



# AGRI RESEARCH Organization annual report 2022-2023

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## AGRIRESEARCH Organization Fiscal 2022-2023 highlights

### Research activities interventions

- ❖ Strengthening agricultural resilience against climatic changes: 2 researches were implemented to develop climate-resilient crops and improve the quality of seeds. The first and second phase of these researches have been completed, and we are currently in the process of validating the findings.
- ❖ 220 students from CAVM70 from TVET Bigogwe, 50 from TVET Gahunga students have paid visits to our installed research Trials and leaned from them.
- ❖ 1 Research study on regenerative agriculture practices was conducted (Evaluate the effectiveness of agricultural practices on Irish potato, Beans and maize toward sustainable production), **500 people** including farmer promoters, facilitators from Musanze district have undergone training on regenerative agriculture practices such as composting, double digging, No-Till Farming, and more.

### Extension and Advisory services interventions

- ❖ 2 climate smart agriculture model farm were installed.
- ❖ 1000 farmers were learnt from climate smart agriculture model farm
- ❖ Demand driven extension services were conducted: 10 cooperatives from Burera district were trained on Good Agricultural Practices
- ❖ Demonstration Plots and Farmer field school plots installations: 2 large scale size of demos of 500 square meter and 2 farmer field school plots were installed,
- ❖ 125 farmers from Busogo sectors have learned good agricultural practices from the demo and Farmer field school plots
- ❖ Production increase: maize production from 1.85T/Ha to 4.55T/ha, Wheat from 1.0 T/ha to 3.055 T/ha, Beans from 0.9 T/ha to 3.45 T/ha and Irish Potato from 8.02T/ha to 16 T/ha.
- ❖ 1 fruit nursery was installed: 740 passion fruits seedlings and 5000 vegetable seedlings were produced and distributed to the farmers
- ❖ Malnutrition rate reduction: 20 families from Musanze district turned from malnutrition state to normal state
- ❖ 756 youth were engaged in agriculture

## ICT in Agriculture

- ❖ Artificial Intelligent features were added in AGRITrials mob app to help farmers get agricultural techniques information in easier manner,
- ❖ Releasing out AGRITrials E-Newsletter to help users get agribusiness advices, weather information and up to date farming information straight to their email inbox. In this context, many users are accessing real time information easily because email is a more professional and accessible platform
- ❖ Artificial Intelligent features were also added in SmartInput mobile to help farmers for Scanning Agro-inputs and record keeping for the profit projections. This is helping farmers to use the light inputs in precisely manner and tract the market respectively,

## Executive Summary

Agriculture needs more effort to continue to feed the population, as it is increasing day by day. In Rwanda, this sector is very fundamental, employing 66% of the working population and contributing about 27% of the national GDP (NISR First quarter report 2023).

In the fiscal year 2022-2023, AGRIRESRACH Organization has taken measures to improve the standard of living of farmers. With a focus on Vision 2050, which envisions citizens with a high living standard by the middle of the 21st century and high-quality livelihoods, AGRIRESEARCH Organization has supported farmers by prioritizing one of the activities under the implementation instrument of the National Strategy for Transformation (NST1). These activities involved working with farmers to modernize agriculture and increase productivity in a sustainable way through research and innovations.

In the fiscal year 2022-2023, we continued to implement research activities to contribute on strengthening agricultural resilience against climate change. We completed the second phase of validating the first phases of the research studies, which were not completed in the previous FY2021-2022. In this context, we continued two relevant research topics and completed the second phase of each. We are eagerly awaiting the results of the third phase of both research topics, which will validate the findings of the first and second phases. Additionally, we conducted research on regenerative agriculture practices to restore the soil for sustainable production. The results of the first phase of this research are promising that the next two phases will yield positive results.

On the other hand, agricultural extension and advisory services have been implemented to drive farmers' growth and development. These services have resulted in increased food security, as well as reduced malnutrition and improve the livelihoods for the farmers we have worked with. We have focused on activities to increase resilience to climate change through the implementation of climate-smart agriculture practices and demand-driven extension for farmers. We have also taken steps to reduce malnutrition by providing farmers with fruit and vegetable seedlings and technical assistance on complete balanced diet preparation. Additionally, the organization has been working on its mission of engaging youth in agriculture and fostering research culture among youth through the AGRIRESEARCH club, which is operating at the University of Rwanda, College of Agriculture, Animal Science and Veterinary Medicine. The club provides coaching and mentorship programs, as well as volunteerism and internship opportunities to agricultural students from secondary schools and higher learning institutions..

To top it off, we have continued to use ICT in our services. We have used our digital solutions to disseminate agricultural information by helping farmers adopt good agricultural practices, find potential markets for their produce, and facilitate linkages among market actors and consumers by using AGRITrials platform. This mobile app was recently upgraded with artificial intelligence capabilities, and it continues to work on two aspects that are integral to food systems: educating farmers on how to sustainably produce food and helping them find potential markets for their produce in an easy way. AGRITrials is also still being used by farmers to get daily weather information. To date, more than 2,000 farmers have downloaded the app from the Play Store and are using it in their daily farming activities.

In this regard of ICT, we also upgraded our SmartInput Technology with artificial intelligence features, where it is providing real-time information, personalized best practices, and expert support to its users. . This solution enables farmers to optimize farming inputs, adapt to climate change, maximize harvests, keep their records, and improve profitability while safeguarding human health and the environment. The technology provides guidance on the proper use and handling of pesticides and chemical fertilizers, as well as other agricultural inputs such as seeds, in non-technical language.

So far, in the FY2022-2023, the number of farmers who have been impacted by the organization's services has increased by 10,000 compared to the previous FY2021-2022. These are promising signs for improved food security, less malnutrition, and a reduction of poverty in Rwanda in the years to come.

## **1. RESEARCH ACTIVITIES**

AGRIRESEARCH Organization has designed and executed Three research topics mainly focused on improving potato resistant seeds to climate harsh condition, , double harvesting from single plant and evaluating the Effectiveness of Regenerative Agriculture Practices with projecting toward increase of productivity in sustainable way.

### **1.1 Research on potato breed to develop high yielding variety,**

The Irish potato is one of the most important crops in Rwanda and is one of the government's six priority crops falling under the Crop Intensification Program (CIP). Rwanda is the 6th largest producer of potatoes in the region, which is significant given the relative land size of the country. In 2019, the Rwanda Agriculture and Animal Resources Development Board (RAB) released five new varieties of Irish potatoes that are high-yielding and disease-tolerant. As proven by the research findings from RAB, these varieties are expected to increase potato production up to between 34 and 40 tons per hectare. However, most farmers have not yet had access to these produced seeds, and their potato yields have not yet increased.

According to the SAS report 2020, the potato production in Rwanda has begun to decrease due to the unavailability and inaccessibility of good-quality seeds to farmers. In the two most recent years, with six cropping seasons, potato production was 8.9 T/Ha and 8.6 T/Ha in 2021 and 2022, respectively. To date, potato production has decreased by 6% compared to the recent production. In 2023, farmers are producing 8.2 T/Ha of potatoes (SAS,2023 A).

In light of the above, AGRIRESEARCH Organization has executed research trials on breeding potato seeds from Belgium which is resistant to drought stress and heavy rainfall to Kinigi Rwandan varieties which suitable for most of Rwandan population in order to increase the availability and accessibility of good potato seeds. If this trial is successful, we hope to have a good-quality seed that is tolerant to drought stress and heavy rainfall and can increase production up to 40 T/Ha.

This research topic was designed and conducted in the Musanze district, Busogo Sector. The first phase involved multiplying potato seeds that would be used in breeding has been completed successfully. The potato seeds were multiplied 10 times, and the next phase will begin with breeding those multiplied seeds.



**Figure 1: Proposed drought resistant potato variety from Belgium**

## 1.2 POMATO GRAFTING

Tomato (*Solanum lycopersicum* L.) is a solanaceous crop that is a significant food component that is widely consumed both fresh and processed around the world. Its nutritional benefits have now been fully recognized, and it has been given due consideration. Its prominence derives from its pleasant acidic taste, low cost, and health benefits. It is a very good source of vitamins A, B, and C, and it is a good appetizer.

In order to improve the quality and quantity of produced tomatoes, and by correlating this with the increasing world population where the current world population of 7.6 billion is expected to reach 8.6 billion in 2030, 9.8 billion in 2050 (UN-2023-Department of Economic and Social Affairs). This means that, there is a need for technology to meet the need of feeding those populations. Therefore, a single plant that can produce both tubers and fruits at the same time would be one of the solutions to this problem.

AGRIRESEARCH Organization has conducted a trial of pomato, a unique technology that can help produce both tomatoes and potatoes on a single plant. The nutritional composition of the crop may change as a result of the source-sink relationship drawn by the rootstock and scion. Grafting tomatoes onto potatoes is an established method for creating pomato. This

technique was used to improve plant adaptation to various abiotic and biotic factors in order to increase plant yield and quality. Grafting performance depends on compatibility between the scion and rootstock. The vascular tissue of the scion and rootstock must come into contact in order to make a successful graft.

This research on pomato was conducted by AGRIRESEARCH Organization in the partnership of University of Rwanda, College of Agriculture, animal sciences and Veterinary Medicine. The trial was conducted in both indoor and outdoor settings to compare the two environments. Tomatoes (variety of Roma VF and Rio Grade) were grafted onto potatoes (variety of Kinigi, Kirundo, and Nkunganire) in order to have a double harvest of potatoes below ground and tomatoes above ground.

This research topic was designed to study the effect of plant (rootstock) height on compatibility of scion and the effect of potato variety (Kinigi, kirundo and Nkunganire variety) and scion height on compatibility of scion. The study is in its second phase to validate the data from the first phase, which was expected to be completed at the end of the study. After validating the three phases that are intended to complete this trial, farmers will be able to obtain the techniques and relevant information on how to produce tomatoes and potatoes from a single plant to feed the community



**Figure 2: Pomato at grafting time**





**Figure 3: Pomato (Tomato aboveground and potato belowground)**

### 1.3. RESEARCH ON REGENERATIVE AGRICULTURE PRACTICES

Soil degradation in Rwanda is becoming an increasingly pressing issue due to factors like over-cultivation, deforestation, and approximately 90% of Rwanda's land is on hills resulting in soil erosion, nutrient depletion, and decreased soil fertility. An estimated 1.4 million tons of land is said to be lost yearly; this is equivalent to losing 320,000 us dollars. This has caused a significant decline in crop yields, leading to food insecurity and poverty. Furthermore, soil degradation has also contributed to water pollution, reduced biodiversity, and increased climate change vulnerability ([Rwanda at a glance | FAO in Rwanda | Food and Agriculture Organization of the United Nations](#) ). At present, the agricultural sector is failing to meet the demands of a rapidly growing population. Regenerative agriculture could be a solution to soil degradation in Rwanda.

In line with this, AGRIRESEARCH Organization has started to execute research on regenerative agriculture practices; sustainable agricultural practice that focuses on restoring and improving soil health by increasing organic matter and crop diversification. This includes practices such as cover cropping, minimum tillage, mulching, composting, double digging, and others. This research on regenerative agriculture practices can help farmers to increase their resilience to climate change and make significant progress in reversing the effects of soil degradation for a more sustainable future.

The research project entitled "Evaluating the Effectiveness of Regenerative Agriculture Practices on Maize, Beans, and Irish Potatoes toward Sustainable Agriculture Production" has been designed and conducted. The research is being conducted by AGRIRESEARCH Organization in partnership with the University of Rwanda-College of Agriculture, Animal Science, and Veterinary Medicine. The research showcases the efficacy of the practices and how they focus on restoring degraded soils and ecosystems, as well as minimizing the use of synthetic inputs.

The first phase of the research was completed and showed positive results where some of the practices are promising to double the yield of the farmers. To date, more than 500 people, including farmer promoters, facilitators from Musanze district, and students from the University of Rwanda-College of Agriculture, Animal Sciences, and Veterinary Medicine (UR-CAVM), KIBISABO, GAHUNGA, and Bigogwe TVET, have undergone training on regenerative agriculture practices such as composting, double digging, no-till farming, and more, during their academic internships.



**Figure3: Students from University of Rwanda- CAVM and Bigogwe TVET respectively, are getting knowledge and skills on Regenerative agriculture practices through academic internships**

## **2. EXTENSION AND ADVISORY SERVICES ACTIVITIES**

### **2.1. Increase Resilience to climate change through climate smart agriculture practices implementation.**

Under the project of “Leveraging Digital Technology and Local Knowledge for Agricultural Transformation in Rwanda”, funded by the MasterCard Foundation - Transition Project at McGill University (MCGILL-MCF/TF). We scaled up the existing Climate Smart Agriculture model farm and installed the second one where farmers and youths were trained at the Climate Smart Agriculture model farms and gained skills on increasing agricultural productivity sustainably, practices that protect the environment and reduce poverty (food availability), farming practices for individual farm families and communities to improve their resilience to climate change (climate adaptation), and practices that can reduce some of the causes of climate change - decrease greenhouse gases to avoid contributing to further climate changes (climate mitigation). Furthermore, farmers have had trainings on the use of SmartInput technology, “a smart farming solution that is leveraging research findings, data and digital technology for farm management decision support for different level of producers, while attracting youth into the agriculture sector. With its embedded artificial intelligence network of weather, soil, crops and market data, SmartInput mobile app provides farmers/users in the simplest possible manner with personalized best practices that will help them to optimize farming inputs and activities, maximize harvest, and negotiate good prices.” to ensure and help them adopt Good Agricultural Practices (GAP) easily in their farms.

As the project aims at impacting to boost adoption of Good Agricultural Practices (GAP) among smallholder producers in Musanze District;

More **than 1,000 people** have learned a lot from the model farm and adopted the operations of the technology, including farmers from Musanze District, students from the University of Rwanda both College of Agriculture, Animal Science, and Veterinary Medicine, and the College of Science and Technology, who paid a visit to the model farm.



*Figure 4: Beans staking with threads- one of the practices in this installed model farm.*

## **2.2. Demand driven extension services to the farmers**

Traditional extension approaches have been criticized for being top-down and prescriptive, and for not being responsive to the needs of farmers (Miiro & Uwitonze, 2016). Demand-driven extension is seen as a way to address this problem by putting farmers at the center of the extension process. By giving farmers a greater say in the design and delivery of extension

services, demand-driven extension can help to build their confidence and skills. This can lead to increased productivity and income, as well as improved food security.

In line with this, AGRIRESEARCH Organization conducted a community outreach and intergenerational knowledge exchange with farmers in Kinyababa Sector, Burera District, in collaboration with the University of Rwanda's College of Agriculture, Animal Sciences, and Veterinary Medicine. The session included field trips and study tours to enable farmers to learn from their elders' experiences and knowledge, and to pass on the wisdom and methods of farming from the past.

AGRIRESEARCH Organization also trained farmers on Good Agricultural Practices (GAPs) and new technologies and innovations to help them maintain a competitive edge in agriculture. The Organization also demonstrated how to make vermicompost and taught other practices that can help farmers understand and appreciate the importance of sustainable farming practices, and how to best care for and protect their land for future generations.

Within this context, AGRIRESEARCH worked with 10 cooperatives from Kinyababa Sector in Burera District, namely:

- Turwanye Imirire Mibi (44 members)
- Twiitezimbere (51 members)
- Urufatiro rwejo hazaza (26 members)
- Ikizero (25 members)
- Termbere Gatare (31 members)
- Duterane Inkunga (32 members)
- Duhuze Imbaraga (37 members)
- Twiyubake (29 members)
- Ubufatanye Bwejo heza (38 members)
- Abahoranamahoro (28 members)

All cooperative members were trained and skilled in ways to improve agricultural production and reduce post-harvest losses in a sustainable way.



**Figure 5:** *AGRIRESEARCH STAFF is conducting training for kinyababa cooperatives in Burerera district*

### **2.3. Demonstration Plots and Farmer field school plots installations.**

Recently, demonstration and farmer field school plots were on the scale of one hundred square meters. In this context, farmers were not persuaded by this approach due to the small scale.

In partnership with the Musanze District Agriculture Unit, Two large-scale demo of 500 square meters and two farmer field school plot were installed at the sector level in Busogo Sector, Musanze District. The plots showcased the model of adopting good agricultural practices, and farmers were convinced that increasing production is possible by adopting these practices.

125 farmers from Busogo Sector learned from the demos and put the skills they gained into action on their farms. The farmers we worked with increased maize production from 1.85 tons per hectare (T/ha) to 4.55 T/ha, wheat production from 1.0 T/ha to 3.055 T/ha, bean production from 0.9 T/ha to 3.45 T/ha, and Irish potato production from 8.02 T/ha to 16 T/ha.



*Figure:6AGRI RESEARCH Agronomist recording data from the installed maize demo plot*



**Figure 7: Chat showing how farmers have increased their production after Adopting Good Agricultural Practices.**

#### 2.4. Youth Engagement In agriculture.

One of AGRIRESEARCH's missions is to engage in agriculture and foster research culture among them. Educating youth and instilling an interest in agriculture is about recognizing and investing in the future of our agriculture. Unfortunately, few young people see a future for themselves in agriculture or rural areas today. On the other hand, older farmers are less likely to adopt the new technologies needed to sustainably increase agricultural productivity, and ultimately feed the growing population while protecting the environment.

In this context, we continued to engage youth in agriculture through trainings, internships, volunteerism, and mentorship programs. Where we continued to support a student club of our origin “AGRIRESEARCH Club” in the University of Rwanda, College of Agriculture, Animal Sciences, and Veterinary Medicine that gathers over 346 members with alumni network of 216 members currently. Through the club, youth have changed their negative perspectives about agriculture to a business sector that provides employment to a large population and boosts sustainable economic development. We have coached and trained AGRIRESEARCH Club members and other students on various aspects of agriculture, including but not limited to climate-smart agricultural practices. The members have been supported and provided with field trainings that helped them to reveal and explore opportunities in agriculture sector. To date, 204 active members from AGRIRESEARCH Club are contributing to changing the perspectives of the other youth in/outside the University through different initiatives including “AGRIRESEARCH INSPIRATION TALKS” on the University radio (CAVM Mount Broadcasting) and community outreach among others.



More than 2000 youth, including students from UR-CAVM, UR-College of Science and Technology, and other agricultural secondary schools, have been engaged in agriculture through the Club, internships, volunteerism, and trainings.



**Figure 8: AGRIRESEARCH Club in Training of Market oriented Agriculture**



**Figure 9: Youth from UR-KIST are taking skills from the farm.**

## 2.5. REDUCTION OF MALNUTRITION

The latest data from the 2020 Rwanda Demographic Health Survey shows that Musanze District has a malnutrition prevalence rate of 45.4%, making it the third district with the highest prevalence in the country.

In response to this, AGRIRESEARCH in partnership with Musanze District has launched an initiative to reduce malnutrition in Musanze District, starting from Busogo Sector and will be expanded to all other sectors in Musanze District in the coming years.

As part of the above context, 740 passion fruit seedlings and 5,000 seedlings of different vegetables have been prepared and distributed to farmers in Busogo Sector with technical assistance. This will help families in Busogo Sector to access fruits and vegetables on a timely basis.

AGRIRESEARCH has also trained families in Busogo Sector on how to prepare nutritious meals and balanced diets. The organization has also provided monitoring and mentorship to families in partnership with the local authorities of Busogo Sector.

To date, 20 families in Busogo Sector have been successfully transitioned from the malnutrition line to the good health line. These services are expected to be expanded to other families in the rest of the sectors.



**Figure 10: Families from Gahanga village, Busogo Sector-Musanze district are taking training on balance diet preparation**

### **3. ICT IN AGRICULTURE**

#### **3.1. AGRITrials mobile app upgration**

As AGRIRESEARCH Organization does agricultural research and extension services, we have thus widened the role of our extension to include issues in rural areas that go beyond agriculture and engage more youth in agriculture through.

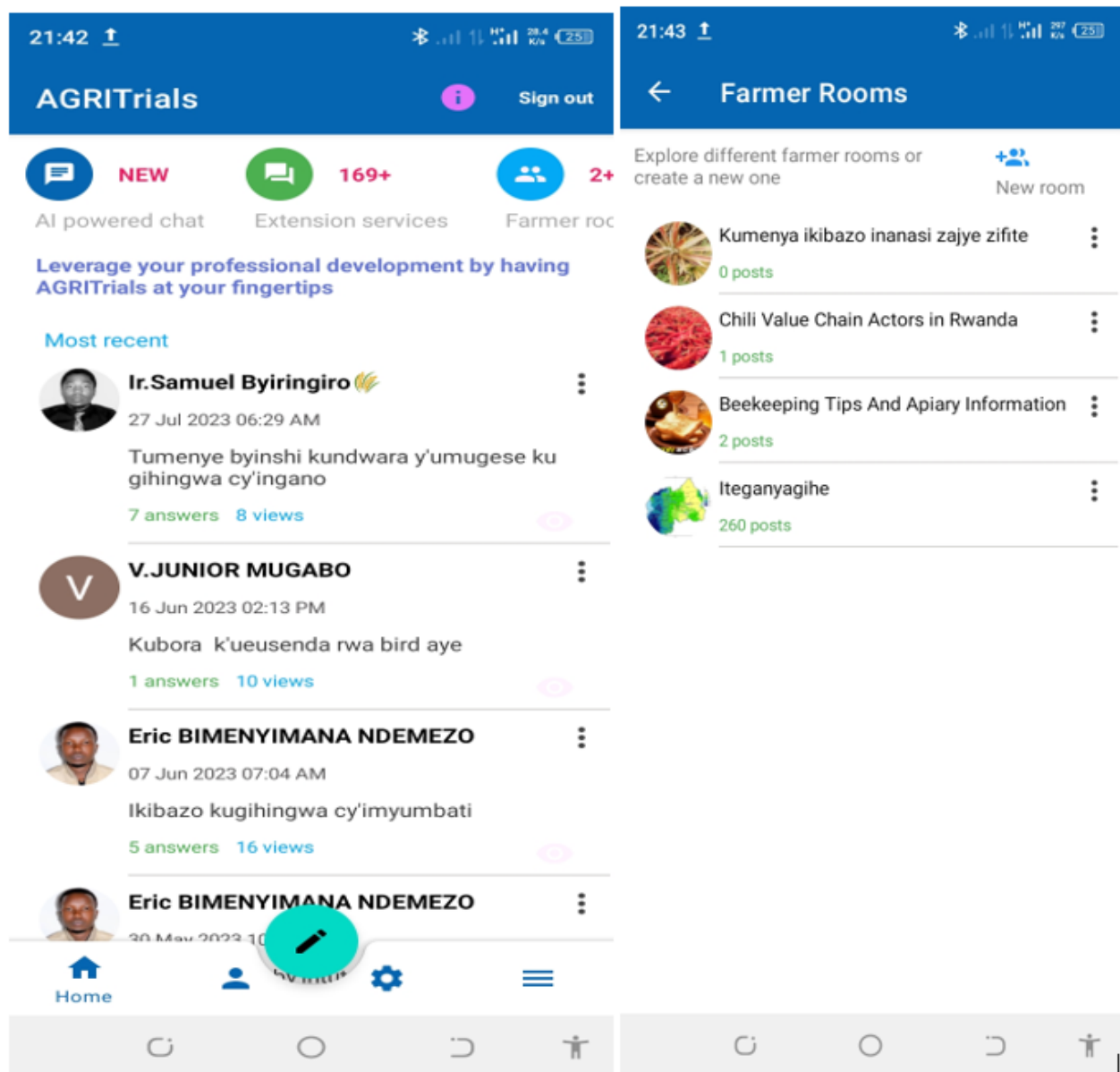
Therefore, since its early release in May 2020, AGRITrials was very popular among farmers mainly in Rwanda as it was a solution to their daily farming challenges especially amid COVID-19 where movement were restricted to contain the spread of the virus. During this time farmers weren't able to meet agronomists and get their farm produce to potential markets.

AGRITrials helped more than 500 farmers, mainly young women and men get buyers and find solutions to their daily farming challenges in real time.

With this being said, AGRITrials was one of the awardees of Young Entrepreneurs Resilience Fund, launched by The Ministry of youth and culture in partnership with the United Nations Development Programme (UNDP) Rwanda and the Embassy of the Republic of Korea through the Korea International Cooperation Agency (KOICA-Kigali) during the pandemic in support of the government's economic recovery plan. AGRITrials was awarded as an innovation in response to the pandemic.

AGRITrials was also Developing Local Extension Capacity (DLEC) video competition winner in April 2021. This app was among top 3 global initiatives in digitalization of extension services by DLEC project.

This year, AGRITrials was upgraded with the artificial intelligence capabilities by leveraging ChatGPT as an online extension agent where farmers can now get instant farming information without direct intervention of verified agronomists. The platform has reached more than 1200 farmers and the number of verified agronomists increased including professional extension agents from outside of the organization.



**Figure 11: AGRITrials mob app upgraded with the Artificial Intelligent (Chat GPT)**

### 3.1.1. Launching AGRITrials E-Newsletter

Since its early release in May 2020, AGRITrials helped more than 500 farmers to get farming information, market linkages and clear their daily farming challenges in real time and to date the users are 1200 users after the app has been upgraded. Bringing together current insights from the users, from March 2022, we launched a new weekly AGRITrials E-Newsletter to help users get agribusiness advices, weather information and up to date farming information straight to their email inbox. In this context, many users are accessing real time information.



**Figure 12: AGRITrials e-News letter**

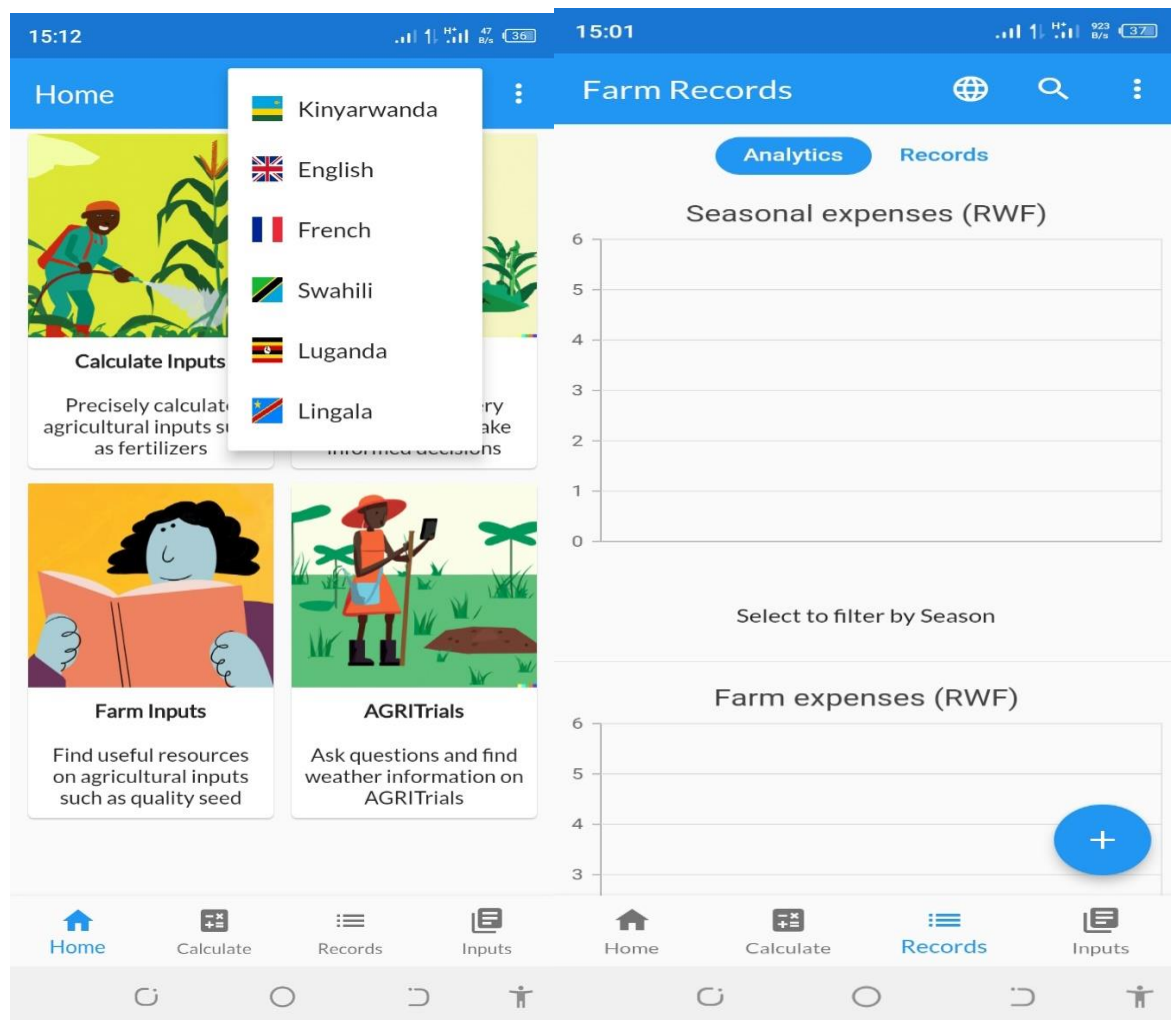
### **3.2. SmartInput mob app upgration**

SmartInput technology, a smart farming solution that aims to provide real-time information, personalized best practices, and expert support to farmers, enabling them optimize farming inputs, adapt to climate change, maximize harvests, keep their records, and improve profitability while safeguarding human health and the environment. A mobile application that was developed by AGRIRESEARCH since 2019 working closely with farmers and uncover several consequences that come with abuse of the agricultural inputs; chemical fertilizers and pesticides including low productivity and environmental pollution.

AGRI RESEARCH has continued to upgrade the mobile app under the support of the McGill University-MasterCard Foundation-Transition fund through the project of “Leveraging Digital Technology and Local Knowledge for Agricultural Transformation in Rwanda.” We have upgraded the mobile app with the artificial intelligence to a revolutionary smart farming and extension services decision tool solution for agricultural development in Rwanda with various features include; on farm financial record keeping, scanning agricultural inputs for having instant access to updated agricultural inputs such as good quality seeds, fertilizers and pesticides, and the use of Global Positioning System (GPS) technologies to instantly calculate land area for calculation of farm inputs, with the support of 26 crops . Furthermore,

the mobile technology has been upgraded to support East African regional languages including; English, French, Kiswahili, Lingala, Luganda and Kinyarwanda (local language), as to allow peruse and adoption of the technology in the region wide.

SmartInput mobile technology has been officially launched at Grand Legacy Hotel, Kigali-Rwanda and convened key different actors in the agricultural sector. The mobile technology is so far hosted by Google Play store with the user base of more than 1,000 local farmers. We will continue with upgration and scale-up plans, and increasing awareness of using this game-changing digital technology to smallholder farmers.



**Figure 13: SmartInput technology with artificial intelligence embedded and languages added**

Key partners

