

INNOVATION FUND

Precision pest and disease management system based on multidimensional big data (PPeDMaS)

Parent project: *Accelerating inclusive green growth through agri-based digital innovation in West Africa (AGriDI)*

PROJECT COORDINATOR



West African Science Service
Centre on Climate Change and
Adapted Land Use (WASCAL)

PARTNERS



Ministry of Agriculture, Animal
and Fishery Resources (MARAH),
Burkina Faso
Afrique Geosciences, Burkina Faso



LOCATION

Burkina Faso



PERIOD

March 2022 – March 2024



EU FUNDING

EUR 261,424.52

SECTOR

Agriculture

KEYWORDS

Digital tools, multispectral
drone mapping, mobile
mapping, capacity building,
early warning system, deep
learning, artificial intelligence



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CHALLENGE

Though the mobile phone has penetrated the rural area of Burkina Faso, the use of digital technologies in crop production by farmers to increase production, enhance market access, and manage diseases and pests is still low. This is due to low level of digital literacy, inadequate planning, and delay in taking advantage of new technologies. The current situation puts farmers at the risk of low production with great implications for food security.



Pest management support to farmers and an extension officer in Thyou, Burkina Faso.

PERSPECTIVES

The project is exploring Artificial Intelligence (AI) methods for pests and disease detection together with other technologies for early warning/detection. Relationships between pest and disease incidences and climatic and environmental variables is also investigated. The focus is on maize, onion and tomato in three regions (i.e., Centre-Sud, Centre-Ouest, and Plateau-Central) of Burkina Faso. The project will deliver a web-based pests and diseases data platform, an early warning web application, and a mobile application that will provide immediate solutions to farmers on pests and diseases.

Farmers and extension officers will learn and contribute to citizen science (i.e., mapping, use of early warning systems, etc.) with respect to pest and disease management in maize, tomato and onion production systems, and benefit from the resulting improved yields. Students will acquire drone-piloting skills and will be actively involved in aerial mapping and other project activities. Other stakeholders in the agriculture value chain will have access to operational tools that can be used in policy formulation, adoption/uptake activities, further research, and development of farmer-based services.

JUSTIFICATION

The use of AI and other advanced technologies (such as cloud-based computational platforms for developing complex geospatial workflows) to study multidimensional big data on climatic and environmental variables of farms as well as biophysical parameters of crops (e.g., those obtained from multispectral UAV images) is necessary to develop a robust set of digital tools such as early warning/detection systems that can be used to effectively manage pests and diseases in high valued crops such as maize, tomato and onion in Burkina Faso.



Fall armyworm management support to farmers in Po, Burkina Faso.



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METHOD

Data collection: crowdsourcing, aerial UAV mapping, and online data mining. Crowdsourcing of locations of pest and disease outbreaks, photos of healthy and pest-affected crops and crop diseases, and other metadata will be collected and transmitted (almost in real-time) via mobile phones by trained agriculture extension officers and farmers of collaborating farmer-based organisations using the well-known Open Data Kit (ODK) methodology. Aerial surveys of affected and neighbouring farms using multispectral drones collect data to determine the set of biotic stress indicators/indices for detecting impacts of common pests and diseases. Existing archives (e.g., <https://www.kaggle.com/>) are explored to collect more image samples of healthy crops and crops with diseases. All collected data serve as inputs for the development of AI systems for automatic detection of pests and diseases and for providing suitable crop management solutions to farmers.

Development of mobile application: A mobile application to provide suitable crop management solutions to farmers will be developed using appropriate programming languages and libraries.

Development of pests and diseases early warning system (EWS): A set of biotic stress indicators/indices for the detecting impacts of common pests and diseases, and the key influencing bioclimatic and environmental factors of pest and disease outbreaks on maize, tomato and onion farms will be determined, followed by the development of an early warning system web app on Google Earth Engine using freely available biophysical, environmental and climatic data.



Drone piloting training to technicians from the Ministry of Agriculture and master-level students in Ouagadougou, Burkina Faso.

INNOVATIVENESS

The project delivers a unique, scalable early warning web app for pest and disease outbreaks in Burkina Faso. This is new, especially in Africa. The developed methods will constitute an important scientific development in precision pest and disease management at national and continental levels. Also, the multi-stakeholder approach strategy which involves farmers (citizen scientists), students, scientists, and technicians (e.g., drone pilots and agriculture extension officers) will ensure that knowledge is cogenerated and sustainable.



Aerial survey of a maize farm with Phantom 4 Multispectral drones in Toece, Burkina Faso.

EXPECTED RESULTS

Impact

- Increased production of tomato, onion and maize in southern Burkina Faso.

Outcomes

- Mobile and early warning system (EWS) applications for pest and disease management used by tomato, onion and maize farmers, and extension officers in southern Burkina Faso.

Outputs

- Online datasets of tomato, onion and maize pests and diseases with management solutions accessible to the public.
- A mobile application for pest and disease management accessible to tomato, onion and maize farmers, and extension officers.
- A web-based early warning system (EWS) application for monitoring pest and disease outbreaks accessible to tomato, onion and maize farmers, and extension officers.
- Tomato, onion and maize farmers, and extension officers trained in the use of mobile and EWS applications for pests and diseases management.

This project is one of 9 supported by the ACP Innovation Fund project: [AGriDI](#), a project implemented by the International Centre of Insect Physiology and Ecology (icipe) in Kenya, in partnership with the University of Abomey-Calavi in Benin, Gearbox Pan African Network in Kenya and Agropolis Fondation in France.

Contributing to a conducive environment for agri-based digital innovations, especially for women and youth farmers, and accelerating inclusive green growth in West African countries, [AGriDI](#) has selected 9 (third-party) projects that are implemented by academic and research institutions, ministries and government agencies responsible for ICT or science, technology and innovation, farmer cooperatives, MSMEs, and civil society organisations in Benin, Burkina Faso, Ghana and Nigeria.

[AGriDI](#) supports the development and scaling of the use of digital technologies for agricultural development, such as in the areas of soil mapping, agro-inputs, crop management, marketing, and policy making.