Excellence in Agronomy

Initiative Status March 2023
Six dimensions of EiA

**Challenge:** Agronomy has not delivered on its potential at scale... low and variable yields... limited adaptation to climate change... low resource use efficiencies... declining soil health...

**Response:** Modernized agronomy around sustainable intensification & climate change adaptation...

... to deliver agronomic gain at scale

1. A globally organized R&D community operating with increased efficiencies
2. A R&D agenda driven by demand from scaling partners
3. Standardized, FAIR, open data and tools
4. Conscious integration of technological advances
5. Operationalization of a holistic agronomic gain assessment framework
6. Process innovation based on agile and informed decision-making
EiA Work Packages

ORGANIZE – Organization, capacity development, performance management
- Organization of communication and advocacy
- Development of capacity of local partners
- Facilitation of centers to share services
- Monitoring & evaluation of EiA performance

TRANSFORM: Hosts past, current & novel data plus analytical capacities
- Primary & secondary data on agronomy and soil health
- Advanced statistical, simulation modelling, and geospatial tools
- Farming system analytics and farmer segmentation
- Decision analytics, with risk assessment information
- Turn-key solutions for transfer of approaches to crops/geographies
- Workflows for ‘speed agronomy’
- Climate change/sustainability
- Long-term observatories to assess changes in soil health
- Long-term assessment of changes in agronomy practices
- Tools to assess the climate-smart nature of agronomy interventions

INNOVATE: Addresses key knowledge gaps & facilitates innovation in agronomy R&D
- Generation of data & tools required to fill key knowledge gaps identified through the DELIVER Module
- Facilitation of innovation in agronomy R&D at scale to create new demand
- Collection of key data that are required for under-research crops
- Facilitation of specific studies of common interest for whole CGIAR presents advantages
- Funding, procurement of Institutes
- Specific tools, expertise, and feedback loops to TRANSFORM

DELIVER: Hosts the delivery of services & products to partners towards improved productivity, climate change resilience, and sustainability
- Development of workflows in response to priority Use Cases
- Deployment of existing data and tools
- Co-creation of solutions
- Facilitation of feedback loops to TRANSFORM

Opportunity driven innovation projects, guided by partner demand, analytics, and ex-ante impact
DELIVER- Cohort I and II Use Cases

Ghana: Cropping calendar advisories for smallholder maize farmers and extension agents in the Guinea Savannah zone.

Nigeria: Co-development of digital solutions to deliver fertilizer and time of planting advice for rice, maize, and cassava.

Egypt: Web-based advisory for in-season yield potential & water productivity of irrigated wheat-based systems.

Rwanda: Accelerating the use of digital tools for delivering agronomic advice in potato-based cropping systems.

Ethiopia: Co-development of targeted fertilizer advisory services to improve NUE, reduce cost and enhance productivity.

Ethiopia: Co-development of agronomy and climate advisory tools for high yielding and high quality wheat production.

Egypt: Web-based advisory for in-season yield potential & water productivity of irrigated wheat-based systems.

Cambodia: Optimizing productivity, profitability and environmental sustainability using mechanized and precise direct-seeded rice.

India: Managing time in the rice-based cropping systems of South Asia.

Vietnam: Optimizing productivity, profitability and environmental sustainability using mechanized and precise direct-seeded rice.

Kenya: Availing digital advisory content through an easily searchable content hub for farmer support organizations.

DRC: Supporting diversification and climate resilience in coffee systems through improved agronomy and advisory services.

Ghana/Cameroon, Cote d'Ivoire, Nigeria: Building a context-specific ISFM in cocoa systems in West Africa through agronomic support services.

Malawi: Improved soybean digitally mediated agronomic advisory to improve yields, soil health and incomes.

Rwanda: Enhancing nutrient use efficiency through site specific nutrient advisories within funded clients.

Ghana: Strengthening climate resilience in cocoa systems in Ghana and West Africa through agronomic support services.

Ghana: Testing hyperlocal digital agronomic advisory services and the delivery pathways in rice-based cropping systems.

Morocco: Scaling conservation agriculture systems in Morocco across 1 million hectares of farmland.

Mexico, Columbia, Peru: Smart farming systems at the local level: Sustainability assessment and targeted data-driven recommendations for smallholder farmers.

Ghana: Developing a site-specific fertilizer recommendation system in Northern Ghana for soybean farmers in maize legume systems.

Ghana: Cropping calendar advisories for smallholder maize farmers and extension agents in the Guinea Savannah zone.

Ghana: Testing hyperlocal digital agronomic advisory services and the delivery pathways in rice-based cropping systems.

Mexico, Columbia, Peru: Smart farming systems at the local level: Sustainability assessment and targeted data-driven recommendations for smallholder farmers.
The validation results show that yield, profitability, NUE, WUE in the new advisory are significantly higher than the blanket recommendation and local control. For instance, there is 12-25% yield gain, depending on the woreda.
Use Case | Digital Green Ethiopia

- **Use Case** has reached piloting stage in 5 woredas; 8k farmers reach; 3384 farmers implemented site specific fertilizer advisory in wheat producing areas in the Ethiopian Highlands. Digital Green, MoA and LERSHA participated as partners.

<table>
<thead>
<tr>
<th>Region</th>
<th>Woreda</th>
<th>Target kebeles</th>
<th>Kebeles with Pico</th>
<th>Registered farmers (Target: 12,500)</th>
<th>Actual Reach</th>
<th>Adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNNP</td>
<td>Lemo</td>
<td>25</td>
<td>15</td>
<td>5,926</td>
<td>1,346</td>
<td>2,600</td>
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<tr>
<td>SNNP</td>
<td>Markeo</td>
<td>16</td>
<td>6</td>
<td>3,565</td>
<td>946</td>
<td>344</td>
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<tr>
<td>Amhara</td>
<td>Basona Warena</td>
<td>20</td>
<td>17</td>
<td>7,820</td>
<td>1,489</td>
<td>144</td>
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<tr>
<td>Amhara</td>
<td>Siyadebir</td>
<td>7</td>
<td>5</td>
<td>2,185</td>
<td>2,649</td>
<td>214</td>
</tr>
<tr>
<td>Oromia</td>
<td>Goba</td>
<td>12</td>
<td>9</td>
<td>4,541</td>
<td>1,575</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>80</td>
<td>52</td>
<td>24,037</td>
<td>7,987 (63.9%)</td>
<td>3,387 (42.4%)</td>
</tr>
</tbody>
</table>

- **Partners** co-piloted advisory based on EiA Decision Support Tool in 5 woredas. **Dissemination** was based on maps, videos, and SMS and IVR when possible.

- Digital Green interested to reach out up to 80 woredas (100,000 households) in the coming years, MoA expressing interest on the way to integrate to the national scale, **private sector (LERSHA) already tested** on three sites and will engage in scaling widely the coming season (MoU under development).
DELIVER – CocoaSoils Use Case

• To develop a STEPWISE approach to deliver integrated soil fertility management practices adapted to the needs of smallholder cocoa producers in West Africa (Cameroon, Cote d’Ivoire, Ghana, Nigeria)

• Control (+insecticide)
• Good Agricultural practice (pruning, full pest control)
• GAP + local fertilizer recommendation
• GAP + ‘Offtake model’ recommendation
TRANSFORM - Standards-compliant data infrastructure critical for Agronomy 2.0

Data & analytics tools, infrastructure
- Tools to enable digital collection of FAIR agronomic data...
- ...and FAIRification of high-value legacy data
- CG Labs collaborative computing for low bandwidths

Interoperable, open data = quicker insights

Unified advanced data search PoC demo
- Standards-compliant FAIR data is searched and aggregated
  (by crop, country, gender, fertilizer...)
- APIs for access to tabular data and geo-data (for spatial analyses)
  Aggregated data is downloadable in crop model/analytics ready formats
There are many forecast products – good decision support often requires knowing which is the most accurate...

- Two products assessed for accuracy of daily rainfall predications: CFS (NOAA) & ECWMF
- Two methodologies: Coefficient of correlation ($R^2$; high = better – column 1) and Root Mean Squares Error (RMSE; high = worse – column 2)
- Applied to months 1 (A) and 3 (B) that farmer received forecasts (not necessarily correlated with rain onset periods)

- In general, CFS performs better than ECWMF
- Longer-term daily rainfall predictions at 3 months (B) are more uncertain than predications at 1 month (A)

- Example of optimal planting date recommendation developed for maize varieties used in the Nigeria Use Case
- Accurate forecasts are critical to make such recommendations, or derive value from them (e.g., fertilizer application timing)

W. A. Atiah, F. Muthoni, E. Bendito, S. Mkuhlani, K. Tijjani, T. Ibrahim, B. Muhamad, C. Kreye
TRANSFORM – Proof of Concept of fertilizer recommendations for 11 counties in Kenya

Step 1. On-farm standardized trial data
Step 2. Optimization algorithm for indigenous N, P, K explaining yield response
Step 3. ML over iSDA, ISRIC soil data to predict indigenous N, P, K supply
Step 4. Empirical or predicted nutrient-limited (baseline) and attainable-yield (ceiling) used; improved using satellite data
Step 5. QUEFTS used to predict yield response to desired fertilizer

Maps indicate recommended rates of (A) DAP (basal) + CAN (topdress) and (B) NPK + CAN for a 30% increase over current maize grain yields by sub-county

*can be optimized for RoI rather than increase in yield

P. Pypers, M. Chernet, A. Ghosh et al. with KALRO, WB
INNOVATE – R&D progress highlights

CAPTain – the Climate Adaptation Prioritization Tool
Purpose designed regional prioritization and discussion tool to challenge assumptions and engage audiences in comparing research and investment priorities.

- Excel Macro based tool; tool in Beta finalization
- Piloted across multiple locations in India, Nepal, Bangladesh with EIA, TAFSSA and Rupantar projects
- Used in BMGF climate convening 1-2 Feb 2023
**INNOVATE – R&D progress highlights**

**Yield at scale R&D projects** aim to generate innovative approaches using remote sensing and rapid & low-cost ground truth data collection to determine yield at scale. Current three projects include:

- Large-scale yield gap estimation and characterization with multi-source remote sensing data for rainfed wheat in Ethiopia
- Scalability of remote sensing-based models for maize yield estimation across sub-Saharan Africa
- Estimation of rice area and yield, and assessment of limiting factors based on remote sensing and rice growth simulation in Nigeria

**Workflow**

1. Collection of ground-truth agronomic information
2. Identification of seasonal rice cultivated area and rice phenology
3. Calibration of crop simulation model
4. Yield estimation by remote-sensing & crop simulation model
5. Identification of rice area and yield limiting factors

**2022 output: Maps of rice area and planting month in Kano, Nigeria**
ORGANIZE - What the work package does

**Use Case**

- Demand partner (public or private)
- Active extension network
- Support partners
- Specific solution (Minimum Viable Product)
- Co-creation process
- Turnkey solution for scaling

**ADD-ONS**

- Yield gap decomposition
- Farmer segmentation
- Gender and youth responsiveness
- Climate adaptation & mitigation potential
- Ex-ante impact assessment

**Impact assessment**

- Baseline/panel studies
- RCT studies

**Agronomic Gain KPI Assessment**

- Productivity
- Yield stability/reduced risk
- Resource use efficiency
- Soil health
EiA's collaborations with other Initiatives

Agro Ecology, Nature+, SI-MFS
- Common themes (M&E) Framework
- cooperation on segmentation and inclusiveness
- Strategy paper on CGIAR’s response to SI, AE, NPS, et al

Plant Health
- Crop health as a common theme
- Cooperation in pest surveillance and integrated insect pest, weed and disease management

Digital Innovation
- Common analytics infrastructure and interoperable agronomic data
- Testing and co-development of tools for data management and reuse

Regional Integrated Initiative
- Respond to agronomy–related demand in the regions and
- Cooperate on specific topics through the EiA Regional programs

HER+
- Joint activity on making Use Cases youth-gender-responsive
- Randomized Control Trial on gender transformation action

MITIGATE +
- Soil health and GHG emissions as common themes
- Cooperation in the areas of simulation modelling
Thank you!