- Code: BARC/CT/CMP (2)-2021

Brief status of the activity

- Activity has to be conducted at coffee growing areas of Western and central Oromia
- Secondary data was taken from 3 zonal administrative (West Shawaa, Southwest Shawa and North Shawaa) (Table4,5,6)

Table 4. Coffee potential areas and area coverage in W/Shawaa

Zone	Potential Districts For Coffee	Area coverage in ha
West Shawaa	Dano	2600
	Bako Tibe	1060
	Nono	430

	Ginda Barat	370
	Abuna Ginda Barat	290
	Ilu Gelan	390
	Mida Kegni	160
	Ilfata	280
	Ade'a Barga	27
	Tokkee	28
	Chaliya	35
	Liban Jawi	12.5
	Total	5682.5

Southwest Shawaa	Potential Districts For Coffee	Area coverage in ha
	Waliso	1437
	Wachi	1546
	Amaya	860
	Goro	665
	Sadan Sodo	114
	Total	4622
North Shawaa	Hidha Bobate	-
	Yayya Gulale	-
	Darraa	-
	Warra Jarsoo	-
	Alaltuu	-
	Girar Jarso	-
	Abootee	-
	Dagam	-
	Dabira Libanos	-
	Kuyyuu	-
	Wacalee	-
	Total	2805

Table 5. Secondary data on climate and agro-ecology of the study area

Zones	Climate Elements	Max	Min	Agro-Ecology (%)		
				H/Land	M/Land	L/Land
West Shawaa	Rain Fall (mm)			-	-	-
	Temperature (°C)			-	-	-

S/W/Shawaa	Rain Fall (mm) Temperature (°C)	1400 30	900 10	29	71	0
N/Shawaa	Rain Fall (mm) Temperature (°C)	1200 31	800 25	42	35	23

Table 6. Secondary data on soil texture and topography of the study area

Zones	Soil type	Topography
West Shawaa	loam, clay & clay loam	flat and steeply
S/W/Shawaa	loam, clay & clay loam	flat and steeply
North Shawaa	loam soil	Flat (51%)

- Data analyzing is under way

Future prospective

- Full write up will be presented on next completed research activities review forum.

2.1.3. Assessment of major Coffee Pests in Western Oromia Coffee Growing Areas, Ethiopia

- Started year: 2020
- Expected year of completion: 2023
- Code: BARC/CT/CMP (2)-2019

Brief status of the activity

Coffee pests assessment was conducted in selected coffee growing districts of East Wallaggaa zone.

Table 7. Representative districts used for coffee pests' assessment during 2020/21

Assessed coffee pests	Number of Districts surveyed
Coffee disease	3
Coffee insect pests	3
Weeds species	4

Distribution and status of major coffee pests in the study areas

Distribution and status of major coffee diseases in surveyed areas

Distribution and status of CBD

Table 8. Distribution and status of CBD in surveyed area during 2020/21

Districts	Prevalence %	Severity %	Incidence %
W/Tuka	53.33	2.73	18.22
Sasiga	73.33	4.93	32.89
Limmu	53.33	2.93	19.56
P-value(0.05)	0.751	0.135	0.176

- There was no significant variation (p>5%) among and within study areas.
- However, variation was observed from district to district PA to PA, farm to farm, and tree to tree and within tree.
- This variation was observed due to some biotic and abiotic factors.

Distribution and status CLR

Table 9. Distribution and status of CLR in surveyed area during 2020/21

Districts	Prevalence%	Incidence%	Severity%
Diggaa	100.00	77.33	36.67
Sibu Sire	100.00	77.33	39.18
Gudeya Bila	100.00	98.67	34.99
P-value(0.05)	2.126	3.023	4.25

- There was no significant variation (p>5%) among and within study areas.

- However, variation was observed from district to district, PA to PA, farm to farm, tree to tree and within tree.
- This variation was observed due to some biotic and abiotic factors.

Distribution and status CWD in surveyed area

Table 10. Distribution and status of CWD in surveyed area during 2020/21

Districts	Prevalence%	Incidence%
W/Tuka	73.33	9.00
Sasiga	80.00	6.67
Limmu	40.00	1.47
P-value (0.05)	0.119	0.009

- There was no significant variation (p>5%) among and within study areas.
- However, variation was observed from PA to PA, farm to farm
- This variation was observed due to some biotic and abiotic factors.

Distribution and status insect pest in surveyed area

Table 11. Distribution and status of coffee insect pests in surveyed area during 2021

Districts	Skeletonizer		
	prevalence	incidence	severity
Diggaa	100.00	98.00	30.33
S/Sire	100.00	92.00	31.99
G/Bila	100.00	82.00	33.72
Blotch leaf miner			
Diggaa	100.00	29.33	2.01
S/Sire	93.33	26.67	5.06
G/Bila	100.00	28.67	5.75
Serpantenizer			

Diggaa	100.00	42.67	7.88
S/Sire	100.00	46.67	4.80
G/Bila	100.00	42.67	5.57

- There was no significant variation (p>5%) among and within study areas.
- However, variation was observed from PA to PA, farm to farm
- This variation was observed due to some biotic and abiotic factors.

Weed composition in surveyed area

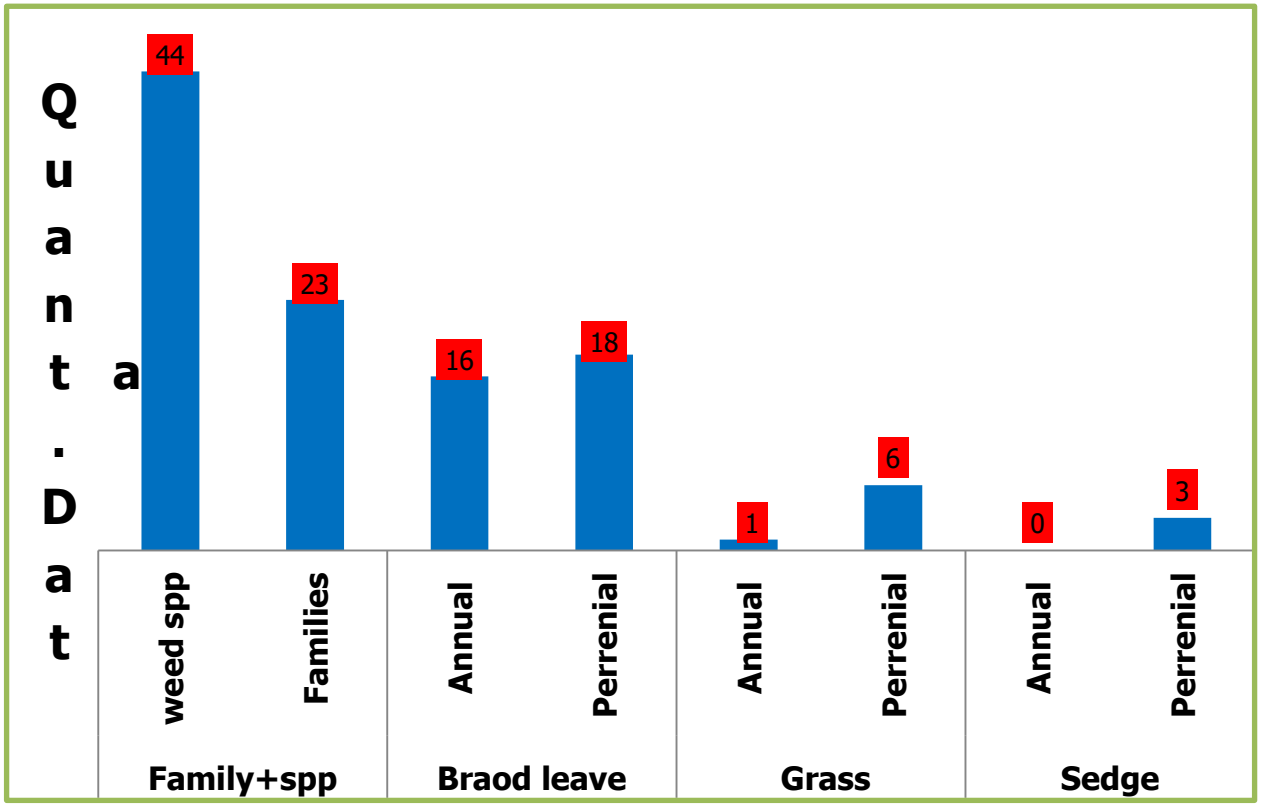


Figure 2. Weed species assessed in East Wallaggaa coffee growing areas during 2021 and their botanical categories

Conclusion and recommendation

- CBD was prevalent in most surveyed areas, particularly at mid to high land areas (≥ 1500m.a.s.l.), while CLR is <1500m.a.s.l.
- CWD was seen at the overall agro-ecology where Arabica coffee has been produced in case of surveyed areas.
- Skeletonizer, blotch leaf miner and serpantenizer are identified as major coffee insect pests in the surveyed area.
- Different weed species belongs to various families are indentified in surveyed coffee growing areas
- The overall average of CBD, CLR, CWD & insect pests' severity and incidence in the surveyed areas were significant ($p < 0.05$) among and within districts.
- Any coffee growers should be used CBD, CLR, CWD & insect pests **resistant/tolerant variety**, **pruning** of both coffee and shade tree, **fertilizer and wider spacing** to reduce the diseases and insect pests damage
- And recommended herbicides and IWM should be used by coffee growers to overcome weed problem in surveyed coffee growing areas.

Future prospective

- Full write up will be presented on next completed research activities review forum.

2.2. Coffee and tea management and protection ongoing activities

2.2.1. Effect of different mulching materials on the growth and yield of coffee in west Oromia

- Year started: 2021
- Expected year of completion: 2027
- Code: BARC/CT/CMP (1)-2021

Brief status of the activity

- The experiment was established at Bako on station and Sibu Sire sub site.
- The trial was laid out using RCBD with three replication.

- Ten treatments and one improve coffee variety (74110) was used.
- Six seedlings/plants per plot were used.

Future prospective

- Treatment application will be made at the early stage of bearing age.
- Usual efforts should be given for the success of trial.

2.2.2. Determination of proper coffee population and spacing for better yield and cup quality, Western Oromia

- **Year started:** 2021
- **Expected year of completion:** 2027
- Code: BARC/CT/CMP (2)-2021

Brief status of the activity

- The experiment was established at Bako on station.
- The trial was laid out using RCBD with three replication.
- Nine treatments were used
- Two improve coffee variety (74110 and 744) with two set was used.
- Due to activity had proposed for the evaluation of population density and spacing saymiltanous on two canopy habit of coffee (compact and open), the trial has become too large and difficult to conduct as a single trial.
- Therefore, the team has decided to break the trial into two sets (set1 for compact canopy and set2 for the open one) to manage the trial properly.
- Currently, both set1 and set2 were established and managed well.
- Improved coffee varieties coded as 74110 and 744 were used for compact and open canopy, respectively.

Future prospective

- All field management will be applied properly.

2.2.3. Evaluation of different shade tree species for coffee yield and quality at Bako, Western Oromia

- Year started: 2021
- Expected year of completion: 2027
- Code: BARC/CT/CMP (3)-2021

Brief status of the activity

- The experiment was established at Bako on station.
- Seedlings of 74110 and 744 varieties were transplanted handled under four treatments using RCBD with three replication.
- Six seedlings/plants per plot were used.
- The trail is performed well.

Future prospective

- Scientific efforts should be given for the success of trial

2.2.4. Determination of coffee (*Coffea arabica* L.) banana (*Musa sapientum*) intercropping at Western Oromia

- **Year started:** 2022
- **Expected year of completion:** 2030
- **Code:** BARC/CT/CI (1)-2022

Current status of the activity

- The trial was established at Bako on station.
- It was laid out using RCBD with 3 replication.
- Improved coffee variety coded as 74110 and improved banana variety Butuza was used.
- Treatment application was done.
- All field management for both main crop and sub crops should be applied.

2.2.5. Evaluation of coffee grain legume intercropping for early growth of coffee (*Coffea arabica* L.) at western Oromia

- Year started: 20221

- Expected year of completion: 2030
- Code: BARC/CT/CMP (2)-2022

Current status of the activity

- The trial was established at Bako on station and Ilala sub site.
- It was laid out using RCBD with 3 replication.
- Improved coffee variety coded as 74110 was used.
- Two improved grain legume were used, while one from soya bean and other is haricot bean
- Treatment application was done.
- All field management for both main crop and sub crops should be applied.

2.2.6. Evaluation of integrated weed management for coffee weed management in western Oromia

- Year started: 2021
- Expected year of completion: 2027

Code: BARC/CT/CMP (6)-2021

Brief status of the activity

- The experiment was established at Bako on station and field transplanting was accomplished.
- The trial was laid out using RCBD with three replication.
- Ten treatments including check were used
- One improve coffee variety (74110) was used.
- Six seedlings/plants per plot were used.
- Treatment application has been started.

Future prospective

- Usual efforts should be given for the success of trial.

2.3. Coffee and tea Management and Protection Extended Activities

2.3.1. Assessment of stumping consequences on production and productivity of coffee in coffee belts of Western Oromia

- Year started: 2021
- Expected year of completion: 2023
- Code: BARC/CT/CMP (4)-2021

Brief status of the activity

- Activity was conducted in 3 districts of Southwest Shawaa Zone namely Waliso, Goro and Wanchi districts.
- Assessment was done in 3 PA/district and 5 to 7 farms/PA
- Totally 50 farms were assessed for the current work
- Data analysis is under way.

Reason of extension

- Due to security problem activity was doesn't conducted for the last 2 years.
- In western Oromia due to security problem, activity was not conducted in proposed duration.
- So, the team decided to shift study area to coffee growing areas of Central Oromia including Southwest Shawaa Zone (Waliso, Goro and Wanchi districts) where no security problem and old Arabica coffee cultivars have been stumped.
- However, to realize the objective this work, the collected data is not enough.
- Therefore, additional duration is needed to accomplish the activity

Future prospective

- The trial will be done as planned in near future.

3.2.2. In-situ selection and collection of coffee berry disease resistant landraces from western coffee growing areas of Oromia

- Year started: 2021
- Expected year of completion: 2023
- Code: BARC/CT/CMP (5)-202

Brief status of the activity

- Activity was conducted in 2 districts (Guto Gidda & Gudeya Bila) of E/Wallaggaa
- Three PA per district were used.
- Inoculum suspension was prepared from CBD infected coffee berries and utilized.
- ABT was implemented via wounding berries
- Disease data (CBD severity) was taken in Guto Gidda district, while it didn't take from Gudeya Bila due to security problem.
- However, due to security problems, seed collection didn't conducted at both Guto Gidda & Gudeyya Bila districts of East Walaga.
- Among 75 coffee mother trees tested at Guto Gidda, beyond 50% of them showed better CBD reaction level (Table 3, red color marked).

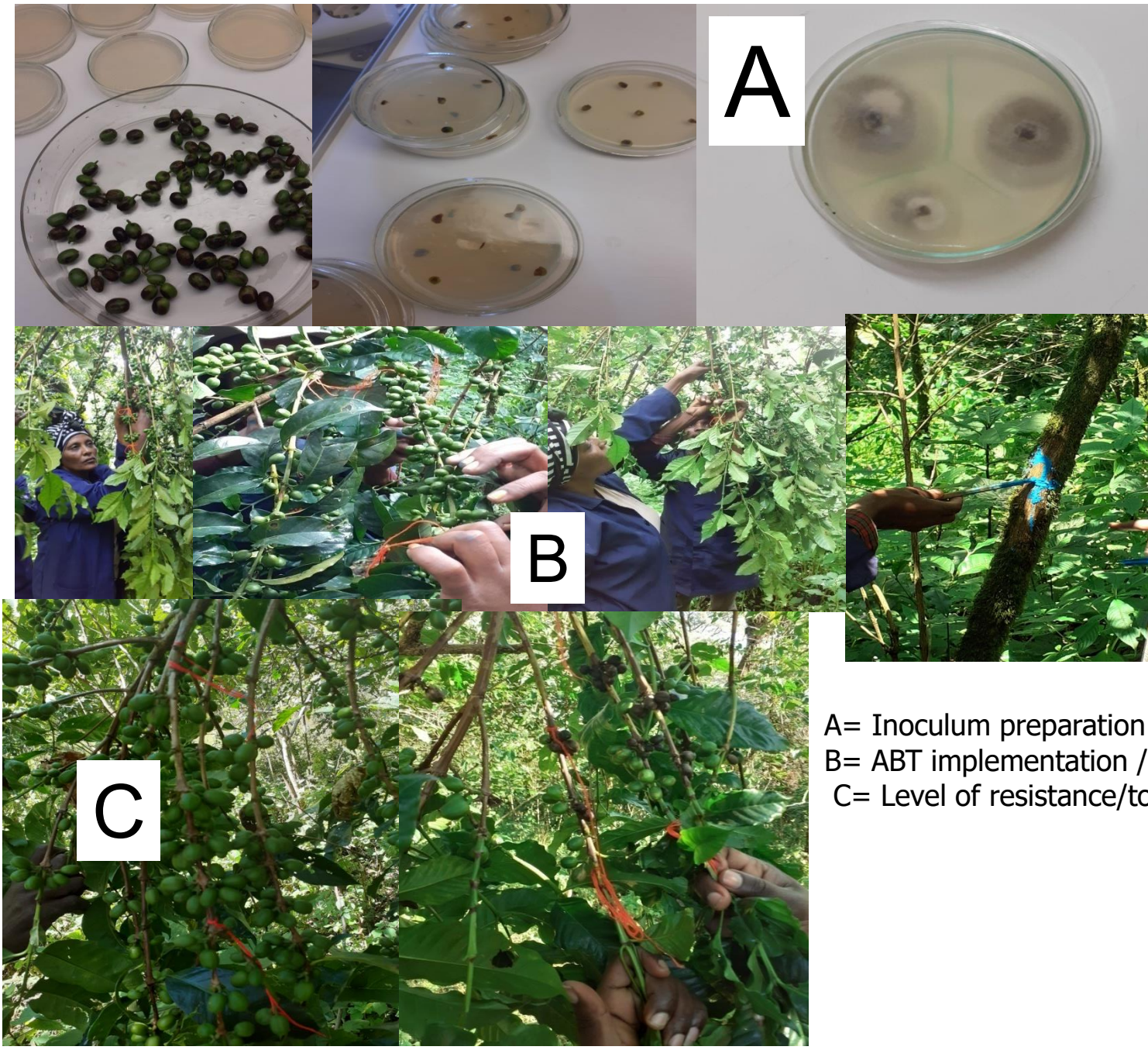
Table 12. Number of coffee mother trees used per PAs per districts of E/Wallaggaa during 2021

Districts	PAs	Numbers of coffee mother trees tested
Guto Gidda	Kitessa	11
	Fayyinerra	34
	Gaarii	30
Gudeyya Bila	Daarbas	4
	Haagaloo	22
	Haroo	34
Total		**135**

Table 13. CBD reaction level of Guto Gidda coffee landraces during 2021

Tree code	Severity %	Tree code	Severity %	Tree code	Severity %	Tree code	Severity %	Tree code	Severity %
T1	0.00	T34	0.00	T67	0.00	T44	5.13	T29	25.00
T2	0.00	T35	0.00	T68	0.00	T28	5.88	T53	38.46
T4	0.00	T40	0.00	T69	0.00	T18	6.90	T20	44.44
T6	0.00	T41	0.00	T70	0.00	T3	7.41	T32	57.14
T7	0.00	T42	0.00	T71	0.00	T54	7.41	T38	66.67
T8	0.00	T45	0.00	T57	1.69	T5	7.50	T43	68.00
T10	0.00	T46	0.00	T21	1.79	T62	7.69	T50	83.33
T12	0.00	T47	0.00	T27	2.17	T25	10.53	T29	25.00
T14	0.00	T48	0.00	T56	2.22	T37	10.87	T53	38.46
T16	0.00	T49	0.00	T33	2.78	T13	11.11	T20	44.44
T19	0.00	T51	0.00	T52	2.78	T11	11.90		
T22	0.00	T59	0.00	T9	3.85	T36	13.79		
T23	0.00	T60	0.00	T31	3.85	T55	15.38		
T24	0.00	T61	0.00	T58	4.55	T66	16.67		
T26	0.00	T63	0.00	T39	4.84	T17	17.19		
T30	0.00	T65	0.00	T15	5.00	T64	23.08		

Note: T stand for tree number, while T highlighted with red colour indicates a coffee mother tree which showed resistance/tolerance to coffee berry diseases.



A= Inoculum preparation
B= ABT implementation /
C= Level of resistance/to

Reason of extension

- In western Oromia due to security problem, activity was not accomplished as per proposed.
- Activity was conducted in G/Gida and Gudeya Bila districts of E/Wallaggaa Zone.
- But due to security problem seed collection wasn't carried out.

- Now, there is a new area with no security problem in Central Oromia where local Arabica coffee cultivars have being produced.
- For example in Southwest Shawaa Zone (Waliso, Amaya, Goro and Wanchi districts)
- The CBD tolerant genotypes will be collected and supplied for breeders and used in further breeding study
- These materials will be pay lion share in CBD resistant varietal development.
- Therefore, to realize the objective this work, activity will be conducted in above listed coffee growing areas for next consecutive 2 years.

Future prospective

- While security problem has solved, the trial will be done as planned in near future.

2.4. New projects of coffee and Tea Management and Protection

2.4.1. The effect of coffee seedling age on the survival of field transplanted coffee seedlings

- Year started: 2024
- Expected year of completion: 2028
- Code: BARC/CT/CMP (1)-2024

Future prospective

It is a new project, but seed sowing has started currently.

2.4.2. Molecular screening of coffee arabica accessions against coffee berry disease using SSR marker

- Year started: 2024
- Expected year of completion: 2027
- Code: BARC/CT/CMP (2)-2024

Future prospective

It is a new project, but it will be started in 2023/24FY

2.4.3. Identification of major inoculum sources of *Colletotrichum kahawae* causal agent of coffee berry disease in Western and central Oromia, Ethiopia

- Year started: 2024
- Expected year of completion: 2026
- Code: BARC/CT/CMP (3)-2024

Future prospective

- **It is a new project**, but it will be started in 2023/24FY

2.4.4. Assessment of major vectors of *Colletotrichum kahawae* causal agent of coffee berry disease at Western and central Oromia

- Year started: 2024
- Expected year of completion: 2026
- Code: BARC/CT/CMP (4)-2024

Future prospective

- **It is a new project**, but it will be started in 2023/24FY

2.4.5. Field screening of Arabica coffee accessions against coffee leaf rust

- Year started: 2024
- Expected year of completion: 2030
- Code: BARC/CT/CMP (5)-2024

Future prospective

- **It is a new project**, but it will be started in 2023/24FY

2.4.6. Field screening of Arabica coffee accessions against major coffee insect pests

- Year started: 2024
- Expected year of completion: 2030
- Code: BARC/CT/CMP (6)-2024

Future prospective

It is a new project, but it will be started in 2023/24FY

2.4.7. Evaluation of different cover crops for coffee weeds management at Western Oromia

- Year started: 2024
- Expected year of completion: 2028
- Code: BARC/CT/CMP (7)-2024

Future prospective

- **It is a new project**, but it will be started in 2023/24FY

Project 2: Development of tea technologies for western Oromia

Activity title. Tea clone adaptation trail

Component: Breeding

- Started year: 2022
- Expected year of completion: 2026
- Status: Ongoing
- Sites: Bako and Sibu Sire (Jaarsoo Waamaa) and Gute site
- Number of clones: 5
- Number of plants per each genotype: 6
- Spacing: 120*60m
- Design: RCBD with three replications

Major work done

- The collected tea materials were planted and under good management
- Gap filling of dead plants were done
- First round pruning and data collection was conducted
- We add one new site at Guutee this season as replication and more confirmation

Date: 12/07/2023, Bako on station

4 Natural Resource Research Process

Agroforestry Research Team Annual Report for 2023

Ongoing ()

1. Adaptation and Growth Performance of Different Timber Tree Species in Western Oromiya, Ethiopia

Summary of the intermediate results/outputs obtained

According to data collected from different timber the survival rate of tree species were ranged from 76% to 100% as shown in figure 1. Growth parameters of *Cedrela odorata*, *Cupressus torulosa*, *Terminalia ivorensis* and *Tectona grandis* were summarized (Table 1).

Table 1: Growth parameters of planted tree species

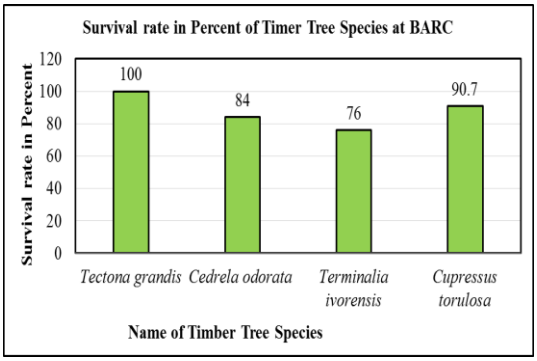


Figure 1: Status of planted tree species.

Name of species	Mean		
	RCD (cm)	DBH (cm)	Height (m)
Cedrela odorata	1.47	2.78	1.54
Cupressus torulosa	1.31	3.03	1.60
Terminalia ivorensis	1.37	2.89	1.59
Tectona grandis	0.78	-	0.30

Figure 2: Photos of planted tree species

2. Potential of Agroforestry and Related Technologies for Degraded Land Restoration and Rehabilitation: A Case Study of Diggaa District, East Wallaggaa Zone, Oromiya, Ethiopia

Summary of the intermediate results/outputs obtained

- About **15,000** seedlings of *Leucaena pallida*, *Calliandra calothyrsus* and *Grevillea robusta* planted yet.
- Seeds and seedlings of Tephrosia (*Tephrosia candida*) species also sowed densely so that it will facilitate fast vegetation recover.
- Chomo grass (*Brachiaria decumbens*) also sowed
- Survival rate is more than 95%.
- Soil data and species diversity data have been taken last year (2020)
- About 12 modern beehives were established
- Maintenance activities have been done accordingly, follow up activities and protecting the restoration site from external pressures (livestock, fire, human interference and etc.) are being done.
- Due to security problems of the area, survival count, soil data, biodiversity data and other follow up activities couldn't performed!
- All activities which couldn't performed will be done as soon as possible (if condition is improved)

Procedural changes

Initial status

- Runoff was high, and high soil loss
- No or very less vegetation cover
- No biodiversity of plants, birds and wildlife
- These all are needed to be restored and resolved



Figure 3: Some selected photos on the initial status of the activity.

Current status

- Vegetation cover increased
- Soil loss due to runoff decreased
- Biodiversity increased
- Honey production started

Figure 4: Current status of the selected rehabilitation site

3. Community Nursery Management and Restoration with Tree Planting at Guduru District, Horro Guduru Zone, Oromia, Ethiopia

Summary of the intermediate results/outputs obtained

- About 2500 tree seedlings were planted on 1 hectare of the demarcated area in 2020
- Survival rate shows more than 90% of 2020/21 planted seedlings were survived
- Assisted natural regeneration planned and done
- *Podocarpus falcatus*, and others regenerated naturally
- Security problems, and as a result lack of data collection and close follow up
- Currently, the protection of this area is underway

Figure 1: Photo taken from the study site (Goma Sijo site of Guduru district)

4. Long-term Evaluation of Agroforest Garden Potential for Sustainable Production and Ecological Management

Summary of the intermediate results/outputs obtained

- Study area identification and demarcation have been done
- Boundary planting on demarcated area were undertaken
- Necessary seedlings are now raised on nursery sites
- Partitioning, planting of main multipurpose tree/shrub species was performed
- Seeds and seedling collection done for horticultural crops and spices
- All implementation procedure and management aspects under way accordingly

Figure 1: Grafted and improved Avocado and Mango

Figure 2: Some selected photos during implementation of the activity

5. Demonstration and promotion of Integrated Termite Management practices using different technologies for rehabilitation of degraded lands in Diga district

Summary of the intermediate results/outputs obtained

- Utilization phase of the restoration has been started with different livelihood improving activities.
- Till now more than 100 kg pure honey produced.
- The farmers in the restoration activity were organized as a micro enterprise, and they have set rule and regulations according to micro enterprise bi-laws.
- One bank account created for the micro enterprise, and they have started saving of the income from the restoration.

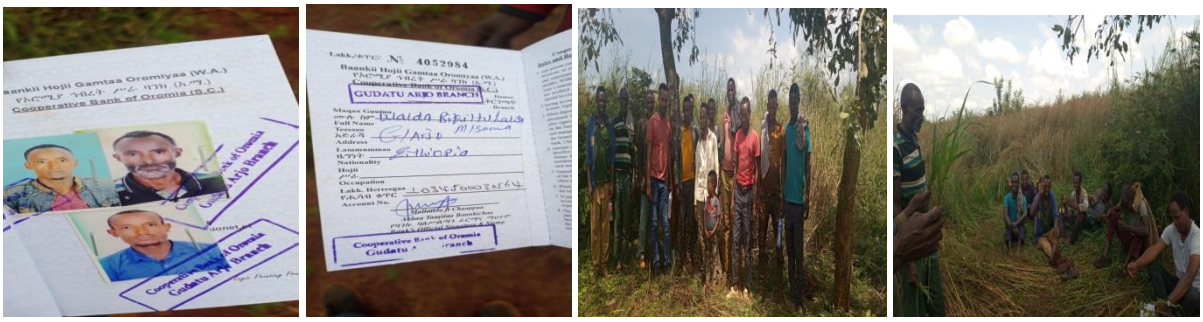


Figure 1: Some selected photos of activities performed

- Soil acidity is being declined.
- Before 2020 soil PH changes from 4.3 to 4.52 and vegetation coverage increased from 22.22% in 2016 to 93% at the end of 2021 (reported on AGP II Proceeding, 2020).
- Soil data, current biodiversity data and livelihood improving potential of the restored area couldn't be collected due to security problem
- Horticultural crop integration and fattening are proposed activities to be started soon (if possible!)

Figure 2: Some naturally restored tree/shrub species

Figure 3: Training for the FRG groups and different experts, honey production and modern beehives

6. Production and demonstration of different tree species' seeds for various forestry practices (Seed Orchard Management)

Started Year: 2013

Expected Year of Completion: 2023

Summary of the intermediate results/outputs obtained:

- Seed source for different exotic and indigenous tree/shrub species has been established
- Assisted natural regeneration system applied and naturally regenerating tree/shrub species are being documented
- Diversity of tree species in the system are assessed
- Demonstration and evaluation of tree seeds started
- Silvicultural operation has been undergone

Figure 1: Some selected photos from seed orchard management site.

7. Implementation of plantation forestry on the woodlot and grass lands of Bako Agricultural Research Center (Fire protection)

Started Year: 2013

Expected Year of Completion: 2023

Summary of the intermediate results/outputs obtained:

Figure 1: Top view of BARC Campus.

Fire break activity have been done on an area coverage of 25 ha (14 ha on plantation site, 6 ha on experimental site and 5 ha on other plantation site) (Figure 2).

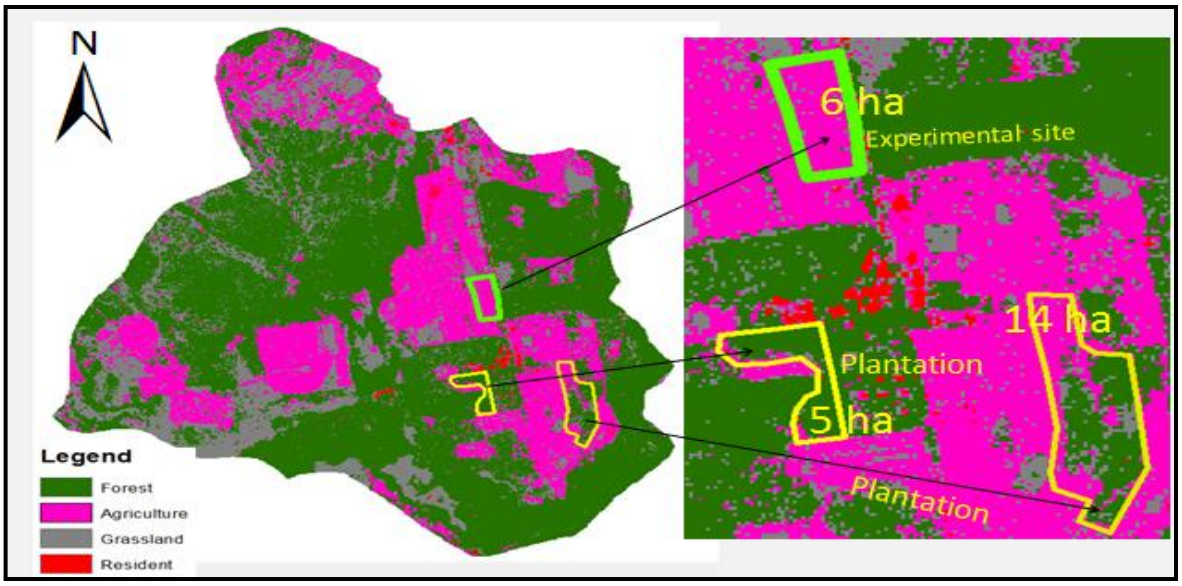


Figure 2:Classified LULC of BARC Campus.

- About 72,000 seedlings dominated by *Grevillea robusta* were planted from the beginning.
- As far as it was needed, grass cover is being superimposed and thereby fire spread up has been reduced especially around the BARC campus.
- The activity has been continued and different silvicultural operations have been made

Figure 3: Some selected photos during implementation of the activity.

8. Introducing of Mushroom Production for Sustainable Livelihood Development

- **Year started:** 2022/23
- **Expected year of completion**: 2024/25

Summary of the intermediate results/outputs obtained Seed collection started

- Awareness on how to implement taken
- Establishment to be started as soon as possible

Figure 1: Some selected photos during experience sharing on mushroom production.

9. Farmland Agroforestry Practices and Their Contribution for Climate Change and Soil Fertility Improvement in Western Oromia

- **Year started:** 2022/23
- **Expected year of completion:** 2023/24

Summary of the intermediate results/outputs obtained

- Questionnaire was prepared for the farmland agroforestry practices and their contribution for climate change and soil fertility improvement.
- Due to security problem the assessment hasn't started yet
- We plan to collect the assessment if the situation gets better

10. Assessment and Collection of Wild Edible Trees/Shrubs (Plants) Species in Low-, Mid- and Highland Areas of Western Oromia, Ethiopia.

- **Year Started:** 2020
- **Expected year of Completion: 2023/24**

Summary of the intermediate results/outputs obtained:

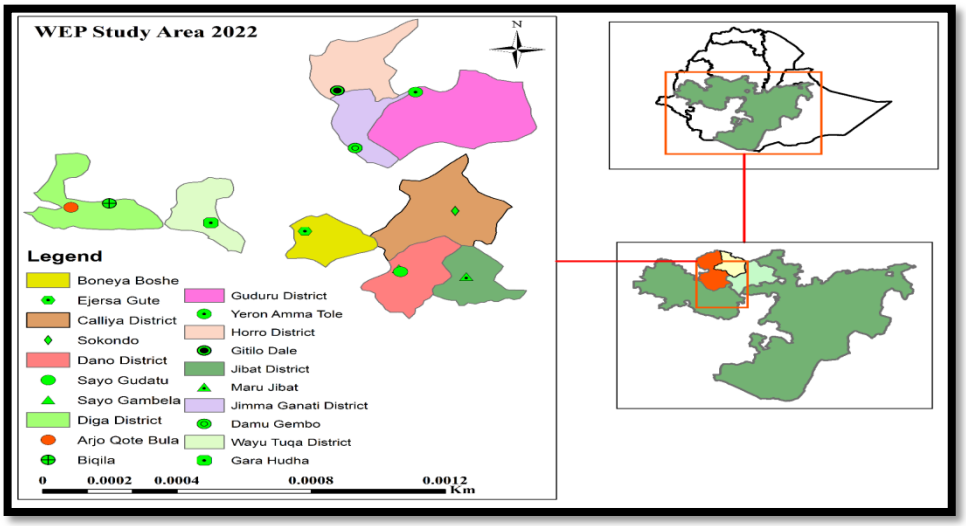


Figure 1: Description of the study area.

- Areas of data collection have been identified and mapped
- Field survey data on WEP have been undertaken
- Collected data was analyzed and summarized

Table 1: Selected Zones, Districts and Kebeles

Zones	District Names	Kebele Names	Number of sampled Households	Percent
East Wallagga	Boneya Boshe	Ejersa Gute	8	7.02
	Diga	Arjo Qote Bula, Biqila	27	23.68
	Wayu Tuqa	Gara Hudha	8	7.02
Horro Guduru Wallagga	Guduru	Yeron Amma Tole	9	7.89
	Jimma Gannati	Damu Gembo	17	14.91
	Horro	Gitilo Dale	11	9.65
West Shawa	Calliya	Sokondo	5	4.39
	Dano	S/Gambela, Sayo Gudatu	25	21.93
	Jibat	Maru Jibat	4	3.51
Total			**114**	**100.00**

- About 82 species by its local names identified, about 30 species identified by its scientific names (names belongs to 27 genera and 22 families).

Habitat/growth form

From the collected WEP, about 35% belongs to trees, 34.2% belongs to shrubs and 15.2 belongs to herb habitat/growth form (Table 2).

Table 2: Habitat/growth form of collected WEP

Habitat/growth form	Percent
Tree	35.0
Shrub	34.2

Liana/climbers	12.4
Herb	15.2
Shrub and Liana/climbers	1.6
Tree and shrub	1.0
Grass	0.7
Total	100.00

Agro ecology and Abundance

About 48.8% and 32.6 of collected WEP found in midland and highland, respectively. About 5.4% and 42.4% were common and rare in abundance form (Table 3).

Table 3: Agro ecology and Abundance of WEP

Agro-ecology	**Percent**
Highland	32.6
Midland	48.8
Lowland	9.4
Highland and midland	2.1
Midland and lowland	6.1
Highland, midland and lowland	1.0
Total	**100.0**
Abundance	
Common	57.4
Rare	42.4
Others (Disappeared)	0.2

Parts Used

Majority of WEP used were obtained from fruits (77.2%) followed by roots (8.1%) and seed (4.5%) (Table 4).

Table 4: Used parts of WEP

Parts used	Percent
Fruit	77.2
Roots	8.1
Seed	4.5
Stem	3.6
All parts	2.6
Nectar	1.8
Haphee, quncee	0.6
Leaves	0.6
Rhizomes	0.5
Stem and flower	0.3
Fruits and leaves	0.2
Total	**100.0**

Mode of Harvesting

Majority of WEP were collected from plucking from mother plant (a. fruits b. seeds c. leaves d. gum) (75.9%) followed by Plucking from mother plant (a. fruits b. seeds c. leaves d. gum) and collecting from the ground (13.9%) (Table 5).

Table 5: Mode of harvesting of WEP

Mode of harvesting	Percent
Plucking from mother plant (a. fruits b. seeds c. leaves d. gum)	75.9
Plucking from mother plant (a. fruits b. seeds c. leaves d. gum) and collecting from the ground	13.9
Digging (tubers and roots)	8.3
Collecting from the ground (ground collection of fallen seeds and fruits)	1.1

Plucking from mother plant (a. fruits b. seeds c. leaves d. gum) and digging	0.7
Total	**100.0**

Regeneration Status of WEPs

According to respondent's response, regeneration of WEP is very poor (27.2%) (Table 6).

Table 6: Regeneration Status of WEP

Regeneration of WEPs	**Percent**
Yes	27.2
No	72.8
Total	**100.0**

Figure 2: Sample photos of wild edible plants.

11. Assessment, Characterization and Mapping of Diga, Cato and Jibat Natural Forests in Horro Guduru Wallagga and West Shawa Zones, Western Oromiya, Ethiopia

Year started: 2020/2021

Expected year of completion: 2024/25

Summary of the intermediate results/outputs obtained:

- Since the project is planned across the IQQO agricultural research centers, training on how to achieve it was facilitated and given at head office
- The training was contained QGIS, Forest Monitoring Tools and Biodiversity Analyzing Tools/Manual
- Due to allocated budget shortage, and also security problems in most parts of the project area, Ground truth sample taking was difficult

- Shapefiles of the selected forest areas was collected
- Classification was under taken with the help of Google earth

Locations of the study forests

Cato forest is located in Horro Guduru Wallagga zone, Diga forest is located East Wallagga zone, while Jibat forest is located in West Shewa zone (Fig. 1).

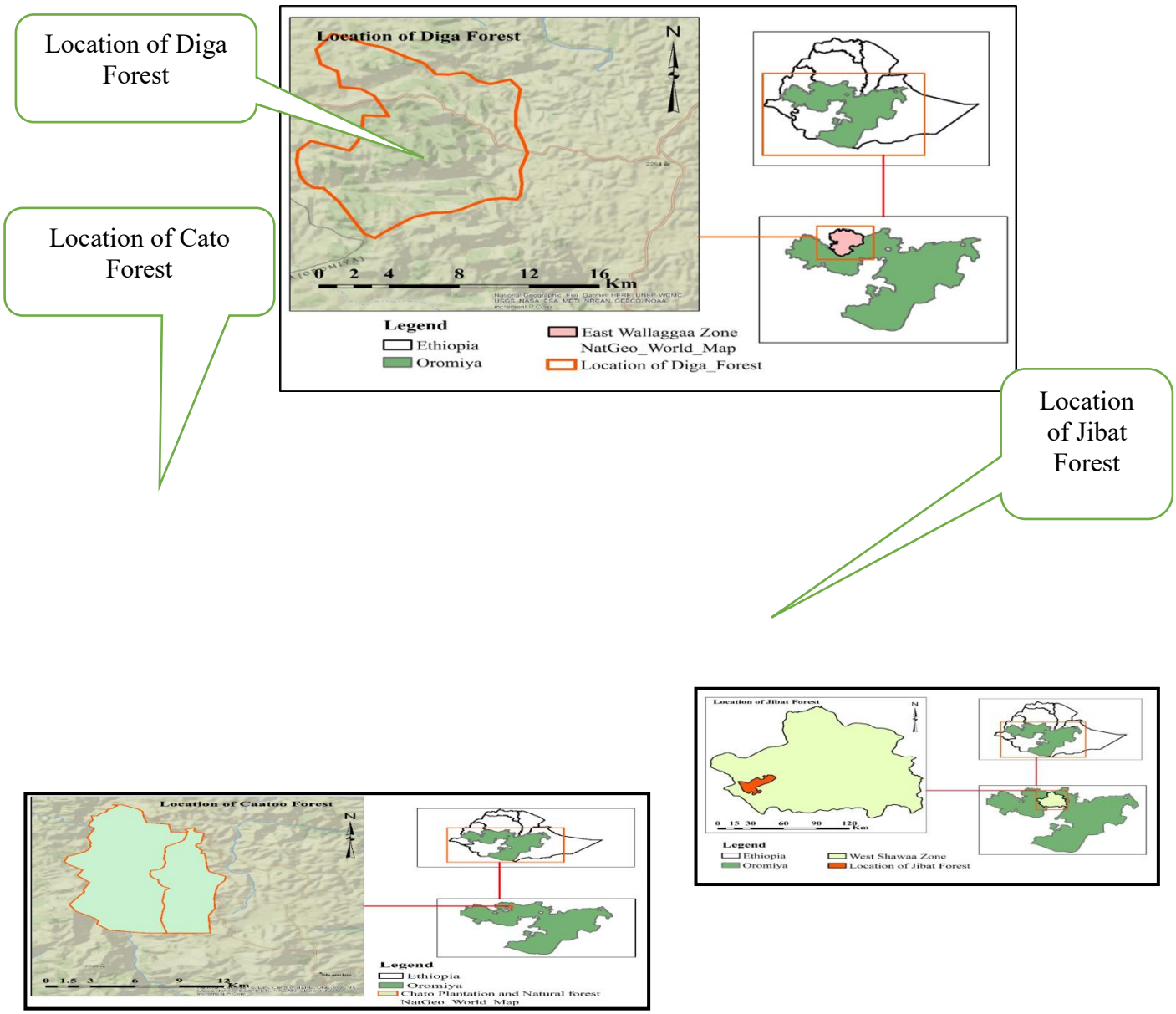


Figure 1: Location of Diga, Cato and Jibat natural forests.

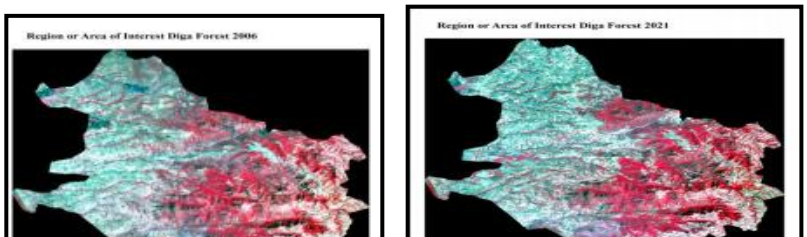
Table 1: Characteristics of Landsat images used in the study forests

Forest Name	No	Sensor type	Acquisition date	Source	Cloud cover	Spatial resolution	Path	Row
Diga Forest	1	Landsat TM	1991/02/18	USGS	0	30*30	170	054
	2	Landsat ETM^{+}	2006/01/18	USGS	0	30*30	170	054
	3	OLI/TIRS	2021/01/19	USGS	0	30*30	170	054
Jibat Forest	1	Landsat TM	1991/01/10	USGS	0	30*30	169	054
	2	Landsat ETM^{+}	2006/02/12	USGS	0	30*30	169	054
	3	OLI/TIRS	2021/01/28	USGS	0.06	30*30	169	054
Cato Forest	1	Landsat TM		USGS	0	30*30	170	053
	2	Landsat ETM^{+}		USGS	0	30*30	170	053
	3	OLI/TIRS		USGS	0	30*30	170	053

*Landsat TM, Landsat 7 ETM^{+} and OLI/TIRS are Thematic Mapper, Enhanced Thematic Mapper Plus and Operational Land Imager and Thermal Infrared Sensor, respectively.

Region of Interest for Diga Forest, Jibat Forest and Cato Forest

Region of Interest for Diga Forest, Jibat Forest and Cato Forest starting from 1991 to 2021 were identified (Figure 2, 3 and 4).



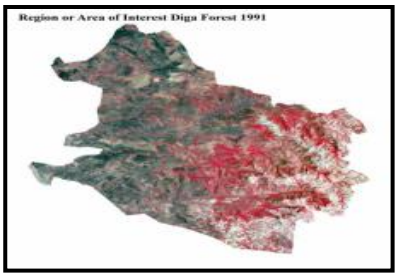


Figure 2: Area or Region of Interest Diga Forest 1991, 2006 and 2021 Satellite Imagery

Figure 3: Area or Region of Interest Jibat Forest 1991 and 2021 Satellite Imagery

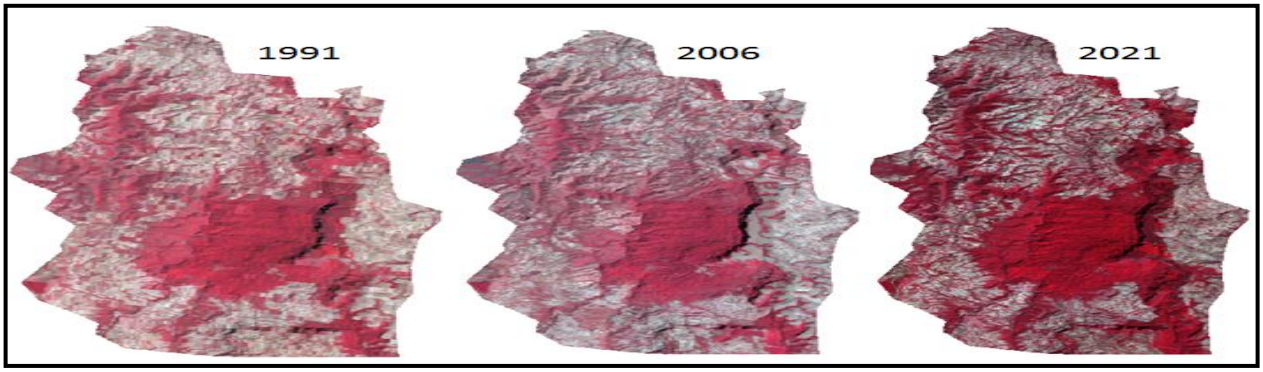


Figure 4: Area or Region of Interest Cato Forest 1991, 2006 and 2021 Satellite Imagery

Forest Cover Classification

The result of this study indicates that, the land cover class categories of 1991, 2006 and 2021 of Diga, Jibat and Cato forests were mentioned below ((Figure 4, 5 and 6; Table 3).

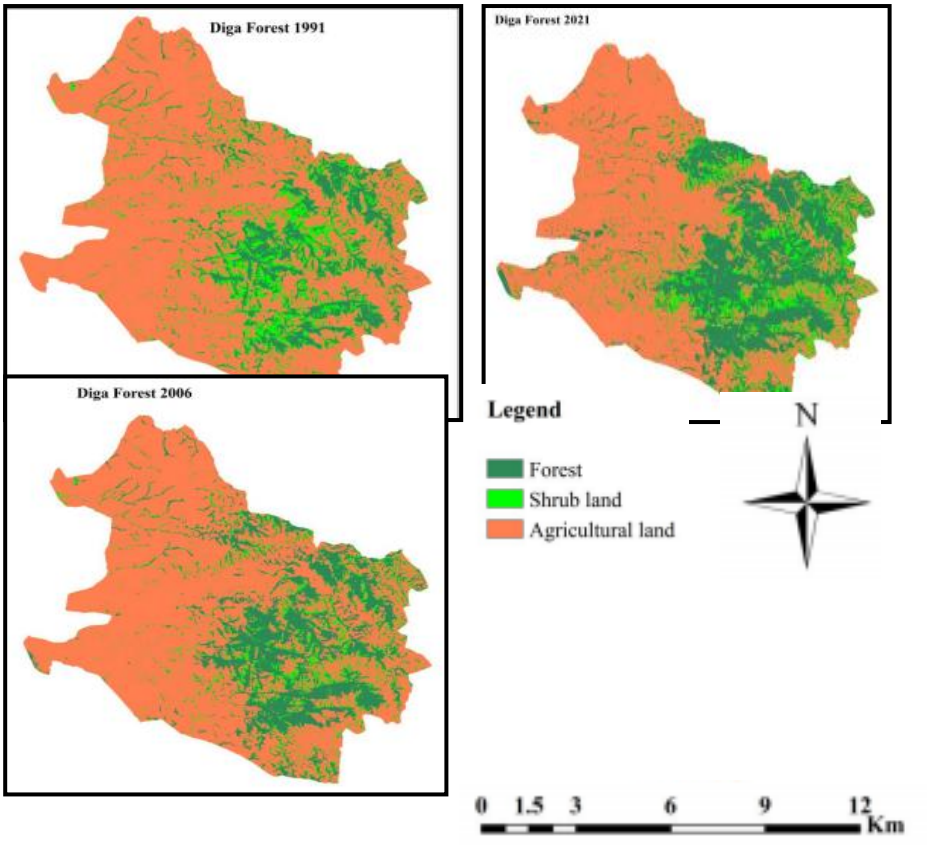
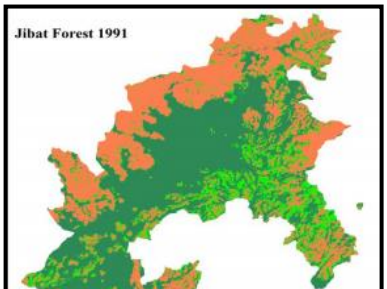


Figure 4: Classified Map of Diga Forest 1991, 2006 and 2021 Satellite Imagery



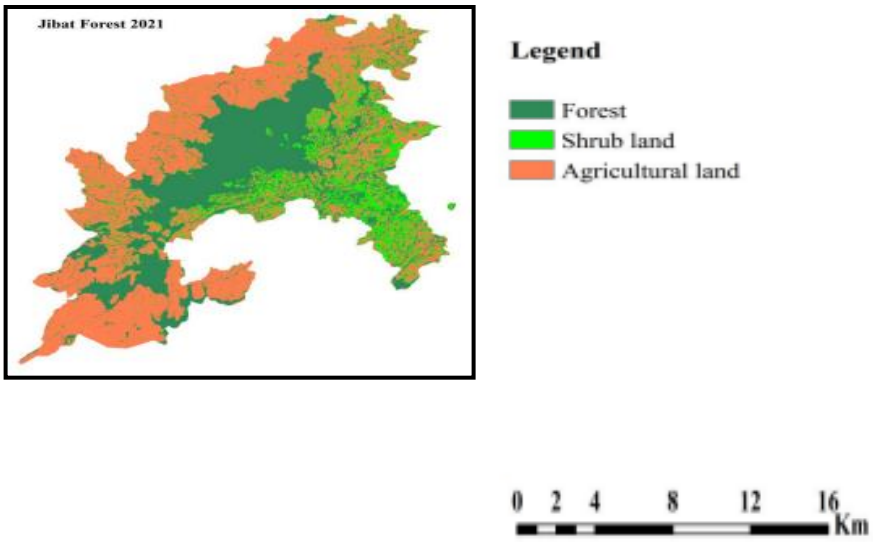


Figure 5: Classified Map of Jibat Forest 1991 and 2021 Satellite Imagery

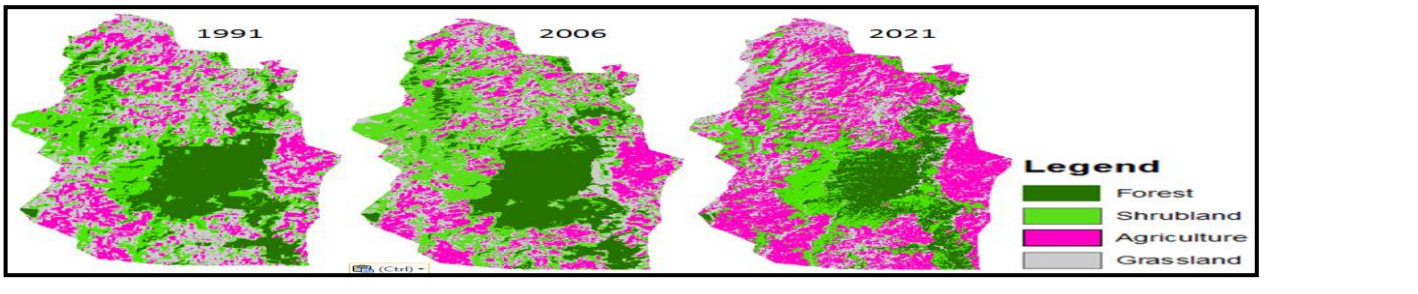


Figure 6: Classified Map of Cato Forest 1991, 2006 and 2021 Satellite Imagery

Accuracy Assessment

Produce's and user's accuracy for each land cover types category and each of the classified images were assessed (Figure 4, 5 and 6). Overall accuracy and kappa coefficient were also computed and summarized (Table 2).

Table 2: Producer's, User's accuracies, Overall accuracy and Kappa coefficient (%)

Forest Name	Land cover classes	1991		2006		2021	
		Prod.	User's	Prod.	User's	Prod.	User's
Diga Forest	Forest	98.85	97.57	98.75	99.04	99.34	98.88
	Shrub land	67.61	84.21	77.03	74.03	71.64	82.76
	Agricultural land	99.91	99.70	99.94	99.92	100.00	99.95
	Overall accuracy (%)		99.15		99.66		99.69
	Kappa coefficient (%)		98.00		99.44		99.50
Jibat Forest	Forest	99.96	99.93			100.00	99.99
	Shrub land	85.57	94.32			85.61	100.00
	Agricultural land	99.97	99.84			99.95	99.05
	Overall accuracy (%)	99.90				99.89	
	Kappa coefficient (%)	99.78				99.73	
Cato Forest	Forest	80.00	83.52	87.13	88.89	95.38	89.86
	Shrub land	86.11	79.49	85.39	85.39	92.47	90.53
	Agriculture	75.32	77.33	80.56	81.69	85.71	92.31
	Grassland	69.35	69.35	86.67	82.54	87.84	95.59
	Overall accuracy (%)	77.17		80.94		87.71	
	Kappa coefficient (%)	77.00		80.00		87.00	

*****Green shade color shows absence of non-corrected satellite images of 2006 for Jibat forest.

Area (ha) computed from the classified Landsat 1991, 2006 and 2021 images. Percentage of area coverage = (Area of the year/total area)*100 (Table 3).

Table 3: Area coverage and percentage statics of land cover class of 1991, 2006 and 2021

Forest Name	Land cover classes	1991		2006		2021	
		Area (ha)	%	Area (ha)	%	Area (ha)	%
Diga Forest	Forest	3699.34	12.775	5898.87	20.36	7866.45	27.15
	Shrub land	3481.05	12.021	2115.72	7.30	3479.31	12.01
	Agricultural land	21777.79	75.204	20955.87	72.34	17624.52	60.84
	Total	**28958.18**	**100.00**	**28970.46**	**100.00**	**28970.28**	**100.00**
Jibat Forest	Forest	24539.36	46.15			17752.14	33.39
	Shrub land	7322.41	13.8			7419.11	13.95
	Agricultural land	21306.31	40.07			27996.82	52.66
	Total	**53168.07**	**100.02**			**53168.07**	**100.00**
Cato Forest	Forest	3308.08	23.15	3150.04	22.05	2249.06	15.74
	Shrub land	3873.65	27.11	4727.34	33.08	3213.02	22.49
	Agriculture	2624.69	18.37	3030.26	21.21	5730.77	40.11
	Grassland	4481.16	31.36	3380.93	23.66	3095.29	21.66
	Total	**14287.58**	**99.99**	**14288.57**	**100.00**	**14288.14**	**100.00**

Forest cover change detection from 1991-2021

It is clear that some land cover classes changed into other classes as far as there is a cover change of an area. That means an area previously covered by a given land cover type may not be completely covered with the same land cover class after a gap of years. Hence, some portion of the area will be covered by other types of land cover types. Change = (Area of the final year- Area of initial year), Average rate of change = change/number of year interval.

Table 4: Extent of land cover classes change in 1991 and 2021 years image data

Forest Name	Land cover classes	2021		1991		Change (ha)	Average rate of change (ha)
		Area (ha)	%	Area (ha)	%		
Diga Forest	Forest	7866.45	27.15	3699.34	12.775	4167.11	138.9037
	Shrub land	3479.31	12.01	3481.05	12.021	-1.74	-0.058
	Agricultural land	17624.52	60.84	21777.79	75.204	-4153.27	-138.44
	Total	**28970.28**	**100.00**	**28958.18**	**100.00**		
Jibat Forest	Forest	17752.14	33.39	24539.36	46.15	-6787.22	-226.24
	Shrub land	7419.11	13.95	7322.41	13.8	96.7	3.22
	Agricultural land	27996.82	52.66	21306.31	40.07	6690.51	223.02
	Total	**53168.07**	**100.00**	**53168.07**	**100.02**		
Cato Forest	Forest	2249.06	15.74	3308.08	23.15	-1059.0	-35.30
	Shrub land	3213.02	22.49	3873.65	27.11	-660.62	-22.02
	Agriculture	5730.77	40.11	2624.69	18.37	3106.09	103.54

	Grassland	3095.29	21.66	4481.16	31.36	-1385.9	-46.20
	Total	**14288.14**	**100.00**	**14287.58**	**99.99**		

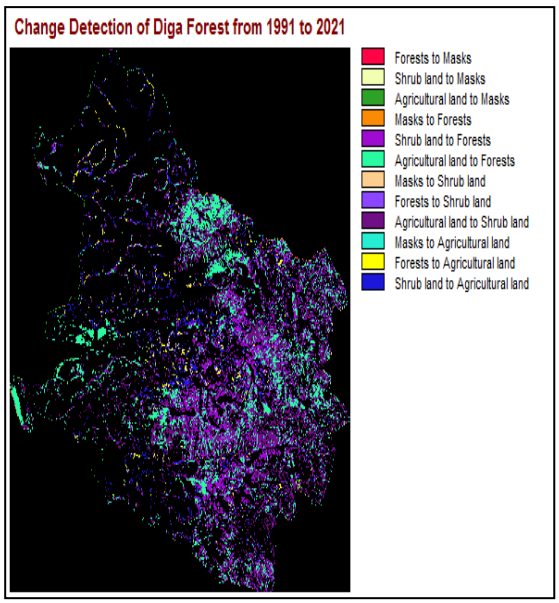
Forest cover change detection

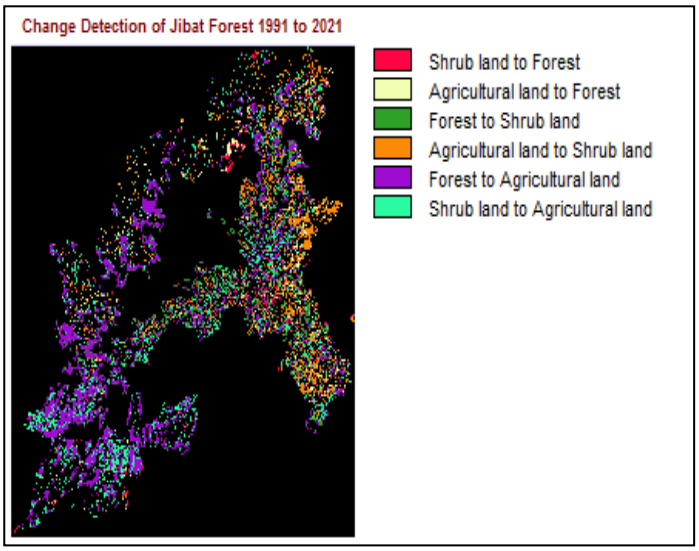
Forest cover change detection from 1991-2006 and 2006-2021 of Diga, Jibat and Cato forests were summarized (Figure 7; Table 5).

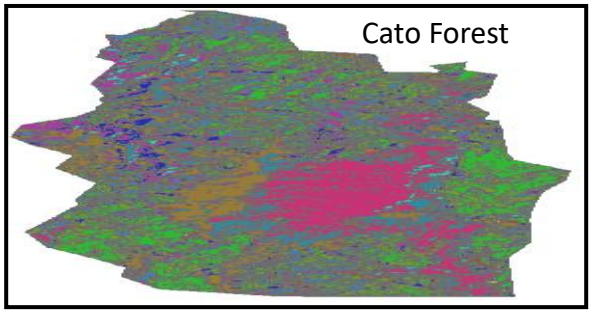
Table 5: Detection change of 1991 and 2021 images data

Forest name	Land cover classes	Converted to	Areas in (ha)	Areas in %
	Forest	Shrub land	230.88	2.75
		Agricultural land	233.93	2.79
Diga Forest	Shrub land	Forest	2260.42	26.92
		Agricultural land	642.48	7.65
	Agricultural land	Forest	2363.86	28.16
		Shrub land	2663.85	31.73
	Total		**8395.42**	**100.00**
	Forest	Shrub land	2080.00	11.87
		Agricultural land	6660.50	38.01
Jibat Forest	Shrub land	Forest	1037.30	5.92
		Agricultural land	3886.69	22.2
	Agricultural land	Forest	915.98	5.23

		Shrub land	2940.70	16.78
	Total		**17521.17**	**100.01**
	Forest	Agriculture	62.58	0.90
		Grassland	269.14	3.86
		Shrub land	1018.45	14.62
	Agriculture	Forest	21.86	0.31
		Grassland	386.40	5.55
		Shrub land	63.38	0.91
Cato Forest	Shrub land	Agriculture	941.98	13.53
		Forest	198.18	2.85
		Grassland	981.05	14.09
	Grassland	Forest	71.50	1.03
		Agriculture	2568.84	36.89
		Shrub land	380.76	5.47
	Total		**6964.12**	**100.00**


Change Detection of Diga Forest from 1991 to 2021
Forests to Masks
Shrub land to Masks
Agricultural land to Masks
Masks to Forests
Shrub land to Forests
Agricultural land to Forests
Masks to Shrub land
Forests to Shrub land
Agricultural land to Shrub land
Masks to Agricultural land
Forests to Agricultural land
Shrub land to Agricultural land


Change Detection of Jibat Forest 1991 to 2021
Shrub land to Forest
Agricultural land to Forest
Forest to Shrub land
Agricultural land to Shrub land
Forest to Agricultural land
Shrub land to Agricultural land


Cato Forest

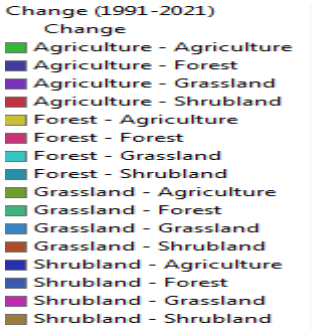

Change (1991-2021)
Change
Agriculture - Agriculture
Agriculture - Forest
Agriculture - Grassland
Agriculture - Shrubland
Forest - Agriculture
Forest - Forest
Forest - Grassland
Forest - Shrubland
Grassland - Agriculture
Grassland - Forest
Grassland - Grassland
Grassland - Shrubland
Shrubland - Agriculture
Shrubland - Forest
Shrubland - Grassland
Shrubland - Shrubland

Figure 7: Map showing land cover class change detection from 1991-2021.

Gains and losses by categories in hectares during 1991-2021

Land cover conversions from one land use system to others were recorded between the periods of 1991-20026 and 2006-2021 for Diga, Jibat and Cato forests (Figure 8; Figure 9 and Figure 10).

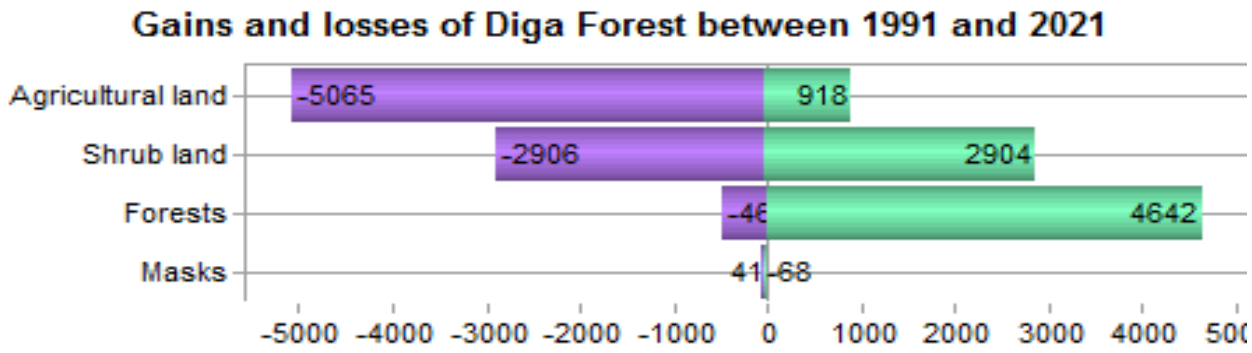


Figure 8: Gains and losses of Diga forest between 1991 and 2021.

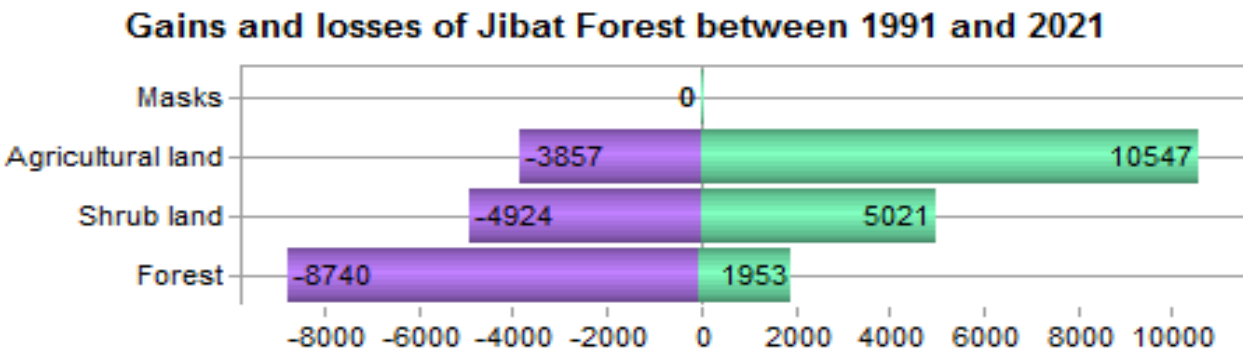


Figure 9: Gains and losses of Jibat forest between 1991 and 2021.

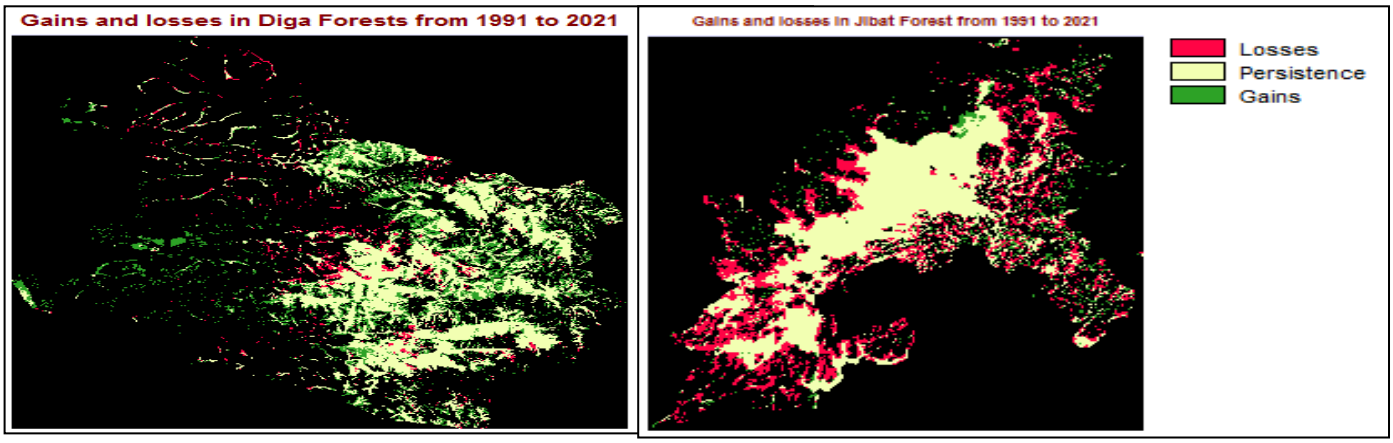


Figure 10: Map showing areas of gains (increase in size), losses (reduction in size) and persistence (area with no change in size) of Diga and Jibat Forest between 1991-2021.

12. Characterization of Trees and Shrubs Species Diversity of Diga, Cato and Jibat Natural Forests in East Wallagga, Horro Guduru Wallagga and West Shawa Zones, Western Oromiya, Ethiopia

Component:

Year Started: 2020/2021

Expected year of completion: 2024/25

Summary of the intermediate results/outputs obtained:

- Since the project is planned across the IQQO agricultural research centers, training on how to achieve it was facilitated and given at head office
- The training was contained QGIS, Forest Monitoring Tools and Biodiversity Analyzing Tools/Manual
- Checklist preparation and area of interest identification was done
- Due to security problem encountered around the study areas, assessment activity haven't done!
- However, we are planning to do some possible biodiversity assessment activities by remote sensing forest monitoring systems.

<u>New (2)</u>

1. GIS and RS-Based Investigating the Farm Landscape for Trees Potentiality in Bako and Cheliya Districts, Western Oromia

- Starting year: 2023
- Expected year of completion: 2025

2. Evaluating climate change Impacts on agro-climatic Suitability of Coffee (*Coffea arabica*) in Western Oromia, Ethiopia

- Starting year: 2023
- Expected year of completion: 2025

Part 2

Technology multiplication Activities

Brief Summary

Ongoing (5)

1. Multiplication and Restoration of Indigenous Tree Species in Western Oromiya

- **Starting Year**: 2021
- **Expected Year of Completion**: 2025

Current status: Can't be started:

- Due to budget allocation constraints, this activity did not started yet at Shambu subsite, Gedo, Diga and Wayu Tuqa.
- Absence of Natural Resource Technology Multiplication team
- However, we are collecting seeds of indigenous trees/shrubs species to start as soon as possible without allocated budget.

2. Tree Nursery Establishment and Management (routine activity)

Summary of the intermediate results/outputs obtained:

Seedlings of different multipurpose tree/shrub species were multiplied

- BARC Nursery has been supplying seedlings of different tree species for various experimentation and development activities both inside and outside the center.
- Produced and distributed approximately **24,863** different tree/shrub species this year

3. Multiplication, Biomass Production and Seed Maintenance of *Moringa Oleifera*

Starting Year: 2021

Expected Year of Completion: 2025

Current status:

- All planted seedlings were properly planted and managed accordingly

Figure 1: Photo taken during the implementation of an activity.

4. Production and Multiplication of Multipurpose Agroforestry Trees and Shrubs Species in Wayu Tuqa Technology Village

Starting Year: 2021

Expected Year of Completion: 2025

Current status:

- *Grevillea robusta*, *Calliandra calothyrsus* and *Leucaena pallida* seedlings were planted in alley cropping system.
- However, due to the security problems occurred, especially follow up didn't successfully done for 1 and half years.

5. *Calliandra calothyrsus* Conservation and Seed Maintenance

Starting Year: 2021

Expected Year of Completion: 2025

- **Current status**: The *Calliandra calothyrsus* seed source which was already established and not producing seeds due to wild fire problem have been conserved and maintained


Challenges/problems encountered and measures taken

No	Problems encountered	Measures taken	Possible solutions suggested
1	Security problem	Using public transportation, and also working closely with local experts, DAs and contract workers by phone	----
2	Budget shortage	Using permanent workers for different activities should be done by daily workers	Allocation of enough budget

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Completed Activities (2)

1. Pre-extension Demonstration of Determined NPS Rate Based on soil test crop Response based phosphorus Fertilizer recommendation on Maize at Bako Tibe and Gobu Sayo District, Western Oromia, Ethiopia

Year of initiation: 2022

Expected year of completion: 2022

Summary of the intermediate results/outputs obtained:

Pre-extension demonstration of soil test crop response based phosphorus fertilizer recommendation for maize was conducted in Bako Tibe and Gobu Sayo districts with the objective of participatory evaluation and demonstration of this technology under farmers' condition in 2022 cropping season. Two treatments were (T_1)

blanket recommendation and (T_2) soil test crop response based recommended phosphorus fertilizer by using improved maize (BH-661) variety. The trial was conducted on eleven farmers' fields which were used as replications. Plot size for each treatment was 10m x 20m with the spacing of 30cm and 75cm between seeds and rows respectively with seed rate of 25 kgha^{-1} and with recommended optimum N-fertilizer rate of 110 kgha^{-1}.The initial phosphorus was from soil test and the others from PC and Pf. In each PAs, two FREG unit comprising of 20 farmers were established. The soil samples were collected from surface soil of the experimental plots 20cm depth before planting and after harvest for laboratory analysis of selected physico-chemical properties of soils. The laboratory result will be incorporated on final complete research forum. Stakeholders were take part on field visit for evaluation during physiological maturity of maize. The average total biomass with soil test crop response based Recommended phosphorus fertilizer was 32,385 kg/ha while blanket recommendation was 27,730kg/ha. Again the average grain yield for STCRBFR was 7,205kg ha^{-1} while blanket recommendation was 4,641kg ha^{-1} in the study area. All soil data and agronomic data of the activity will be presented on completed research forum and during full write up of the paper. Therefore, depend on the above yield data and other parameters soil test crop response based recommended phosphorus fertilizer recommendation should further scale up/out /to reach more maize producer farmers in area.

2.Evaluation of Integrated Nutrient Managements on Rice Yield, Soil Fertility Improvement and Acidity Managements Under Limed Condition at Bako and Chewaka Districts, Western Oromia, Ethiopia.

Year started: 2021

Expected Year of completion: 2023

Summary of the intermediate results/outputs obtained:

A field experiment was conducted for two consecutive main cropping seasons (2021-2022) at Bako Agricultural Research Center on station and at Chewaka sub-site as well as on farm for rice, Western Oromia. The objective is to evaluate and determine the effects of integrated nutrient management of vermin-compost, NPS under lime application on yield, soil fertility improvements and acidity management in the study areas. Besides, to determine the best interaction effects of vermin-compost, NPS rates on yield, soil fertility improvement and acidity managements. Treatments (NPS, Vermin-compost, and the control) were integrated to evaluate their performance on crop yield and soil fertility dynamics. The treatments were combined in different levels designed in RCBD in factorial arrangement replicated three times on plot area of 5m x1.4m for each. Field layout and fine seed bed was prepared according to its design. Eventually, significant differences were observed between treatments on soil physico-chemical properties, yield and yield components of rice over locations. Accordingly, the collected and analyzed post-harvest soil parameters revealed that there is a progressive change on soil physico-chemical properties in all experimental sites for the two consecutive years as compared to composite soil samples collected before sowing while the experiment was launched (2021).The final post-harvest soil data, Partial budget analysis and full write up of the paper will be presented on completed forum to have conclusive recommendations.

Ongoing Activities (5)

1. Evaluation of Strains for their Nodulation, in Improving Soil Fertility and on Yield of Soy beans at BARC and Gobu Sayo Districts, Western Oromia.

Year started: 2021

Expected Year of completion: 2023

Summary of the intermediate results/outputs obtained:

The activity was conducted both on farm and on station by collecting six different strains from HARC, Menagesha and Nekemte soil Lab. Research Center. Two soybean varieties (Diddessa and Jalalle) combined with strains and assigned in factorial arrangements. Data was collected from both locations and promising strains were observed from intermediate results. Significant differences were observed on number of nodules per plant, effective nodules, above ground biomass and on grain yield. Besides, soil physico-chemical properties showed that progressive changes were observed while pre-sowing composite soil samples were compared with post-harvest soil results. Finally, the experiment was conducted as it was planned and smoothly ongoing.

2.Verification of soil test crop response based phosphorous recommendation for bread wheat (*Triticum species*) under limed conditions in Jimma Geneti District, Western Oromia

Starting year: 2023

Expected year of completion: 2023

Summary of the intermediate results/outputs obtained:

The study was carried in Jimma Geneti District of Western Oromia. It was conducted at purposefully selected district since P-critical and Pf was completed last year consequently it should be verified on 10 farmers' sites. Composite soil samples was collected from each plot before planting and analyzed for initial available phosphorus, pH levels. Improved bread wheat variety (Dandea) for the area was used as test material. The activity was conducted on plot size of 10 m x 10 m =100 m^2 used for each treatment over 10 farmers/sites/ in the district. Improved Bread wheat variety (Dandea) was used as test material to conduct the experiment. The activity was started by using three treatments (Trt1.Blancket recommendation, Trt2. STCRBFR and Trt3. Control). The activity was going as it was planned and smoothly ongoing.

3.Verification of soil test crop response based phosphorous recommendation for bread wheat (*Triticum species*) under limed conditions in Jimma Rare District, Western Oromia

Starting year: 2023

Expected year of completion: 2023

Summary of the intermediate results/outputs obtained:

- ✓ The activity was not started due to existence of security problem in the area.

4. Soil test based crop response to phosphorous calibration study under limed conditions on grain yield of Rice at Chewaka District of Western Oromia

Starting year: 2023

Expected year of completion: 2025

Summary of the intermediate results/outputs obtained:

The study was started to be conducted at purposefully selected district (Chewaka) depending on their potential for rice production. Composite soil samples was collected from the selected sites to characterize the level of soil phosphorus (low, medium and high). In this year the study was conducted on six farmers' fields depending on their interest. To determine the optimum level of nitrogen in the district, five levels of N (0,46, 69, 92 and 138 kg ha^{1-} from urea) and six level of P (0, 10, 20, 30, 40, and 50 kg ha^{-1} from DAP/TSP fertilizer source) was combined in factorial arrangement and replicated three times. The activity was conducted as it was planned and smoothly ongoing.

5. Soil Test-based Crop Response Study for Phosphorus on Tef [*Eragrostis tef* (Zucc.) Trotter] in Ilu Galan District of West Shewa Zone, Western Oromia, Ethiopia

Starting year: 2023

Expected year of completion: 2025

Summary of the intermediate results/outputs obtained:

On farm site selection, composite soil sample was collection was under taken on six sites at Illu Galan District. Treatments five levels of nitrogen (0, 46, 69, 92, 138 kg/ha) and six levels of phosphorus (0, 10, 20, 30, 40, and

50kg/ha) were arranged in factorial with RCBD and replicated three times. After pre-sowing soil samples analyzed lime was applied for soil acidity reclamation before sowing. Sowing will be started in this weekend. Generally the activity is going as scheduled and smoothly ongoing.

Maintenance and Developmental Activities (3)

1. Multiplication and maintenance of vermi-compost worms for enhancing crop productivity and improving soil fertility at Bako on station

Summary of the intermediate results/outputs obtained:

The worms' station is well managed and it's protected from the entrance of flying predators as well as to prevent the composting worms from the attacks of ants and other crawling enemies of the worms. Worms are fed soybean residues and cattle manure properly. They are multiplied and distributed for agricultural development in addition to this the vermin compost is provided to researchers and students for experimental purposes and for development agents for demonstration as well as for promotion activities. And it is going as the scheduled.

2 Meteorological data management and maintenance of meteorological station at Bako Agricultural Research Center

Summary of the intermediate results/outputs obtained:

The station was protected from different evaporation effect by weeding and clearing the surrounding in appropriate way. Daily data of minimum and maximum temperature, rain fall, and wind speed and soil temperature with different depth are collecting and summarizing as usual and data summary and entry are undertaken.

3. Maintenance and management of natural resource technology demonstration site at Bako Agricultural Research Center, Western Oromia

Status (New)

Not yet started at this moment due to overlapping of the activities.

5 Socio economics and Agricultural Extension research Process

1. INTRODUCTION

Socio-economics and Agricultural Research Process objectives are to improve internal and external efficiency of agricultural research technologies and to demonstrate and popularized new technologies of the center. To achieve those objectives, research process is focused on: characterization of agricultural production systems, adoption and impact study, agricultural marketing analysis for both internal & external efficiency, technology dissemination and popularize with local innovation. This annual report contains completed and ongoing activities of socioeconomics and agricultural extension research process that have been undertaken during July 2022- June 2023 by IQQO and Non-IQQO funds.

2. NUMBER OF RESEARCH ACTIVITIES PLANNED AND EXECUTED IN THE YEAR

Table 14. Number of research activities executed by government (IQQO) budget

No	Research team	Number research activities planned to be executed in the year	Number research activities completed in the year (July 2022-June 2023)	Number research activities discontinued/ Suspended in the year*	Number research activities passed to next year	New proposals approved for (2023/43)	Total number of activities for (2023/24)
1	Socio-economics	7	1*	0	6	0	**6**
2	Agricultural Extension	14	7 +1*=8	1	4+1**=5	9	14
Total		**21**	**9**	**1**	**10**	**9**	**20**

*No activity's discontinued/Suspended in the 2022/23 and ** is student PhD dissertation.

Table 15. Number of research activities executed by Non-government (Non-IQQO) budget

No	Research team	Number research activities planned to be executed in the year	Number research activities completed in the year (July 2022-June 2023)	Number research activities discontinued/ Suspended in the year*	Number research activities passed to next year	New proposal approved for next year (2023/24)	Total number of activities for next year (2023/24)
1	Socio-economics	1	1	0	0	1	1
2	Agricultural Extension	0	0	0	0	1	1
Total		**1**	**1**	**0**	**0**	**2**	**2**

*No discontinued/suspended activities in 2014 E.C.

3. MAJOR FINDINGS FROM COMPLETED RESEARCH ACTIVITIES IN THE YEAR

3.1 Pre-extension demonstration of improved soybean (medium & late maturity) technology in selected districts of East Wollega and Bunno Bedelle Zones of Western Oromia

Status: write up is not completed.

Major findings: The activity was conducted at Diga and Chewaqa districts. The medium new variety Billo with cheri standard check with 24.13 Qts yield and 15.47 Qts per hectare respectively. The yield of new variety over standard check was statistically significant at 1% and it is more profitable than check. The farmers preferences ranked as first. Thus, the variety should be wider scale up for the same agro-ecology. The late maturing new variety Gute with katta standard check with 25.35 Qts yield and 19.15 Qts per hectare respectively. The yield of new variety over standard check was statistically significant at 1% and it is more profitable than check. The farmers preferences ranked as first. Thus, the variety should be wider scale up for the same agro-ecology.

3.2 Pre-extension demonstration of improved sorghum technology in selected district of Bunno Bedelle Zone of Western Oromia

Status: Write up is not completed.

Major finding: The activity was conducted at Chewaqa district. New variety Merera with Gemedi standard check with 40.33 Qts yield and 33.67 Qts per hectare respectively. The yield of new variety over standard check was statistically significant at 1% and it is more profitable than check. The farmers preferences ranked as first. Thus, the variety should be wider scale up for the same agro-ecology.

3.3 Pre-extension demonstration of improved finger millet (Black seeded) technology in selected districts of East Wollega Zone of Western Oromia

Status: Write up is not completed.

Major finding: The activity was conducted at Wayu Tuka & Chewaqa districts. New varieties Diga_1 & Diga_2 with commercial check. The yield obtained from Diga_ and Diga_2 was 12.95 Qts and 15.84 Qts per hectare respectively against 10.23 Qts per hectare commercial check. But the demand of the crop is less than other improved finger millet varieties due to low yield and black color. The varieties are not preferred by the farmers due to the above reasons. Therefore, the varieties should be not wider scale up.

3.4 Pre-extension Demonstration of improved bread wheat technology in selected districts of West Shewa and East Wollega Zone of Western Oromia

Status: Write up is not completed.

Major finding: The activity was conducted at Chaliya district. New variety Lakkuu with Liban standard check with 41.43 Qts yield and 32.25 Qts per hectare respectively. The yield of new varieties over commercial check was statistically significant at 1% and it is more profitable than check. The farmers preferences ranked as first. Thus, the variety should be wider scale up for the same agro-ecology.

3.5 Pre-extension demonstration of improved triticale technology in selected districts of East Wollega Zone of Western Oromia

Status: Write up is not completed.

Major finding: The activity was conducted at Diga district. New variety Kombolcha with Abdisa standard check with 22.84 Qts yield and 16.36 Qts per hectare respectively. The yield of new varieties over commercial check was statistically significant at 1% and it is more profitable than check. The farmers preferences ranked as first. Thus, the variety should be wider scale up for the same agro-ecology.

3.6 Cluster based Pre-scaling up of Improved Teff Technology in Selected Districts of Highlands of West Shewa, Horro Guduru and East Wollega Zones

Status: Write up is not completed.

Major finding: The activity was conducted at Chaliya & Jimma Arjo districts for three years. using new variety Dursi. About 85 farmers on 44 hectares were participated for three last years (2012/13-2014/15). The average yield of the variety over the three years was 20.10 Qts per hectare. It is more profitable than other varieties. Therefore, the variety should be wider scale up by extension for the same agro-ecology.

3.7 Pre-scaling up of improved finger millet (Bako-09) technologies in potential districts of East Wollega zone

Status: Write up is not completed.

Major finding: The activity was conducted at Wayu Tuka, Diga, Boneya Boshe districts for three years using new variety Bako-09. About 173 farmers on 52.5 hectares were participated for three last years (2012/13-2014/15). The average yield of the variety over the three years was 21 Qts per hectare. It is more profitable than other varieties. Therefore, the variety should be wider scale up by extension for the same agro-ecology.

3.8 Cluster Based Pre-scaling up of Improved Bread Wheat at Cheliya District of West Shewa zone (AGP-2)

Status: Write up is not completed.

Figure 5. Wheat farmers field performance at Guduru and Jimma Rare districts

Major finding: The activity was conducted during 2012/13 cropping season on 50 hectares of farmers' field. Dende'a wheat variety was used for this activity on 43 farmers. From this activity 34 farmers were directly benefited (hosted farmers) and 46 farmers were indirect benefited (field visit and field day). Theoretical & practical trainings were given for 50 participants (34 farmers, 5 DAs and 11 SMS) for the district. Field days also organized and about 150 participants (80 farmers, 60 experts and 10 researchers) were participated on the field day. The average yield obtained from the cluster was 52 quintals per hectare. This yield is higher last year cluster average yield which was 43.50 quintals per hectare. Therefore, it needs to be further popularized in the areas.

Performance of Dende'a variety during field day organized

4. STATUS OF ONGOING CTIVITIES

4.1 Socio-economics Research Team Activities

4.1.1 Assessment of Forage Production in Western Oromia

The activity was conducted in three zones (East Wollega, Horro Guduru Wollega, and parts of West Shewa) with objectives of: 1) to assess the production status of improved forage crops; 2) to assess major constraints and opportunities of improved forage production; 3) to assess farmers' perception on improved forage production; and 4) to identify factors affecting production of improved forage in western Oromia. For this study questionnaire and checklist were developed and entered to CSPro software for data collection. From three zones 8 (3 from East Wollega, 3 from H/G/Wollega & 2 from parts of West Shewa) districts and 16 kebeles (6 from East Wollega, 6 from H/G/Wollega, & 4 from parts of West Shewa) were selected. Farmers selection and primary data collection will be conducted in July 2023- June 2024 year.

4.1.2 Smallholders Farmers Coping Mechanisms with Wheat Rust Disease: The case of western Oromia

The activity was conducted in three zones (East Wollega, Horro Guduru Wollega, and parts of West Shewa) with objectives of: 1) to assess the existing smallholder farmers' practice in coping mechanisms of wheat rust disease; 2) to assess smallholder farmers' perception on controlling wheat rust disease; 3) to examine smallholder farmers coping mechanisms of wheat rust disease;

and 4) to identify factors affecting coping mechanism of wheat rust in the study areas. For this study questionnaire and checklist were developed and entered to CSPro software for data collection. From three zones 6 (3 from Horro Guduru Wollega, 2 from East Wollega and 1 from parts of West Shewa) districts and 12 kebeles (6 Horro Guduru Wollega, 4 from East Wollega and 2 from parts of West Shewa) kebeles were selected. The remaining activities such as farmers' selection and primary data collection will be conducted in the next years.

4.1.3 Faba Bean and Field Pea Production and Competitive Advantage over Wheat and Tef in Selected Zones of Oromia

The activity was conducted in three zones (East Wollega, Horro Guduru Wollega, and parts of West Shewa) with objectives of: 1) to assess the production status and systems of faba bean, field pea, tef, and wheat in the targeted districts; 2) to identify factors affecting faba bean and field pea productivity & production in the targeted districts; 3) to estimate the competitive advantage of faba bean and field pea over teff and wheat in the targeted districts; and 4) to assess major constraints and opportunities of major pulse and cereal crops in the targeted districts. For this study questionnaire and checklist were developed and entered to CSPro software for data collection. From three zones 6 districts (3 from H/G/wollega, 2 from east wollega and 1 from parts of west Shewa) and 12 (6 from H/G/wollega, 4 from East Wollega and 2 from parts of West Shewa) kebeles were selected. Farmers selection and primary data collection will be conducted in the next years.

4.1.4 Potato Value Chain Analysis and Gender role in Selected Districts of Western Oromia

The activity was conducted in two zones (Horro Guduru Wollega and parts of West Shewa) with objectives of: 1) to identify the major potato value chain actors; 2) to identify marketing channels choice in the chain; 3) to assess the determinants of market supply of potato; and 4) to identify factors affecting women's participation in the potato value chains in the study areas. From two zones 3 districts (2 from H/G/Wollega & 1 from parts of West Shewa) and 6 kebeles (4 from H/G/Wollega & 2 from parts of West Shewa) were selected. Farmers selection and primary data collection will be conducted in July 2023- June 2024 year.

4.1.5 Adoption of Improved Sesame Varieties in selected Districts of Western Oromia

The activity was conducted in Chewaqa district with objectives of: 1) to identify factors affecting adoption of improved sesame varieties; 2) to identify factors affecting intensity of adoption of improved sesame varieties; and to identify the major constraints of sesame production in the area. For this study questionnaire and checklist were developed and entered to CSPro software for data collection. Chewaqa district was selected purposively based on sesame production potential and 3 kebeles were selected randomly. Farmers selection and primary data collection will be conducted in July 2023- June 2024 year.

4.1.6 Impact Evaluation of Adopted Improved Rice Variety in Chewaqa District

The activity was conducted in Chewaqa district with aimed of assesses the impact of improved rice varieties on farmers' income in the study area. For this study questionnaire and checklist were developed and entered to CSPro software for data collection. Secondary data was collected from Chewaqa district. five (2 from adopted and 3 from non-adopted) kebeles were selected randomly. Other activities like farmers' selection and primary data collection will be conducted in July 2023- June 2024 year.

4.2 Agricultural Extension Research Team Activities

4.2.1 Pre-scaling up of Improved Finger Millet (Kumsa) Technologies in Potential Districts of East Wollega and Bunno Bedelle Zones

This activity was conducted in Wayu Tuka, Digga Boneya Boshe and Chewaqa districts of East Wollega and Bunno Bedelle zones, respectively. For this study Kumsa variety was used during 2021/22 cropping season. The activity was conducted on 62 farmers on 21.5 hectares during 2021/22 cropping season. This activity will be continued for the next two years.

4.2.2 Pre-scaling up of Improved Teff Technology (Jitu) in Selected Districts of West Shewa and East Wollega zone

This activity was conducted in Jimma Arjo and Cheliya districts. For this study Jitu variety was used during 2021/22. The activity was conducted this year on 26 farmers on 13.5 hectares. This activity will be continued for the next two years. Last year 2014/15 cropping season about 4.5

quintal were distributed to around 96 farmers covering a total of 19.5 ha at Jimma Arjo. The activity is smoothly ongoing and will be continued.

4.2.3 Pre-scaling up of Improved Sesame Technologies in Selected Districts of East Wollega & Bunno Bedelle zones

This activity was conducted at Guto Gida (uke), Wayu Tuka, and Chewaqa districts of East Wollega and Bunno Bedelle zones. For this study Yale and Hagalo new varieties with walin std. check were planted on 12 farmers during 2020/21 and 2021/22 cropping seasons. The activity was not good performed in all sites and the data was not collected from best performed (Uke) in both cropping seasons due to high rainfall and security problems. Therefore, this activity will be continued for this year (July 2023- June 2024) with one-year extension.

4.2.4. Pre- extension Demonstration of improved hulless barley Technologies in Selected Districts of East Wollega and West Shewa Zone of western Oromia

The activity was proposed to be started this year (2022/23) cropping season, but due to lack of the so called *"Qaaxxee"* the commercial check, this activity was not undertaken this year. Therefore; due to this reason we are forced to take this activity for this year 2023/24 cropping season) in Jimma Arjo and Cheliya districts.

Note: Use tables 3 and 4 below for pre-extension demonstration & pre-scaling up activities to summarize the required information

Table 3. Pre-extension demonstration activities performed in the 2022/23 cropping season

No	Title of the activity	Name of the technologies demonstrated	Location (District, PAs & FTCs)	Plot size (m^2) per farmer used for the trial	Amount of technology distributed (kg)	Number of participants farmers/ pastoralists					Benefits obtained productivity(qt)
						Adult men	Adult women	Young men	Young women	Total	
1	Soy bean PED	Gute & Bilo varieties	Chewaqa & Diga	100	30	8	1	-	-	9	25.35 & 24.13
2	Sorghum PED	Marara variety	Chewaqa & W/Tuka	100	20	7	-1	-	-	8	40.43
3	Finger millet PED	Diga-1 & Diga-2 varieties	Chewaqa & Diga	100	4	9	1	-	-	10	12.95 & 15.35
4	Bread wheat PED	Lakkuu variety	Chaliya	100	25	7	2-	-	-	9	41.33
5	Triticale PED	Kombolcha variety	Diga	100	15	8	-	-	-	8	28.84

Table 4. Pre-scaling up activities performed in the year (support with pictures)

No	Title of the activity	Name of the technologies scaled up/out	Location (District)	Plot size (ha) per farmer used for the trial	Amount of technology distributed	Number of participant farmers/pastoralists					Productivity
						Adult men	Adult women	Young men	Young women	Total	
1	Pre-scaling up of improved tef	Dursi variety	Cheliya & J/Arjo	0.25	8	72	13	-	-	85	20.1

2	Pre-scaling up of improved tef (Jitu)	Jitu variety	Cheliya & J/Arjo	0.25	6.5	41	9	-	-	50	18.75
3	Pre-scaling up of improved finger millet	Bako-09 variety	W/Tuka, Diga & B/Boshe	0.25	11.2	150	23	-	-	173	21
4	Pre-scaling up of improved finger millet	Kumsa variety	W/Tuka, Diga, B/Boshe & Chewaqa	0.25	4.5	50	12	-	-	62	20.5
5	Cluster based LSD of wheat (AGP-2)	Dende'a	Cheliya	1	45	32	2	-	-	34	52

Note: Pictures should be put under the table with its description (what it is, location, year and other relevant information)

5. TRAININGS GIVEN FOR SMS, DAS AND FARMERS IN THE YEAR

Table 5. Farmers participated on different training topics

Research team	Training topic	Location (District)	Duration (days)	Number of participants				
				Adult Men	Adult Women	Young men	Young women	Total
Socioeconomics	Potato Value chain	Shambu, Harato & Cheliya	10	15	5	4	-	24
Agricultural Extension	Sesame production and management	Chewaqa	5	29	8	3	-	40
	Soybean production management	Chewaqa & Diga	6	15	5	-	-	20
	Sorghum production management	W/Tuqa & Chewaqa	10	15	5	-	-	20
	Finger millet production management	Diga & Chewaqa	6	33	5	2	-	40
	Bread wheat production and management	Cheliya	5	29	9	2	-	40
	Triticale production and management	Diga	5	19	3	2	-	24
Total			**47**	**155**	**40**	**13**	**0**	**208**

Note: Pictures should be put un***der the table with its description (what it is, location, year and other relevant information)***

Table 6. .SMS and DAs participated on different training topics

Research team	Training topic	Location (District)	Duration (days)	Number of SMS trained			Number of DAs trained			Total
				Male	Female	Total	Male	Female	Total	
Socio-economics	Ptato value chain (input, production & marketing) linkage	Horro, J/Geneti & Cheliya,	30	13	3	16	5	3	8	24

Agricultural Extension	Sesame production and management	Chewaqa	5	3	1	5	5	3	8	12
	Soybean production management	Chewaqa & Diga	5	3	1	4	6	2	8	12
	Sorghum production management	W/Tuqa & Chewaqa	10	3	2	4	3	1	4	9
	Finger millet production management	Diga and Chewaqa	7	3	2	5	3	2	5	10
	Bread wheat production and management	Chaliya	4	3	2	3	2	2	4	9
	Sesame production and management	Chewaqa	3	2	1	5	3	1	4	7
Total			**64**	**30**	**12**	**42**	**27**	**14**	**41**	**83**

Note: Pictures should be put under the table with its description (what it is, location, year and other relevant information)

6. FIELD DAYS ORGANIZED IN THE YEAR

No	Technologies/research activity on which field day was organized	Location (districts)	Number of participants (farmers/pastoralists)					Extension workers	Other stakeholders (GOs & NGOs)	Total
			Adult Men	Adult Women	Young men	Young women	Total			
1	Soybean pre-extension demonstration	Chewaqa & Diga	31	8	0	0	39	12	0	51
2	Sorghum pre-extension demonstration	Chewaqa	15	8	0	0	23	6	0	29
3	Finger Millet pre-extension demonstration	Diga	16	0	1	0	17	6	0	23
4	Bread wheat pre-extension demonstration	Chaliya	32	9	1	0	42	9	0	50
5	Triticale production and management	Diga	19	3	2	0	24	8	0	32
	Total		**113**	**28**	**4**	0	**145**	**41**	0	**185**

Note: Pictures should be put under the table with its description (what it is, location, year and other relevant information)

7. FRGS ESTABLISHED/STRENGTHENED IN THE YEAR

Table 8. FRGs established/strengthened on different commodities in 2022/23 cropping season

No	**Research activity which FRG was established/strengthened**	**Number of FRGs**		**Location (District)**	**Number of members**				
		Newly established	**Strengthened**		**Adult Men**	**Adult Women**	**Young men**	**Young women**	**Total**
1	Demonstration of improved sorghum technologies in Western Oromia	2	-	W/Tuka & Chewaqa	20	5	3	2	30
2	Demonstration of improved finger millet technologies in Western Oromia	2	-	Diga & Chewaqa	21	6	3	-	30

3	Demonstration of improved sesame technologies in Western Oromia	2	-	Chewaqa	25	4	1	-	30
4	Demonstration of improved soybean technologies in Western Oromia	2	-	Chewaqa & Diga	24	6	-	-	30
5	Demonstration of improved wheat technologies in Western Oromia	2	-	Cheliya	25	5	-	-	30
6	Demonstration of improved triticale technologies in Western Oromia	1	-	Diga	13	-	-	-	13
	Total	**11**	**-**		**128**	**26**	**7**	**2**	**163**

8. ARTICLES PUBLISHED IN THE YEAR BY RESEARCH TEAM

Table 16. Type and quantities of papers published during 2021/22 cropping season

No	Research Team	Title of the article	Type of articles	Name of the author(s)
1	Socio-economics	Degefa, K., Biru, G., & Abebe, G. (2022). Factors Affecting Sorghum Production in Western Ethiopia: Evidence from Smallholder Farmers. International Journal on Food, Agriculture and Natural Resources, 4(2): 33-39. https://doi.org/10.46676/ij-fanres.v4i2.109	Journal	Kifle D., Getachew B. & Galmesa A.
2		Kifle D, Hailu F. & Addisu T (2023). Assessment of Irrigated Wheat Production in Western Oromia, Ethiopia: The Case of Constraints and SWOT Analysis. Trends in Agricultural Economics; 16(1): 1-12. https://doi.org/1o.3923/tae.2023.1.12	Journal	Kifle D., Hailu F. & Addisu T.
3		Degefa, K., Biru, G., & Abebe, G. (2022). Factors Affecting Tomato Productivity in Western Oromia, Ethiopia: Evidence from Smallholder Farmers. International Journal on Food, Agriculture and Natural Resources, 3(2), 5-10. https://doi.org/10.46676/ij-fanres.v3i2.70	Journal	Kifle D., Getachew B. & Galmesa A.
4		Degefa, K., Biru, G., & Abebe, G. (2022). Determinants of Market Outlet Choices of Tef Producers in Western Ethiopia: Evidence of Multivariate Probit Model. Turkish Journal of Agriculture-Food Science and Technology, 10(8), 1496-1505. https://doi.org/10.24925/turjaf.v10i8.1496-1505.5122	Journal	Kifle D., Getachew B. & Galmesa A.
5		Galmesa A, Kifle D & Getachew B (2022). Characterization and Analysis of Farming System in Horo Guduru Wollega Zone, Oromia National Regional State, Ethiopia. Journal of Natural Sciences Research; 13(17): 35-48. https://doi.org/10.7176/JNSR/13-17-04.	Journal	Galmesa A., Kifle D., & Getachew B.
6		Galmesa A, Kifle D, Getachew B & Tamirat T (2022). Determinants of Adoption of Improved Rice Variety by Small Scale Farmers in Chewaka District of Buno Zone of Oromia Regional	Journal	Galmesa A., Kifle D., & Getachew B.

		State. Journal of Biology, Agriculture and Healthcare; 12(23): 10-17. https://doi.org/10.7176/JBAH/12-23-02.		
7	Agricultural Extension	Effa W., Berhanu S., Bayisa G., Dubiso G. (2022). Pre-extension Demonstration and Evaluation of Improved Tef Technology in Selected Districts of West Shewa, East Wollega and Horro Guduru Wollega Zones of Western Oromia. International Journal of Applied Agricultural Sciences; 8(6): 218-224. https://doi.org/10.11648/j.ijaas.20220806.14	Journal	Eff W., Birhanu S., Bayisa G., & Dubbiso G.
8		Effa W., Berhanu S., Bayisa G. & Dubiso G. (2022). Pre- scaling up of improved Yam technology to potential district of Western Oromia.	Proceeding	Effa W., Birhanu S., Bayisa G & Dubbiso G.
9		Effa W., Berhanu S., Bayisa G. & Dubiso G. (2022). Pre- scaling up of improved field pea technology to potential district of Western Oromia.	Proceeding	Birhanu S., Effa W., Dubbiso G. & Bayisa G.

9. EXTENSION MATERIALS PRODUCED AND DISTRIBUTED IN THE YEAR

Table 17. Type and quantities of extension materials distributed during 2022/23 cropping season

Research team	Topic & type of extension materials	Quantity prepared	Quantity distributed		
			Farmers	Others	Total
Agricultural Extension	Leaflet	150	80	70	150

10. CHALLENGES ENCOUNTERED AND MEASURES TAKEN

1. Security issue: public transportation were used and limed activities on relatively better in security issue and similar agro-ecology.
2. Seed shortage (especially finger millet, ground nut, field pea and soybean): Purchase seed from farmers who hosted last year the activity and maintain the crop this year and continue for the coming year.

4. Technology or varieties and Information Released this Year by BARC

By this fisical year as BARC about 46 activities were planned to release new technologies/ information and vareities. But due to security problem in majority of our mandate areas the center was unable to collect data for about four (4) activities two from on farm and two from on station. There fore, about 42 activites were released as information and/ or varieties, out of which about six (6) released technologies were new varieties released by BARC by this yrear. The information on the released technologies are summaried below.

Table 1. Varieties Release by BARC 2023

No	Crop	Candidate	Yield Level	Yield Advantage St. Check (%)
1	Bread Wheat	Acc. ETBW 9413	42.39	16.1
2	Tef (white seeded)	BK-01-1817	25’48	25.7
3	Tef (Brown Seeded)	BK-5317	25.9	39
4	Pigeon (Late set)	ICAP 01499	20.39	35.2
5	Pigeon (Medium set)	ICAP 00979	20.40	36.8
6	Soybean	JM – PR142/CLR-15-5C- 2	27.20	14.05

Figure. 3 Photo of Released Bread wheat and Soybean

Figure. 4 Photo of Released Tef Vareities

Figure. 5 Photo of Released Pigean pea Vareities

5. Technology multiplication and Distribution

5.1 Multipilication of Basic Crop Technologies and Distribution

Crop Type	Lines/pre-basic/basic/cert.	Annual plan (Qt)	Achievement (Qt)	Distribution (%)
	CML-395XCML-	240	86	100

Maize	202			
	BKL-004	150	55	100
	BKL-003	40	16	100
	BKL-001	120	19	100
	142-1-e	60	17	100
	BH-661	100	42.5	100
Sorghum	Marara	90	92	50
Finger Millet	Bako-09	10	6.5	100
	Diga-2	8	2.5	100
	Urji	8	6.5	100
	Kumsa	9	0.38	100
Soybean	Addis 01	8	1.68	100
	Katta	8	1.9	100
	Ethio-ugozlavia	8	1.5	100

5.2 Multiplication of Livestock and Forage seed technologies

Works Done	**Measuremet**	**Annual Plan**	**Achivements**
Management of Established Rhodes grass	ha	4	4
Collection of Rhodes grass seed	Qt	4	4
Heifers Multiplication	No	17	6
Oat Seed production	ha	0.5	0.5
Management of seeded Oat	ha	0.5	0.5
Management of Leucana Palida	ha	1	1
Dismoodi'eemii faca'e kunuunsuu	ha	0.125	0.125

5.3 Basic Technology Multiplication by Type

Process	**Annual Plan**	**Achivements**	Distribution (%)
Crop	21	21	100
Livestock	15	15	100
Natural Resource	17	17	100

5.4 Breeder Seed Multiplication and Distribution by Research Processes

Process/Team	**Annual Plan**	**Achivements**	Distribution (%)
Crop	26(Qt)	26(Qt)	100
Horticulture*	600(suckers)	670(suckers)	100
Aimal Feed	12(type)	12(type)	100

*= about 450 suckers of Banana were Given to Adami Tulu Researcher center

6. Human Resource Development

Human Resource	Researchers		Supportive staff		Total
	Female	Male	Female	Male	
Curretly on workn	**1**	**67**	**25**	**187**	**280**

Retired	0	1	1	3	4
Left at all	0	1	0	5	6
Left by change	0	0	0	3	3
Newly requreted	0	0	2	7	9
Total	1	69	28	207	**302**

6.1 Long term Training

Table. Researcher on Long term training by Process

No	Research Process	No of Researcher	Educational Level	
			Msc	PhD
1	Crop	6	3	3
2	Crop protection	2	1	1
3	Livestock	4	2	2
4	Natural Resource	3	2	1
5	Extension and socio-economics	3	2	1
	Total	18	10	8

7. Community Services

- Summary of community service activities performed in this fisical year by our center
- Advisory service on how to produce irrigated wheat
- PhD and Msc student support and advisory services
- Provision of breeders and pre-basic seeds of different crops and forage
- Adivisory services were given to different stake holders through training and one to one contact with researchers on differet agricultural technology utilization
- Three researchers were sent to Batu and Jimma Twons for three weeks and given traing for zonal, woreda expersts and Das.
- Different Agricultural technologies user manuals were prepared by our center research with collaboration with other stakeholders

8. Budget utilization

8.1 Regular and Capital Budget Utilization (IQQO)

Team	Annual Budget	Expenditure	Balance	Utilization (%)
Cereal	1,894,100.00	1,893,288.04	811.96	99.96
Pulse and Oil	1,794,800.00	1,791,497.50	3,302.50	99.82
Poultry	1,565,000.00	1,563,879.10	1,120.90	99.93
Apiculture	188,000.00	184,505.00	3,495.00	98.14
Animal Feed	905,000.00	904,779.00	221.00	99.98
Soil fertility	485,000.00	484,685.00	315.00	99.94
Agroforestry	852,300.00	852,280.00	20.00	99.98
Coffee and Tea	1,923,200.00	1,920,934.32	2,265.68	99.88

Sheep and Goat	1,000,000.00	998,961.60	1,038.40	99.90
Irrigation Eng.	181,300.00	181,300.00	0.00	100.00
Farm	6,952,000.00	6,951,694.20	305.80	99.90
Dairy	1,196,000.00	1,193,944.85	2,055.15	99.83
Meat	806,000.00	797,511.15	8,488.85	98.95
Extension	907,800.00	907,585.83	214.17	99.98
Horticulture	701,900.00	701,614.35	285.65	99.96
Socio-economics	560,100.00	559,689.35	410.65	99.93
Crop Protection	1,210,700.00	1,090,454.72	538.28	97.07
Recurrent	**30,291,829.00**	**28,270,900.98**	**2,020,928.02**	**93.33**

8.2 Capital Budget Utilization, Non-IQQO

Project/Type	Annual Budget	Expenditure	Balance	Utilization (%)
EGS-ISSSE	113,140.00	113,140.00	0.00	100.00
OARI-Food	45,000.00	45,000.00	0.00	100.00
Sesame-Seed RAT	259,080.00	240,532.50	547.50	97.20
FSRP-Comp 1.2.2	3,049,000.00	2,498,428.41	550,571.59	90.35
FSRP-Comp 1.2.1	2,205,000.00	2,154,163.41	836.59	89.25
CALMP4R	1,800,000.00	1,723,281.39	76,718.61	85.35
SMILL	178,330.00	138,642.00	39,688.00	87.35
Irrigated Wheat	20,328,474.26	19,639,153.36	689,320.90	96.61

9. Internal Revenue Collection

Annual plan (ETB)	Annual Collection (ETB)	Achievement %
2,500000	2470000	98.8

10. Cross Cut Issues

Gender mainsteaming, youth participation and HIV AIDS prevention activities

Under this specific issue, ony one specifiec activity was done as Bako Agricultural research center; which is identification of individualand/or family in the work that are victim of HIV AIDS and helping those families. Example. As our center Two families from workers were identified them selves as HIV AIDS victim and supported with their all family members.

11. Ethical Promotion Activities

In this budget year, training was given on the issue of ethical rules and regulations for all workers for one day and New regulations and guidelines have been identified and employees have been made aware of them.

Table. Performance of Ethical Promotion Activities of the Center

S/N	Main activities planned	Unit	Annual plan	Anual implemenation	% (P/I)
1	Collect customer feedback on our services and analyze public satisfaction levels	Quarter	4	4	100
2	Monitoring the use of the government's budget to ensure that it is put to good use and produces the desired outcomes	Quarter	4	4	100
3	Observing how center staff use government equipment and materials to ensure that they are solely used for office tasks	Quarter	4	4	100
5	Assess any potential ethical dilemmas or difficulties at work, and respond right away if they arise	Quarter	4	4	100
6	Support the ethics and anti-corruption councils of the centers; establish a schedule for debating any ethical issues and processes for resolving them if they arise	Quarter	4	4	100
7	Monitor precence and application of important laws, rules, and regulations	No of monitored documents	4	4	100
8	Conduct studies on practices that leave room for fraud and misconduct	No	2	0	0
9	Collaborate with various groups to encourage moral conduct and a sense of responsibility at all levels in the center.	Quarter	4	4	100
10	If any corruption offense has been committed, is suspected of having been committed, or if any third-party complaints have been received, they will be registered and submitted to the center's director and OARI	Month	No of corruption offense or complaints	0	0
11	Employee ethics, those who set an example at work, those whose disciplinary infractions have been advised and who have received disciplinary punishment	Good model	8	0	0
		Adivised	8	4	50
		Punished	8	2	25
12	Keep track of and make corrections to internal and external audit reports	Quarter	Reported Audit problem	0	0
13	Review ethical progress and remain vigilant on activities at various levels	Quarter	4	2	50

14	Receive and give feedback	Quarter	4	3	75
15	Enhance the preservation of evidence/documentation of ethical development and activity monitoring	Days	Working hours	Monitoring was done	Monitoring was done
16	Giving training	Yearly	250	229	91
17	Conduct M and E On Ethical issue		2	1	50
18	Asset registration of employe		250	230	92

12. Job Creation for Unemployed Community

Several youths acquired temporary jobs on station and at different research sites of Center in this fisical year and on average about 1500 idividuals got temporary job in our center, BARC.

13. Citizenship Service Promotion

Bako Agricultural research center enter into citizenship Services before two years just through planting different trees in the coupound and clearing of roads in contributing there ways to green legacy. To this effect the center also plant about 19598 different types of plants in the center as usual for their contribution to green legacy.






14. Initiative works/Activities

The Oromia regional government has given direction and plan through ATO to produce diffent strategic crops and given Suggestion to have strategic interventions to transform our agriculture for food self sufficieny/Food security, job creation, export market, import substitution/raw material for industry. Irrigated Wheat production was one and main strategic crops to fulfill the stated objectives which can be gained through suplus production. IQQO take its part on this issue just by taking un assiment to give tacnical back up and seed production for this Irrigated wheat production and from this BARC was given its share and work on the issue for the last three years including this year.

BARC Irrigate Wheat seed Production Plan and achievents are indicated below.

Table. Achievement of Irrigated Seed production in this year 2022/23

Zone	District	Plan(ha)	Achievement(ha)	No of participated HHs			№ of cluster s established
				Male	Female	Total	
E/Wollega	W/Tuka	70	70	119	9	128	2
W/Shewa	Dandi	65	65 (1*)	38	7	45	2
	Ejersa Lafo	74	74	79	11	90	2
	Total	209	209	236	27	263	6

- Training of Experts, DAs and Farmers on method of planting, furrow making and field cannel preparation was given theoretically and practically.

Trainings Was Given for
Farmers=263
DAs=7
Experts=24
Total=294

Highest yield was obtained in West shoa

Field Day was organized at Dandi District

Table.Yields Obtaned

Zone	District	Planted area(ha)	Yield Obtained in qt/ha		Total volume of production in (Qt)
			Min	Max	
E/Wollega	Wayu Tuka	70	36	66	2940
W/Shewa	Dandi	65	34	55	2240
	Ejersa Lafo	74	24	30	1974
Total					4508

15. Summary of main Initiatives Scheduled for the Upcoming fisical year

In addition to the initiative of Irrigated wheat Seed production BARC has been playing its part in achieving the Green Legacy in the last 3 to 4 years by planting different types of plants in the

research Compound and further more the center has been contributing its part by producing different pre-basic seeds of different crops that had been added as new initiatives this year.

Exmple: BARC has been producing pre-basic seed of different Soybean varieties on ten hectar of land (10ha) and also pre-basic seed of Rice on six hectar of land (6ha) on station in the center ought to be used as seed source for initiative of the crops meantioned above for upcoming year.

16. Wester Cluster ATO Achievement and 2016 E.C Plan

It is recalled that the Oromia regional government established the regional agricultural transformation council to improve the culture of working together in the region to realize agricultural transformation. To this effect the regional administrative Council approved regulation 227/2022 which clearly shows how the stakeholders should coordinate through the ATO coordination office that is overseen by regional councils; to this end, the region was divided into seven Clusters which are working to leverage the potential of clusters' members synergically. BARC has been selected as a Wester Cluster chair of the region and play a coordination role for the Cluster for the last one year and effectively held two consecutive cluster meetings at Zonal level.

The 1st round meeting of the cluster council comes up with different agricultural constraints that humble the agricultural productivity in western cluster. This comes from gothering and discussion of different stakeholders from different concened governemetal and non governmental organizations.

The 2nd round meeting of the cluster council was more realistic and come up with coined agends from 1st round and present plus discussion were made on the issues and clear directions were given at the end of the meeting. The title and agenda of the 2nd round meeting were:

- 1. Cluster achievements & government directions
- 2. Awareness creation on wheat diseases with special focus on fusarium head blight and rust);
- 3. White mango scale insect

Figure. Photo taken during 2nd round ATO Cluster Coucil Meeting

Major Challenges (comments Raised by Participants)

- Soil acidity
- Input Shortage
- Increasing diseases and insects due to climate change:
- White mango scale insect
- Mono cropping problem
- Lack of agro-processing Industry in the cluster**:** (feeding process for dairy & red meat initiatives)
- Cluster establishment and strengthen at district level (methods of information transfer to the root level)
- Non-Functionality of liquid nitrogen plant
- Shortage of modern hives: (due to shortage of wood)
- Shortage of Motor pump for irrigated wheat production

- Market problems
- Limitation of livestock initiatives
- Lack of Manual Guidelines

Table 18. Western Cluster ATO Action plan for 2016 E.C.

No	Activities	Unit	Target	Quarters			
				1st	2nd	3rd	4th
1	Identify/customized key research and development issues of western cluster	Round	1	x			
2	Propose problem-oriented research and development activities	No.	1		x		
3	Review research & development proposals for (new and ongoing) programs and initiatives	Round	1		x		
4	Develops mechanism for technology multiplication and transfer	Round	1			x	
5	Identification of demand and supply system for agricultural input and output market	Round	1			x	
6	Monitors and evaluates research and development initiatives at the field level	Round	1		x		
7	Builds capacity of the research and development actors (investors, experts, NGOs, etc)	Round	2	x		x	
8	Develops mechanisms knowledge sharing on current and severity diseases (Universities & Research Centers are responsible)	Round	2	x		x	
9	Cluster council annual meeting	Round	2	x		x	
10	Establishing and strengthen zonal and district level councils meeting	Round	1			x	
11	Refine and customize available packages	No.	1	x			
12	Annual activity and budget planning	Round	1			x	
13	Reporting	Round	4	x	x	x	x

Table 19. Western Cluster ATO Council Participants Planned for 2016 E.C.

Participants	**Number institution**	**Number of participants**
Research Centers*	6	36
Universities	2	16
Zones (Irrigation, Agri. Offices, Mayors, Urban Agri. Offices, Plant Clinic, etc)	4	72
Districts** (Agr. Offices head)	61	305
Seed dealers	12	46
Unions and coops (seed producers)	16	45
NGOs	15	50
Others (micro finance & Trade offices)	25	75
Total	**141**	**645**

**Four regional (IQQO) and 2 national (EIAR) research centers and **17 districts (East Wollega), 12 districts (H/G/Wollega), 11 districts (Q/Wollega and 21 districts (West Wollega) zones*

17. Major Activities Planned for up coming year 2016 fisical year

- Compile Concept Notes for 2017 E.C and send to respective directors
- Prepare the 2016 center activities work plans
- Perform Mand E at field level for two rounds as already planned
- Planing point of discussion for up coming Western Cluster ATO meeting Coucil
- Make maintenance and repairs Cars, office fence, recidencial house and other research materials
- Encourage and support all employees to take part in various discussion workshops, have team meetings, and record and document all work data
- Compile information on the project's completed activities, then use that information to create articles and suggest taking advantage the outcomes.
- Hold management meetings at center level to discuss the planned activities status and any issues that have been found and encourage M &T team to actively participate in the monitoring and evaluation of the planned annual works of the center.
- Support and strengthen availble FRG groups and establish new ones to carry out technology demonstrations and scale-ups in different zones and agro-ecologies
- Strengthen Citizenship Service Provision and Volunteering works
- Perform twice-yearly employee evaluations in the upcoming plan year 2016 E.C
- Compile all events and report them in monthly, quarterly, and annual reports
- Preparing field day for popularization, demand creation and promotion of the released technologies

18. Major Problems Incountered During this fiscal year

- Budget short as whole
- InSecurity
- Compitition for grazing land and disturbance of Sourding farmers animal and wildlife
- Shortage of irrigation facility
- Wage payement (amout to be payed per day)
- Shortage field Vehicles

Report Compiled by:

Name: Dereje Bekele Signature_____ Date 18/08/2023

Approved by:

Name: _____Signature_____ Date_____