



PART 1: Description and all information of the outcome/impact reported

TITLE

Transforming Ethiopian agriculture: validating and scaling site-specific fertilizer recommendations to 72,000+ farmers via digital advisory.

YEAR

2024

OUTCOME IMPACT CASE REPORT

Study #AFR - 2418

Stage of Maturity of change reported: **stage 3**

GEOGRAPHIC SCOPE: NATIONAL



COUNTRY:

Ethiopia

Comments:

The DST-based advisory pilot has reached over 72,000 farmers across 37 districts in five Ethiopian regions. It has directly contributed to significantly increased wheat yields, achieving up to a 20% improvement at research stations and an impressive 38% on farmers' fields, with implementation by over 10,000 Ethiopian farmers. These results outperform conventional agronomic practices, highlighting the strong demand for scaling up the initiative. Integrating digitally supported DST-based agro-advisory into the national extension package is essential to amplify its transformative impact on agricultural productivity and sustainability nationwide [4].

OUTCOME STORY/IMPACT STATEMENT

The independent validation of the NextGen Decision Support Tool (DST)-based advisory by Ethiopia's national research system highlights its superior performance and marks a pivotal step in integrating site-specific, digital fertilizer recommendations into the national extension framework. This advisory has boosted wheat yield by 14% to 20% and increased net returns by up to \$665 per hectare. With demonstrated impact and scalability, reaching over 72,000 farmers, the DST is improving productivity, sustainability, and livelihoods, solidifying its position as a transformative asset for Ethiopian agriculture.

CGIAR INNOVATION(S) OR FINDINGS THAT HAVE RESULTED IN THIS OUTCOME OR IMPACT

The NextGen Decision Support Tool (DST), a cutting-edge, data-driven innovation, was developed collaboratively by government agencies, research institutions, and partners from the development and private sectors. In partnership with these key stakeholders, the Alliance co-developed, validated, and piloted the DST to deliver season-smart, site-specific agro-advisories tailored to the unique conditions of individual farmers. The DST has demonstrated exceptional impact, boosting wheat yields by 38% among over 10,000 Ethiopian farmers, significantly surpassing traditional agronomic practices [1,2,3].

The Ethiopian government's decision to integrate the DST into a nationwide harmonized extension framework marked a significant step forward in transitioning from traditional blanket recommendations to precise, digitally-enabled fertilizer advice that is efficiently distributed to local extension agents and farmers through agile channels. This initiative highlights tailored agronomic advice as an effective agricultural innovation to enhance crop production in Ethiopia and serves as a model for transformative agricultural practices worldwide [4].

Contributing external partners:

- Digital Green (DG)
- Green Agro Solution PLC (LERSHA)
- Ministry of Agriculture (MoA) of Ethiopia
- Zonal Bureau of Agriculture in Ethiopia
- District Bureau of Agriculture in Ethiopia
- NARS partners (i.e., Ethiopian Institute of Agricultural Research)
- Regional Agricultural Research Institutes (RARIs)
- Gessellschaft für Internationale Zusammenarbeit (GIZ) in Ethiopia
- Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)

ELABORATION OF OUTCOME/IMPACT STATEMENT

The NextGen Decision Support Tool (DST) is transforming Ethiopian agriculture for thousands of farmers by delivering data-driven, site-specific fertilizer recommendations (SSFRs) that boost productivity and sustainability. Developed collaboratively by the Alliance of Bioversity and CIAT, EIAR, and other key stakeholders, the DST leverages extensive datasets such as legacy soil profiles, agronomic trials, and environmental variables. By integrating advanced technologies such as machine learning and crop modeling frameworks (e.g., Quantitative Evaluation of the Fertility of Tropical Soils), it analyzes complex soil, crop, and environmental data to generate practical, tailored agro-advisory content [3]. These site-specific recommendations are delivered through agile digital platforms, including interactive voice response (IVR), SMS, video tutorials, and chatbots, along with face-to-face training to ensure effective implementation [4].

During the 2021/2022 cropping season, SSFRs generated by the NextGen DST significantly outperformed conventional practices, increasing grain yields by between 16% and 25%, and improving nitrogen use efficiency by 30% [2, 3]. This advancement reduced environmental impacts and input costs while boosting productivity.

During the 2022/2023 cropping season, the Ethiopian Institute of Agricultural Research (EIAR) independently validated SSFRs at 25 sites across seven wheat-growing districts. These trials compared SSFRs with traditional and research-based recommendations, resulting in 14% to 20% higher yields and additional net returns of USD 475–665 per hectare per season.

The findings highlighted the financial viability and effectiveness of SSFRs in optimizing inputs, enhancing productivity, and boosting farmers' profitability [4]. Building on this success, the NextGen DST has been expanded to other crops, including maize, teff, and sorghum. In 2024, validation trials for maize (across 60 farms in central Ethiopia and Oromia) further demonstrated its adaptability to diverse cropping systems [4].

Recognizing the outstanding performance of the DST as an agro-advisory tool, the Ministry of Agriculture's Extension Division piloted its use within Agricultural Commercialization Clusters (ACCs), engaging over 600 farmers. This pilot highlights the government's strong commitment to scaling up this innovative technology and integrating it into national agricultural strategies [4].

Since its launch in 2022 and through 2024, the NextGen DST advisory services, in collaboration with key partners including government, development, and private sector stakeholders, have reached approximately 72,800 farmers, with over 10,000 actively implementing its recommendations across 37 districts in five regions [1, 4]. This initiative marks a transition from blanket fertilizer recommendations to tailored, technology-driven advisories, equipping farmers with actionable insights [1,3]. Its proven success and scalability provide a solid foundation for integration into national agricultural strategies, enhancing food security and improving farmer livelihoods across Ethiopia.

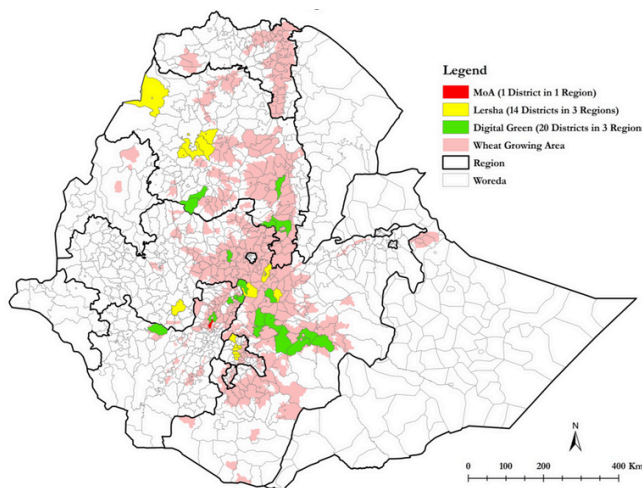


Fig 1. Zone of Influence by demand partners for the Digital Green Use Case in Ethiopia (as of September 2024)

GENDER, YOUTH, CAPACITY DEVELOPMENT AND CLIMATE CHANGE

Gender relevance: 1 - Significant. Gender is a crucial aspect of making the advisory services gender-responsive. To better understand the needs of farms and households, an “add-on” survey was conducted to provide tailored agro-advisories aimed at addressing specific yield gaps and gender-related issues. During the piloting phase of the Decision Support Tool (DST) by partners such as Digital Green and LERSHA, it was recommended that at least 20% of participants be women. Strategies were made to address the specific needs of the different gender categories by organizing separate groups for men and women. These were nominated for trial evaluations, specialized training, and improved access to financial services [4].

As a result, women's participation increased significantly, with over 20% of the farmers being women. Furthermore, gender-disaggregated questions were incorporated into the ODK data collection process during the piloting phase, capturing detailed insights. This approach ensures that the unique needs of both men and women are effectively recognized and addressed, promoting inclusivity and equity in agricultural practices [1, 4].

Youth relevance: 1 - Significant. Youth inclusion is essential for ensuring equal access to decision-support tools for young people. To promote the inclusion of youth in scaling agro-advisory services, specific measures were implemented to address the needs of group-based extension services and develop inclusive strategies. This included the formation of new groups, such as youth-only and women-only groups, to better engage these demographics alongside other social groups [4].

These initiatives also involved setting quotas to ensure fair participation across different social and gender categories, organizing community awareness events, integrating social innovations, and designing interventions aimed at creating gender- and youth-responsive agronomic solutions. By focusing on these strategies, the project aims to enhance the accessibility and effectiveness of agricultural innovations for all stakeholders [4].

Capacity Development relevance: 1 - Significant. The 2024 training program was developed in response to partner requests and to address gaps identified during previous piloting and pre-scaling activities. Training workshops were conducted to enhance the capacity of extension agents, experts, and researchers from government agencies, research institutions, universities, and NGOs across target districts. The workshops aimed to equip participants with the knowledge and skills needed to deliver site-specific fertilizer recommendation (SSFR) advisory services effectively at both village and individual farmer levels. Additional training sessions focused on advanced skills, including data management, predictive modeling for SSFR, and conducting on-farm validation trials using digital data collection tools. These specialized sessions targeted researchers and experts across Ethiopia to further strengthen their technical capabilities [4].

Climate Change relevance: 1 - Significant. The advisory system is designed to be "season-smart," offering adaptable agronomic solutions tailored to local contexts and specific growing seasons. It dynamically updates fertilizer and other agronomic recommendations based on seasonal climate predictions generated by the Ethiopian Digital Agro-Climate Advisory Platform (EDACaP) [1]. To mitigate weather and climate risks while enhancing advisory implementation, the system strategically integrates agro-climate advisories with insurance and credit services. This approach, demonstrated by the private partner LERSHA during its pilot phase, successfully reached more than 8,000 farmers to digitally profile farmers for loan, transferring part of the risk to insurers and providing secure financial solutions. By ensuring investment security, this model encourages farmers to adopt the recommended practices. Key climate adaptation features of the system include: (a) providing timely information on rainfall onset and optimal planting dates, (b) utilizing climate data to predict crop responses to fertilizer application, and (c) incorporating agro-climate forecasts to fine-tune advisories for the upcoming seasons. Through EDACaP's integration of climate and crop modeling, the system generates actionable agroclimatic advisories, ensuring season-smart recommendations that improve productivity and resilience for Ethiopian farmers [1, 4].

PART 2: Mapping to Alliance strategy and structure

KEY CONTRIBUTOR AND STRATEGIC OUTCOMES



Lever 2: Multifunctional Landscapes



Lever 3: Climate Action

SECONDARY CONTRIBUTORS

Lever 5: Digital Inclusion
Gender, Youth and Inclusion

S01: National and subnational authorities in priority countries implement policies and incentives that promote evidence-based agro-environmental solutions that enhance ecosystem services and livelihoods in rural areas.

S02: Land managers and development actors participate in the co-design and deployment of land uses that are more diverse and reduce the environmental impact of agricultural systems in priority countries.

S01: Development partners use tailored climate services in priority countries to help farmers and their institutions reduce the impact of climate risks.

S02: Development agencies make smarter investments that deliver climate adaptation and mitigation based on agricultural and climate risks profiled.

SDG TARGETS



- **1.5** - By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters.
- **2.4** - By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, help maintain ecosystems, strengthen capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters and that progressively improve land and soil quality.
- **13.1** - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- **13.2** - Integrate climate change measures into national policies, strategies, and planning.

PART 3: One CGIAR Alignment

LINK TO IMPACT AREAS AND GLOBAL TARGETS



Impact Area 1: Nutrition, Health, and Food Security

- End hunger for all and enable affordable healthy diets for the 3 billion people who do not currently have access to safe and nutritious food.



Impact Area 2: Poverty Reduction, Livelihoods, and Jobs

- Lift at least 500 million people living in rural areas above the extreme poverty line of US \$1.90 per day (2011 PPP).



Impact Area 3: Gender Equality, Youth, and Social Inclusion

- Close the gender gap in rights to economic resources, access to ownership, and control over land and natural resources for over 500 million women who work in food, land, and water systems.



Impact Area 4: Climate Adaptation and Mitigation

- Implement all National Adaptation Plans and Nationally Determined Contributions to the Paris Agreement.
- Equip 500 million small-scale producers to be more resilient to climate shocks, with climate adaptation solutions available through national innovation systems.



Impact Area 5: Environmental Health and Biodiversity

- Stay within planetary and regional environmental boundaries: consumptive water uses in food production of less than 2500 sq. km. per year (with a focus on the most stressed basins), zero net deforestation, nitrogen application of 90 Tg per year (with a redistribution towards low-input farming systems) and increased use efficiency, and phosphorous application of 10 Tg per year.

EVIDENCE AND REFERENCES

1. Desta L., Mesfin T., Liben F., Worku W., Ebrahim M., Tilaye A., Tesfu D., Getachew G., Hawinet B., Kebede A. (2024). NextGen agro advisory boosts Ethiopian wheat yields by 38%. Rome (Italy): Bioversity International; Cali (Colombia): CIAT. (5 p). (available [here](#))
2. Mohammed, E., Tewodros, M., Tamene, L., Feyera, L., Wuletawu, A. & Amsalu, T. (2024). Agronomic and socio-economic drivers of fertilizer use and crop productivity in smallholder wheat production systems in Ethiopia, Discover Environment, 2(1), 130. (available [here](#))
3. Liben, F., Abera, W., Chernet, M.T., Ebrahim, M., Tilaye, A., Erkossa, T., Degefie, D.T., Mponela, P., Kihara, J. & Tamene, L. (2024). Site-specific fertilizer recommendation using data-driven machine learning enhanced wheat productivity and resource use efficiency, Field Crops Research, 313, 109413. (available [here](#))
4. Tamene L., Mesfin T., Tibebe D., Abera W., Desta G., Liben F., Agegnehu G., Tigabie A., Legesse G., Chernet M., Ebrahim M., Tilaye A., Tesfu D., Desalegne T., Yitafferu B., Gashaw G., Bekele H., Ayele K., Endrias A. (2024). Closing yield gaps in Ethiopia: Leveraging data-driven approaches to optimize fertilizer use and soil health. Periodic Table of Food Initiative Technical Report. (17 p). (available [here](#))

PROMOTIONAL PRODUCTS & COMMUNICATIONS

- The Alliance of Bioversity International & CIAT blog. 3 Jun 2024. AI-Powered Recommendations Boost Wheat Yields in Ethiopia (available [here](#))
- Alliance of Bioversity and CIAT blog Alliance of Bioversity and CIAT blog. 23 Oct 2024. Scaling Optimized Fertilizer Use for Sustainable Maize Farming (available [here](#))

EIAR. (2024). Report of on the farm validation of Site-Specific Fertilizer Recommendation for Wheat Production across Seven Districts in Amhara, Oromia, and Central Highlands of Ethiopia. (available [here](#))

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The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) delivers research-based solutions that harness agricultural biodiversity and sustainably transform food systems to improve people's lives. Alliance solutions address the global crises of malnutrition, climate change, biodiversity loss, and environmental degradation.



The Alliance is part of CGIAR, a global research partnership for a food-secure future.

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