OROMIA AGRICULTURAL RESEARCH INSTITUTE

BATU SOIL RESEARCH CENTER

ANNUAL RESEARCH REPORT

August, 2015

Batu

Introduction

The Batu Soil Research Center is one of seventeen research centers overseen by the Oromia Agricultural Research Institute. The center is geographically placed as follows: Longitude: 0468586E; Latitude: 0877118N; Altitude: 1631 masl; 165 kilometers from Addis Abeba in Batu town, Adami Tulu Jiddo kombolcha district, East Shewa Zone. Currently, the Center has three (3) research teams: the Soil Fertility Improvement Team, the Soil Resource Survey Team, and the Soil Testing Team. In addition, it has three (3) support staff, namely the human resources team, the finance team, and the planning department. The center now has eight (8) researchers and thirty-one (31) support personnel, totaling thirty-nine (39) staff people.

Agricultural Economics is built on research. However, agricultural production and productivity are not keeping up with the current population growth. Although there are numerous causes for a lack of production and productivity, degradation of natural resources, particularly soil erosion, soil fertility absorption, soil salinity and acidity, and soil water retention, play a key role. The agricultural system's backwardness, as well as the fact that new technology has not been deployed in the needed form and degree in accordance with local practice, has aggravated the situation. Sustainable use and conservation of natural resources (soil) are essential for increasing agricultural production and productivity. It offers soil testing services in ten administrative zones: Hararghe, West Harghe, East Shewa, Bale, and Arsi, West Arsi, Borana, Guji, West Guji and South west shewa.

Research focus area

- ❖ Soil Fertility Improvement Research
- ❖ Soil and Water Defense Research
- ❖ Survey of Problem Soils (Soil Salinity, Acidity)
- ❖ Soil Resource Studies and Map Preparation
- ❖ Irrigation Water Quality Study
- ❖ Agricultural land Suitability Survey
- ❖ Provides Services for Soil, Water, Plant and organic and Artificial Fertilizer analysis

Vision

The Batu Soil Research Center's goal is for farmers to become self-sufficient in food by utilizing technology that assure sustainable production and soil productivity.

Mission

The mission of the Batu Soil Research Center is to develop and adapt various technologies, as well as improve and protect the environment's natural resources, in order to achieve sustainable production and productivity, increase agricultural production, reduce poverty, and improve the livelihood of farmers/farmers in a sustainable manner

2. Current manpower status of the process

No	Research team/support process	PhD		MSc/ MA		MVS C		DVM		BSc/ BA		Dip./level		Certificate		Others		Total	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	Research			7						1	0	4	2	0	0	0	1	12	3
2	Support									4	4	6	4	1	0	5	0	16	8
	Total			7						5	4	10	6	1	0	5	1	28	11
																			39

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

3.1. By Government budget

Research team	Number of total activities planned to be executed for the year		# of Completed in the year (c)	# of Discontinued in the year *(d)	# Passed to next year (e=b-c-d)	New proposal approved for next year (f)	Total to be executed in next fiscal year (g= e+f)
	(as KBI(a)	Actual (b)					
SFI	19	17	8	-	9	8	17
SRS	6	4	1	-	3	0	8
Total							**25**

*Reason for discontinued activities: - no research activities were discontinued.

3.2. By Non-Government budget (Collaborative activities)

Research team	Number of total activities planned to be executed for the year		# of Completed in the year (c)	# of Discontinued in the year *(d)	# Passed to next year (e=b-c-d)	New proposal approved for next year (f)	Total to be executed in next fiscal year (g= e+f)
	(as per KBI)(a)	Actual (b)					
	1	20	1	0	20	0	20
Total							**20**

***Reason for discontinued/suspended activities** no research activities were discontinued.

4. Technologies/ information generation in the year

4.1 Number planed and achieved

No	Research team	# of technologies/ information planned to be generated in the year (as per GTP-II plan)	Technologies/ information generated		Reason for under performance, if any
			Number	As % of annual plan	
1	SFI	2	6	>100	
2	SRS	1	0	0	No completed activity

4.2 Technology/Information generated

lakk	Name of technologies	Information generated
1	Soil Test Crop Response Based Phosphorus Study for Bread Wheat in Dodola District of West Arsi Zone of Oromia	Optimum nitrogen rate (69 kg N/ha), critical phosphorus concentrations (20 ppm) and phosphorus requirement factors (4.15)
2	Verification of Soil Test Crop Response Based Phosphorus Calibration Study on Bread Wheat in Liban chukala District, Oromia	Optimum nitrogen rate (69 kg N/ha), critical phosphorus concentrations (23 ppm) and phosphorus requirement factors (9.86) verified
3	Verification of Soil Test Crop Response Based Phosphorus Calibration Study on Teff crop in Liban chukala District, Oromia	Optimum nitrogen rate (46 kg N/ha), critical phosphorus concentrations (21 ppm) and phosphorus requirement factors (5.47) verified
4	Soil Test Crop Response Based Phosphorus Calibration Study on Teff crop in Bora district, Oromia, Ethiopia	Optimum nitrogen rate (46 kg N/ha), critical phosphorus concentrations (16 ppm) and phosphorus requirement factors (5.49)
5	Characterization, Classification and Mapping of Soils of Resources IN A/T/J/Kombolcha, Oromia, Ethiopia	Five soil type identified
6	Effect of vermi-comost on selected soil physico-chemical properties, yield and yield components of maize in Dugda District, Oromia.	100% N equivalent level of VC (at 5.3 t/ha) and Pc = 10 ppm recommended

5. Soil Fertility Team Research work done so far within this cropping period/2022/23

4.1. Completed Activities

Activity title 1. Soil Test Crop Response Based Phosphorus Study for Bread Wheat in Dodola District of West Arsi Zone of Oromia, Ethiopia

Summary

The activity was carried out in the Dodola District with the goal of determining the economically optimum N fertilizer for bread wheat in the cropping seasons 2020/2021 to2022/23 for soil test crop response based phosphorus calibration studies for bread wheat in the second years of calibration. Furthermore, the best nitrogen was determined in 2020/21 and reported to the Natural Resource Directorate. As a result, for phosphorus calibration in the district, correct site selection, soil sample collection, soil sample analysis for actual experiment based on initial phosphorus concentration categories below critical P-concentration, land preparation, and planting were carried out. After three weeks of planting, intensive soil samples were obtained from each treatment. Each year, soil samples were analyzed for specific soil characteristics. Field management includes first and second weeding, disease control, and top dressing. As a result, all agronomic and soil data were gathered. Harvesting and threshing were completed correctly. Bread wheat grain yield, biomass yield, seed per spike, spike length, plant height, and TKW all responded substantially (p0.01) to P fertilizer application rate. P rate had a significant (p0.01) effect on grain yield. Thus, applying 50 kg P ha-1 resulted in significantly higher grain yield. In general, the results demonstrated that P fertilizer treatment had a considerable impact on wheat production and yield components.

Activity 2: Pre-extension Demonstration of NPS Fertilizers Based on Pc and Pf for Bread Wheat on Eutric Vertisols in Kofole District, West Arsi Zone of Oromia, Ethiopia.

Summary

In the 2022/23 cropping season, the activity was carried out in the Kofole district for soil test crop response based phosphorus calibration studies for bread wheat in the second year of calibration. As a result, site selection, soil sample collection, soil sample analysis for actual experiment based on starting phosphorus content categories below critical P-concentration, land preparation, and sowing were all completed correctly. Furthermore, soil sample analysis revealed that the accessible P concentration of the soil ranged from extremely low to medium. Land

preparation, planting, field management (weeding 1st, 2nd, and disease control), top dressing, harvesting, and threshing were all completed correctly. The shown technology's yield performance. The following chart summarizes the mean yield of exhibited at all sites using soil test-based fertilizer recommendations and farmer practices. This demonstrated that soil test-based fertilizer recommendations are reliable and work well across locations in the study area. Regular collaborative monitoring and assessment (follow-up actions) and technical guidance were provided at various crop stages based on increasing knowledge and skill demands. As a result, participating farmers valued soil test-based fertilizer recommendations for their high yield, good uniformity, good seed color, numerous rows, high number of seed/spike, strong tillering capacity, and good crop stand. Farmers' fields were used for pre-extension demonstration and evaluation of soil test-based fertilizer recommendations and farmer practice. As a result, the exhibited Soil test based fertilizers advice functioned successfully in all testing sites. Moreover, the participant farmers liked the Soil test based fertilizers recommendation for its high yield.

Activity 3: Pre-extension Demonstration of NPS Fertilizers Based on Pc and Pf for Bread Wheat on Mollic Andosols in Negelle Arsi District, West Arsi Zone of Oromia, Ethiopia.

Summary

In the second year of calibration, soil test crop response based phosphorus calibration experiments for bread wheat were conducted on Mollic Andosols in the Negelle Arsi district. As a result, site selection, soil sample collection, soil sample analysis for actual experiment based on starting phosphorus content categories below critical P-concentration, land preparation, and sowing were all completed correctly. Furthermore, soil sample analysis revealed that the accessible P concentration of the soil ranged from extremely low to medium. Land preparation, planting, field management (weeding 1st, 2nd, and disease control), top dressing, harvesting, and threshing were all completed correctly. The average production from soil test-based fertilizer recommendations and farmer practices was summarized for all locations. This demonstrated that soil test-based fertilizer recommendations are reliable and work well across locations in the study area. As a result, participating farmers valued soil test-based fertilizer recommendations for their high yield, good uniformity, good seed color, numerous rows, and high number of seed/spike, strong tillering capacity, and good crop stand. Farmers' fields were used for pre-extension

demonstration and evaluation of soil test-based fertilizer recommendations and farmer practice. As a result, the exhibited Soil test based fertilizers advice functioned successfully in all testing sites. Furthermore, the high output of the soil test-based fertilizers advice appealed to the participating farmers.

Activity 4: **Pre-extension Demonstration of NPS Fertilizers Based on Pc and Pf for Bread Wheat on Eutric Vertisols in Negelle Arsi District, West Arsi Zone of Oromia, Ethiopia.**

Summary:

In the second year of calibration, soil test crop response based phosphorus calibration studies for bread wheat were conducted on Eutric Vertisols in the Negelle Arsi district. As a result, site selection, soil sample collection, soil sample analysis for actual experiment based on starting phosphorus content categories below critical P-concentration, land preparation, and sowing were all completed correctly. Furthermore, soil sample analysis revealed that the accessible P concentration of the soil ranged from extremely low to medium. Land preparation, planting, field management (weeding 1st, 2nd, and disease control), top dressing, harvesting, and threshing were all completed correctly. The average yield of soil test-based fertilizer recommendations displayed in all locations. This demonstrated that soil test-based fertilizer recommendations are reliable and work well across locations in the study area. Regular collaborative monitoring and assessment (follow-up actions) and technical guidance were provided at various crop stages based on increasing knowledge and skill demands. As a result, participant farmers valued soil test-based fertilizer recommendations for their high yield and uniformity, large number of rows, large number of seed/spike, strong tillering ability, and good crop stand. Farmers' fields were used for pre-extension demonstration and evaluation of soil test-based fertilizer recommendations and farmer practice. As a result, the exhibited Soil test based fertilizers advice functioned successfully in all testing sites. Moreover, the participant farmers liked the Soil test based fertilizers recommendation for its high yield.

Activity 5: Verification of Soil test based crop response phosphorus calibration study for Tef in Liban Chukala District of East Shewa Zone, Oromia, Ethiopia

Summary

The research was carried out on six farmers' fields in the Liban Chukala District of Oromia's East Shewa Zone during the major cropping seasons of 2022-2022. The purpose of these experiments was to validate the determined Phosphorus critical (Pc) and Phosphorus requirement factor (Pf) for Tef. There were three treatments: soil test based crop response phosphorus application (STBCR), blanket recommendation (100kg NPS/100kg urea), and control, for a total of three treatments. The tests were set up in simple nearby plots and reproduced across multiple locations. The gross plot size was 10 m × 10 m (100 m^2), with 20m^2 plot portions harvested. The analysis of variance revealed that the treatment had no significant effect on plant height, spike length, or biomass yield. However, the major effect of NP fertilizer rates had a highly significant (p 0.01) influence on tef grain yield. In the Liban Chukala District, soil test-based crop response phosphorus fertilizer treatment resulted in the maximum grain yield (2322 kg/ha).

Activity 6: Verification of Soil test based crop response phosphorus calibration study for bread wheat in Liban Chukala District of East Shewa Zone, Oromia, Ethiopia

Summary

The research was carried out on six farmers' fields in the Liban Chukala District of Oromia's East Shewa Zone during the main cropping seasons of 2022-2023. These investigations were carried out in order to validate the previously determined Phosphorus critical (Pc) and Phosphorus requirement factor (Pf) for bread wheat. There were three treatments: soil test based crop response phosphorus application (STBCR), blanket recommendation (100kg NPS/100kg urea), and control, for a total of three treatments. The tests were set up in simple nearby plots and reproduced across multiple locations. The gross plot size was 10 m × 10 m (100 m2), with 20m2 plot portions harvested. Plant height, spike length, number of seeds per spike, biomass yield, and grain yield were found to be significant in the analysis of variance were highly influenced (p< 0.01) by the primary effect of fertilizer application methods or treatment. The highest plant height (88.18cm) was achieved with blanket fertilizer treatment. However, the soil test based crop response phosphorus fertilizer application method for bread wheat production in Liban

chukala District yielded the greatest (45.28) seed per spike, the largest (12.85 ton ha-1) biomass, and the highest (42.61 kg ha-1) grain yield.

Activity 7: Effect of vermi-compost on selected soil physico-chemical properties, yield and yield components of maize in Dugda District of East Shewa Zone of Oromia, Ethiopia.

Summary

The study was carried out to investigate the effect of vermicomposting on maize yield and yield components on six farmers' fields in the Dugda District. Plant height, ear height, number of rows per ear, biomass, grain yield, and HKW were among the agronomic and yield data obtained. The mean analysis of variance (table 3) revealed that there were no significant changes (P 0.05) in plant height, number of rows per ear, HKW, and HI between treatments. However, the treatments had a substantial (P 0.05) effect on maize ear height, biomass, and grain yield. Treatment five (75% N + 25% N equiv.) produced the most biomass (25.50 ton/ha). Treatment five (75% N + 25% N equiv. level of VC + P-critical) and treatment six (100% N equiv. level of VC + Pc) had the highest ear height (8.88 cm) and grain yield (6988 kg/ha). The partial budget and dominance analysis revealed that treatment six (6) with the highest MRR (730.65) had the highest net of return (146,315 ETB). According to the findings of this study, applying 100% N equiv. level of VC + Pc resulted in the maximum grain yield (6988 kg/ha) of maize and the highest NR (146,315 Birr ha-1) when compared to the other treatments. In conclusion, based on the findings of this study, farmers are advised to use a 100% N equivalent level of VC (at 5.3 t/ha) and Pc since it produced a higher yield and an economic advantage over the use of only inorganic fertilizers. As a result, in terms of economic return and productivity of Maize (Melkasa II variety) in the research region, interactive application of VC at 5.3 ton/ha and Pc may be recommended.

Activity 8: **Soil Test Crop Response Based Phosphorus Calibration Studies for Tef in Bora District, East Shawa Zone, Oromia, Ethiopia.**

Summary

The study was conducted on 26 farmers' fields in Bora District, during the main cropping seasons of 2020-2022. In the first year, three levels of TSP (0, 100, and 200) kg ha-1 and six levels of nitrogen (0, 23, 46, 69, 92, and 115) kg ha-1 were used in factorial combinations to determine the optimum N. In second and third years, the experiment was conducted to determine phosphorus critical and phosphorus requirement factor. The treatments consisted of six levels of phosphorus (0, 10, 20, 30, 40 and 50) kg ha-1 combined with a single level of nitrogen (46 kg ha-1) that gave a total of seven treatments including control and optimum N (46 kg/ha) as single

treatment. The yield data were analyzed and the analysis of variance indicated that biomass, grain yield and HI were significantly (p <0.05) influenced by the main effect of NP fertilizer rates between the treatments (table 5). The maximum biomass (6.25 ton ha-1) and grain yield (1227 kg ha-1) were recorded by application of 46 N kg ha^{-1} and 30 P kg ha^{-1} respectively. Accordingly, the phosphorus critical concentration above which the responses of the crop become minimal was 16 ppm. Hence, P critical value for Teff production in Bora district was 16 ppm. Phosphorus requirement factor (Pf) is the amount of phosphorus in kg needed to raise the soil P by 1ppm. Average of phosphorus (ppm) after 21 days of each applied phosphorus treatment and phosphorus increase over the control were calculated. Phosphorus requirement factor also determined from the difference between available soil test phosphorus values and from plots that received 0-50 kg P ha-1. Phosphorus requirement factor (Pf) = kg of P applied/Change in soil P. In general, soil test crop response based phosphorus calibration study for Teff production has been conducted for three consecutive years (2020-20023) in Bora district. Accordingly, Optimum nitrogen rate (46 kg N/ha), critical phosphorus concentrations (16 ppm) and phosphorus requirement factors (5.49) for Teff have been determined in Bora district.

5.2. On Going Activities

Activity 1: Soil Test Crop Response Based Phosphorus Calibration Study for Maize in Bora District, East Shewa Zone of Oromia, Ethiopia.

Brief status:

The first year experiment was conducted on five Farmers' field in Bora district, east Shewa Zone, with the objectives of determining economically optimum N fertilizer for Maize in Bora district and Phosphorus critical and phosphorus requirement factor for Maize in Bora district. Expected output: Economically optimum N, pc and pf determined for Maize Crop in Bora district. Application of NP has highly significant effect on grain yield of maize at P=0.05. The maximum grain yield of maize (5314 Kg ha-1) was obtained on the treatment applied 115N Kg ha-1 (urea 250 Kg ha-1) and 40 P Kg ha^{-1} (TSP 200Kg ha^{-1}) while the minimum grain yield of maize (2601 Kg ha-1) was obtained on control treatment. The partial budget and dominance analysis showed that the highest net benefit 127,008 Birr ha-1 was obtained in the treatment that was treated with 100 kg ha^{-1} urea and 200 kg TSP ha^{-1} while the lowest net benefit 67,862 Birr

ha-1 was obtained in the control treatment. The economic analysis revealed that a treatment to be considered worthwhile to farmers (100% marginal rate of return), application of 46kg Nha-1 with 40 kg TSP ha-1 are economically feasible. Therefore, the optimum Nitrogen Fertilizer for Maize production in Bora district could be 46N kg ha-1. Phase will be continuing uniformly using Optimum 46NKg ha-1 for next two consecutive cropping seasons on twenty Farmers fields with five levels of P (10, 20, 30, 40 and 50 P Kg ha^{-1}).

Activity 2: **Soil Test Crop Response Based Phosphorus Calibration Study for Food Barley in Kofole District of West Arsi Zone of Oromia, Ethiopia.**

Brief status:

The activity was under taken in Kofole District in 2023 cropping season for soil test crop response based phosphorus calibration studies to determine economically optimum N fertilizer for food barley in the first years of calibration. Accordingly, the analysis of variances show that the main effect of applications of nitrogen fertilizer rates showed highly significant difference (P<0.01) except Spike length (cm), seed per spike and harvested index (%), all agronomic data were highly significantly (p<0.01) influenced by N fertilizer rates. However, the highest harvest index (36.85%) ,the highest Spike length (9.03 cm), Seed per spike (48.66) and were recorded by 46,92 and 92 kg N ha-1 respectively. The 69 kg N ha-1 +46 P2O5 Kg ha-1 gave the grain yield (62.29 Qt ha-1). But the high grain yield was obtained from the 138 kg N ha^{-1} +92 P2O5 Kg ha-1 grain yield (65.57 Qt ha^{-1}) which is not economical recommended. The economic analysis revealed that for a treatment to be considered as worthwhile to farmers (100% marginal rate of

return) application of treatment 46 kg N ha^{-1} + 92 P2O5 Kg ha^{-1} gave the grain yield (50.31 Qt ha-1) is profitable and recommended for farmers with net benefit of (149,943.71 ETB ha^{-1}) at the marginal rate of return 469.99 % in Kofole district.

Activity 3: Soil Test Crop Response Based Phosphorus Calibration Study for Maize Crop in Boset District of East Shewa Zone of Oromia, Ethiopia

Brief status:
- ❖ Year of started: 2022
- ❖ Year of completion: 2025
- ❖ Initiator: Tilahun Fromsa
- ❖ Responsible persons: Soil fertility improvements
- ❖ Budget source: IQQO
- ❖ Expected output: Economically optimum N, Pc and Pf determined for Maize for Boset district

Specific Objectives
- ➢ To determine economically optimum N fertilizer for Maize in Boset district
- ➢ To determine site-specific soil test based phosphorus fertilizer and recommendation guidelines (Pc and Pf) for   Maize production in Boset District.

District consultation was made and they recommended us it's better to start next year; because **the security problem** in the District has not been good for the activity to start this year which mean 2023. But, also due to the high market inflations of agricultural inputs, it was decided at center level to start by its own budget of 2024.

Activity 4: Soil Test Crop Response Based Phosphorus Calibration Study for Teff in Boset District of East Shewa Zone of Oromia, Ethiopia

Brief status:

- ❖ Year of started: 2022
- ❖ Year of completion: 2025
- ❖ Initiator: Tilahun Fromsa
- ❖ Responsible persons: Soil fertility improvements
- ❖ Budget source: IQQO
- ❖ Expected output: Economically optimum N, Pc and Pf determined for Teff at Boset district

Specific Objectives

- ➢ To determine economically optimum N fertilizer for Teff in Boset district
- ➢ To determine site-specific soil test based phosphorus fertilizer and recommendation guidelines (Pc and Pf) for Teff production in Boset District.

District consultation was made and they recommended us it's better to start next year; because **the security problem** in the District has not been good for the activity to start this year which mean 2023. But, also due to the high market inflations of agricultural inputs, it was decided at center level to start by its own budget of 2024.

Activity 5: Soil Test Crop Response Based Phosphorus Calibration Study for Bread Wheat in Heben Arsi District of West Arsi Zone of Oromia, Ethiopia

Brief status:

- ❖ Year of started: 2022
- ❖ Year of completion: 2025
- ❖ Initiator: Tilahun Fromsa
- ❖ Responsible persons: Soil fertility improvements
- ❖ Budget source: IQQO

❖ Expected output: Economically optimum N, Pc and Pf determined for bread wheat at Heban Arsi district

Specific Objectives

❖ To determine economically optimum N fertilizer for bread wheat at Heban Arsi district

❖ To determine site-specific soil test based phosphorus fertilizer and recommendation guidelines (Pc and Pf) for bread wheat at Heban Arsi district

District consultation was made and they recommended us it's better to start next year; because **the security problem** in the District has not been good for the activity to start this year which mean 2023. But, also due to the high market inflations of agricultural inputs, it was decided at center level to start by its own budget of 2024.

Activity 6: Effect of vermi-compost on soil properties of sodic soil, yield component and yield of Maize under gypsum application at Dugda District, East Shewa Zone of Oromia, Ethiopia

Year of starting: 2022
Expected year of completion: 2024
Budget Source: IQQO
Initiator/s: Tilahun Abera
Responsible persons: All Soil Fertility Improvement Team

Objective

➢ To assess the effects of vermin-compost on soil properties of sodic soil and yield of maize under gypsum application

➢ To recommend optimum rates of vermin-compost for mitigating soil properties of sodic soil and optimum production of maize crop.

Expected output

❖ Effect of Vermi-compost on soil properties of sodic soil, yield component and yield of Maize under gypsum application determined and availed for end users

Brief Status

The activity was under taken in Dugda District in 2021/2022 cropping season, to assess the effects of vermi-compost on soil properties of sodic soil and yield of maize under gypsum

application. Accordingly all agronomic and soil data were collected. Harvesting and threshing of first year data were properly accomplished. However, to finalize the experiment second year data will be left and will be implemented according to the action plan of this year.

Figure 1. Maize plant grown on salt affected soil and treated soil in central rift valley

Activity 7: Effect of vermin-compost on selected soil physico-chemical properties, yield and yield components of bread wheat under limed condition in Kofole District, West Arsi Zone of Oromia, Ethiopia**.**

- ❖ Year started: 2022
- ❖ Expected year of completion: 2024
- ❖ Initiator/s: Amante Lema
- ❖ Responsible persons: All Soil Fertility Improvement Team

Objectives

- ✍ To determine the effect of vermin-compost on yield and yield components of bread wheat
- ✍ To evaluate the effect of vermin-compost on selected soil physico‑chemical properties

Expected output

- ✍ Effect of vermin-compost on selected soil physico-chemical properties, yield and yield components of bread wheat determined and availed for end users

Current status of the activity

The study was conducted on three farmers' fields in Kofole District.Vermi-compost was prepared from animal manure and wheat straw in 4:1 ratio. The vermin-compost was analysed

for its nutrient contents (pH, EC, OC, TN, Av. K, Av. P, Exch. acidity, CEC, Exch. Ca^{+2}, Exch. Mg^{+2}, Exch. Na^{+}, and Exch. K^{+}). The N equivalence level of vermin-compost was calculated from its total nitrogen. Pre soil samples were collected and analyzed for pH, EC, OC, TN, Av. K, Av. P, Exch. acidity, CEC, Exch. Ca^{+2}, Exch. Mg^{+2}, Exch. Na^{+}, and Exch. K^{+}. Based on the soil *exchangeable acidity,* lime requirement was calculated and applied uniformly to all treatments. The treatments were arranged in RCBD with two replications having a plot size 4 m x 5 m. Land preparation, sowing, top dressing, weeding, harvesting, threshing and agronomic and yield data (plant height, spike length, seed per spike, biomass, grain yield, and thousand kernel weight) collection were accomplished accordingly. After harvesting also soil samples were collected and the analysis is underway. In general it is going smoothly and in this coming season (2023) the activity will be conducted on 5 farmers and finalized.

Activity 8: Effect of bio-char integrated with inorganic fertilizer on selected soil physico-chemical properties, yield and yield components of bread wheat in Lume District of East Shewa Zone of Oromia, Ethiopia.
- ❖ Source of fund**:** IQQO
- ❖ Year started: 2022
- ❖ Expected year of completion: 2024
- ❖ Initiator/s: Amante Lema
- ❖ Responsible persons: All Soil Fertility Improvement Team

Objectives
- ✎ To determine the effect of bio-char yield and yield components of bread wheat
- ✎ To determine the effect of bio-char on selected soil physico-chemical properties

Expected output
- ✎ Effect of bio-char on selected soil physico-chemical properties, yield and yield components of bread wheat determined and availed for end users

Current status of the activity

However, the activity was initiated in 2021 and desired to be started by the budget of 2021. Due to the high market inflations of agricultural inputs, it was decided at center level to start by its own budget of 2022. In this year, survey for bio-char material was made and place for bio-char preparation was identified. The activity was smoothly going according to the plan and Bio-char material collection, bio-char preparation and testing its quality, site selection, soil sampling, land

preparation, sowing, and planting are the next activities to be carried out for the coming cropping season (2023).

Activity 9: Effects of conventional compost prepared from bio-slurry integrated with inorganic fertilizer on yield and yield components of bread wheat and selected soil physic-chemical properties in Lume District, East Shewa Zone of Oromia, Ethiopia.

❖ Year started: 2022
❖ Expected year of completion: 2024
❖ Initiator/s: Amante Lema

Objectives

✎ To determine the effect of conventional compost and inorganic fertilizer on yield and yield components of bread wheat

✎ To evaluate the effect of compost and inorganic fertilizers on selected soil physico-chemical properties.

Expected output

✎ Effect of compost and inorganic fertilizer on selected soil physico-chemical properties, yield and yield components of bread wheat determined and availed for end users

Current status of the activity

This activity was initiated in 2021 and desired to be started by the budget of 2021. However, due to high market inflations of agricultural inputs it was decided to start by its own budget of 2022. Survey for composting material (bio-slurry) was made and place for pit preparation was identified.

Compost preparation and testing its quality, site selection, soil sampling, land preparation, sowing, and planting are the next activities to be carried out for the coming cropping season (2023).

6. Soil Resource Survey team Research work done in 2023

6.1. Ongoing activity

Activity 1: Characterization, classification and mapping of soil resources in Rift Valley area, Dugda District, East Shawa Zone, Oromia.

Initiation year: 2021/2022

Expected year of completion: 2024/2025

Initiator: Hussein Namu

Current status (activities performed so far)

The aims of this activity were to define the morphological and physicochemical qualities of soils and to classify the major soils according to the World Reference Base for Soil Resources (IUSS Working Group/WRB, 2022). The preliminary district boundary was delineated using a topographic map of the study area (1:50,000) and a Digital elevation model (DEM: 30x30m resolution). The district's soil mapping units (SMU) were prepared, both disturbed and undisturbed soil, and forty-three (43) soil samples were collected. At the field, selected morphological features of soil from all pedons opened were described. Soil physical properties include texture (due to disturbance); The laboratory bulk density and total porosity of all undisturbed soil were estimated Physicochemical parameters of all 43 obtained soil samples were evaluated in the lab. This activity's expected results were a map of the district's soil types and access to the district's soil geo-database.
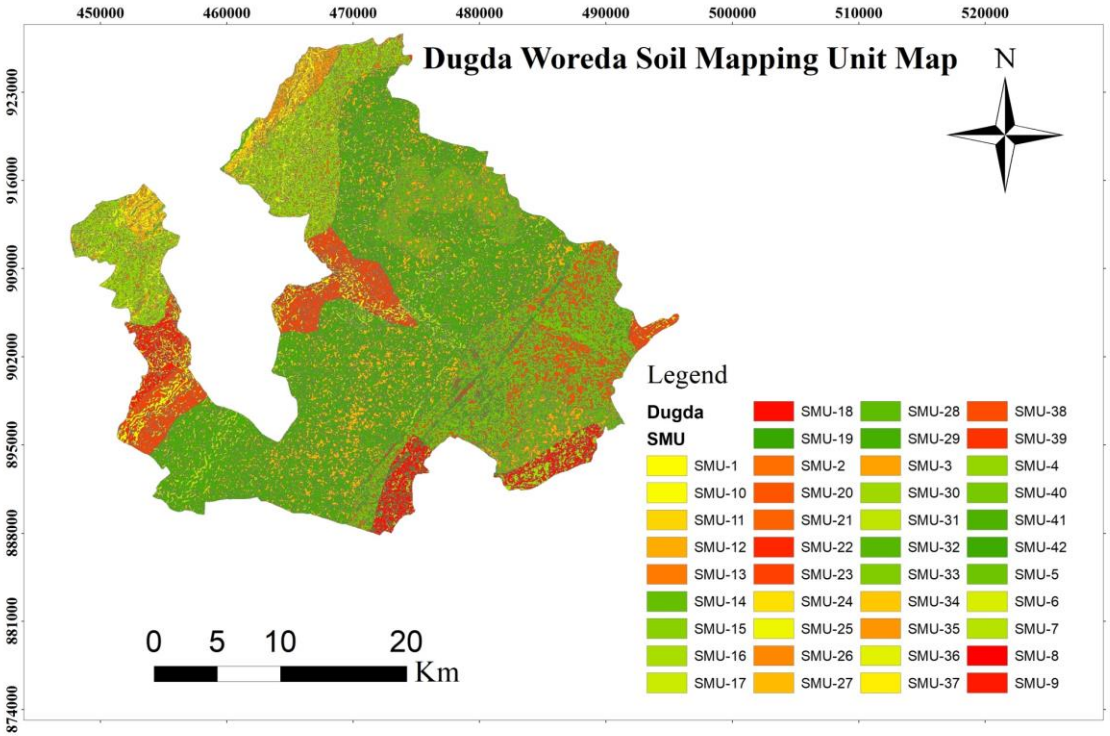
Figure 1. Dugda district soil mapping units

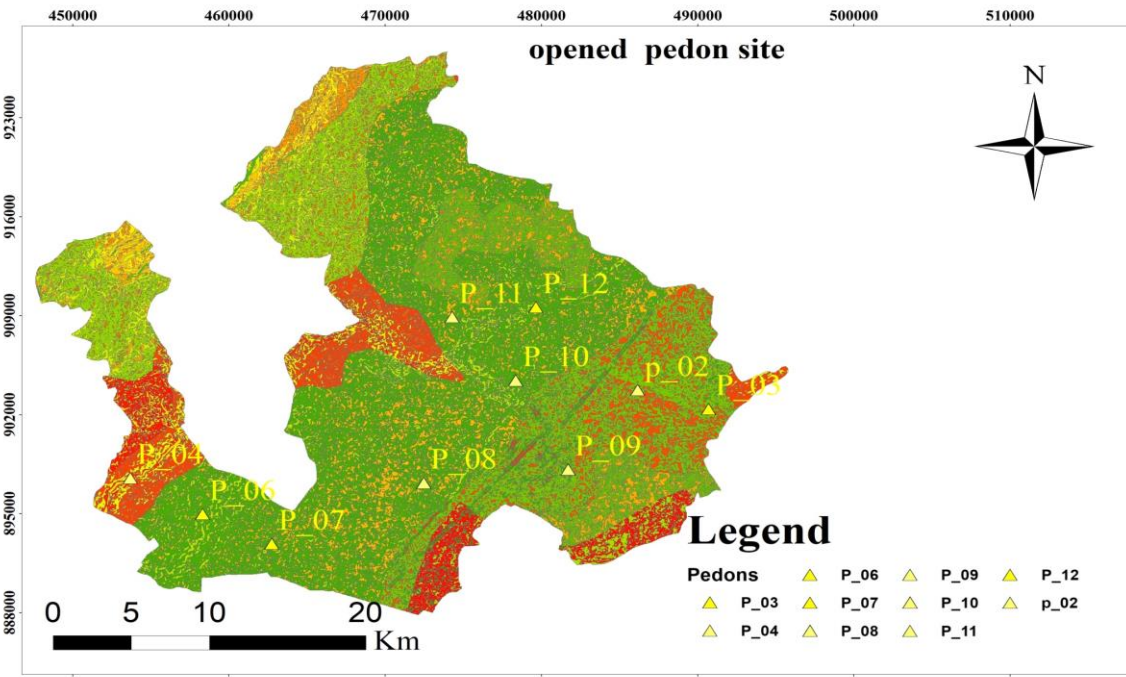Depend on soil mapping units ten (10) pedons were opened.

Figure 2.described pedon site of Dugda district.

Photo taken during pedon description

Activity 2: Characterization, classification and mapping of soil resources in Rift Valley area, Liben Chukala District, East Shewa zone, Oromia,Ethiopa.

Initiation year: 2021/2022

Expected year of completion: 2024/2025

Initiator: Hussein Namu

Current status (activities performed so far)

The activity was proposed at Liban Chukala district to address the objectives of preliminary district boundary delineation using topographic map of the study area (1:50,000), characterizing the morphological and physicochemical properties of soils, classifying the major soils according to the World Reference Base for Soil Resources (IUSS Working Group/WRB, 2022), and producing soil classification maps of the district. The district's digital elevation model (DEM: 30x30m resolution) and soil mapping units (smu) were created. A total of fifty (50) soil samples, both disturbed and undisturbed, were collected, and disturbed soil samples are being analyzed for

physicochemical properties. At the field, selected morphological properties of soil from all pedons opened were described. The total porosity and bulk density of all undisturbed soil were calculated. Eleven (11) pedons were opened based on soil mapping units. This project is planned to produce a map of soil types in the district as well as a soil geo-data base for the district.
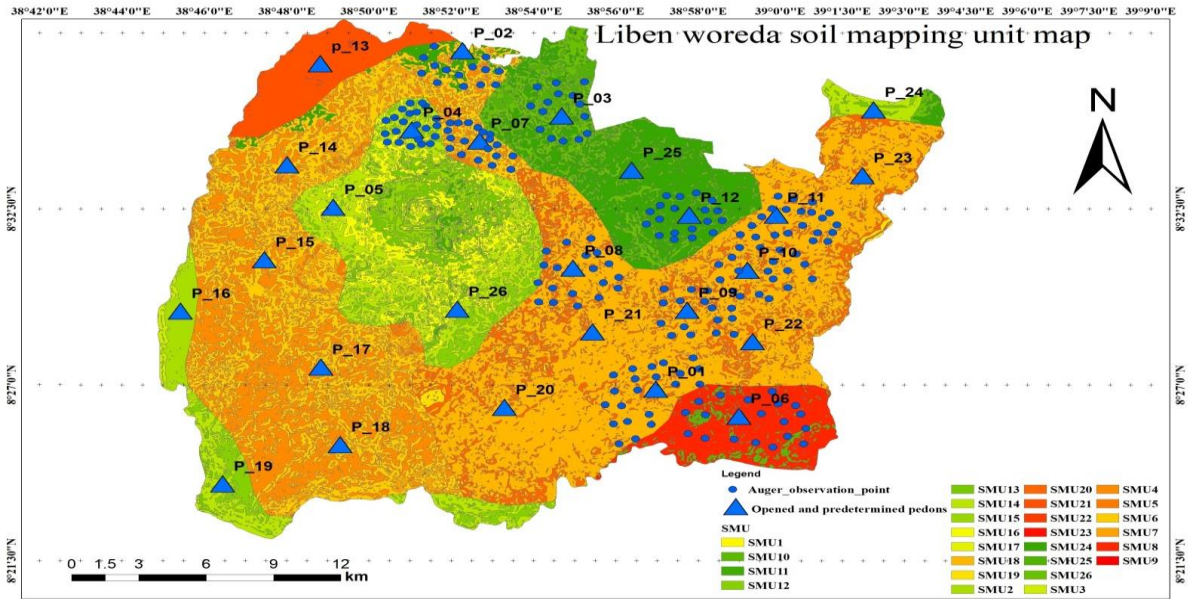

Figure 3. Soil mapping unit, Aguer observation points, opened and predetermined pedons of the District

Poto taken during pedon description

Activity 3: Characterization, classification and mapping of soil resources in Rift Valley area, Bora district, East Shawa Zone, Oromia, Ethiopa.

Initiation year: 2021/2022

Expected year of completion: 2024/2025

Initiator: Bekele Abebe

Responsible persons: Hussein Namu and Bekele Abebe

Current status (activities performed so far)

The activity have been conducting in Bora district of East Shewa Zone, Oromia With the Objectives of characterizing the morphological and physicochemical properties of soils, To classify the major soils according to the World Reference Base for Soil Resources (IUSS Working Group/WRB, 2022) and To produce soil classification maps of the District. The Preliminary district boundary was delineated using topographic map of the study area (1:50,000) and Digital elevation model (DEM: 30x30m resolution) Soil mapping units (smu) of the district were prepared, Depending on soil mapping units sixteen (16) pedons. Both disturbed and undisturbed soil with a total of Eight nine (89) soil samples were collected and Selected morphological characteristics of soil of all pedon opened were described at field. Bulk density and Total porosity of all undisturbed soil were calculated and 31 soil sample physico chemical properties were analyzed and 58soil sample were on process to be analyze Soil bulk density and total porosity of pedon opened at Bora district. The bulk density of soils in the surface horizons ranged from 1.03 to 1.34 g cm^{-3}, and the corresponding values for the subsurface horizon ranged from 1.09 to 1.42 g cm^{-3}. Total porosity ranged from 55.8% in Pedon 2 to 61.1% in pedon 6 of the surface soil horizons On the other hand; it varied from 46.40% in pedon 6 to 58.34% in pedon 5 of the subsurface soil horizons. Chemical Soil Characteristics: The chemical properties of were on under way to analyze parameters for opened pedon like, OM, TN, CEC, Ca, Mg, K, Na, P^{H} and available phosphorus. The expected out puts will be Map of soil types of the District developed and Soil geo-data base of the District availed.
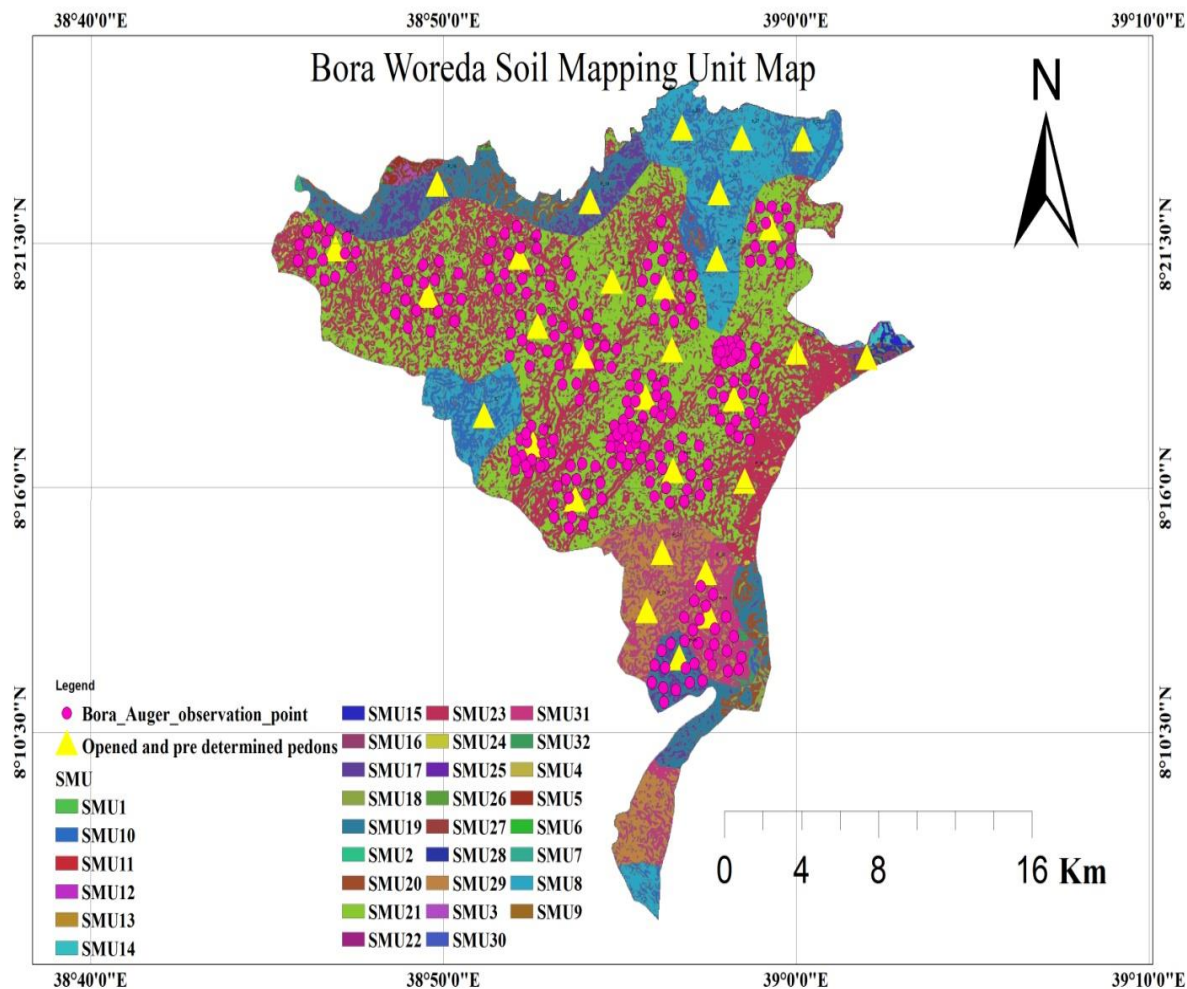
Figure 4.SMU, Auger observation points and opened and predetermined pedonsof Bora District

7. Technology demonstrated

No.	Name of technology demonstrated	Annual plan			
		Male	female	young	
1	Pre-extension Demonstration of NPS Fertilizers Based on Pc and Pf for Bread Wheat for *Mollic Andosol* in Nagelle Arsi District	83	17	6	
	Pre-extension Demonstration of NPS Fertilizers Based on Pc and Pf for Bread Wheat for *eutric vertisols* in Nagelle Arsi District				
	Pre-extension Demonstration of Pc and Pf for Bread Wheat Kofole District				
	Demnostration of STBFR and phosphoures map on bread wheat and teff in lume district				
				106	

8. Field day

No	Type of technology	location	Farmers			Extension			Others		
			M	F	Total	M	F	Total	M	F	Total
1	Pre-extension Demonstration of NPS Fertilizers Based on Pc and Pf for Bread Wheat for *Mollic Andosol* in Nagelle Arsi District	Negelle Arsi	9	1	**10**	0	1	**1**	0	0	**0**
2	Pre-extension Demonstration of NPS Fertilizers Based on Pc and Pf for Bread Wheat for *eutric vertisols* in Nagelle Arsi District										
3	Pre-extension Demonstration of Pc and Pf for Bread Wheat Kofole District	Kofole	30	0	**30**	0	1	**1**	0	0	**0**
4	Demnostration of STBFR and phosphoures map on bread wheat and teff in lume district	Lume	37	2	**39**	0	2	**2**	0	3	**3**
	Ida'ama							85			

Demnostration on STBPR and Phosphoures Requirement Map on Teff at Jala Danse, Lume District CALM P 4R

Demonstration on STBPR and Phosphorus Requirement Map on bread wheat at Jala Danse, Lume District CALM P 4R
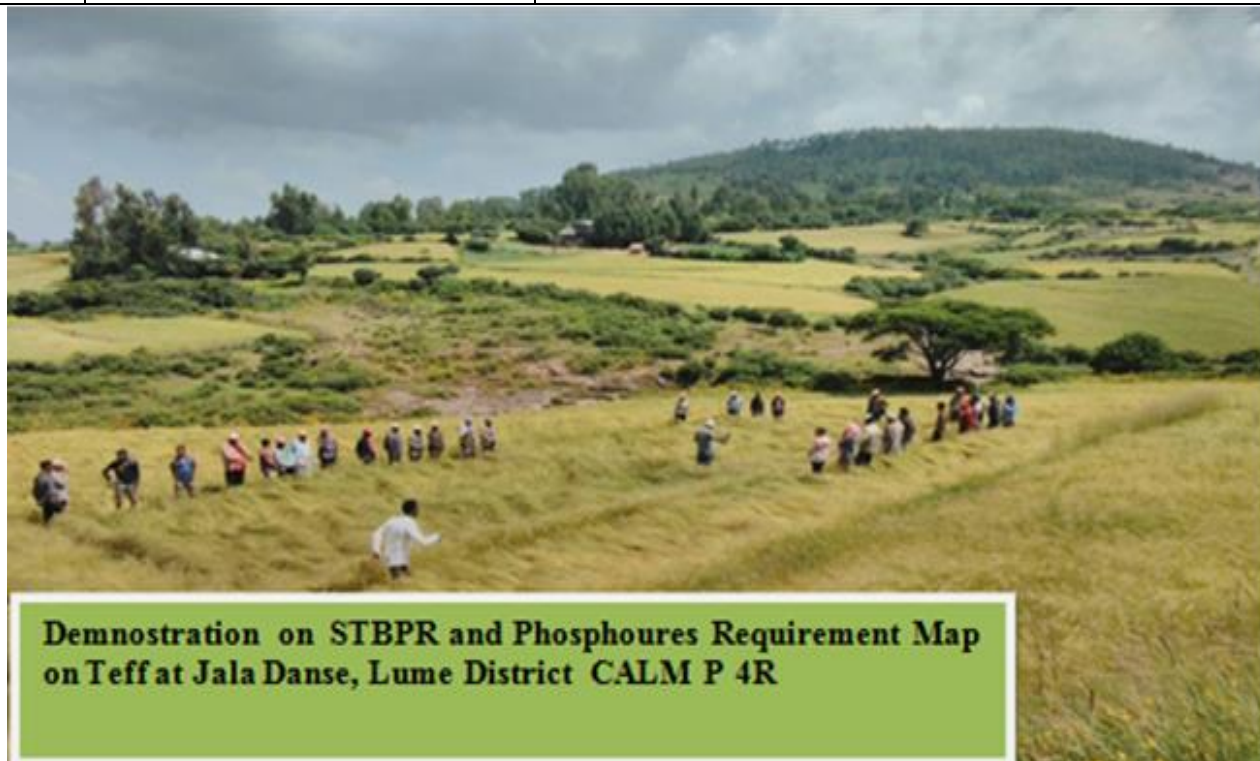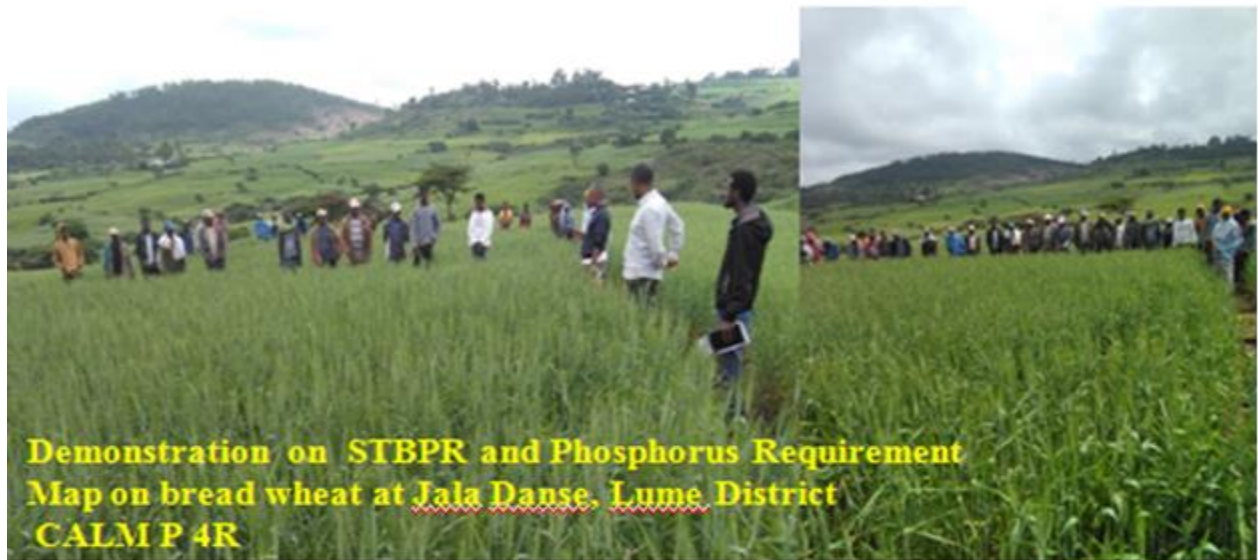
9. Publication (jornal, prosidin)

Lakk	Maqaa	Gosa barreefamaa	
	SFI	Tilahun Abera, Tilahun Firomsa, Abdurhman Husen, Amante Lema. Determination of NPS Fertilizer Levels on Yield Components, and Yield of Maize at Dugda District, East Shewa Zone, Oromia, Ethiopia. International Journal of Applied Agricultural Sciences. Vol. 8, No. 6,	Journal
	SFI	Amante Lemma, Tilahun Abera and Tilahun Firomsa. Effect of NPS Fertilizer Rates on Growth, Yield and Yield Components of Maize in Shashemene District, West Arsi Zone of Oromia, Ethiopia.	Journal

10. Budget Utilization

Type of budget	Annual plan	utilization	Annual ut.%	remark
Kapital	1,940,800	1,939,141.67	99.91	
Reccurent	5,459,754	5,175,072	94.78	
CALMP4R	1,707,737.57	1,614,870.24	94.56	
Irrigation	340,000	339,911	99.97	
FSRP	1,055,000	382,650	36.27	
AECFR	217,920.7	129730	59.5	
Internal revenue utilized	477203	477133	99.98	
Internal revenue collected	115,036	430,232.78	> 100	

11. Monitoring and evaluation

12. Center level Development works

Figure 1. hundred meter fences constructed at Batu center on station

13. Training given by DBFZ for Researchers and Laboratory technician

No.	Participants from four centers	Title of training	participants			Remark
			M	F	Total	
	Researchers and lab technicians from batu soil Each t wo lab.technician from badele, fiche and nakemte	Use of laboratory instruments such as AAS, computerized spectrophotometry etc.	15	5	20	

14. Water shade management by CALMP4R project

15. Technical and administrative challenges and problems encountered

No	Problems encountered	measures taken	Solutions suggested	Remarks
1	Shortage of budget			
2	Inflation			
3	Shortage of human power			
4	Shortage of car			
5	Lack of stable security			
6	On time absence of agricultural input			