



Oromia Agricultural Research Institute

Haro Sabu Agricultural Research Center

Annual Research Report
(Research work done so far within this cropping season)
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1. Introduction

The general objective of the center are identification prioritization of crop, livestock and natural resource production problems and planning and executing problem oriented research. Generation of agricultural technologies and promotion to the end users. In short target of the center are:

- Increase production & productivity of crops and animal resources
- Sustainable management & utilization of natural resources
- Enhancing food security and food self sufficiency

2. Number of research activities planned and executed in the year

2.1. Number of Research Activities Executed by Government (IQQO) Budget

No	Research team	Number of research activities planned to be executed in the year	Number of research activities completed in the year (July 2014- June 2015 E.C.)	Number of research activities discontinued/ suspended in the year*	Number of research activities passed to next year	New proposals approved for next year (2016 E.C.)	Total number of activities for next year (2016 E.C)
1	Cereal team	10+1*	7+1*	4	4	9+1*	13+1*
2	Horticultural team	7+1*	5+1*	-	2	4+1*	6+1*
3	Pulse team	14+1*	6+1*	1	7	10+1*	17+1*
4	Coffee and Tea improvement	3	-	-	3	1	4
5	Coffee management and protection	2	1	-	1	-	1
	Processing and quality	1	-	-	1	1	2
6	Pathology	6	3	-	3	4	7
7	Weed Science	2	-	-	2	2	4
8	Entomology	1	-	-	1	1	2
9	Soil Fertility Improvement team	2	1	-	1	1+1*	2+1*
10	Agroforestry team	5	-	-	5	1*	5+1*
11	A/Extension team	9	4	-	5	3	8
12	S/Economics	2	-	-	2	-	2
13	Irrigation, WH &D. Engineering team	2	1	-	1	3	4

1 4	Animal feed team	6	5	-	1	6	7
1 5	Apiculture team	2	-	-	2	1	3
	Total						

* indicates: breeder seed maintenance(Crop), multiplication of adapted multipurpose trees and vermiculture maintenance (NRM)

2.2. Number of research activities executed by Non-Government budget (Collaborative activities)

No	Research team	Number research activities planned to be executed in the year	Number research activities completed in the year (July 2014-June 2015 E.C.)	Number research activities discontinued/ Suspended in the year*	Number research activities passed to next year	New proposal approved for next year (2016 E.C.)	Total number of activities for next year (2016E.C.)
1	Agroforestry	3	1	-	3	3	6
2	Soil fertility Improvement	2		-	2+1*	1	3+1*
3	Apiculture	1	1	-	-	-	-
	Total	6	1	-	6	4	10

* indicates: recently added activities NP rates determinations (AECFRP) on three crop commodities (5 sites for maize, 6 sites for teff and wheat respectively)

3. Major findings from completed research activities in the year

3.1. Crop research process

3.1.1. Cereal team

3.1.1.1. Finger Millet Variety Verification Trial (FMVVT)

Major findings (in abstract form): One Candidate genotype (FMC-33) collected from landraces was evaluated against two standard checks (Ikulule and Meba) at Haro Sabu, Lalo Kile, Sadi Chanka and Seyo for two years by using non replicated simple plot of 10mX10m design. Accordingly, the trial was evaluated by Variety Releasing Committee and the candidate genotype expected to be released as variety.

3.1.1.2. Finger Millet Regional Variety Trial

Major findings (in abstract form): Thirteen (13) genotypes (IBC materials) promoted from Preliminary Yield Trial were evaluated against two standard checks (Meba and Bako 09) at Haro Sabu, Sayo, Sadi Chanka and Lalo Kile for two consecutive years by using RCBD design with 3 replications. Two (2) promising genotypes were selected and promoted to Variety Verification Trial as candidates.

3.1.1.3. Effect of NPS and Nitrogen Rate on Yield and Yield Components of Finger Millet

Major findings (in abstract form): Different levels of NPS and N fertilizer were evaluated on Finger Millet, variety Bako 09 at Haro Sabu and Lalo Kile for two years by using RCBD design with 3 replications. Accordingly, 125 kg/ha of NPS and 46 kg/ha of N was recommended

3.1.1.4. Effect of Seed Rate and Row Spacing on Yield and Yield Components of Finger Millet

Major findings (in abstract form): Different levels of seed rates and row spacing were evaluated on Finger Millet, variety Bako 09 at Haro Sabu and Lalo Kile for two years by using RCBD design with 3 replications. Accordingly, 15 kg/ha of seed rate and 45 cm inter-row spacing were recommended.

3.1.1.5. Sorghum Observation Nursery

Major findings (in abstract form): 259 Sorghum genotypes were evaluated against standard checks; Sadii and Merera at Haro Sabu Onstation for one year by using Augmented design. Data collection and characterization of the genotypes were undertaken and two sets of sorghum genotypes were identified based on maturity. Accordingly, 49 Medium maturing and 49 late maturing totally 98 genotypes were promoted to Preliminary yield trial for further evaluation.

3.1.1.6. Tef Preliminary Yield Trial (White seeded)

Major findings (in abstract form): 34 White seeded tef genotypes were evaluated against two standard checks (Dursi and Bishoftu) at Bellam for one year by using 6X6 simple lattice design. 13 Genotypes were selected and promoted to Regional Variety Trial.

3.1.1.7. Tef Preliminary Yield Trial (Brown seeded)

Major findings (in abstract form): 34 Brown seeded tef genotypes were evaluated against two standard checks (Filagot and Bishoftu) at Bellam for one year by using 6X6 simple lattice design. Accordingly Thirteen (13) genotypes were selected and promoted to Regional Variety Trial.

3.1.2. Horticultural research team

3.1.2.1. Potato Preliminary Yield Trial in Kellem Wollega Zone

Major findings (in abstract form): Thirty four (34) genotypes were evaluated with the standard checks (Belete and Gudane) in 6x6 alpha lattice design using 3x1.5m plot size at the row and plant spacing of 75cm and 30cm, respectively. The field experiment was carried out to achieve the specific objective aimed at evaluating, selecting and promoting high yielding, insect and pest tolerant genotypes. All agronomic data were collected and analyzed by SAS software. Finally, ten (10) genotypes with the yield advantage of greater than 10% were promoted to regional variety trial.

3.1.2.2. Anchote Preliminary Yield Trial in Kellem Wollega Zone

Major findings (in abstract form): Thirty five (35) anchote accessions were evaluated with Desta-01 as the standard check during 2021/2022 at HsARC station in 6x6-alpha lattice design. The study was carried out with the objective to evaluate, select and promote high yielding and disease tolerant genotypes. A plot size of 2x1.5m was used at 50cm and 20cm, row and plant spacing, respectively. Root yield and yield component data were collected and analyzed by SAS software. Finally, ten (10) genotypes with the yield advantage of greater than 10% were promoted to regional variety trial

3.1.2.3. Adaptation Trial of Orange Fleshed Sweet Potato Varieties in Kellem Wollega Zone

Major findings (in abstract form): Six (6) Orange Fleshed Sweet Potato varieties were brought from Hawasa agricultural research center were evaluated with local check at HSARC (Onstation), Sedi Chanka (Egu) and Lalo Kile (Sego). The main aim of the study was to evaluate, select and recommend high yielding, insect and pest tolerant variety for potential areas. Randomized complete block design with three replications was used in 3mx5m plot size and 100cm and 30cm, row and plant spacing. Agronomic data were collected and analyzed using SAS and GenStat (Gen Stat, 2016) software. On the base of combined analysis, significantly higher mean value of root yield was obtained from Kabode and Vita varieties. Generally Kabode and Vita varieties were found superior in terms of yield and other yield related parameters. These varieties also stable than all other varieties evaluated and tolerant to alternaria leaf blight diseases. Thus they are recommended for popularization and wider production in test locations and similar agro-ecologies.

3.1.2.4. Adaptation Trial of White Fleshed Sweet Potato Varieties in Kellem Wollega Zone

Major findings (in abstract form): Six (6) white Fleshed Sweet Potato varieties were brought from Hawasa agricultural research center were evaluated with local check at HSARC (Onstation), Sedi

Chanka (Egu) and Lalo Kile (Sego FTC). The main aim of the study was to evaluate, select and recommend high yielding, insect and pest tolerant variety for potential areas. Randomized complete block design with three replications was used in 3m x 5m plot size and 100cm and 30cm, row and plant spacing. Agronomic data were collected and analyzed using SAS and GenStat (Gen Stat, 2016) software. On the base of combined analysis, significantly higher mean value of root yield was obtained from Tola, Berkume and Hawassa-09 varieties. Generally Tola, Berkume and Hawassa-09 varieties were found superior in terms of yield and other yield related parameters. These varieties also stable than all other varieties evaluated and tolerant to alternaria leaf blight diseases. Thus they are recommended for popularization and wider production in test locations and similar agro-ecologies.

3.1.2.5. Inter and intra row Spacing Effects on Growth, Yield and Yield Components of Small pod hot Pepper production in Kellem Wollega Zone

Major findings (in abstract form): The experiment was carried at Haro Sabu, Sedi Chanka and Lalo Kile for two consecutive years (2021-2022/23). The main objective of the study was to identify the main effect of different inter and intra row spacing on yield and yield components of small pod hot pepper, Malka Dera variety. The experiment consists of four inter row spacing (50,60,70 and 80 cm) and three intra row spacing (20,30 and 40 cm), comprising 12 treatments. The trial was laid out in randomized complete block design (RCBD) with three replications in factorial arrangement. The spacing of 1m and 0.7m was used between replication and plot, respectively. Although the experiment was conducted on three locations for two years data from Sedi Chanqa and Lalo Qile were too poor and not included. On the base of combined analysis, significantly higher mean value of pod yield and yield components was obtained from 50cm inter row spacing and 20cm intra row spacing.

3.1.3. Pulse and Oil research team

3.1.3.1. Bush Bean RVT (Large and medium red mottled)

Major findings (in abstract form): Field trial was conducted on 11 genotypes including Jabdu and Ibado standard checks during 2021-2022/23 main cropping season. The Experiment was conducted at Sadi chanka, Haro sabu, Lalo Kile and Sayo locations by using RCBD design with 3 replications. Agronomic data were collected based on common bean descriptor, combined analysis was done by SAS and Genstat software and significant genotypic difference was obtained for grain yield and yield components. Therefore, genotype G-19 and G-65 were high yielder, stable, and promoted to variety verification trial.

3.1.3.2. Bush Bean RVT (Biofortified)

Major findings (in abstract form): Field performance evaluation was conducted on 11 genotypes including Zoasho and Tafach standard checks during 2021-2022/23. The experiment was executed at Sadi chanka, Haro sabu, Lalo Kile and Sayo locations by using RCBD design with 3 replications. Agronomic data were collected based on common bean descriptor, combined analysis was done by

SAS and Genstat software and significant genotypic difference was obtained for grain yield and yield components. Therefore, Genotype G-1 showed higher mean and stable grain yield. Hence, G1 was promoted to variety verification trial.

3.1.3.3. Lima Bean RVT (Large Red Mottled genotypes)

Major findings (in abstract form): Field performances of 12 genotypes were evaluated during 2021-2022/2023 at Haro sabu, Lalo Kile, Sayo and Sadi Chanka by using RCBD with 3 replications. Data were analyzed by SAS and Genstat software and significant genotypic and GXE difference was exploited for grain yield, indicating the importance of genotypic stability estimation. Accordingly, Genotypes 145,147 and 161 were promoted to VVT based their mean grain yield, yield stability and disease tolerance.

3.1.3.4. Lima Bean RVT (Large White)

Major findings (in abstract form): Ten (10) genotypes including the standard check, American Baby was tested during 2021-2022/23 at Haro sabu and Lalo Kile, Sayo, Sadi Chanka by using RCBD with 3 replications. Data were analyzed by SAS and Genstat software and three genotypes (57,78 and 83) were promoted to VVT.

3.1.3.5. Groundnut Variety Verification Trial

Major findings (in abstract form): Field evaluation was conducted on 23525 and 23528 genotypes with Manipinter and Milkaye standard checks at Haro Sabu, Lalo kile and Sadi chanka research station and farmers' field. The performance of the trial was evaluated by Technical committee and One variety is expected to be verified by the standing committee.

3.1.3.6. Sesame Variety Verification Trial

Major findings (in abstract form): Two genotypes; G-13 and G-11 were sown with standard checks (Dincho and Hocalu) at Haro Sabu and Sadi chanka research and farmers' field. Performance of these genotypes was visited by technical committee and at least one candidate variety (G-11) is expected to be verified by the standing committee.

4. Major activities performed under each ongoing research activities

4.1. Horticulture research team

4.1.1. Adaptation Trial of Commercial Head Cabbage Varieties in West and Kellem Wollega Zones

Six commercial head cabbage varieties were evaluated on Haro Sabu Agricultural Research center at Bellam FTC location. Due to security problems around the study area the experiment was conducted only at one location. The experiment was done using RCBD with three replications. All phenological and yield data was collected and analyzed using SAS software. LSD (0.05) was used for mean separation. The results of three years revealed that statistically there was none significance difference

between varieties, but numerically bakker and monarch are high yielder when compared with other varieties evaluated. However, the trial was repeated in 2015/2016 for further recommendation.

4.1.2. Adaptation trial of Improved Fenugreek varieties in West and KellemWollega Zones of Western Oromia

Six improved varieties of fenugreek were brought from Kulumsa agricultural research center and Tepi national spice research center. Their performance evaluation was done along with local check on Bellem FTC. The experiment was done using RCBD with three replications. Due to security problems around the study area the experiment was conducted only at one location. All phenological, yield and yield component data were collected and analyzed using SAS software. LSD (0.05) was used for mean separation. The results of one year revealed that Local check is high yielder when compared with other varieties evaluated. However, the trial was repeated in 2015/2016 for further recommendation.



Fig.1. Adaptation Trial of Commercial Head Cabbage Varieties



Fig.2. Adaptation Trial of Fenugreek varieties

4.2. Pulse and Oil research team

4.2.1. Climber Bean Regional Variety Trial (Large and Medium) at West and Kellem Wollega Zones, West Oromia, Ethiopia

Eleven climber bean genotypes including Tibe (standard check) were tested at Haro Sabu and Lalo Kile research sites during 2021/22 main cropping season. The main objective of the study was to evaluate, select and promote high yielding, widely adapted, stable and disease tolerant genotype/s to variety verification trial. Randomized Complete Block Design (RCBD) with three replications was used at the spacing of 2m, 1m, 60cm and 10cm between replication, plot, row and plant, respectively. Inorganic fertilizer, NPS was applied at the rate of 100 Kg/ha at sowing time. Crop data were collected following the procedures developed in climber bean descriptor for respective traits. Three promising candidate genotypes (G27, G46 and G76) were obtained. However, the trial was repeated in 2015/2016 for further recommendation.

4.2.2. Lima bean Regional Variety Trial (Medium Red) at West and Kellem Wollega Zones, West Oromia, Ethiopia

Eight medium red lima bean genotypes including one standard check were evaluated at research sites of Haro Sabu and Lalo Kile. The main objective of the study was to identify, select and promote high yielding, stable and disease tolerant genotype/s to variety verification trial. The field experiment was carried out in Randomized Complete Block Design (RCBD) with three replications at the spacing of 2.5m, 2m, 1m and 30cm between replication, plot, row and plant, respectively. Crop based data were collected based on standard developed for each parameter in lima bean descriptor. NPS was applied at sowing time at the rate of 100 Kg/ha. Two promising candidate genotypes (G30 and G44) were obtained. However, the trial was repeated in 2015/2016 for further recommendation.

4.2.3. Lima bean Regional Variety Trial (Small Red) at West and Kellem Wollega Zones, West Oromia, Ethiopia

Field experiment was conducted on eight small red lima bean genotypes with one standard check at Haro Sabu and Lalo Kile research location. The study was carried out to achieve the main objective to identify, select and promote high yielding, stable and disease tolerant genotype/s to variety verification trial. The trial was done using Randomized Complete Block Design (RCBD) with three replications at the spacing of 2.5m, 2m, 1m and 30cm between replication, plot, row and plant, respectively. Agronomic data were collected following the procedure developed in lima bean descriptor. NPS was applied at sowing time at the rate of 100 Kg/ha, like wise, all field operations including weeding, hoeing etc. were implemented as uniformly as required. Two promising candidate genotypes (G51 and G40) were obtained. However, the trial was repeated in 2015/2016 for further recommendation.

4.2.4. Field Pea Regional Variety Trial (Shiro type) at West and Kellem Wollega Zones, West Oromia, Ethiopia

Thirteen shiro type Field pea genotypes including the standard check were evaluated at Mid-altitude research site (Bellam-FTC) of Haro agricultural research center during 2021/22. The main objective of the study was to evaluate, select and promote high yielding, stable and disease tolerant candidate genotype to variety verification trial. Field experiment was conducted in Randomized Complete Block Design (RCBD) with three replications at the spacing of 2.5m, 2m and 20cm between replication, plot and row, respectively. Inorganic fertilizer, NPS was used at the rate of 100 kg/ha during sowing time. Seedlings were thinned at the spacing of 5cm after well establishment. All field operations including weeding, hoeing etc. were uniformly commenced for all plots as per crop require. Crop data were collected based on field pea descriptor. The collected data were analyzed by SAS software. Three promising candidate genotypes (G177, G97 and G114) were obtained. However, the trial was repeated in 2015/2016 for further recommendation.

4.2.5. Field Pea Regional Variety Trial (Kiki type) at West and Kellem Wollega Zones, West Oromia, Ethiopia

Eight (8) genotypes including the standard check were evaluated at mid-altitude of Haro Sabu Agricultural Research Center (Bellam FTC) during the main cropping season of 2021/22. The main aim of the study was to identify and promote high yielding, stable and disease tolerant kiki type field pea genotype/s to variety verification trial. Experiment was carried out using Randomized Complete Block Design (RCBD) with three replications at the spacing of 2.5m, 2m and 20cm between replication, plot and row, respectively. NPS was applied at the rate of 100 Kg/ha at sowing time. After well establishment, field pea seedlings were thinned at the spacing of 5cm. And all the remaining field operations were done as uniformly as need for all genotypes. Crop data were collected based on field pea descriptor. Two promising candidate genotypes (G61 and G115) were obtained. However, the trial was repeated in 2015/2016 for further recommendation.

4.2.6. Chick Pea Regional Variety Trial (Kabuli type) at West and Kellem Wollega Zones, West Oromia, Ethiopia

Ten Kabuli type chick pea genotypes including Arerti (standard check) were evaluated at Mid-altitude of Haro Sabu Agricultural Research site (Bellam FTC) during 2021/22 main cropping season. The study was conducted with the objective to evaluate, select and promote high yielding, stable and disease tolerant genotype/s to variety verification trial. Randomized Complete Block design with three replications was used at the spacing of 1.5m, 1m, 40cm and 10cm between replication, plot, row and plant, respectively. NPS was used at the rate of 100 kg/ha at sowing time, and all field operations including weeding, hoeing etc. were accomplished as uniformly as require for all genotype. Agronomic data were collected following the procedures developed in chick pea descriptor. Two promising candidate genotypes (G23221 and G18352) were obtained. However, the trial was repeated in 2015/2016 for further recommendation.

4.2.7. Chick Pea Regional Variety Trial (Desi type) at West and Kellem Wollega Zones, West Oromia, Ethiopia

Field experiment was carried out on twelve (12) desi type chick pea genotypes at mid-altitudes of research site (Bellam FTC) of Haro Sabu Agricultural Research Center during 2021/22. The study was carried out to evaluate, identify, select and promote high yielding, widely adapted/ stable, disease tolerant genotype to variety verification trial. Trial was handled in Randomized Complete Block Design (RCBD) with three replications at the spacing of 1.5m, 1m, 40cm and 10cm between replication, plot, row and plant, respectively. Inorganic fertilizer; NPS was applied at the rate of 100 Kg/ha during sowing time. Other crop management practices were done as uniformly as needed for all genotypes. Data were collected following the procedures developed in chick pea descriptor as usual. Two promising candidate genotypes (G4352 and G4367) were obtained. However, the trial was repeated in 2015/2016 for further recommendation.

4.3. Cereal research team

4.3.1. Food Barley Regional Variety Trial (FBRVT)

The trial was planned to be sown on three locations (Bellam, Sayo and Hawa Gelan) however, due to security problem, the trial was couldn't be sown at Sayo and Hawa Gelan areas so, the trial was decided to be extended again to this year following the same methodology.

4.3.2. Food Barley Preliminary Yield Trial

The trial was sown at planned location and seed was emerged very well. But at establishment, more than 50 % of the seedlings were destroyed by termite and the seed was collected from the remaining stands/population. So, the trial was decided to be extended following the same methodology.

4.3.3. Bread Wheat Regional Variety Trial

The trial was planned to be sown on three locations (Bellam, Sayo and Hawa Gelan) however, due to security problem, the trial was couldn't be sown at Sayo and Hawa Gelan areas so, the trial was decided to be extended again to this year following the same methodology.

4.3.4. Adaption Trial of Improved Highland Sorghum Varieties at West and Kellem Wollega Zones

The trial was planned to be sown on three locations (Bellam, Sayo and Hawa Gelan) however, due to security problem, the trial was couldn't be sown at Sayo and Hawa Gelan areas so, the trial was decided to be extended again to this year following the same methodology.

5. Crop Protection Research

5.1. Major findings from completed research activities in the year

5.1.1. Screening of Large Seed Common Bean Genotype for Major Diseases in Kellem Wollega Zone.

Major findings: 34 resistant genotype was promoted to further study Status: write up not completed. Large seed common bean genotype screening for major disease. 35 genotypes which was resistant to major disease was promoted to breeder.

5.1.2. Screening of Small Seed Common Bean Genotype for Major Diseases in Kellem Wollega Zone.

Small seed Common bean genotype Screening. 13 genotypes of Small seed genotypes which was resistant to major disease was promoted to breeder.

5.1.3. Advanced Screening of Sorghum (Sorghum bicolor L.) Germplasm Resistant to Anthracnose and Grain Mold Diseases in Kellem Wollega Zone.

24 genotypes of sorghum with resistant to major diseases were promoted to further study.

5.2. Major activities performed under each ongoing research activities

5.2.1. Effect of Potato Varieties and Fungicides in Management of Late Blight (Phytophthora infestans).

Three Fungicides: Redomil Gold, Mancozeb and Ethiofixer Fungicides with three application frequency were performed. Three fungicide with three application frequency was evaluated. Potato late blight data was recorded and Efficacy of three fungicide was seen and analysed to SAS software .

Table 1. Effect of Potato varieties and Fungicides Frequency in Late Blight

SV	Df	Mean Square				
		SC	ILB	SLB	IPV	TY
Trt	2	130.20	10.06	81.06	16.46	1242.97
Error	57	10.31	23.68	1090.66	10.40	835.73
Total	59					
CV		14.15	39.30	63.98	86.38	63.91

Where SC= Stand count, ILB= Late Blight Incidence, SLB= late blight Severity, IPV= PotyVirus incidence, TY= Total Yield



Figure 1. After fungicide applied on potato

5.2.2. Screening of Finger Millet Germplasm Resistance to Blast in Kellem Wollega Zone

Objective of the study was to identify Finger millet germplasms resistant /tolerant diseases. The materials evaluated under natural disease epidemics. Major diseases; blast, cescospora leaf spot, bacteria leaf spot and common blight incidence and severity was recorded. About 61 genotypes were promoted for further study

5.2.3. Assessment of Prevalence and Severity of Diseases on Major Horticultural crops in West Wollega And Kellem Wollega

Assessment was done at Qellam Wallaggaa zone on three major horticultural crop; Hot pepper, Anchote and Tomato. Hotspot area was selected purposively with Agricultural zone office. So, four district was selected and prevalence of Anchote and hotpepper disease was identified. However, due to security problem this activity was not done atwest Wallaggaa Zone. So this activity registered as extended activity

Districts	No. of fields	Types and incidence %						
		Ant	BLS	CLS	FW	Leaf B	MV	PhB
Daallee Sadii	23	17.18	15.92	21.41	10	19.55	2.33	12
Sadii Canqaa	13	29	17.74	20.9	25	28.12	19	34
H/ Galaan	9	15	18	13	15	22	16	14

Ant= Anthracnose, BLS= Bacterial Leaf Spot, CLS= Cercospora Leaf Spot, LB= Leaf Blight, MV= Mosaic Virus, PhB= Phytophthora Blight



5.2.3. Assessment and Identification Weeds of Major Cereal Crops in West Wollega And Kellem Wollega.

This activity is proposed to be done for two years. 14 kebele of Three district data were collected

Table.1 Characteristic features of surveyed major cereal crops fields in one Zones of study area.

Zone	Districts	No.of field assessed	Altitude (m.a.s.l)
Kellem Wollega	S/chanka	24	1312_1500
	D/Sadi	32	1452_1605
	L/kile	28	1355_1507
	Total	84	



5.2.4. Integrated Management of Weeds in Common Bean (*Phaseolus vulgaris* L.) Through Hand Weeding and Hoeing in West Wollega And Kellem Wollega

Intermediate result: Table 2. Integrated weed management of common bean through hoeing and hand weeding on plant height, number of branches, number of pods per plant, seed pods per plant, and hundred seed weights

Treatments	PH	NB	PPP	SPP	HSW
1HW	40.56ab	3.65ab	8.80abc	3.45ab	37.45ab
2HW	41.1a	4.00a	9.86ab	3.55ab	38.41a
3HW	41.66a	3.58ab	10.18a	3.43ab	38.71a
1HW+1H	39.95ab	3.50ab	8.33bc	3.25bc	38.75a
2HW+1H	40.51ab	3.55ab	8.77abc	3.81a	38.80a
3HW+1H	41.23a	3.38b	8.26bc	2.93c	37.56ab
1H	38.40b	3.38b	8.51abc	3.31bc	36.35b
WC	39.42ab	3.13b	8.0500c	2.91c	37.13ab
WF	39.4ab	3.46b	8.63abc	3.31bc	38.83a
LSD (0.05)	2.57	0.52	1.68	0.42	38.83
CV (%)	5.45	12.82	16.24	10.96	4.11

5.2.5. Integrated Management of Termite in Hot Pepper (*Capsicum annum*) in kellem Wollega Zone

The experiment was conducted using Melka Dera variety of Small pod hot pepper. Management method was Integrated insect management system which include botanical Neem tree (*Azadracta indica*), cultural (putting different wood ash in the soil) between row of the crop, chemically by applying different insecticides such as Megaban plus (Chlorpyriphos-Ethyl 48% EC), Chlorpyrifos, Chlourguard and Dursban.

6. Coffee and Tea Research

6.1. Major activities performed under each ongoing research activities

6.1.1. Adaptation trial of improved coffee varieties at West and Kellem Wollega zones

In this 2015 year; yield and yield component data's were collected from Hawa Galan and Haro Sabu location trial as indicated in the following (Table 1 & 2) respectively. Up to a date, from evaluating materials; sinde improved coffee variety have been best performance. All recommended field management practices were done uniformly as needed.

Table 1: Combined mean of yield and yield components of coffee adaptation trial at Hawa Galan location in 2015E C.

Variety	PH	HFPB	DiMS	NMSN	NPB	LLPB	AvLLPB	NSB	AvILMS	NILPB	LA (cm ²)	CANDIA (cm)	GBY/ha (Kg)	Disease severity
														Leaf rust
Dessu	104.63a	8.3767c	2.5400b	15.75c	40.377b	50.63bc	46.927dc	19.377a	4.05a	12.75b	28.98	88.253b	819.4ba	1.67ba
Local	120.63a	3.8767d	3.1900a	16.50bc	66.75a	109.75a	77.077a	15.627ba	4.25a	16.75ba	29.95	116.00a	839.2ba	1.00b
Chala	77.00b	21.000a	1.4300c	10.250d	15.250c	36.00c	30.750d	6.000b	2.55b	7.75c	26.04	62.25c	347.00b	1.00b
Sinde	122.33a	2.0833d	2.7533b	23.00a	53.00ba	107.08a	70.457ba	18.833a	3.63a	17.25a	28.25	116.67a	1701.4a	2.33a
74110	107.25a	12.1267b	2.4800b	20.46ba	40.377b	75.75b	55.327bc	11.50ba	4.13a	17.627a	28.80	97.19ba	542.00b	1.00b
LSD(0.05)	25.57	2.18	0.41	4.03	19.86	30.79	16.32	11.41	0.96	4.23	ns	20.26	1125.60	1.29
CV	12.77	12.20	8.73	12.45	24.41	21.56	15.45	42.48	13.76	15.57	13.82	11.20	70.35	48.80

PH=plant height, HFPB=Height up to first primary branch, NMSN=Number of main stem, LLPB=Length of longest primary branch, AvLLPB=Average of length of longest primary branch, NSB=Number of secondary branch, LA=leaf area, CANDIA=Canopy diameter GBY/ha=Green bean yield per hectare

Table 2: Mean performances of yield, yield component and disease severity data of coffee adaptation trial at Haro Sabu on station in 2015EC.

Variety	PH	HFPB	DiMS	NMSN	AvILMS	NPB	LLPB	AvLLPB	NSB	NILPB	CANDIA	GBY/ha (kg)	Disease severity(1-9) scale
													Leaf rust
Desu	144.38	9.50	3.86	20.34	4.93a	30.13	86.13	78.10	44.75	19.63	110.19	1335.20	2.00ba
Manasibu	132.38	19.38	2.51	20.63	2.56b	43.13	67.90	55.03	29.63	10.75	91.75	366.50	1.00b
Sinde	151.25	4.25	3.55	23.00	2.33b	39.00	104.75	83.45	51.50	12.50	117.88	395.80	3.00a
LSD	NS	NS	NS	NS	0.945	NS	NS	NS	NS	NS	NS	NS	1.31
CV	13.15	66.37	30.26	23.70	12.72	26.63	26.89	31.22	33.25	56.86	25.51	98.78	28.87

PH=plant height, HFPB=Height up to first primary branch, NMSN=Number of main stem, LLPB=Length of longest primary branch, AvLLPB=Average of length of longest primary branch, NSB=Number of secondary branch, LA=leaf area, CANDIA=Canopy diameter, GBY/ha=Green bean yield per hectare



Figure1: Picture of activity on field

6.1.2. Evaluation and Characterization of coffee landraces for lowland areas of West and Kellem Wollega zones

All recommended field management practices were done uniformly as needed. From lowland coffee collections about 12 accessions and 2 standard checks were performed. So, from performed accessions 2nd year yield and yield components data's were collected as indicated in the following (Table 3)

Table 3: 2nd year mean performances of yield and yield components of lowland coffee collection established at Haro Sabu in 2015 EC.

Sn.	Check	Ph	hfpb	dims	nmsn	avilms	Npb	llpb	avlpb	nsb	nilpb	candia	GBY/ha(Kg)
1	Check A	124.38	15.38	2.49	16.88	3.21	25.38	55.13	39.85	24.38	11.00	62.31	169.84
2	Check B	138.50	6.63	2.68	18.13	3.73	33.00	83.25	67.88	17.63	37.00	87.81	139.91
Mean		131.44	11.00	2.58	17.50	3.47	29.19	69.19	53.86	21.00	24.00	75.06	154.88
	Accn no.												
1	accn 53	148.75	9.50	2.75	25.75	3.85	43.50	79.00	58.35	21.00	40.75	101.13	372.13
2	accn 56	65.50	10.50	1.05	9.00	1.40	16.50	40.00	25.65	10.25	17.50	36.38	12.50
3	accn 105	82.75	1.50	1.43	13.25	2.25	24.75	53.00	34.20	12.25	26.75	32.38	571.88
4	accn 7	99.75	0.00	1.35	9.75	2.40	19.00	54.75	35.65	9.25	7.50	46.38	180.00
5	accn 6	88.00	8.00	1.38	12.25	3.00	22.75	43.75	30.25	9.00	8.75	52.63	145.44
6	accn 10	155.25	7.50	2.60	20.75	3.80	42.00	57.50	50.85	17.25	33.00	75.38	55.56
7	accn 5	125.25	7.25	2.30	22.25	3.00	43.25	64.25	37.15	12.00	20.25	68.25	153.19
8	accn 13	136.50	10.00	3.23	23.25	3.95	49.50	76.50	59.30	16.75	62.75	107.50	1476.38
9	accn 3	136.25	1.00	2.03	18.75	4.75	34.75	110.00	51.70	16.00	36.00	66.00	82.25
10	accn 12	115.25	27.25	1.75	12.25	3.90	20.00	56.00	37.40	8.50	19.25	52.00	6.06
11	accn 8	147.75	10.00	3.03	32.25	4.65	37.00	110.50	58.30	19.25	23.50	86.13	172.94
12	accn 32	79.25	4.50	1.25	13.75	2.20	16.50	24.25	19.35	8.00	9.75	34.00	17.25
Mean		115.02	8.08	2.01	17.77	3.26	30.79	64.13	41.51	13.29	25.48	63.18	270.46

Check-A= Mana sibu, Check-B= Haru-I, Check-C= Dessu and accn=accession

6.1.3. Evaluation and Characterization of coffee landraces for highland areas of West and Kellem Wollega zone

From established highland coffee accessions 1st year yield and yield component data and disease severity data (leaf rust) were collected in this year. All recommended field management practices are done uniformly as per the recommendation.

Table 4: Mean performances of Yield and disease severity data in 2015 EC.

No.	Accn.	GBY/ha (kg)	Leaf rust severity	No .	Accn.	GBY/ha(kg)	leaf rust severity	No .	Acc n.	GBY/ha(kg)	Leaf rust Severity
1	42	695.13	3	15	158	18.81	1	29	3	1001.75	1
2	115	75.38	3	16	96	501.38	3	30	22	1647.13	1
3	137	519.5	1	17	113	1699.63	1	31	0 2	247.44	1
4	104	120.69	3	18	114	30.88	1	32	43	2688.75	1
5	99	78.56	1	19	138	902.63	1	33	32	565.19	1
6	128	713.69	1	20	162	57.06	1	34	26	653.25	1
7	148	951.81	1	21	110	93.13	1	35	30	1211.44	1
8	130	1015	1	22	46	329.94	1	Standard checks			
9	146	2796.88	3	23	20	493.75	3	No.	Chec k	GBY/ha(kg)	Leaf rust severity

10	145	984.75	3	24	7	2090.5	1	1	A	2728.9a	1.33
11	82	733.25	1	25	6	2326.25	1	2	B	224.2b	1.33
12	85	239.94	1	26	11	615.69	1	3	C	1258.0b	1.67
13	68	81.63	1	27	13	1353.06	3		LSD (5%)	1108.9	ns
14	166	160.69	1	28	27	3409.88	1		CV (%)	61.41	32.64

A=Mana sibu, B=Haru-1, C=Desu

6.1.4. Effect of integrated weed management methods on Arabica coffee yield and Cup quality at West and Kellem Wollega zones of Oromia

For the study since improved coffee varieties were transplanted on the main field. To achieve the objectives of the study integrated weed management methods were applied as its treatment arrangements. Weed data were collected from each treatment in 50*50cm quadrant and Mean of weed density was determined as indicated in the following (Table 5). All routine field management rather than treatment like; shade, fertilizer and watering were applied uniformly as per recommendation.

6.1.5. Effect of integrated weed management methods on Arabica coffee yield and Cup quality at West and Kellem Wollega zones of Oromia

For the study since improved coffee varieties were transplanted on the main field. To achieve the objectives of the study integrated weed management methods were applied as its treatment arrangements. Weed data were collected from each treatment in 50*50cm quadrant and Mean of weed density was determined as indicated in the following (Table 5). All routine field management rather than treatment like; shade, fertilizer and watering were applied uniformly as per recommendation.



Table 5: Mean of sampled of weed density of the effect of integrated weed management methods in 2015E.C.

S/ N	Treatments	Quadrant(50cm*50cm)		Types of weed species in the experimental site
		Broad leaf	Grass weed	
1	Two times slashing and digging,	31.33	8.33	Ageratum conyzoides L., Amarannus hybrids, commolinadiffusal, bidenpachyloma, cynodondactylon, Elusinaindica, Biden pilosa, Nicandraphysolodes, Guzostia scarab, Artemisia draeulncy, Galysogaparviflora
2	One time slashing + round up(2lt/ha),	39.83	14.17	
3	One time slashing + mulching with un-decomposed coffee husk at 15ton/ha,	31.17	10.83	
4	Un-decomposed coffee husk mulching at 15ton/ha,	49.00	7.50	
5	Roundup(2lt/ha) + un-decomposed coffee husk mulching at 15ton/ha,	40.00	7.83	
6	Noug (Guizitiaabyssinica L) cover crop at 20kg/ha,	40.33	6.33	
7	One time slashing + round up(1.5lt/ha) + un-decomposed coffee husk mulching at 10ton/ha	40.33	7.83	
8	Noug (Guizitiaabyssinica L) cover crop at 15kg/ha + un-decomposed coffee husk mulching at 10ton/ha	28.00	10.83	
	LSD(0.05)	Ns	Ns	

6.1.5. Assessment of pre and postharvest management practices affecting Arabica Coffee (Coffea Arabica L.) Quality in west wollega and Kellem wollega zone

To achieve the objectives of the study, Survey sample collection questionnaires were prepared and to conduct survey three districts were selected from each zone based on coffee production level. Accordingly three kebeles were selected from each selected districts based coffee production level of the districts as indicated in the following (Table 6).

Table 6: Selected study area

From West Wollega zone		From Kellem Wollega zone	
Selected districts	Selected Kebeles	Selected districts	Selected Kebeles
Lalo Asabi	Jarso Damot	Sadi Canqa	Kombo
	Nabbo Dalati		Ciracha
	Horda Dalati		Dogono
Haru	Genet Abo	Sayo	Alaku Gambi
	Kombosha yonge		Ado Sako
	Wara Baro		Duli
Homa	Homa giyorgis	Dale Sadi	Hawetu Gendaso
	Siba yesus		Arere Hogiho
	Homa city		Chamo

6.1.6. Effects of Pot Size and different soil media on Emergence and Subsequent Seedling Growth of Coffee (Coffea Arabica L.) in west and Kellem Wollega zones of Oromia

To achieve the objective of the study; soil sample physicochemical analyses were done (Table 7). As well as; Seedling emergency data were recorded starting from 45th up to 90th days to sowing at an

interval of 15 days till complete emergence and Mean days to emergency, percent emergency, emergency rate and seedling vigor index at two true leaves were determined and analyzed. And also, shoot extension growth data were recorded after the completion of days of emergency at an interval of a month. For this study the remains are growth data and dry matter partitioning data interring and full write up.

Table-7: Physicochemical properties of forest soil and soil media

Soil Sample	Parameters										
	pH (H ₂ O)	Total Nitrogen (%)	Available P (ppm or mg/kg soil)	Excha. Acidity (meq/100g Soil)	Excha. Ca (meq/100g Soil)	Excha. Mg (meq/100g Soil)	Exchangeable Na (cmol (+)/kg soil.	Exchangeabl K (cmol (+) /kg Soil.	CEC (meq/100g Soil)	Organic Carbon (%)	Soil Texture Classification
FS	5.35	0.43	1.36	0.31	19.44	6.20	0.28	0.31	29.27	5.23	Clay Loam
3FS:2C:1S	6.25	0.54	17.36	0.48	14.86	8.06	0.63	--	29.98	6.02	Sandy Clay Loam
3FS:1C:0S	6.16	0.44	12.08	0.55	14.33	5.21	0.61	--	22.86	4.96	Clay Loam
2FS:1C:1S	6.18	0.47	12.10	0.44	16.59	5.71	0.54	--	24.37	4.68	Sandy Clay Loam

FS=Forest Soil; C= Compost; S=Sand

Table 8: Combined means for seedling emergency and seedling vigor index at early growth stage

Treatment	MDE	%E	ER	SVI-2
Pot size				
12*22	63.73 ^a	84.31	0.28	7.14
10*20	60.86 ^b	85.56	0.29	7.41
8*18	58.02 ^c	83.89	0.28	7.02
LSD (0.05)	1.73	NS	NS	NS
CV	1.64	5.55	5.42	6.73
Soil media				
FS	58.45 ^c	88.52	0.30	8.22a
3FS:2C:1S	63.35 ^a	82.59	0.27	6.24c
3FS:1C:0S	60.43 ^{bc}	83.71	0.28	7.46ba
2FS:1C:1S	61.24 ^b	83.52	0.28	6.63bc
LSD (0.05)	2.00	NS	NS	1.15
CV	1.64	5.55	5.49	8.03

*Means with the same letters are not statistically different at $P \leq 0.05$, NS= Non significant, MDE- Mean Days to Emergence; ER- Emergency Rate; %E- Percentage of Emergency, SVI- Seedling Vigor index at six month



7. Livestock Research Process

7.1. Animal feed and Range land mgt team

7.1.1. Major activities performed under each ongoing research activities

7.1.1.1. Nursery observation of *Sesbania sesban* (L.) Merrill genotypes

The experiment was conducted with the objective to evaluate and select superior *Sesbania sesban* (L.) Merrill genotypes for fodder yield and disease/pest tolerant to the next breeding stage. About a total of forty four (144) genotypes and one standard check (DZF-405) were brought from ILRI forage gene bank and Debre ziet ARC respectively, and they were evaluated at HsARC (On station). The augmented design was used as the experiment design with having the plot size of 2 m x 2 m. All the planted *Sesbania sesban* (L.) Merrill was germinated and some are dried gradually. Phenological and agronomic parameters like emergence date, growth habit, stand and vigor, plot coverage, plant survival, leafiness, plant height were recorded. Biological data (forage yield, seed yield and disease/insect) was measured and recorded. Based on the mean performance, the forage yield, disease/insect reaction, and other parameters data were varied among the tested genotypes. Therefore, thirty five (35) superior yield and disease/insect tolerant candidate genotypes against the check were selected and promoted to the next breeding stage.

7.1.1.2. Guinea grass (*Panicum maximum* jacq.) RVT

The study was carried out at Haro sabu (on station), Kombo and Ayira sites for two consecutive years with the objective to evaluate, select and promote high yielding and disease/pest tolerant *Panicum maximum* accessions/genotypes. Eleven Guinea grass (*Panicum maximum*) accessions/genotypes including standard check 'Degun geziya' variety were evaluated. The accessions/genotypes were evaluated in a Randomized Complete Block Design with three replications. The agronomic and biological data were recorded and measured. Mean dry matter yield was higher for accession/genotype NG-0105 (15 t/ha) and NG-0104 (13.97 t/ha) across locations giving a yield advantages of 40.58% and 30.93% over standard check, respectively. With regard to disease reaction, all accessions tested in the present study in general and NG-0105 and NG-0104 in particular showed good tolerance to the *Panicum maximum* diseases. In addition, the selected accessions/genotypes had good forage quality as compared to the check. Therefore, NG-0105 and NG-0104 accessions/genotypes were promoted to next stage with standard check independently.

7.1.1.3. *Pennisetum polystachion* RVT

The study was carried out at Haro sabu (on station), Kombo and Ayira sites for two consecutive years with the objective to evaluate, select and promote high yielding and disease/pest tolerant *Pennisetum polystachion* accessions/genotypes. Four accessions/genotypes and one standard check (Nechsare) of *Pennisetum polystachion* grass were evaluated. RCBD was used with having a plot size of 1.8 m x 3 m. The necessary agronomic and biological data were recorded and measured. Accessions of NG-0121 and NG-0057 were performed more in agronomic performance, dry matter yield and

disease/pest tolerance and are stable than the other accessions/genotypes and standard check across the locations. However, those genotypes had lowered the nutritive values as compared to the standard check, while greater than the threshold required for ruminant animals. Therefore, NG-0121 and NG-0057 accessions/genotypes were promoted to next stage with standard check independently.

7.1.1. 4. Rhodes grass (*Chloris gayana*) preliminary variety trial

The experiment was conducted with the objective to evaluate and select high yielder, disease and pest tolerant Rhodes grass (*Chloris gayana*) genotypes for the next breeding stage. About a total of fifteen (15) genotypes and one standard check (Massaba variety) were evaluated at On-station of Haro sabu ARC. The simple lattice 4*4 design was used as the experiment design with having the plot size of 1.2 m x 2 m. Phonological and Agronomic Parameters like emergence date, growth habit, stand and vigor, plot coverage, plant survival, leafiness, plant height were recorded. Biological data (forage and seed yield) and disease/pest were measured and recoded. Based on the mean performance, the forage yield, disease/pest reaction, and other parameters data were varied among the tested genotypes. Therefore, nine (9) candidate genotypes which had higher yield advantages over the standard check and disease/pest tolerant were selected and promoted to the next breeding stage.

7.1.1.5. Sesbania machranta Preliminary Variety Trial

The experiment was conducted with the objective to evaluate and select high yielder, disease and pest tolerant *Sesbania machranta* genotypes for the next breeding stage. About a total of twenty four (24) genotypes and one standard check (DZF-0092) were evaluated at On-station of Haro sabu ARC. The simple lattice 5*5 design was used as the experiment design with having the plot size of 4 m x 4 m. Phonological and Agronomic Parameters like emergence date, growth habit, stand and vigor, plot coverage, plant survival, leafiness, plant height were recorded. Biological data (forage and seed yield) and disease/pest were measured, collected and recoded. Based on the mean performance, the forage yield, disease/pest reaction, and other parameters data were varied among the tested genotypes. Therefore, ten (10) candidate genotypes which had higher yield advantages over the standard check and disease/pest tolerant were selected and promoted to the next breeding stage.

7.2. Major activities performed under each ongoing research activities

7.2.1. Brachiaria brizantha Preliminary Variety Trial

Activities/work done so far

The activity was conducted at On-station of Haro sabu ARC during the main cropping season of 2022/23 with the objective to evaluate and select superior yield, and disease/pest tolerant *Brachiaria brizantha* genotypes. Twenty five (25) *Brachiaria brizantha* genotypes were established and evaluated. Simple lattice 5*5 design was used as experimental design. The planted genotypes showed lower survival rate and performance due to termite problem during the time of planting and the nature

of plant that have slow growth habits. Because of this the required parameters were not collected and measured.

Reason for Extension

Termite problem affected rejuvenation/re-growth of plant genotypes. The grass has slow growth behavior during establishment period, and because the required data measurements and records was not taken. Therefore, the team has decided to extend the experiment for additional two year to get full necessary data.

7.3. Apiculture Research Team

7.3.1. Major findings from completed research activities in the year

7.3.1.1. Physicochemical properties, Antioxidant and Antibacterial activities of monofloral honey (*Apis mellifera* L.) types produced in Ethiopia (Coordinated work: EIAR)

Summary of the activity

The activity was initiated with the objective of evaluating the antioxidant, antibacterial and physicochemical activities of honey based on floral source. Accordingly six different monofloral honey, namely: *Guizotia scabra* (75.3%), *Coffee arabica* (68.6%), *Vernonia amygdalina* (90.5%), *Schefflera abyssinica* (100%), *Croton macrostachyus* (64.4%) and *Eucalyptus globulus* (100%) were cropped through December, February, February, April, May, and June respectively. All the tested honey types exhibited good antioxidant properties with the highest total phenol content (TPC) (77.2 ± 0.7 mgGAE/100g of honey), total flavonoid content (TFC) (65.0 ± 3.8 mgQE/100 g of honey), and antioxidant content (AC) (65.4 ± 0.3 mg AAE/100 g of honey) by *V. amygdalina* whilst *S. abyssinica* was the least in TPC (24.1 ± 0.4 mgGAE/100g of honey), TFC ($18.6 \pm 2.765.0 \pm 3.8$ mgQE/100 g of honey) and AC ($5.6 \pm 0.565.4 \pm 0.3$ mg AAE/100 g of honey). Regarding on antibacterial susceptibility test, *C. macrostachyus*, *V. amygdalina*, *G. scabra* and *C. arabica* were comparatively more effective, while *S. abyssinica* was the least effective at inhibiting the growth of all bacterial isolates tested. The large grand mean zone of inhibition ranged from 16.9 ± 1.2 mm by *C. macrostachyus* to 10.51 ± 0.9 mm by *S. abyssinica* honey against all bacterial isolates. Besides, the MIC of the botanical honey type ranged from $11.7 \pm 3.3\%$ w/v in *C. macrostachyus* vs. *S. aureus* to $37.5 \pm 1.0\%$ w/v in *S. abyssinica* vs. *P. aeruginosa*.

7.3.2. Major activities performed under each ongoing research activities

7.3.2.1. Physicochemical composition, Antibacterial and Antioxidant activities of bee pollen from Haro Sabu, Kelem Wollega Zone

Work done so far:

Major pollen releasing plants namely *Bidens prestinaria*, *Bidens pilosa*, *Guizotia* spp, *Vernonia* spp, *Eucalyptus* spp and *Croton macrostychus* were recognized and their pollen were collected. They all demonstrated a good antioxidant properties (phenol, flavonoid and total antioxidant content) with the

highest total phenol content (TPC); $69.34.2 \pm 0.7$ mgGAE/100g of pollen, total flavonoid content (TFC); 53.0 ± 1.8 mgQE/100 g of pollen, and antioxidant content (AC); 53.4 ± 0.3 mg AAE/100 g of pollen by *Eucalyptus* spp whilst *Guizotia* spp was the least in TPC (34.3 ± 0.8 mgGAE/100g of pollen), TFC ($8.6 \pm 2.765.0 \pm 3.8$ mgQE/100 g of pollen) and AC ($14.6 \pm 0.565.4 \pm 0.3$ mg AAE/100 g of pollen). Their physicochemical and antibacterial activities are underway.

7.3.2.1. The effect of Honeybee (*Apis mellifera* L.) pollination on seed yield and nutritional qualities of Sesame (*Sesamum indicum* L.) at Dale Sedi, Kellem Wollega **Work done so far:**

The activity was initiated with the objective of identifying the effect of bee pollination on seed yield and nutritional composition between pollinated and not pollinated *Sesamum indicum* L. (Dincho variety) at Haro Sebu on station. An average of 11.26 Kun/ha from a plot caged with bees, 10.84 Kun/ha from an open plot and 7.80 Kun/ha from a plot excluded from any pollinators (insects) were recorded. Nutritional qualities analysis are underway.

8. Socio-economics Agricultural Extension Research

8.1. Agricultural Extension Team

8.1.1. Major findings from completed research activities in the year

8.1.1.1. Pre-Extension Demonstration and Evaluation of Teff Technologies in Selected Districts of West Wolega and Kelem Wolega Zones

Now day's teff is among the major cereal crops cultivated in Ethiopia. Considering this in to account adaptation trial of different teff varieties had been conducted by Haro Sebu agricultural research center and recommended some varieties to be demonstrated. Following this Pre-Extension Demonstration and Evaluation of Tef Technologies in Selected Districts of West Wolega and Kelem Wolega Zones was conducted with the objective of demonstrating and evaluating the yield performance and profitability of teff technologies under farmer's management condition. Dukem variety was demonstrated both on selected farmers' fields and FTC under their management condition. The plot area of 100 m² was used for each variety. All necessary data were collected and analyzed using SPSS software and the result was presented using simple descriptive statistical tools. The result indicated that the newly demonstrated variety provided lower mean yield (mean yield of Dukem 9.52 qt/ha), when compared with the slandered checks (mean yield of dursi 12.02 qt/ha and mean yield of Guduru 10.38 qt/ha). Participatory variety selection techniques were also used in all accessible sites at maturity stage of the crop. During participatory variety selection all FRG members, DAs and model farmers were invited in to demonstration field to evaluate the performance of the verities setting their own criteria. Farmers' preferences feedbacks were collected and analyzed using pair wise matrix rankings. In the ranking, Dukem variety was selected as the least performed variety while dursi was selected as the best performed variety among compared varieties. Accordingly, dursi variety (standard check) was preferred and selected first by farmers for its highest yield, medium plant size, early maturity, and medium lodging percentage while Guduru was selected second by farmers for its seed quality, medium yield and large stoke. Thus, the demonstrated variety could not pass to pre scaling up

stage. Therefore, the target team should focus on other new teff varieties which could respond to farmers' feedback in the study areas.

8.1.1.2. Pre-Extension Demonstration and Evaluation of Small Pod Hot Pepper Technologies in Selected Districts of West Wollega and Kellam Wollega Zones

Hot pepper is the most widely produced horticultural crops in West and Kelam wollega zones. Considering this Pre-Extension Demonstration and Evaluation of Hot Pepper Technologies in Selected Districts of West Wollega and Kellem Wollega Zones was conducted with the objective of demonstrating and evaluating the yield performance and profitability of hot pepper technologies under farmer's management condition. Melka oli and Melka dera varieties were demonstrated with a local check. The plot area of 100 m² was used for each variety. Training was given for a total of 26 farmers, 6 DAs, and 4 agricultural experts during this activity implementation on the contents of improved agronomic practices needed and post-harvest handling required for hot pepper yield and seed quality. Data were collected from a total of fifteen (15) farmers' fields. The result indicated that the mean yield obtained from Melka oli, Melka dera and local varieties were 15.13 qt/ha, 12.68 qt/ha and 11.46 qt/ha respectively. Accordingly, the yield advantage of 56.73 % and 44.53 % were obtained from Melka oli and Melka dera over the local variety respectively. Participatory variety selection techniques were used in all accessible sites at maturity stage of the crop. During participatory variety selection, all FRG members, DAs and model farmers from vicinity were invited to the demonstration fields to evaluate the performance of the varieties setting their own criteria. Farmers' preferences feedbacks were collected and analyzed using pair wise matrix rankings. Melka oli variety was selected first for its highest yield potential, medium pod size, medium maturity, uniform pod color, easiest release of the pod from calyx and closeness of the pod. Melka dera variety was selected second for its medium yield potential, most tolerance to disease, most attractive pod color, largest pod size, late maturity, ease of release from calyx, and closeness of the pod. Local variety was selected in third place for its early maturity, lowest yield potential, medium disease tolerance than Melka oli and smallest pod size. There should be appropriate mechanism to access this selected varieties for farmers in the study area. Thus both zonal and district level agricultural offices, agricultural cooperatives and unions as well as HSARC should avail such important technologies to farmers in the study areas.

8.1.1.3. Pre-Extension Demonstration and Evaluation of Improved Common Bean Technologies in Selected Districts of West Wollega and Kellam Wollega Zones.

Common bean (*Phaseolus vulgaris* L.) is an essential pulse crops in western Ethiopia used for food and cash crop. However, the actual grain yield of common bean on smallholder farmers is low (11qt/ha) compared with the mean grain yield of (19 qt/ha) obtained adaptation. Based on this, Pre-Extension Demonstration and Evaluation of Improved Common Bean Technologies in Selected Districts of West Wollega and Kellam Wollega Zones was implemented to evaluate the yield and profitability of the common bean technologies under farmers condition. The trial was replicated on a total of fifteen (15) farmers' fields for two consecutive years (2021–2023 G.C). Haro Sebu-1 variety

was demonstrated with a standard check (nasir) variety. The results indicated the mean yields of 15.64 qt/ha and 12.14 qt/ha were obtained from haro sebu-1 and nasir varieties respectively with yield advantage of 28.83 % of the newly demonstrated variety over the standard check. During participatory varieties selection farmers assessment feedbacks were collected. The newly demonstrated variety was preferred by farmers because of its high-yielding, early maturity, seed per pod, pod per plant, seed colour and disease-tolerance traits. There should be appropriate mechanisms that deliver this selected variety to the common bean producers for the sustainable production of common bean in the study areas. Offices of agriculture both at zonal and district level should create awareness on appropriate planting time of common bean. In addition, research institutions should focus on solving insect (bean stem maggot) and diseases (rust and halo blight) to improve the production of common bean in the study area and areas with similar agro-ecology.

8.1.1.4. Pre-extension Demonstration and Utilization of Triticale (X-Triticosecale) Technologies in West Wollega and Kellem Wollega Zones

Triticale is an essential newly introduced cereal crop in Ethiopia used for food and feed. However, farmers in the study area do not know this crop. Based on this, Pre-extension Demonstration and Utilization of Triticale (X-Triticosecale) Technologies in West Wollega and Kellem Wollega Zones was conducted to evaluate the yield performance and utilization of Triticale technologies under farmers' condition. Zenkiet variety was demonstrated with a standard check (Kombolcha variety). Data was collected from a total of eight (8) farmers' fields for two consecutive years (2020–2022 G.C). The results indicated that the mean yield of 26.08 qt/ha and 25.59 qt/ha were obtained from Zenkiet and Kombolcha varieties respectively with yield advantage of 1.91% of the newly demonstrated variety over the standard check. During varieties evaluation and selection by stakeholders although the newly demonstrated variety was high yielder than the standard check farmers selected both varieties because of small yield difference, similar maturity, seed per plant, seed size and disease-tolerance. There should be an appropriate system that delivers this new technology to the farmers in the study areas. In addition to this, utilization training should be given to farmers in the study area by agricultural bureaus and offices, Haro Sebu Agricultural Research Center, agricultural focused NGOs and cooperatives for sustainable production of triticale technologies in the study area.

8.1.2. Major activities performed under each ongoing research activities

- ❖ **Note: Use tables a&b below for pre-extension demonstration and pre-scaling up activities to summarize the required information**

Table a): Pre-extension demonstration activities performed in the year (support with pictures)

No	Title of the activity	Name of the technologies demonstrated	Location (district, PAs and FTCs)	Plot size (ha) per farmer used for the trial	Quantity/amount of the technology distributed	Number of participant farmers/pastoralists					Benefits obtained (productivity/income gain)
						Adult men	Adult women	Young men	Young women	Total	
1.	8.1.2.1. PED of Improved Sorghum Technologies in Selected Districts of West and Kelem Wolega Zones, West Oromia.	Sedi	Dale Sedi (Cammo 2, B/Birbir) Seyo (H/Karro) Mana Sibru (Benguwa)	100 m ²	0.15 kg per farmer's field	47	13	0	0	60	Yield advantage of 25.37 % over the local variety
2.	8.1.2.2. PED of Field Pea Technologies in Selected Districts of West Wolega and Kelem Wolega Zones	Bilalo, Adi and Burkitu	Dale Sedi (Belam), H/Galaan(Arrere) Bo/Dirmaji (Leta Bobine & Daro Sombo } Gimbi(I/Dabal & B/Tokuma) Nadjo(Bariyo Badeso & Lalisa Qami	100 m ²	1.5 kg per farmer's field	113	24	1	0	138	Bilalo=9.89 qt/ha with yield advantage of 5.21 % over local
											Adi=10.73 qt/ha with yield advantage of 14.14 % over local
											Burkitu = 11.16 qt/ha with yield advantage of 18.12%
3.	8.1.2.3. PED of large seed sized Common Bean Technologies in Selected Districts of West Wolega and Kelam Wolega Zones	Jabdu	Dale Sadi (A/Gandaso and B/Birbir) Lalo Asabi (O/Dalatti & J/Damota	100 m ²	0.95 kg per farmer's field	48	12	0	0	60	Jabdu =12.62 qt/ha with yield advantage of 22.52 % over local
4.	8.1.2.4. PED of Groundnut Technologies in Selected Districts of West Wolega and Kelam Wolega Zones	Bulki	Dale Sedi (Chamo, Chamo2 , A/Cole)	100 m ²	0.9 kg per farmer's field	58	18	8	0	84	Bulki=13.68 qt/ha with yield advantage of 5.47 % over manipinter which is standard check



PED of Sorghum at Dale Sedi (Chamo), 2015 E.C



PED of Field Pea at Dale Sedi (Belam) , 2015 E.C



PED of Large Seed Sized Common bean at Dale Sedi , 2015 E.C



PED of Large Seed Sized Common bean at L/Asabi , 2015 E.C



PED of Triticale Nedjo (Gida Qumbi), 2014 E.C



PED of Ground nut in D/Sedi (Cammo), 2015 E.C

Table b): 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 and PAs)	Plot size (ha) per farmer used for the trial	Quantity/amount of the technology distributed	Number of participant farmers/pastoralists					Benefits obtained (productivity/income gain)
						Adult men	Adult women	Young men	Young women	Total	
1.	8.1.2.5. Pre-scaling up of Desho Grass Technologies in Selected Districts of West Wolega and Kellem Wollega Zones of Oromia Regional State.	Kindu Kosha -2 and Kulumsa	Sayo(H/Karo & Shogo), Dale Sadi(Belam, A/Gabi, A/Ogiyo) Guliso(Warabu) , Lalo Asabi(O/Dalati & Inango	0.01- 0.17 ha	6 qt/Kebele	157	38	13	0	208	Around 256 cattle had benefitted from this technology.



8.2. Socio economic team

8.2.1. Major activities performed under each ongoing research activities

8.2.1.1. Assessment Pepper Production and Marketing Systems in the Case of West and Kellem Wollega Zone, Oromia.

Work done so far:

Regarding the status of the activity, study site was selected from both Kellem Wollega and West Wollega Zones. Accordingly, two districts namely; H/gelan and S/Chenka from Kellem Wollega zone and Nedgo and Gimbi from West Wollega zone based on potential of Pepper production and accessibility were selected. The secondary data were collected from Bureau of Agriculture. Checklists and structured questionnaires were prepared for FGD and primary data collection. Primary data (Survey) was conducted from Kellem wollega zone selected districts. But four kebele are left due to serious security problem at the study area (West Wollega zone). Data entry started for collected primary data. To conduct survey from the left site the training was given for the development agent for facilitation and collection of primary data. The intermediate result/out puts will be obtained after the activity is completed

8.2.1.1. Determinants Influencing Adoption of Soybean (Glycine Max) Varieties in the Case of West and Kellem Wollega Zone, Oromia.

Work done so far:

Regarding the status of the activity, study site was selected from both Kellem Wollega and West Wollega Zones. Accordingly, two districts namely; H/gelan and Seyo from Kellem Wollega zone and Gimbi and Mandi from West Wollega zone based on potential of Soybean production and accessibility were selected. The secondary data were collected from Bureau of Agriculture. Checklists and structured questionnaires were prepared for FGD and primary data collection. The training given for development agent to collect primary data. The intermediate result/out puts will be obtained after the activity is completed.

9. Natural Resource Research

9.1. Soil Fertility Improvement

9.1.1. Major findings from completed research activities in the year

9.1.1.1. Evaluation of nutrient content of vermicompost made from different local available substrates at Haro Sabu On station, Kellem Wollega Zone, Western Oromia

This research activity was conducted at Haro Sabu on-station with the objectives of evaluating the nutrient content of Vermicompost made from locally available different substrate and identifying and recommends the best substrates. For this study, ten (10) treatments were evaluated. Vermicompost was prepared after worm feeding (as per treatment). Samples were taken from each treatment. Vermicompost laboratory analysis is underway. Therefore write up will be under taken after analysis.

9.1.2. Major activities performed under each ongoing research activities

9.1.2.1. Soil test crop based site specific phosphorus calibration study on maize under limed conditions of acid soils at Yubdo District, West Wollega, Oromia.

Major activities done so far:

Soil samples were collected from 12 farmer's field and analyzed. Lime were applied to treats the soil before maize planting. After lime application maize was sown on 12 farmers' fields to have a total of 21 farmers' field data including last year farmers field for determining P critical and requirement factors for maize in the study area.

9.2. Agroforestry Research Team

9.2.1. Major activities performed under each ongoing research activities

9.2.1.1 Pre-Extension Demonstration and Evaluation of lowland bamboo Technologies in Selected Districts of West and Kellem Wollega Zones

Major activities performed in the year

Two districts from Kellem Wollega (D/Sadi& Seyo) and One (L/Asebi) from West Wollega was selected. The total of Six (6) FRG's (two FRG at each selected district) were established and trained. Necessary input (polythene tube) was purchased and Cutting of two selected bamboo species was grown at nearby nursery site. Nursery management operations (Weeding, Watering etc) were done accordingly at selected nursery site.

9.2.1.2. Assessment of Agro forestry practice in West and Kellem Wollega

Major activities performed in the year

Two districts from each zones (Sadi chanka & Seyo) of Kellem Wollega and (L/Asebi & Gimbi) from West Wollega was selected. Questioner was prepared.

9.2.1.3. Assessment and Mapping of Abasena and Hine Forests in West and Kellem Wollega Zones, Western Oromia, Ethiopia

GPS points were taken from Kellem and west Wollega branches of Oromia forest and wild animal enterprise. Mapping of "Abbaa seenaa" \and "Hinee" forest was done depending on downloaded satellite images of 1985, 2000 and 2020 (Figure 2).

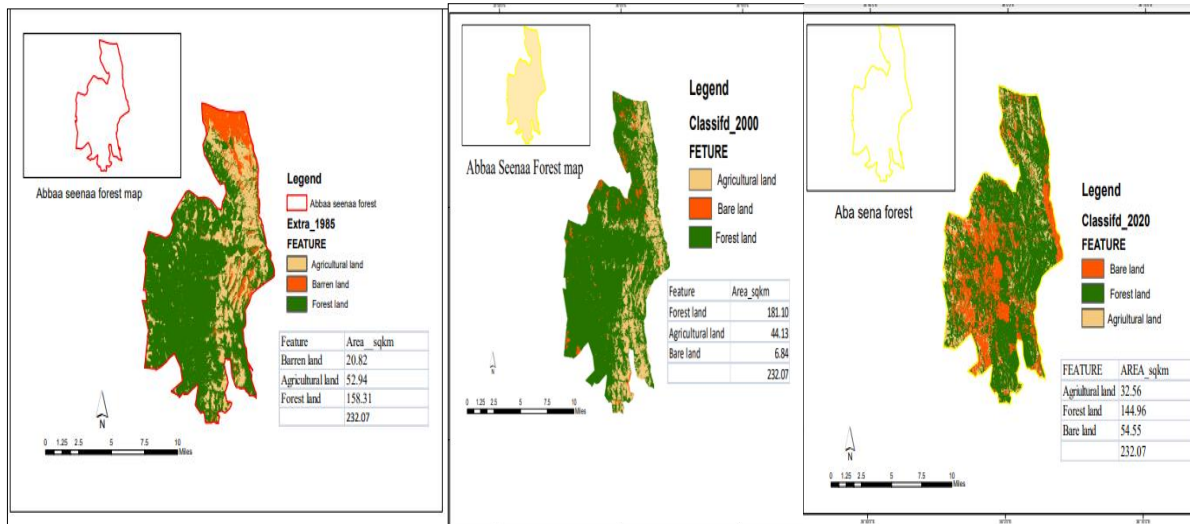


Figure2. “Abbaa seenaa” forest map



Figure 3: Hine forest map

9.2.1.4. Assessment and Collection of Wild Edible Trees/shrubs (plants) Species in Lowland of West and Kellem Wollega Zones Western Oromia Major activities performed in the year (July 2022-June 2023)

Two districts and 3 PA were selected from each zone. Data was collected from 20 farmers of each selected PA. The collected data was arranged for analysis. The collected data was analyzed for some parameters such as Major WEP, Overall Abundance of WEP Habit/Growth form of WEP and Parts of WEP used in study area.

9.2.1.5. Characterization of Trees and Shrubs Species Diversity of Abasena and Hine Forests in West and Kellem Wollega Zones western Ethiopia Major activities performed in the year (July 2022-June 2023).

This activity was not done at all due to security problem at selected forests.

10. Agricultural Engineering Research

10.1. Major findings from completed research activities in the year

10.1.1. Determination of Optimum Irrigation Water Requirement of Wheat at Sayo District, Kellem Wollega, Oromia

Major findings (in abstract form)

The field experiment was conducted at Sayo district, DaDU's experimental field on wheat. The main objective of the study was to determine optimum irrigation depth for wheat at Sayo District. Five irrigation water depths were evaluated. The soil textural class was clay loam that scheduled as 10 days to irrigate. All necessary data was collected accordingly. Data analysis and conclusion is underway.

10.2. Major activities performed under each ongoing research activities

10.2.1. Determination of irrigation interval on yield and water productivity of Maize in Kellem Wollega zone of Oromia.

Major activities performed in the year: The activity was conducted for one year at Hawa Gelan district, Keto irrigation scheme. Activities like Metrological data collection, calculation of crop water requirement, soil sampling and analysis, infiltration rate test have done. Five irrigation schemes were evaluated. All necessary data of one year was collected.

Summary of the intermediate results/outputs obtained in the year = overall data analysis is underway.

11. Challenges

- Security problem
- Inadequate budget and not timely released
- Lack of permanent site
- Lack of manpower (mainly turnover and not timely replaced)
- Lack of farm machinery (tractor maintenance)
- Lack of laboratory
- Lack of irrigation facilities
- Absence of office get off/fences,
- Absence of farm fence,
- Unfinished office building (in & out)
- Lack of storage

12. Center Development Activities performed in the year

- ❖ Farm machinery shade/house
- ❖ Bureau get dour
- ❖ Farm stations border fences (500m) long
- ❖ Green legacy plantation and management

13. Human resources of the center

- Total of human resources of the center :76
- Researchers = 26 (On MSc training: 3, On work : 23 (MSc 8 + BSc 15)
- Supportive staff = 50
- Turnover: 3 researchers and 1(Janitor)
- Newly hired: 2 (1 Guard and 1 Janitor)

➤ Retirement: No

SN	Human Resources of the center												
	Process	MSc		BSc		BA		Dip/level		Others		Total	
		M	F	M	F	M	F	M	F	M	F	M	F
1	Crop Research	2		5(1*)				4				12	0
2	Livestock	2		(1*)				2		2	2	7	2
3	Natural Resource Mgt	1		2				1		1		5	0
4	SE and A/Extension	1		2								3	0
5	Human Resource mgt					2		2		10	3	14	3
6	Finance					5	3		1	4		9	4
7	Planning					1						1	0
8	Secretary								1			0	1
9	Irrigation, D& WH	1		1								2	0
10	Technology multiplication							2		1		3	0
11	Center Director	1										1	0
12	Crop Protection			4								4	0
13	Coffee & Tea			1(1*)				1		1	1	4	1
	Total	8	0	18	0	8	3	12	2	19	6	65	11

*On training (MSc)

S N	Research and TA/Supporte Process	Qualifications										Total		
		MSc		BSc		BA		Dip/level		kan biroo		M	F	T
		M	F	M	F	M	F	M	F	M	F			
1	Researcher	8		15 (3*)								26		26
2	TA							10				10		10
3	Supportive staff					8	3	2	2	19	6	29	11	40
	Total	8		18	0	8	3	15	2	19	6	65	11	76

* on training (MSc)

Long term training

Process/Team	Level of Education	Plan and implementation			Reason for under performance
		Plan	Excution	%	
Socio-economics team	MSc	1	0	0	Due to scarcity of human power to take responsibility for the planned activities
Irrigation, D and WH team	MSc	1	0	0	
Coffee and Tea	MSC	1	0	0	
Total		2	0	0	

14. Managements

- Managements meeting: held 8 times in the year
- All staff meeting: 2 times

Meeting	Unit	Plan	Achievement
Management	round	12	8
All staff worker	round	4	2

15. Citizenship service

- Insurance book was opened for 11 households
- Support of money in cash (10,000) and purchase of oil (200 litre) for road construction done in the woreda
- Apparentship for 8 students from different universities was given
- Support of grain for food for more than 15 households

16. Job opportunity

Planned activities	Unit	Annual plan	Implemented plan	% (P/I)
Guarding and others works	Number of workers	261	329	126

17. Cross cutting issues (Youth and HIV/AIDS)

S/N	Works planned	Unit	Annual plan	Annual Implementation	% (P/I)
1	Awareness given for employer on HIV/AIDS	Number	80	52	69
2	Support of Vulnerable children and Adults by HIV/AIDS (2%)	Number	6	9	150

18. Initiatives

As a center, no work done on initiatives in the year

19. Discipline measures taken

- On three employees disciplinary measures were taken

20. Research output promotion

- Some teams, like the pulse and oil team and the Agri extension team, undertaken a mini-field day.

21. Training given for stakeholders

S/N	Research team	Plan	Achievement	% Achievement
1	Cereal	30	27	90
2	Pulse and oil crop	40	40	100
3	Horticulture	0	0	0
4	Crop protection	14	18	128
5	Coffee and Tea	14	16	114.29
6	Apiculture	18	18	100
7	Animal feed	18	18	100
8	Soil Fertility Improvement	6	6	100
9	Agroforestry	10	10	100
10	Irrigation, Drainage and WH Engineering	0	0	0
11	Socio economics	10	16	160
12	Agri-Extension	184	123	66.84

	Total	344	292	84.88
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22. Budget and its utilization

S/N	Budget source	Annual Budget (ETB)	Achievement	% Achievement
1	Capital	6,593,900	6,523,019	98.92
2	Recurrent	10,953,377	10,438,086	95.29
3	Internal revenue collection	354,494	436,490	123.13
4	Project (CALMP4R)	850,000	776,288.55	91.32

23. Logistics

- Total number of vehicles owned by the center: **4**

No	Type of Vehicles	Quantity	Functional	Not functional	Repairable	Remark
1	TOYOTA Hillux	1	√			Served for 9 yr
2	TOTOTA Hardtop	1			√	Served for 7 yr
3	NISSAN	1			√	Served for 13 yr
4	HHN2 Bishoftu	1	√			Served 4 yr

24. Laboratory

- No any laboratory exist in the center

25. Research sites

- We have only a farm as a permanent study site, but we used different FTC

26. Summary of main initiatives scheduled for the upcoming fiscal year

- Prepare the 2015/16 center activities work plan
- For ongoing research activities, different data collection and recording will continue as per the plan. For new activities/projects experimental set ups and starting data collection and recording will be started based on the budget situations
- Hold a series of meetings at the center management level to discuss the planned activities status and any issues that have been found
- Encourage monitoring and evaluation