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The Ethiopian Institute of Agricultural Research is a federal research institute that conducts research in various spectrums of agricultural disciplines to provide demand-driven and market-competitive agricultural technologies that contribute to increased agricultural productivity, quality, sustainable food security, economic development, and conservation of the integrity of natural resources and the environment.

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Emulating India's 'Operation Flood' to Transform Ethiopia's Dairy Sector

Dejene Girma

Ethiopian Institute of Agricultural Research, Biotechnology Research Directorate, HQ

This short piece reflects EIAR's continued gesture to building virtue of prudence in the community.

> "For a typical Ethiopian farming family, cows' pregnancy brews a sense of hope. Whatever the sex of the newly born calf, when contrasted with its human experience, the farming family regards the availability of milk at the house as a shower of blessings.

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Until the early 90s, calf's sex was determined purely by chance. Thanks to advancements in reproductive biotechnology, this has now become a matter of choice with nearly |90% accuracy". In just four years, more than 600 heifers were produced from sexed semen technology under various production schemes.

Naturally, semen is composed of the X and Y chromosomes. In contrast, sexed semen is semen in which the fractions of X-bearing and Y-bearing sperm have been separated from the natural mix through sorting and selection. Even though the basic sexed semen technology was developed in the 1980s, a process for creating sex-sorted cattle semen for freezing and use in artificial insemination (AI) was developed in the late 1990s by researchers at Colorado State University (CSU). Since then, sex pre-selection of females has become the most common method to achieve the desired number of heifers in dairy sectors.

Ethiopia houses the largest cattle population in Africa but is milk deficient because of low productivity of the local breeds. This has necessitated dairy cattle genetic improvement through crossbreeding with non-native breeds. Despite the appreciable improvements made so far, meeting the milk demand in the country is still a challenge and integrating modern tools into the existing cattle genetic improvement seems inevitable.

Turning some pages of recent history on dairy sector development in the world, one would read India's 1970s **'Operation Flood'**, an ambitious plan aimed at transforming its dairy sector. The initiative started by importing 100 cows from New Zealand and transformed India into one of the world's largest milk producers in two decades. Leaving the question of whether Ethiopia should emulate India's Operation Flood and transform its dairy sector to the reader, below, we will give a brief account of the successes made by the ag-biotech research directorate in this frontier.

Started out of a candid discussion between a humble Ethiopian farmer, an animal biotech researcher, and a US professor in 2018, the sexed semen technology is impacting the lives of our farmers. After their discussion, the professor thought of establishing a dairy village, which was then picked up by the animal biotech team at Debre Zeit Agricultural Research Center (DZARC). The technology was first attempted on the station at DZARC in 2019 using 19 (23) cows to demonstrate the applicability of estrous synchronization and artificial insemination with sexed semen. Of the 19 gynecologicallyexamined and screened cows, 17 (89%) were selected technically, synchronized using single-shoot prostaglandin-based estrous synchronization protocol, and inseminated with sexed semen upon showing behavioral estrus signs. Of these inseminated animals, 16 (94%) became pregnant. Of these, 15 calves were born of which 14 (93%) were female and 1 (0.06%) was male showing a successful application of the sexed semen technology in Ethiopia (Fig 1).

Figure 1. The first batch of 14 heifers born from AI with sexed semen on station at DZARC.

This recent development has created excitement amongst researchers in the Agricultural Biotechnology Research Directorate and their interest in integrating the technology into their assisted reproductive biotechnology toolbox to enhance the dairy sector in the country was sky-high. Trained with a top-notch reproductive biotechnology expert and coupled with their time-tested experience, our researchers perfected the application of the technology on-station. The successive efforts gave them confidence and optimism for the wider application of the sexed semen technology in our country. A typical dairy village consists of farmers in a selected area who are willing to be beneficiaries of the technology. The concept is touted to increase the operational efficiency of the technology at the community level thereby facilitating its adoption.

EIAR established the first Model Dairy Village at *Denkaka,* East Shoa, Oromia Region in 2022. The field implementation of the technology involved researchers, AI technicians, and development agents from the Ministry of Agriculture. So far 287 calves were born of which 96% were heifers. As part of the **'Beyond the Lab'** initiative, two additional dairy villages were established

at *Sendafa* and *Sululta* in 2023. While establishing the dairy village, the awareness created by the animal biotech program generated demand for the technology in urban and peri-urban areas around *Debre Zeit, Ameya, Ada'a, Akaki, Bishoftu, Dukum,* and *Woliso*. A typical example is Mr. Cherinet's farm in the *Dukum* area (Fig 2). Mr. Cherinet established a dairy farm consisting of 24 replacement female calve crops from this technology. His farm has attracted the attention of policymakers, local media, and ignited interest in the use of the technology in the neighborhood. So far, under village-based heifer production scheme more than 470 heifers, and in ranch-based scheme 149 heifers were produced.



Figure 2. Denkaka village was visited by the highest echelons of the sector as shown in this image of Dr. Fikru Regassa, State Minister, Ministry of Agriculture, and Dr. Diriba Geleti, Deputy Director General, EIAR. The last picture shows the dairy farm of Mr. Cherinet in Dukem.

Any meaningful change to our dairy sector requires in addition to improved genetics, the need to incorporate animal nutrition, animal health, and management. Our dream is to see a transformed dairy sector in Ethiopia with the application of modern reproductive biotechnology and to see our dairy farmers' prosperity at the farm gate. The ag-biotech research directorate is committed to creating at least one dairy village every year and increasing the supply of replacement heifers and hence milk self-sufficiency at the village level.

We strongly believe that the passion, commitment, and leadership exhibited in our irrigated wheat initiative can be replicated to our dairy sector. Given adequate attention, commitment, and investment, we believe that the proper and widespread application of the sexed semen technology will change the structure of the dairy sector and ensures a 'milky' way to food security at the village level.

Amendments of Acid soil through Cluster Based Large Scale Demonstration of Lime Technology in Selected Districts of Bench Sheko Zone, Southwest Ethiopia

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The problem of soil acidity is one of the major challenges for crop production in southwest Ethiopia. For the past three years, Teppi Agricultural Research Center has conducted a cluster-based large-scale demonstration of Lime technology to ameliorate soil acidity. From June 2020 to 2023 a total of 203 hectares of land was amended by 304.5 tons of lime and incredible yield improvements were achieved in Bench Sheko Zone; Shey Bench and Semen Bench Districts.

A total of 344 smallholder farmers benefited from the large-scale demonstration (LSD) (Figure 1). Teppi Agricultural Research has provided improved seed for the farmers.

Before the implementation of LSD, theoretical and practical trainings were given for farmers and developmental Agents (DA). For each cluster year, field days were organized to promote the lime technology at the national, regional and zonal levels.

From the cluster unit, a small number of farmers were interviewed about the yield advantage after lime was applied to their lands. A total of 60 farmers were interviewed for the yield estimation of their lands before lime and after lime.

Accordingly, a wheat grain yield obtained from no lime applied field was 10, 9.6 and 9.7 quintals per hectar while, the lime applied field gave 35.75, 36.1 and 36.4 quintals per hectar during the 2020, 2021, and 2023 cropping seasons respectively (Table1).

Farmers earned a net benefit of 11,910, 15,800, and 23,750 Ethiopian birrs per hectar from the local selling price of wheat from no lime applied and 103,520, 68,580 and 103,050 Ethiopian birrs when lime was applied during 2020, 2021, and 2023 cropping season respectively (Table1).

In the overall clustering year, the average wheat yield of 9.77 and 36.08 quintals was obtained from no lime and lime applied field respectively (Table 2). Statistically, without lime and with lime-amended soil had significant ($p \leq 0.05$) differences in both wheat grain yield and economic net benefit. The statistical analysis of a t-value indicated negative signs -39.28 and -26.54 showing that no lime amended field had both lower yield and net benefit when compared with the lime applied field respectively (Table2). Overall the cluster based large scale demonstration of lime technology had a yield improvement of 114.77% and 136.98% economic benefit when compared with without lime applied.

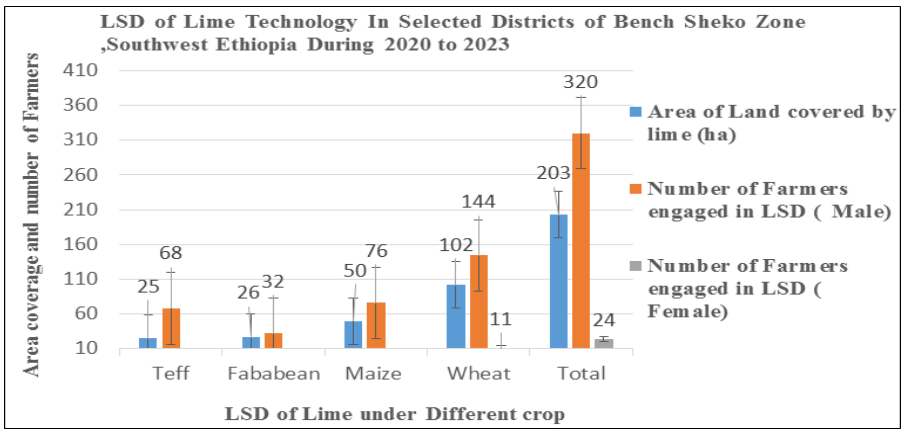

Figure 1. An area coverage of lime amended land and number of farmers benefited from cluster based LSD of lime Technology in Shey Bench and Semen Bench Districts Southwest Ethiopia during 2020 to 2023 cropping season

Table 1. Comparative Economical advantages of Lime in Acid prone areas of wheat farms at Shey Bench Southwest Ethiopia (N=60)-disaggregated by year

Cropping season of Cluster						
	2020		2021		2023	
Variables	Soil Amendments types					
	Without lime	With lime	Without lime	With lime	Without lime	With lime
Yield Q ha-1	10	35.75	9.6	36.1	9.7	36.4
GFB	15,000	107,250	19,200	72,200	29,100	109,200
TVC	3090	3730	3400	3620	5350	6150
NB	11,910	103,520	15,800	68,580	23,750	103,050

GFB= Gross field Benefit (Grain yield kg/ha *Local selling price of 100kg wheat) in Ethiopian birr, TVC= Total cost that vary (cost of Lime + fertilizer for lime applied land, cost of Fertilize only for no lime applied land), NB= Net benefit (GFB-TVC) in Ethiopian birr

Table 2. Comparison of average aggregated economic advantage of soil amendment with Lime in wheat farming at Shey bench (N=60)-over the 3 years

Variables	Soil Amendment Type	Mean	Standard Deviation	Coefficient of Variation	t-value
Wheat Yield Q ha-1	without lime	9.77	2.47	25.28	-39.28
	with lime	36.08	4.57	12.67	
Net Benefit (EBT ha-1)	without lime	17,153	3.71	0.022	-26.54
	with lime	91,717	1.41	0.0015	

Figure 2. Wheat and Faba bean field performance after ameliorating Acid soil with lime at Shey Bench District, Southwest Ethiopia

Development of Livestock Water points Monitoring System

Liyuneh Gebre, Project-PI and associate researcher
Climate & Computational Science Research Directorate
Ethiopian Institute of Agricultural research, Head Quarter

Pastoral communities in Ethiopia's lowlands are highly vulnerable to the frequent extreme climate risks such as droughts and floods. With our recent memory, the failed consecutive five rainfall seasons between 2021-2022 had resulted in the loss of millions of livestock heads and forced people to leave their places. Climate change is expected to bring more frequent extreme weather events which will have high negative consequences for the vulnerable pastoral communities of the country. To this end, the availability of early warning system in the country is crucial to reduce the impact of climate risks.

Livestock Water Monitoring and Risk Management System Project has been implemented by lead Alliance and Biodiversity and CIAT and Ethiopian Agricultural Research Institute (EIAR) with collaboration of Ministry of Agriculture (MoA), Oromia Agricultural Research Institute (OARI) and United States Geological Survey (USGS). The project is funded by Bill and Melinda Gates Foundation (BMGF). The objective of the project is to provide a near real-time surface water information monitoring system to pastoral areas of Ethiopia. A pilot project is currently underway in the Borana zone to help the vulnerable and marginalized communities in building resilience to climate risks. This initiative created a palatable water points , forage and climate information resources which will also assist the evidence-based decision-making process.

Climate and computational science Research Directorate was involved in the model integration to the EIAR server. This process had taken email exchanges and assisted with a virtual meeting from FEWS NET and USGS developer teams. For calibration tasks 10 daily water point depth data was collected and archived online with the collaboration of IQQO (Yabelo Pastoral & Dry Land Agricultural Research Center). This valuable data was also shared by NASA and the USGS and it has benefited the wider scientific research community. The EIAR team also significantly contributed in system design and data migration to the new platform in collaboration with the CIAT climate action team in Cali, Colombia.

The world known designer Bruce Mau emphasized the importance of considering an ecological perspective in our design process. He said that "Design is not about control, it's about responsibility". This project adopted a human-centered design (HCD) approach which prioritizes understanding of people's needs, behaviors, and motivations. This helped us in identifying the most effective solutions and communication channels during the platform development. After a year of development, the platform was launched successfully on February 6, 2024 at Hayat Regency Hotel in Addis Ababa. The event included remarks from a State Minister Dr. Fikru Regassa from the Ministry of Agriculture and Professor Tess Russo BMGF senior program officer.

The platform offers various functionalities to deliver near real-time information on water points and forage monitoring. The monitoring section as it is illustrated in the figure below displays the status of each water point using a five-category system: GOOD, WATCH, ALERT, NEAR DRY, and SEASONALLY DRY. Each category has an assigned color for easy status presentation of the water point. In addition to the status overview, the system provides a dashboard utility for users to explore historical and current water point data in detail with time-series graphs. One of the unique features of the platform is its ability to provide a weekly bulletin and an alert system to specific water points based on the user preference with a subscription to the platform. To improve accessibility for wider audiences we included Amharic and Afan-Oromo to the platform. With the project expansion to parts of the pastoral regions of the country additional local languages are anticipated to be incorporated. To explore more of the utilities, please visit https.//et. waterpoints monitoring.net and subscribe to the platform and use the contacts at homepage any of your comments and questions. detailed information about the water points is found in the profile section.

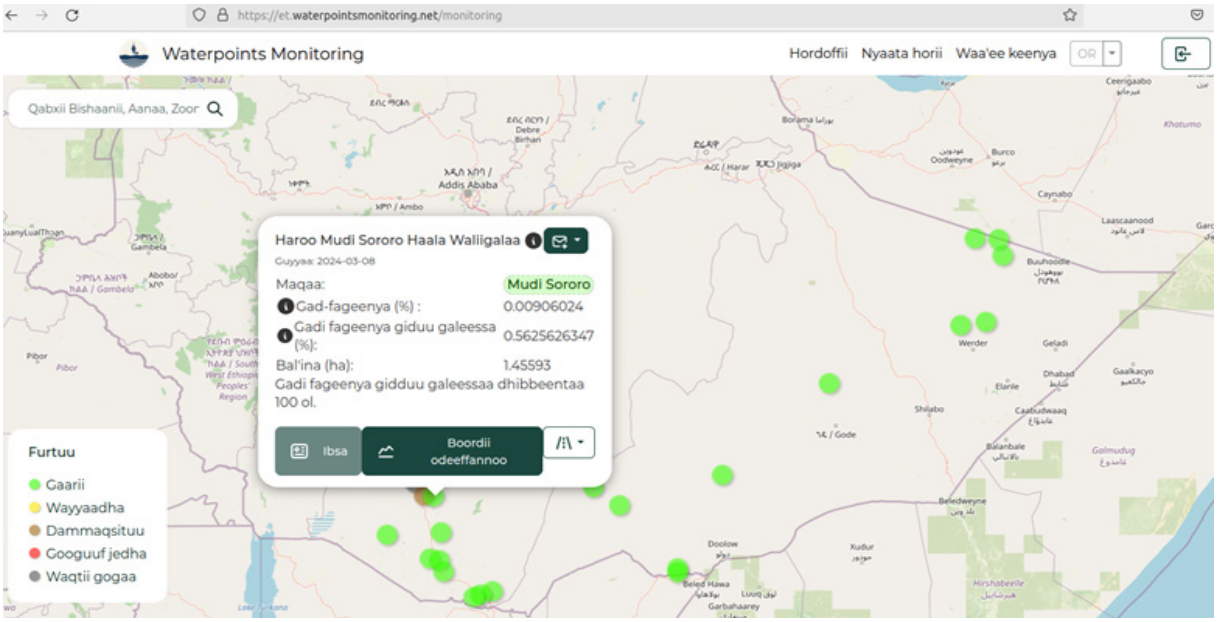

Figure 3. Water points monitoring with a pop-up information in Afan-Oromo for water pond Mudi Soraroo.

Establishment of Water Hyacinth Weevils on Water Bodies in the Rift Valley of Ethiopia

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Water hyacinth *[Eichhornia crassipes* (Mart.)] is one of the top ten serious weed types invading water bodies in the world. It is a rapidly spreading alien invasive aquatic weed in Ethiopia, causing environmental and socioeconomic problems. Environmentally, it causes encroachment of water bodies and hinders ecological services in the country. The main economic effects due to this weed are decreased production of fish, rice, and livestock, and disruption of electric power generation, navigation, irrigation, and tourism activities.

Biological control is the most cost-effective and long-term management technique in reducing or retarding the growth of water hyacinth plants. Based on global experiences, the use of *Neochetina bruchi* and *N. eichhorniae* is the most preferable technique. These weevils are host-specific and eco-friendly, and they have successfully decreased infestations of the weed from water bodies. In Ethiopia, the introduction of the weevils from Uganda was done in 2008. At theWonji Suger Factory, basic studies such as the weevils' adaptability, host specificity, and efficacy had been undertaken under the Lath house condition. The weevils were found adaptable, host specific and effective in reducing both the reproductive and vegetative growth of the weed.

Furthermore, the weevils were mass-reared at Ambo Agricultural Research Center and released in the Central Rift Valley Lakes, i.e., Dembel, Ellen, and Koka, and River Awash in Ethiopia during the 2019 main season. Both species of the *Neochetina* have successfully been established with a success rate of 100% on the water bodies. They were found under better conditions both at larval and adult stages (Figure 1. A-C). In addition, larvae tunnel in petioles, stolons, and crowns, and feeding scars on the surface of the leaves and leaf petioles across the release sites indicated good establishment and effectiveness of the weevils (Figure 2. A-C). Similarly, a study conducted in the lath house condition of Wonji Sugar Factory indicated that the *N. bruchi* and *N. eichhorniae* populations were well adapted to the area (Firehun et al., 2015). The same study indicated that the N. *bruchi* had a higher population growth rate, damaged more the host plant, and recommended as a potential biological agent under similar conditions in Ethiopia.

Figure 1. A) Larvae B) Adult weevils beneath the leaf petioles C) Adult weevils feeding on the leaf

Figure 2. A) Petiole tunnel by larvae B) Old leaves with feeding scars C) Young leaves with feeding scars

The weevils showed good population build-up and damage on water hyacinth for the past consecutive four years at the released sites (Figure 3). Both weevils were well established with ratios of 3:2, 2:2, 2:1, and 2:1 at Lakes Koka, Ellen and Dembel, and River Awash, respectively. The average number of adult weevils per plant was 6, 4, 3, and 3 at Lakes Koka, Ellen and Dembel, and River Awash, respectively (Figure 4). The population of N. *bruchi* was found higher than that of *N. eichhorniae* in all the release sites except Lake Ellen; which might be due to the shorter period requirement of the species to double its generation than that of N. *eichhorniae.*

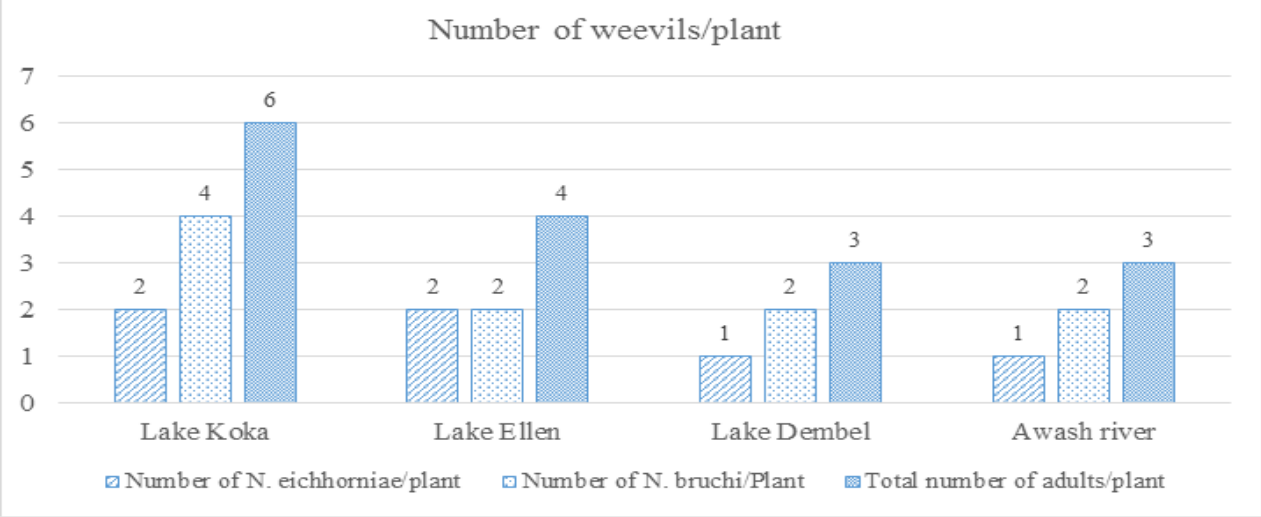

Figure 3. Number of adult *N. bruchi* and *N. eichhorniae* per plant

Four years after the release of bio-agents, the number of water hyacinth populations decreased by about 42, 39, 20, and 18%, respectively at Lakes Ellen, Koka and Dembel, and River Awash (Figure 5). Water depth seems one of the factors accelerating the death of weevil-infested water hyacinths

The quantity of water hyacinths considerably declined in water bodies with a higher depth, because water enters through weevils tunneled leaf petioles and stolons of the floating plant, sinks beneath the water bodies, and kills the sunken plant.

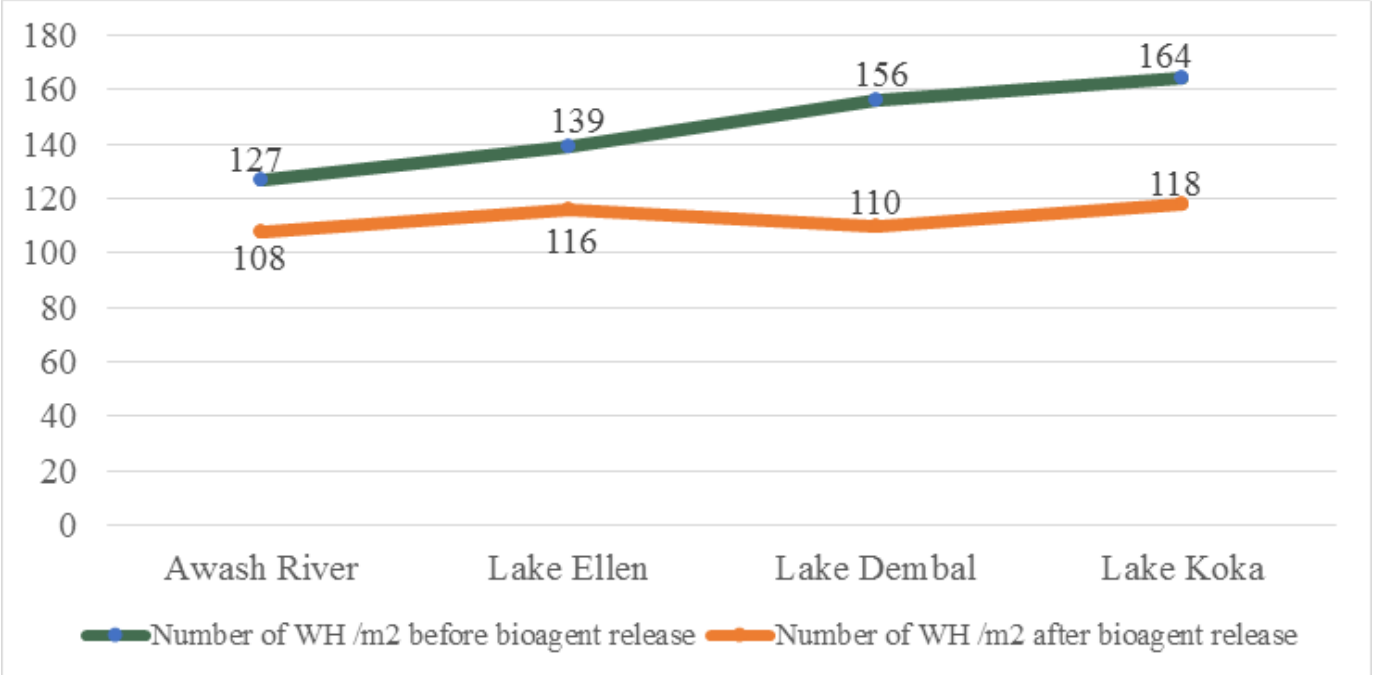

Figure 4. Number of water hyacinths before and after the release of *N. bruchi* and *N. eichhorniae*

The number of weevils-infested water hyacinth populations increased as the number of un-infested water hyacinth populations decreased across the study locations, after the 2019 release (Figure 5).

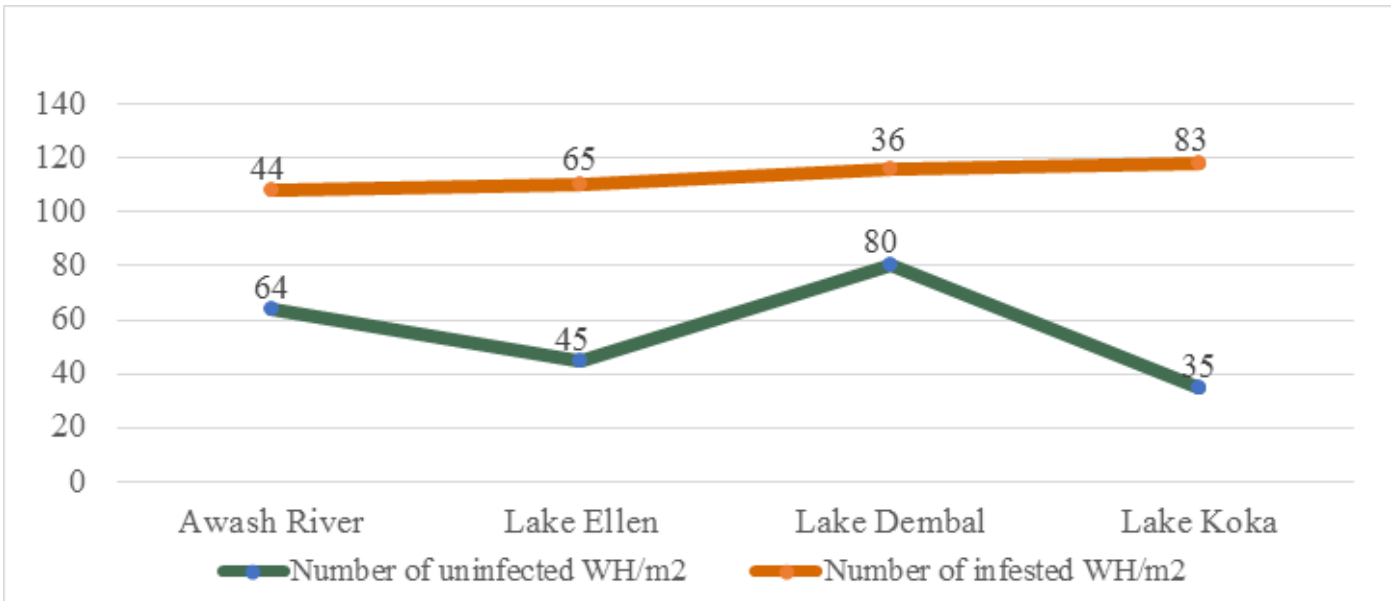

Figure 5. Number of weevils infested and uninfected water hyacinths after the release

The number of feeding scars and severity of attack on water hyacinth plants increased with the increasing number of the associated weevils. Four years after the release of the weevils, 16–56 feeding scars with a severity of 5-20% were observed on water hyacinths across the study areas (Figure 6). At Lake Koka, number of adult weevils, leaf-feeding scars, and severity were found highest.

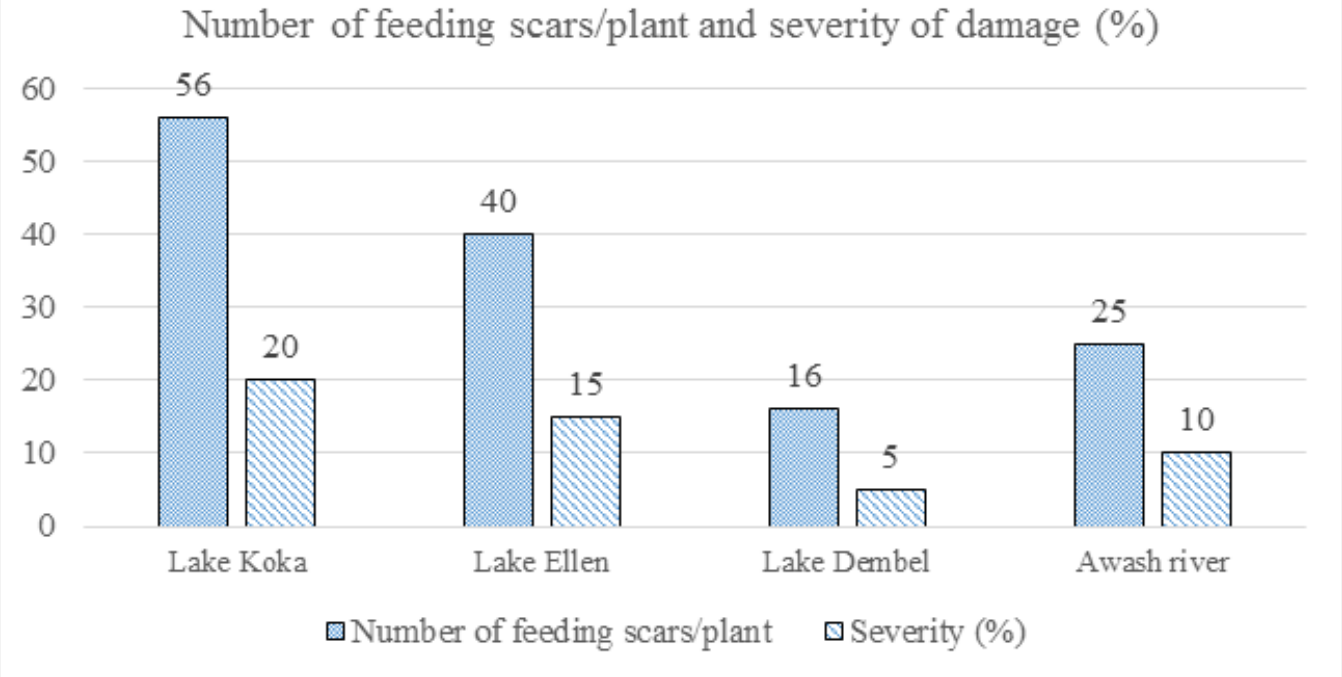

Figure 6. Number of feeding scars per plant and severity of damage on water hyacinth plants

Based on the type of water bodies, the weevils have spread out for 0.10–0.50 kilometers per year in every direction from each release point. At Awash River due to the speedy flow of the river as compared to the lakes, the weevils have spread out to the longest distance of 0.50 km per year to a direction of water flow. Whereas at the lakes, the weevils have spread out for 0.10–0.15 kilometers per year. At Lake Dembel, the weevils found moved the shortest radius of 0.10 km due to the stagnant nature of the release points, whereas at Lakes Koka and Ellen, the weevils moved the intermediate radius of 0.15 km. At each release site, the weevils covered a total area of 0.32-0.79 square kilometers of water bodies per year.

In conclusion, both N. bruchi and N. eichhorniae have been released, established, adequately increased their population, and caused severe damage to water hyacinth at Dembel, Ellen, and Koka Lakes, and Awash River in the Rift Valley of Ethiopia. The use of the bio-agents played a considerable role in reducing the water hyacinth population. *The management of water hyacinth using the bio-agents was found promising in the country. Therefore, future studies should focus on quantification of the impact of the weevils at the released sites and further release of the inoculums to unaddressed but infested water bodies in the country.*

Field Releasing of Leaf Feeding Beetle, Zygogramma bicolorata L. (Coleoptera: Chrysomelidae) in Ethiopia

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Parthenium (Parthenium hysterophorus L.) is one of the most invasive weed species in the world. It has the capacity to adapt and grow in diverse agro ecologies and soil types that enhanced its distribution. This weed was first observed in Ethiopia at Haramaya University in 1968 and then in Dire Dawa in 1988. It affects crop and forage production and productivity, biodiversity, and animals. So far, different management options like manual, mechanical, cultural, chemical, and biological control were practiced to control parthenium weed. Among these practiced options, biological (leaf feeding beetles and stem boring weevils) control is the most effective option in different countries like South Africa, Australia, Mexico and Tanzania.

The leaf-feeding beetle, Zygogramma bicolorata was introduced into Ethiopia in 2007. Since then, the biology, host range and feeding capacity of the beetle have been studied under quarantine condition at Ambo Agricultural Research Center.

The host specificity of leaf feeding beetles was tested against economically important crops in Ethiopia and the result showed that the tested beetles did not cause damage and complete its lifecycle on the crops. Based on these findings and additional host range tests, field release permission was grantedby the Ethiopian Ministry of Agriculture to study its field establishment.

Accordingly, for the first time, starting from May 04/2021, 52,000 adult beetles have been released in two rounds at Sekoru (Gibe valleys) (18,500), Omo Nada (20,000), Shebe Sombo (12,500), and Gomma (1000) districts of Jimma zone, Oromia region, Ethiopia (Figure 2: A and B). Its establishment, population increase and leaf defoliation data were collected (Figure 2: C and D).

After the initial release, continuous follow ups were made to check the multiplication of the beetles at the released sites. So, after two months of release, the increase of beetles population and damage on the weeds were observed at the all released sites (Figure 1). As the beetle's population increased at the field, the percentage damaged of weeds plants also elevated. Consequently, leaf damage of 74.44% at Omo Nadda district were recorded (Figure 1A). Similarly, different stages of beetles, such as eggs, larvae, and adults, were detected and recorded at all released sites (Figure 1B, C and D). This confirms that the initial released beetles are continuously rearing and multiplying in the released sites. This implies that the beetle has the potential to cause leaf damage on parthenium weed in Jimma area. In summary, based on the so far study result and observation, it is important to building up the population of the beetles in the field for the successful establishment of the beetles and management of the weed in the area.

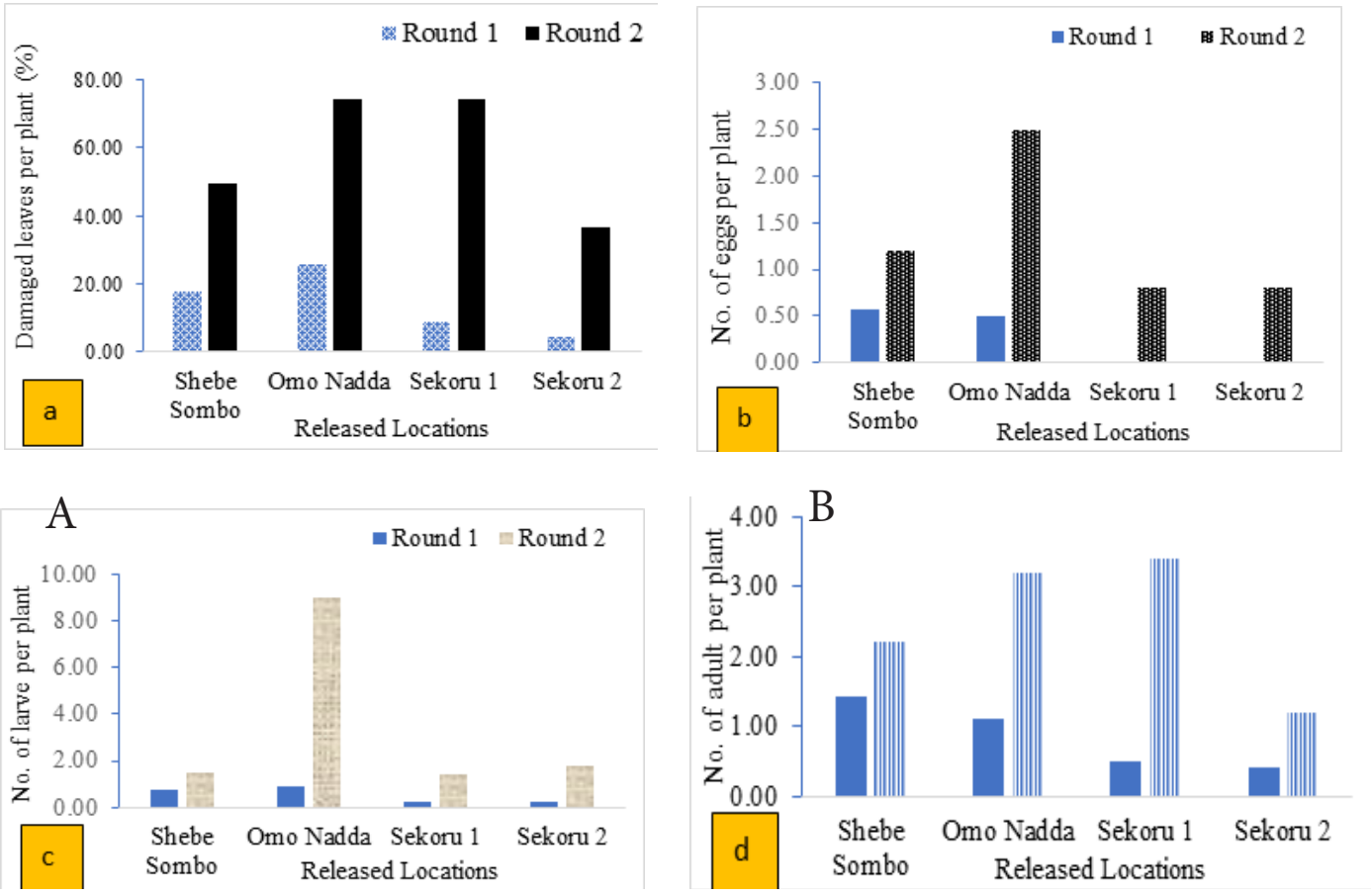

Figure 1: The status of beetle's population in released areas: a) Parthenium leaves damage per plant, b) Population of beetle's eggs per plant, c) Population of beetles' larvae per plant, and d) Adult beetles population per plant

Figure 2: The status of parthenium weed released areas: A) Selected Parthenium seedlings, B) Adult beetles released at field, C) Emerged and observed beetles' larvae per plant at field, and D) Parthenium leaves defoliated on field. Adultbeetles' populations per plant

Integrated Management of Fall Armyworm (Spodoptera frugiperda) in Maize Production

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The fall armyworm (Spodoptera frugiperda (JE Smith) is a notorious pest that challenges maize production in tropical and sub-tropics. Its first outbreak was reported in Ethiopia in 2017 and rapidly dispersed to all maize-producing areas and caused significant yield loss. Since its introduction, attempts have been made to identify the pest, study its occurrence, distribution, and prevalence, and develop management options to combat its damage to maize.

IPM strategic project supported by the Korea-Africa Food and Agriculture Cooperation Initiative (KAFACI) and European Union (EU) project have been developed as "Integrated Management of Invasive Fall Armyworm (Spodoptera frugiperda) for sustainable food security in Ethiopia" and commenced since 2020 cropping season. The project consists of monitoring and population dynamics, survey for native natural enemies, management of fall armyworm using selected insecticides, bio pesticides, botanicals, cultural practices (Intercropping and push-pull technology), and screening of maize genotypes and finally developing IPM for insect pests. Thus, for two consecutive years (2020 and 2021), we have evaluated and validated the individual management options.

Then after, we integrated the most effective and compatible options and validated them for two other cropping seasons (2022 and 2023). In addition, the population dynamics of FAW in the southwestern part of the country are being conducted. This helped us identify the season when the pest pressure is high, the appropriate time for management intervention, and the identification of natural enemies that exist in the area.

Overall, the study revealed that the pest pressure is high on maize production during the off-season and needs due attention if the off-season maize production is targeted. Based on the pest and damage level monitoring, it has been suggested that management intervention should be initiated at the early stage of maize following the inspection for the eggs or larval presence.

Among the evaluated management options, Coragen 200 SC (Chlorantraniliprole) (insecticide), Azadrachita indica (botanicals), Radiant 120 SC (Spinetoram) (Biopesticide) and Lume-500 (Lufenuron + Emamectin benzoate) (Biopesticide) showed the best control efficacy of

FAW. Following the result, and the environmental safeness of the bio pesticides, we have evaluated and demonstrated the two effective bio pesticides namely, radiant and Lume on the farmers, field.

In addition, based on the on-station study, we have observed that climate-smart technology (Push-pull technology) plays a great role in the management of fall armyworms. Briefly, the Desmodium sown in between the maize rows pushes the oviposition due to chemical deterrence and Brachiaria grass pull resembling the host plant.

Finally, the best-bet FAW-IPM was evaluated and validated. The study result indicated that bio pesticides-based IPM is promising in the management of FAW. Having the result, we are anticipating evaluating and demonstrating on the farmer's field

Figure 1. Demonstration of a bio pesticide for the management of FAW

Figure 2- Climate smart (Push-Pull) for the management of FAW

Figure 3-The on-station experimental field for the development of FAW management

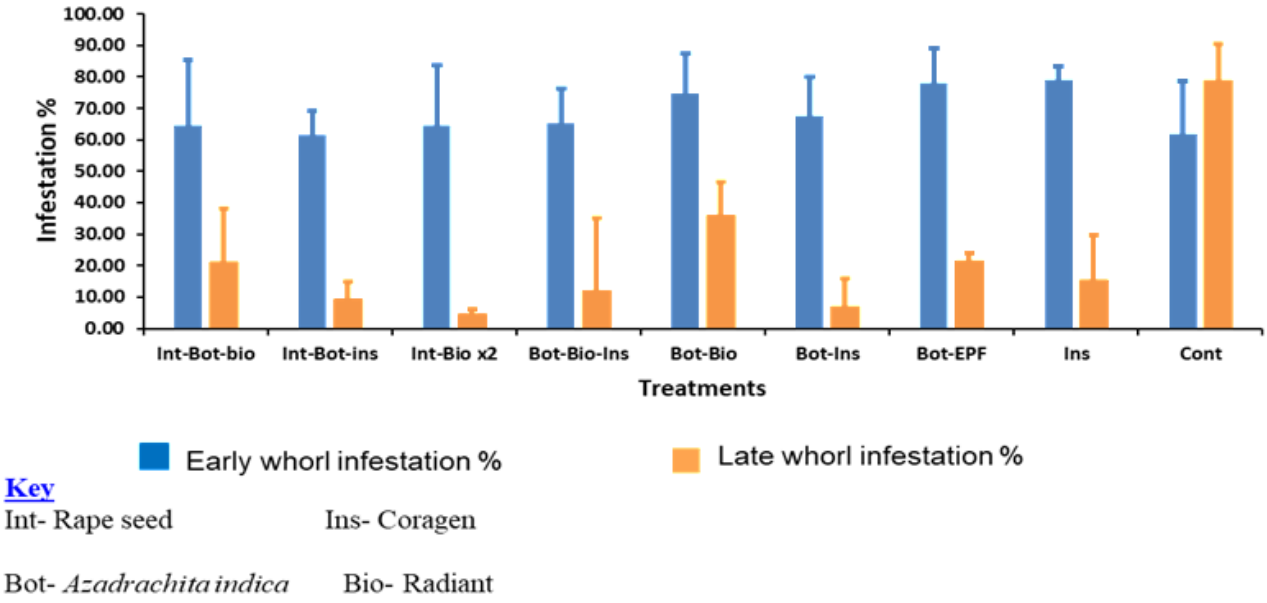

Figure 4. Effect of the best-bet Integrated FAW management on the management of FAW

Table 1. Validation and demonstration of bio pesticides on FAW

Treatment	FAW infestation at early whorl (%)	FAW infestation at late whorl (%)	Early whorl FAW damage score (1-9 scale)	Late whorl damage level (0-9)
RADIANT 120 SC (Spinetoram)	21	0	1.32	0
Lume-500 (Lufenuron + Emamectin benzoate)	21	0	1.12	0
Coragen 200 SC (Chlorantraniliprole)	20	1	0.84	0
Untreated	18	36	1.44	1.64

Integrating Fish Farming with Sweet Basil and Selected Vegetables- Lessons from NFALRC's On-Station Demonstration Trial

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There is wide range of experience to integrate the production of other agricultural commodities with small scale fish farming activity in Ethiopia (Addisu et al., 2022; Alemayehu et al., 2022; Deribew et al., 2022; Mekonen et al., 2021; Teklay, 2021; Respikius et al., 2020; Lemma et al., 2015; Lemma et al., 2014 Getu et al., 2017; Daba et al., 2017; Mohammed et al., 2016; Daba and Toku ma, 2012; Alemu and Abera, 2010; Alayu et al., 2009). The aim of integrating agricultural commodities in fish pond based farming systems is for farm resource use efficiency, productivity (yield improvement) of the fish or its conjugates and sustainable agricultural production. These practices gradually became adaptable to existing farming system of smallholders. This resulted in making them part of a recommendation domain, where small scale

fish farming is practiced. Despite the variation in the yield and efficiency of resource use among many smallholders in Ethiopia, the overall benefit of this practice as part of smallholder farming system is eminent.

In the National Fisheries and Aquatic Life Research Center (NFALRC), integrated fish farming experiments were conducted with onion, tomato, potato, Alfalfa, sweet basil, beet root and poultry as companion agricultural commodities. Results obtained from these experiments showed positive results in terms of reducing the use of chemical fertilizer as well as improved yield of the companion commodities. Among these, experiences and lessons from demonstration of fish farming integrated with onion, tomato, sweet basil and beetroot are discussed here.

Why is it Important?

The demonstration activity had an ultimate objective of showcasing and developing a model integrated farming system, where fish is a part. Target beneficiaries in mind were small-scale fish farmers in southwest and west shewa zone of Oromia region. The activity is aimed at generating evidence for successful implementation of the same model on farmers' land.

Generating Evidence from Yield

As an intermediate result, yield evaluation was done for the selected crops. Meanwhile, the result was compared against national average yield registered for two table varieties of tomato: Woyno and Mersa (MOANR, 2009). Yield obtained from the tomato showed that it was by 17% and 22% higher than the average national yield of Woyno and Mersa varieties respectively. If integration with fish farming is used, yield of sweet basil variety as shown in table 1 increases by an average of 57%. However, fish pond yield resulted in more of vegetative growth than the consumable part (bulb yield), thus needs further study for recommendation. As a result of the integration, yield of Baro onion increased by 1.8 times more than if no fertilizer is used.

Table 1.Yield obtained for vegetables and herbs irrigated and non-irrigated with fish pond water

S/No	Name of the herb/vegetable crop	Area planted	Yield/plot year	Loss/plot/ year	Yield/ha/year
1	Tomato (Local Variety) Irrigated	7.83 m2	26.56kg	5.16kg	339.2qt
2	Sweet Basil(V-02-WOL WGSB II) Irrigated	3.8 m2	9.36kg	-	246.31 qt
3	Baro Onion Irrigated	2.99 m2	20.02kg	-	669.57qt
4	Baro Onion Non-Irrigated	3.4 m2	8.06kg	-	237.06qt
5	Beet Root Non-Irrigated	3.42 m2	5.36kg	-	156.73qt
6	Beet Root Irrigated	3.8 m2	4.82kg	-	126.84qt

Fig 1. During on-station demonstration

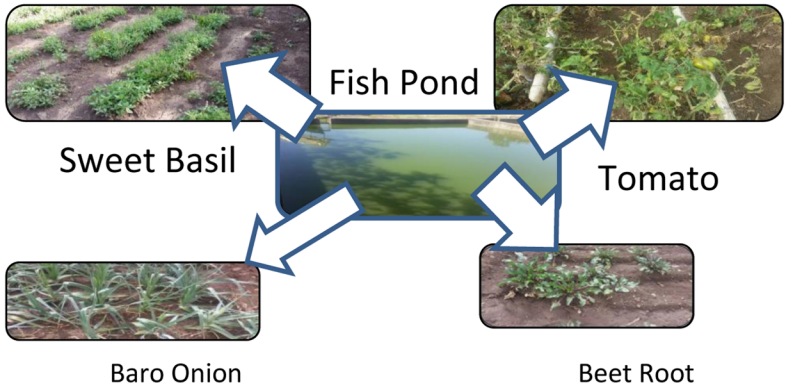

Fig 2.Nutrient flow in the integrated farming

Generating Evidence from Farmers' Response

Apart from the yield evaluation conducted during the activity, some testimonials were also taken from an overall performance of the farming system itself, as perceived by the participant farmers themselves. As the result of analyzing feedback

from the participants, the following two lessons were taken;

- For small scale farmers in Ethiopia, perceived success of integrated fish farming adoption depends on four definitive factors: Diversification of vegetables integrated, the systems' resource use efficiency, sustainabil ity of fish feed and fingerling supply and context specific integrated system design.
- Recommendation domains in applying integrated fish farming should not be prescriptive regarding which crop or livestock commodity is to be part of the system and thus needs to leave a gray space in letting farmers choose among a set of available options.

The Ethiopian Institute of Agricultural Research Hosted a Research System Capacity Building Event on Enhancing Research-University-Industry Linkage and Application of Artificial Intelligence (AI) in Agriculture

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1 Briefing on the topics & objectives of the innovation platform

The quest for success in agricultural transformation is multidimensional which demands relentless strives to search and research problem-solving technologies, their proper adoptions by users and participation of relevant actors. In this context, the realm of agricultural transformations globally in 21st century appeared to be revolutionized due to intervention of three sharpen blades approaches, among others, namely promotion of biotechnology, artificial intelligence and strategic partnership. In pursuit of sensitizing leaders and senior system in creating better awareness to such sharpened blade approaches, an event was organized on **Enhanced Research-University-Industry Linkage and Application of Artificial Intelligence (AI) in Agriculture on January 24 and 25/2024** at the headquarter of EIAR by the Research System Coordination Office of EIAR in collaboration with Bio & Emerging Technology Institute (BETin) and Ministry of Education (MOE). About 175 participants from 25 various organizations (federal and regional research institutes, public univer sities, CGIAR representatives, representatives of private agro-industries) had effectively attended the program.

2 Themes of Day One Deliberations

- Research priority ensuring food and nutri tion resilience in agricultural system,
- Research-University-Industry Linkage: a new proclamation of Ethiopian Govern ment,
- Enhancing strategic partnerships in agricultural research, and
- Science, technology, and innovation for research and development in Ethiopia

The entitled training workshop was launched with commencement of an opening speech delivered by HE Dr Feto Esimo (DG, EIAR). His speech was well articulated with rescuing the great timeless time roles of agriculture in Ethiopian economy. Recent advancements stride on and the brighter future that agriculture's pivotal impacts shall contribute with food and nutrition security, export diversification and import substitutions were emphasized. During all this process, our research system provided multitude of improved technologies catalyzing the agriculture growth and development, even if it went its 7th cyclic changes and evolutionary dynamics in Ethiopia. Besides, he presented a brief account of the historical background; different types of linkages exerted in Ethiopia since 1952, scattered type of linkage with no solid arrangement, called upon all the participants to embark on a real linkage that must foster an emphatic and mutual relationships, enhance capacity, and inventive delivery of meaningful outputs, and above all positive cooperation's.

His speech has well valorized the current weird concepts of application of artificial intelligence (AI) in agriculture which appears to be among one of emerging technologies with owing multifaceted benefits by enhancing efficiency of scare resource utilization like time which is rare commodity to our research system.

After the opening speech, keynote address has been delivered by Dr. Kassahun Tesfaye, Director General of Bio and Emerging Technology Institute. He explained the role of biotech & global trends of biotech science and products: - challenges that the world is facing, alarming population growth and limited resources, climate change induced challenges, rapid urbanization, forced migration, emerging & re-emerging infections.

How can we respond to these challenges? Application of biotechnology is among one of the key approaches used in Agriculture: - crop improvement, animal health improvement, livestock genetic improvement, crop protection and others. He described the nature of emerging technologies:- key for agricultural R&D such as sensor technologies, robotics, automation technology, big data management, block chain, satellite imaging, drones, vertical farming and precision farming were highly emphasized as mindful approaches.

Topics presented to the participants

I. Research priority ensuring food and nutrition resilience in agricultural system:-as it was presented by HE Dr. Diriba Geleti (DDG of EIAR) with broad arena of explanation on the points of the size of food import, food security as an issue of national concern, demands for raw materials from the industries were elaborated. Challenges affecting food system like: - climate change – GHG emissions, limited spending in Agri. Research, regulatory issues, linkage among actors, land degradation, soil acidity and others were colourfully and inspiringly presented to the trainers. Opportunities were also mentioned like: - untapped productivity (yield achieved, achievable, full package, and potential innovation), arable land availability, possibility of expansion to new frontiers (e.g. Irrigation), unexploited water bodies (dams, irrigation), biophysical diversity and others.

II. Research-University-Industry Linkage: A new proclamation (No. 1268) of Ethiopian Government:- Dr. Solomon Benor (CEO, Res. & Community Engagement, MoE) has presented the new legal frameworks and modalities of partnership and linkage. Critical issues regarding the historical background of research-university linkage, guideline on Higher Education training-Research institutions and Industry linkage, the need of frequent ongoing discussions in strengthening the linkage, the contexts of the new proclamation, drafted six guidelines towards implementing the proclamation were high lightened.

III. Enhancing strategic partnerships (SP) in agricultural research:-It was presented by Dr. Nigussie Dana (Director of FSRP, EIAR) and he focused on mainstreaming strategic partnerships in every institution like in EIAR. Critical to keep an organization relevant & competent which can bolster sharing resources, knowledge and expertise, building innovations and complete package of new solutions, scaling quickly, risk sharing. Also some wonderfully displayed stories include- Successes and Failures in the SP, the need for operationalizing SP, institutional Strategic Partnership Directorate (ISPD): EIAR, core functions of the directorate, revitalizing partnerships with International (food/agriculture) Research Institutions in Ethiopia was also presented.

IV Science, technology, and innovation for research and development in Ethiopia:- Dr. Habtamu Abera (CEO, National R&D, MinT) has delivered with focused on the following issues:- research governance and policy, long-term focussed research, coordination and networking, research data management, essentiality and establishment of national research fund (NRF), research fund management, intellectual PR management, incentive policy, supporting platform, implementation framework, inclusiveness of Ethiopian diaspora scientists platform and improving invest in Agricultural research.

Discussions and the Lessons forwarded: -

Major topics raised during discussion time from those presentations were the following:-

- What were the contributions, challenges and drawbacks of the previously existing linkages /connections?
- In order for the linkage to be continuous and essentiality of accountability with trust must be established,
- Working together in a sustainable pathway that can bring about effective change, it should include farmers, all private agro-industries and research partners,
- The need of a central database to avoid duplication and relevance of linkage for competence as well as survival,
- The importance of joint planning (where the linkage should takeoff), need to clearly identify and agree-on the area of collaboration,
- Enforcement of the linkage through the proclamation should be carefully handled,
- Interface b/n the new proclamation and the different linkage platforms at different existing models like Research-University forum (Amhara region) Agriculture Council - cluster based (Oromia region),
- Use of Joint infrastructure (Resource mapping – where and how to use), in placing pooled/central services, laboratories, workshops, etc,
- Internalizing the linkage i.e. beyond paper, coming together, keeping together and working together,
- EIAR, MoE, MinT, BETin should sit together and work on the way-forward eg. next innovation platform meetings

3. Themes of Day two Deliberations

Major topics raised during discussion time from those presentations were the following:-

I. Application of AI in Agriculture,
II. Research trends of AI in Agriculture,
III. Intersection of satellite imagery, AI and agriculture,
IV. Alignment of agricultural research with the fourth industrial revolution CGIAR practical experiences,
V. AI for Agricultural Extension, and
VI. Digital Agricultural Extension Advisory Services (DAEAS)

I. Artificial Intelligence and its Application in Agriculture:- Mr Yonas G/Michael from (BETin) has begun with his training on the topic by showing a short video of a robot harvesting wheat fields in Sululta, that drained attentions of trainees to uncover further magic of AI in transforming agricultural research and innovation. It was narrated that the whole idea of AI can be summarized as "mimicking human intelligence". But defining AI is not universal and is difficult. But this is an advantage because it allows us to improve the field. In fact, imagination is the only limitation to technology. Humans are using AI in our everyday activities because we are using applications such as Google search, texting, voice assistants, Whatsapp, Telegram, and YouTube etc. Hence, AI is classified as based on its capabilities

and functionality. The presentation introduced the three types of AI categorically. The first is a weak (narrow) AI or only a single task; the second a general intelligence; which does anything like that of a human being, and the third type is a super intelligence one, which surpasses human level of intelligence.

The question is why we need AI in Agriculture in modern day? AI in agriculture can be used in different disciplines and activities such as for crop yield estimation, early warning in disease and pest prediction, big data analysis, digital farming, precision farming, early problem tackling unlike the traditional research approach, and so on.

II. Research trends of AI in Agriculture:- Dr. Menor Tekeba (AAiT-Addis Ababa University) has delivered his training module beginning with the phrase "sowing the seeds of the future:- how AI can transform Agriculture amazingly in our today's world". From his presentation it was clear to learn that AI is a game changer tool for sustainable and efficient farming. The use of AI in agriculture can optimize the resource (input) using different types of sensors in soil moisture for irrigation, soil fertility, weeding; as predictive power in weather prediction, price prediction, robotic workforce, and in empowering farmers in training and support. Some practical uses displayed during the event include:-precision agriculture, optimizing resources and maximizing yield, the eye in the sky like drones and aerial imaging. The power of AI and its predictive nature like AI forecasting the future, prices, weather, and robot workforce: automating tedious tasks, disease and pest control. Moreover, livestock health monitoring, keeping animals thriving and beyond the field were discussed. AI in the market supply chain of major commodities, the farmer's tool box, AI apps and software, empowering aspects of farmers, education and accessibilities were thought. The need of collaborative efforts, partnerships for progress, and the need to focus on the application of AI in agriculture than the science itself to enhance transformation of our agricultural development goals were underlined.

III. Intersection of satellite imagery, AI and agriculture:- The module was covered by Mr Melaku Muka (Space Science and Geospatial Institute). It was commenced by providing a short and precise introduction about satellite imagery in relation to agricultural practices and the image types (multi temporal, multi scale, and multilevel) nature description, satellite imagery area of application in agricultural and finally presented a case study in relation to agricultural practices in crop yield estimation.

IV. Alignment of agricultural research with the fourth industrial revolution CGIAR practical experiences:- Dr Degefe Tibebe (Alliance of Bioversity International and CIAT) has paid attention to emphasize on challenges in agricultural growth and development including increasing population, environmental degradation and climate change, rising costs, limited land resources and the power of digital and data driven agriculture in tackling of those agricultural transformation barriers.

The need for disruptive digital technologies, AI in digital agriculture, IoT, AI & sensor application in smart irrigation of agricultural fields, AI and block chain in food system transformation, and Chat GPT for personalized farm advisory with existing CGIAR practical experiences were displayed as lessons.

What Ethiopia is doing in all the above regards? The coalition of the willing for data sharing (agri-data hub), data and data governance, fertilizer harnessing activities, block chain system for seedling, nursery and restoration practices, hotspot line for primary data collection direct from the farmer were tutored as models works.

V. AI for Agricultural Extension:- W/rt Selamawit Retta (Digital Green, Ethiopia) has shared her experiences on how Digital green works with Small Holder Farmer in Ethiopia, Kenya and India. Generative AI based for extension agents, conversational UI and AI methods were discussed. Farmers chat AI application for farmer to farmers support/help link approach was presented. The system works in bilingual mode in the selected countries. In Ethiopia, the system facing a language problem as most or all DAs and users has poor knowledge of English language. Therefore, to get help, the system requires twice translationand some of the requests even don't have data to answer.

VI A digital extension platform:-Dr. Mandefro Nigussie (DG, ATI) presented institutional and country level ongoing efforts of ATI about the Digital Agricultural Extension Advisory Services (DAEAS). The DAEAS include the 8028 hotline, 6077 national market information system, e-input voucher system (e-IVS), etc. services that enhanced the knowledge of participants about the power of Digital tools in transforming the nation agriculture in broad.

Discussions and the Lessons forwarded: - After the presentation, major topics raised during the discussion and way forwards about AI in agriculture were:-

- Institutionally, two representatives from EIAR (possibly ICT and Partnership directorates) need to sort out what is necessary to apply AI and linkage,
- Clear pathway for delivery of AI technology to the farmers must be sorted out and indicated,
- Digitalizing and AI agricultural research must be invigorated possibly as one directorate or wing of EIAR,
- Data for use as AI input need to be credible and high quality to avoid garbage in garbage out scenario. It must first be refined before being fed to the AI machines,
- The linkage and AI need to be organized at national level by establishing an entity,
- Any technologies including AI must be channeled through a well-established entity to allow the private sector or commercial farms to use them. That is, it needs to include extension system for the private sector,
- Proactive collaboration with AI institute need to add its inputs ,
- Partnership directorate must be open for the private sector and other research organizations,
- Capacity building (human and physical) must be facilitated to use the AI technology in the EIAR and beyond,
- A national entity to coordinate this must be identified or established,
- Young researchers must be encouraged to be engaged in AI for agricultural research,
- All the EIAR directorates must generate big data using available resources and use AI and integrate it to its system,

4 Concluding Remarks by HE Dr Diriba Geleti (EIAR D/Director General) on AI for agriculture

"There is a huge possibility to cop-up with the AI advances and to introduce it as a tool enhancing efficiency of our research system and agricultural transformation. The most important thing is a continued, credible and refined data. All completed research activities have been published and this has to be the source of data for AI (to be converted into AI applications). There is an AI institute and a high level steering national committee that leads the institute. Therefore, we need to work in collaboration. I paraphrase it again collaboration towards betterment of synergy in achieving our common development goals. It only needs a little fine tuning to work for the benefit of the farmer and in the context of agricultural research. AI should be mainstreamed in the context of agricultural research. ATI is using plenty of AI application and it is not very new. Being pragmatic is very important. Research on AI is very expensive and not easily available.

Application of AI must be given priority but the research on AI should also be undertaken hand-in-hand with the application to avoid dependency on lords of AI and the developed world. We are now in the post truth era. All things will use AI now and in the future. AI is addictive and there are risks associated with using it. It can also negatively impact human intelligence, community and social aspects. AI can be used for harmonization of our activities and initiatives. The EIAR will take initiatives and responsibilities in this regard. Leadership is very important in this regard to harmonize existing initiatives on AI in the different institutions. Digital infrastructure is important to apply AI. Human capacity building is also important.

Enabling environments must be created in institutions such as legal framework. We need to explore all possibilities. Involvement of private sector, an awareness creation, digital literacy and on boarding the agendas is important. Avoiding redundancy is important. Some have precise data but not use it. We need to read each other and push AI forwards. This forum will continue in any convenient way. The EIAR will discuss the issue and follow the matter very strictly."

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በኢትዮጵያ ገብርና ምርምር ኢነስቲትዩት የወርር ግብርና ምርምር ማዕከል በአፋር ክልል በአሚባራ ወረዳ በሲድሃፋጌ ቀበሌ ያከናወናቸወን የምርምር ስራዎች የማስተዋወቅ ስራ መጋቢት 2016 ዓ.ም እካሄደ።

በክልሉ ከተለዩት የግብርና ችግሮች ውስጥ አንዱ የአፈር ጨዋማነት ችግር ሲሆን ይህ ችግር በአሁኑ ሰዓት በከፍተኛ ሁኔታ አየተሰፋፋ የመጣ እና የሰብልን ምርታማነት በከፍተኛ ሁኔታ የሚቀንስ አፈር ነክ ችግር ነው፡፡ የአፈር ጨዋማነት በክልሉ በተለያዩ ቦታዎች ላይ ተከስቶ የሚገኝ ሲሆን በተለይም በአሚባራ፥ ሃሩካ እና አዋሽ ፈንታሌ ወረዳዎች ላይ በከፍተኛ ሁኔታ እየተስፋፋ በመምጣት ብዙ የእርሻ መሬቶችን ከምርት ውጭ እያ ደረገ የሚገኝ ችግር ነው። የአፈር ጨዋማነት ችግርን በተለያዩ መንግዶች ማሻሻል የሚቻል ሲሆን አንዱ ዘዴ ችግሩን ተቋቁመው ምርት ሊስጡ የሚችሉ የሰብል፥ የእንስሳት መኖ ዝርያዎችን በስፋት ማልማትና መጠቀም አዋጭ ዘዴ እንደሆን ይታመናል።በዚሁ መሰረት በማዕከሉ የጨዋማ አፈር ምርምር ፕሮገራም ከዚህ በፊት በምርምር የለያቸወን ጨዋማነትን መቋቋም የሚችሉ ሁለት የስንዴ ዝርያዎች የማስተዋወቅ ስራ እያከናወነ ይገኛል።

በመስክ ቀን በዓሉ ላይ የተገኙት የምርምር ማዕከሉ ዳይሬክተር አቶ ሽመልስ አለማየሁ እንደተናገሩት ማዕከሉ የአካባቢውን የግብርና ችግሮች ሊፈቱ የሚችሉ የሰብል ፥ የእንስሳት፥ የአፈርና ውሃ አያያዝ፥ የሰብል ጥበቃ እና በሌሎች ዘርፎች ላይ ቴክኖሎጂዎችን፥ የአሰራር ዘዴዎቸን እና መረጃ ዎቸን በምርምር በማፍለቅ፥ በማባዛትና በማስተዋወቅ ሰፊ ስራዎቸን ሲያ ከናውን የቆየ አንጋፋ የምርምር ማዕከል መሆኑን አስታውስው በዛሬው ቀንም የምንመለከተው የአፈር ጨዋማነትን የሚቋቋሙ የስንዴ ዝርያዎ ችን የማስተዋወቅ ስራ የዚሁ ማሳያ መሆኑን ተናግረዋል። ዳይሬከተሩ አክ ለውም ማዕከሉ የሚያወጣቸውን ቴክኖሎጂዎች በተገቢው ሁኔታ ከተተ ገበሩ ምርትና ምርታማነትን ማሻሻል እንደሚቻል የዛሬው ጉብኝት ማሳያ መሆኑን አስታውሰው በቀጣይ ተጠቃሚዎች ይህንን ተሞክሮ በመውሰድ በሰፊው በኩታ ገጠም በመተግበር እና በማልማት በጨው የተጠቁ መሬቶ ቸን ምርታማነት እንዲያሻሽሉ መልዕክታቸውን አስተላልፈዋል።

በመስክ ቀኑ ተሳታፊ የነበሩ እና የማስተዋወቅ ስራውን ያከናወኑት ከፊል አርባቶ አደር አቶ አሊ ኡቶ መሬታቸው ከዚህ በፊት የተለያዩ ሰበሎቸን ቢዘ ሩበትም በቂ ምርት ሳይሰጣቸው መቆየቱን ተናግረው አሁን ማዕከሉ ያመጣው የስንዴ ዘር ግን በጥሩ ሁኔታ የበቀለ እና እድገቱም አስደሳች መሆኑን ገልጸው የተሻለ ወጤት እንደሚጠ ብቁ ተናግረዋል። በቀጣይም የምርምር ማዕከሉ ተገቢወን ድጋፍና ክትትል እንዲ ያደርግላቸው የጠየቁ ሲሆን በዘንድሮው ዓመት የተከሰተው የግሪሳ ወፍ ግን ስጋት እንደጋረጠባቸው ተናግረው የሚመለከ ተው አካል የቅደመ መከላከል ስራ ከሰራ በቀጣይ ቴክኖሎጂውን በሰፊው ከሌሎች ጎረቤቶቻቸው ጋር በመሆን ለመስራት ፍላጎት እንዳላቸው ተናግረዋል። በመስክ ጉብኝቱ የተገኙት ሌሎች ከፊል አርብቶ አደሮች እነዚህን ቴክኖሎጂዎች መጠቀም እንደሚፈልጉ ተናግረው በቀጣይ የምር ምር ማዕከሉ ከዘር አባዥ ተቋማት ጋር በመሆን ዘሮቹን በማባዛት ተጠቃሚ እን ዲያደርጋቸው ጠይቀዋል።

በመጨሻም የምርምር ማዕከሉ በሌሎች ሰብሎችም ላይ እየተከናወኑ ያሉ የምር ምር ውጤቶቸን በሰፊው ለተጠቃሚዎች ለማድረስ ጠንክሮ እየሰራ እንደሚገኝ እና ተጠቃሚዎች በምርምር የሚወጡ አዳዲስ ቴክኖሎጂዎችን እና የተሻሻሉ የአ ሰራር ዘዴዎቸን በተገቢው ሁኔታ መተግ በር እንደሚገባቸው የማዕከሉ ዳይሬክተር ገልጸዋል ። በመስክ ቀን በዓሉ ላይ የማዕ ከሉ ተመራማሪዎች፣ የድጋፍ ሰጪ የስራ ሂድት ሃላፊዎች፥ የግብርና ባለሞያዎች እና ከፊል አርብቶ አደሮች ተሳትፈዋል።

TThe Ethiopian Institute of Agricultural Research Appointed New Directors in its Various Research Directorates

Following the expiry of term of duration of previous directors, the Ethiopian Institute of AgriculturalResearch (EIAR) has appointed new directors for its various research directorates. Here is the summary of biography of the newly assigned directors.

Bedru Beshir (PhD)
Director of Research Quality Assurance and Evaluation Directorate

Dr. Bedru beshir obtained his Ph.D. in International Development from Nagoya University in Japan in March 2013. His professional career started when he graduated from Haramaya Agricultural University with a BSc degree in Agricultural Extension in July 1998 and joined the Oromia Cooperative Bureau office as a junior farmers' cooperative organizing expert, serving from August 1998 to June 1999. After that, he joined the EIAR Melkassa Agricultural Research Center as a junior researcher in July 1999 and promoted to senior researcher going through the growth up ladder in theEIAR since then. His research interests are agricultural technology dissemination, seed systems, social networks, and regenerative agriculture. He has published over 50 peer- reviewed journal articles, book chapters, workshop proceedings, research reports, and policy briefs. Throughout his 20-year plus professional career, he has received 21 awards and certificates from local, national, and international communities and institutions. He has served as chairperson and secretary in the Agricultural Developments Partners Linkage Councils and Chairperson of the Oromia Agricultural Transformation Central Council for the last 15 years. In the past five years, he has served as the director of the Melkassa Agricultural Research Center. Currently, He is appointed and serving as the Director of Research Quality Assurance and Evaluation in the EIAR.

Nigussie Dana (PhD)
Program Manager, Food Systems Resilience Program- Research component

Dr. Nigussie Dana is a PhD holder in Animal Breeding and Genetics from Wageningen University, the Netherlands. He served as senior researcher of livestock and coordinator of research effectiveness and recognition in the then Ethiopian Agricultural Research Council Secretariat (2019—2023 GC). He also worked as Director General of the then South Agricultural Research Institute, SARI (2010-2019). He was a Management board member of Hawasa, Dilla and Wolayta Sodo Universities (2017-2019). He served EIAR starting from assistant to senior researcher level in livestock and poultry research. He was head of animal science research department at Debre Zeit Agricultural research center and leader of national poultry research project (2001-2006 GC). He has a research interest in the area of livestock and poultry and published over 60 articles in peer reviewed journals, proceedings, and research reports. He secured a Silver Medal award at the 6th Science, Technology and Innovation Award (12-14 Nov., 2015) from the Ministry of Science and Technology for contribution in poultry research, and Certificates of Acknowledgment for contributions in research and leadership. Currently he is appointed and serving as Program Manager, Food Systems Resilience Program- Research component at the institute

Minilik Tsega
Director of Climate and Computational Science Research Directorate

Mr. Minilik Tsega Ejigu has studied statistics at BSc and MSc level as well he has secured another MSc degree in development Economics. He had served Central Statistics Authority (CSA) for eight years (form 1998 up to 1906) as senior researcher in areas of vital statistics and survey methodology. During his time with the authority, he has participated in a number of national level studies like annual agricultural production, labour force, child labour, demography and health, social welfare, vital statistics, household consumption and expenditure with different capacities that ranges from junior to senior researcher level. He has also played a major role in the first National Agricultural Sample Census that the authority conducted in 2002.

Minilik has joined Ethiopian Institute of Agricultural Research (EIAR) in 2006. Since then he has been involved in a number of research activities and has published 12 journal articles in collaboration with EIAR and international researchers working in the agriculture sector. His research primarily focuses on bridging knowledge gaps related to biometrics, climate and economic development. Besides research undertaking, he has been serving the institute as a dependable resource person in areas of statistical methods, research design, data management and data analytics. Currently, he is Director of Climate and Computational Science Research Directorate of the institute

Netsanet Bacha (PhD)
Director of Plant Protection Research Directorate

Dr, Netsanet Bacha is a breeder-pathologist at the Ethiopian Institute of Agricultural Research. She received her Ph.D. in Plant Breeding in 2015 from the University of KwaZulu-Natal, South Africa; MSc in plant pathology from Haramaya University in 2005 and BSc in plant science from the same university in 2003. In 2006, she joined the Ethiopian Institute of Agricultural Research stationed at Ambo Agricultural Research Center, where she served as cereal pathologist, national wheat rust surveillance coordinator and national plant pathology research program coordinator from 2016-2019. She coordinated pesticide and plant quarantine research program at EIAR-Head Quarter from 2019 to 2023. She has been serving as PI and Co-PI of many collaborative research projects financed by various international institutes. She was awarded a scholarship by the Bill & Melinda Gates Foundation to pursue her PhD through Alliance for a Green Revolution in Africa at the University of KwaZulu- Natal. She was also a fellow of African Women in Agricultural Research Development (AWARD) fellowship program, Kenya. Her research interest is developing wheat cultivars with resistance to biotic stresses. She is the (co-) author of more than 40 publications on the subject of plant pathology and plant breeding. Currently, she is a senior researcher and plant protection research director at the institute

Alganesh Tola (PhD)
Director of Food Science and Nutrition Research Directorate

Dr. Alganesh Tola is senior professional who received her BSc in Animal Sciences from the then Alemaya University of Agriculture, now Haromaya University. MSc in Animal production from Haromaya University and PhD in Post- harvest Technology from Jimma University. Formerly, she worked at Bako Agricultural Research Center as a researcher in dairy technology. Besides, she worked as lecturer in Ambo University. She has served as a researcher and a director of Holeta Agricultural Research Center. She is an alumni of AWARD (African Women in Agricultural Research and Development) Award fellowship. She is an alumni of ADA (African Doctoral Academy) scholarship, Stellenbosch University, South Africa. She is an alumni of Norman E. Borlaug International Agricultural Science and Technology, Pennsylvania State University, USA.

Served as a part-time project officer for four years in the center for food sciences in Addis Ababa University. She is involving in different food and nutrition research activities and active member of different national and international societies. She has published more than forty one publications. Served as a par-time consultant for ILRI on piloting of strengthening capacities, incentives and institutions for food safety in Ethiopia. In addition, she is teaching and supervising PhD and MSc students on food safety aspects at Jimma University, Addis Ababa University, Haromaya, Selale, and Arsi Universities. Currently, she is working as a director for Food Science and Nutrition Research Directorate of the institute.

Fekadu Gurmu (PhD)
Director of Crop Research Directorate

Dr. Fekadu Gurmu Balcha is a Senior Researcher at the Ethiopian Institute of Agricultural Research (EIAR) in Addis Ababa, Ethiopia. He obtained his PhD in plant breeding from the University of KwaZulu-Natal, in South Africa in 2016. He had been working for the South Agricultural Research Institute (SARI) as a junior, assistant, associate and senior researcher for over 17 years. He had been coordinating National Soybean Research Project; Nation Root crops Research Program and served as a head of crop research in Hawassa research center. He was also a PI for various externally funded projects. He is specialized in plant breeding and developed over 18 varieties of different crops along with his team. He has published over 40 journal articles. Dr Fekadu has received awards and letters of recognition from the Ethiopian former Prime Minister, His Excellency Mr. Hailemariam Desalegn, and from the former President of the South Regional State in Ethiopia, His Excellency Mr. Dessie Dalke, in recognition of his contribution to food and nutrition security through the development of bio-fortified sweet potato varieties, seed production and technology dissemination to end-users. In 2020, he was awarded by SARI as an outstanding researcher and the same year, he was selected as a young affiliate of The World Academy of Science (TWAS). Currently he is assigned as director of Crops Research Directorate of the institute..

Tadele Mamo (PhD)
Director of Agricultural Economics Research Directorate

Dr. Tadele Mamo is a senior researcher in agricultural Economics in the Ethiopian Institute of Agricultural Research. He held his PhD Degree in Agricultural Economics from Haramaya University. He has nearly 30 publications of which 17 are journal articles. His research has primarily focused on addressing knowledge gaps in value chain analysis and market research on both crop and livestock commodities. Adoption and Impact evaluation of agricultural technologies is also among his research focusses. Beyond his research endeavors, Dr. Tadele actively engages in resource mobilization, policy advocacy, and outreach efforts. He has played a crucial role in mentoring several young researchers and postgraduate students, served as an advisor, and provided valuable academic reviewing services. Before holding his current position, he served the institute basing at Holetta Agricultural Research Center (HARC) where he played different leadership roles including department head and leading several externally funded projects. Currently, he is appointed as Director of Agricultural Economics Research Directorate of the institute.

Zecharias Shumeta (PhD)
Director of Knowledge Management and Intellectual Property Protection Directorate

Dr. Zecharias Shumeta is a senior researcher and associate professor in Agricultural Economics. He obtained his PhD degree in Agricultural Economics from Ghent University, Belgium. And Msc degree in the same field from Haramaya university, Ethiopia. He served as a senior researcher and coordinator of the agricultural economics research coordination department of the then Ethiopian Agricultural Research Council Secretariat (EARCS). He was also instructor (lecturer-associate professor) and head in the Agricultural Economics department of Jima University, Ethiopia.. He also served as assistant and senior socioeconomics researcher at Jima and Holeta research centers of EIAR respectively. He has a research interest in marketing, impact evaluation, production economics and food security. He has published 30 research articles and one book on topics of agricultural economics research. He supervised and evaluated a substantial number of post graduate research studies (both Msc and PhD) at Ambo, Addis Ababa, Jima and Haramaya universities. He also served as a jury member (member of board of examiners) for evaluating a PhD dissertation at Ghent University, Belgium. Currently, he is appointed as director of knowledge management and intellectual property protection directorate of the institute.

Geremew Taye (PhD)
Director of Research Centers Coordination Directorate

Dr, Geremew Taye has a PhD degree in soil sciences. He secured his MSc in Agronomy and physiology, Bsc in plant production and dry land farming and diploma in plant sciences. He has 13 years of research experiences apart from his long years of service in other offices. He served as dean of Poly technic College at Nedjo, West Wollega zone, from Feb, 2006-Dec. 2010. He was also ccoordinator for Development of Fertilizer Recommendation Schemes for Strategic Crops in Different Agro-ecologies of Ethiopia from June 2014- Dec. 30, 2015. He was also a task-force Member of Oromia Region Crop Technology Pre-scaling up from 2012- 2013 and head of Natural Resources Management Research from Dec. 1, 2013- Oct. 2015. He has been serving as program leader for National Acid Soil Management Research at EIAR from April 1, 2022 to date. Currently, he is appointed as director of Research Centers Coordination Directorate of the Institute.

Researchers from the Ethiopian Institute of Agricultural Research Participated in China-Africa Wheat Head Scab Workshop

Jemal Tola
Ethiopian Institute of Agricultural Research, Ambo Agricultural Research Center

Ethiopian researchers have actively participated in the **Training Workshop on Wheat Head Scab Resistance Breeding and Pest Control in Africa** which was held at Beijing and Nanjing, China from April 10-23,2024. This workshop, sponsored by the Chinese Ministry of Commerce, aimed to introduce Chinese policies, successful cases, and practical experiences in wheat head scab or Fusarium head blight (FHB) disease control.

Experts from the International Maize and Wheat Improvement Center (CIMMYT), the Ministry of Foreign Affairs, CAAS, Jiangsu Academy of Agricultural Sciences (JAAS), Zhejiang University, and Huazhong Agricultural University were invited.

The workshop brought together 20 agricultural officials, researchers, and enterprise representatives from Ethiopia, Lesotho, and Zambia among which 14 of them were from Ethiopia; seven researchers from the Ethiopian Institute of Agricultural Research (EIAR) and seven experts from the Ethiopian Agricultural Authority (EAA).

Their collaboration focused on exploring methods relevant to breeding wheat resistant to fusarium head blight and integrated FHB disease control tailored to the national conditions and natural environment of African countries. This initiative represents the first cooperation between CAAS and international organizations in organizing a training program sponsored by the Ministry of Commerce for China Aid. The emphasis was on technical training and experience sharing specifically tailored to address wheat fusarium head blight disease prevalent in African countries, to enhance food security in Africa, and actively contribute to advancing agricultural technology cooperation with African nations.

Figure. Photo of Ethiopian participants after on closing ceremony, JAAS, Nanjing China.

This collaborative effort underlines the importance of international cooperation in addressing agricultural challenges and promoting sustainable food production. By sharing knowledge and expertise, researchers from Ethiopia and other countries can contribute to global efforts in wheat research and FHB management.

Ethiopian researchers' participation in this workshop demonstrates their commitment to advancing agricultural practices and strengthening global partnerships. Since the 2021 and 2022 FHB epidemics in major wheat-growing areas such as the Arsi and Bale zones of Oromia region, the Ethiopian Ministry of Agriculture and Ethiopian Institute of Agricultural Research (EIAR) just set the disease as a top-priority and have taken remarkable measures for the management of the disease in the region. Awareness creation, research initiation and experience sharing from the countries that have over year experience in FHB disease control were some of the works done so far. This has shown incredible progress in the wheat FHB management in Ethiopia.

However, more research works and international collaboration are still needed to sustainably suppress the disease's impact on wheat production in Ethiopia.

In this particular training workshop, several lectures and field trips have been made addressing resistant breeding against FHB, integrated FHB disease, and its mycotoxin management in China. China's and CIMMYT's experiences in the management of wheat Fusarium head blight were well demonstrated both theoretically and practically. It was also noted that as the disease is difficult to control by a single method, an integrated approach that constitutes the use of host resistance, agronomic/cultural practices, chemical fungicides, and biological agents is needed.

Moreover, participants learned that supportive government policy, strong individual dedication, appropriate resource allocation, and international collaboration are crucial in overcoming the impact of destructive wheat diseases, particularly FHB.

Apart from creating a strong linkage between China and Africa, the workshop generated an environment for networking among researchers across African countries that would help strengthen their future collaboration in FHB management, in particular and agricultural development, in general.


EIAR-CALM
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