FERARI

FERTILIZER RESEARCH & RESPONSIBLE IMPLEMENTATION

IFDC

Developing Agriculture from the Ground Up

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VALIDATING DRONE IMAGERY ANALYSIS THROUGH ON-THE-GROUND DATA COLLECTION FROM FERARI FIELD TRIALS

To validate data accuracy and enhance analysis consistency, FERARI deployed staff expertise in data collection activities. Akua and Angela were tasked with collecting agronomic parameters such as plant height, leaf area, stem girth, and chlorophyll content using specific instruments. Drone specialists Jephthah and Geoffrey were assigned to integrate drone technology into the data collection process. The drone navigated FERARI trial fields to capture high-resolution images and data in a fraction of the time required by traditional methods. "Our field trip enriched our knowledge of how data is collected manually and demonstrated the incredible potential of drones in agriculture. Seeing firsthand how drones are transforming the face of agriculture by making it more efficient, data-driven, and sustainable was an eye-opening experience. The cutting-edge technology of drone-assisted data collection can help us optimize agricultural productivity." ■

FERARI FEATURE

FERARI FACILITATES USE OF DRONE TECHNOLOGY IN AGRICULTURE

▲ *FERARI staff Jephthah Nimo Marfo and Geoffrey Amaniampong operate a drone over a trial field in Mampong, Ashanti region.*

Drone technology has revolutionized data collection in various industries, including agriculture by providing a faster, cheaper, and safer way to collect data that is reliable, accurate, and highly detailed. These unmanned aerial vehicles (UAVs) are equipped with sensors that collect data in real-time and provide insights into crop health, yield potential, and other factors. Drones capture high-resolution images and data that enable farmers to monitor crops, detect pests and diseases, and optimize irrigation and fertilizer application, among other things. Drone field data collection in agriculture is especially useful for large-scale farms where monitoring crop health and identifying potential issues can be labor-intensive and time-consuming. With drones, vast areas of farmlands can be monitored in a short period of time to collect accurate data that can be used to allow farmers to make informed decisions about crop management practices.

Overall, the integration of drone technology in agriculture can improve productivity, increase yields, and reduce the costs associated with manual labor and traditional data collection methods. As the industry continues to evolve, the use of drones will become an integral part of modern farming practices. FERARI envisions a future where drone-assisted data collection becomes an integral part of agriculture in Ghana and across West Africa.

"On the field, the drone and the Real Time Kinematics (RTK) are set up. The calibration panel is placed on level ground to be photographed by the drone before and after the flight, to establish geo-reference identification for each drone flight recording. Afterward, the flight is planned for the mapping. All safety protocols are checked and the drone is launched for field mapping. The drone returns to the home point after completing the flight," FERARI staff explained.

Back in the office, the images captured by the drone are processed using photogrammetry software and analysed using QGIS. The orthomosaic, Digital Terrain Model (DTM), Digital Surface Model (DSM), and band reflectance are used in monitoring plant growth, nutrient deficiencies, delineating field plots. Estimating and analyzing the Normalized Difference Water Index (NDWI) allows for monitoring crop water stress, and the Green Normalized Difference Vegetation Index (GNDVI), the Normal Difference Vegetation Index (NDVI) and Normalized Difference Red Edge (NDRE) allows plant chlorophyll content (crop health) assessment and also modulation and recommendation of nitrogen fertilizers.

Analysis of the drone data speeds up the laborious process of inventorying crops and estimating crop yield through statistical (machine learning and deep learning) and systems modeling and for macro agricultural intelligence (MAI). ◼

FERARI SPECIALISTS ENGAGE WITH DRONE TECHNOLOGY & DATA

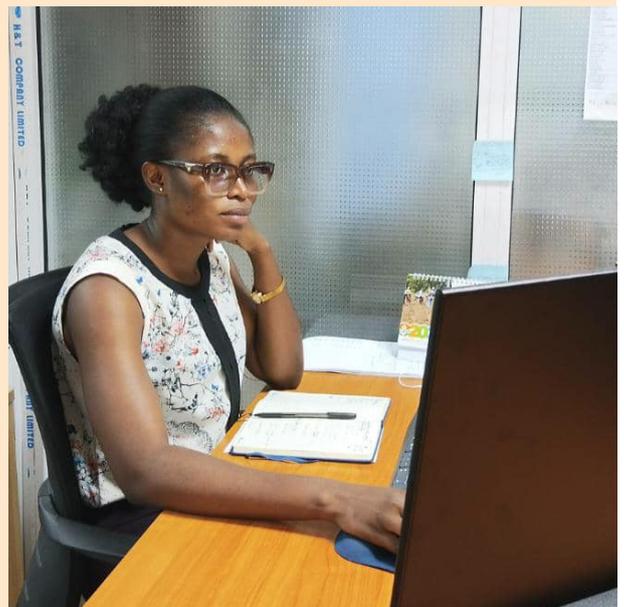### AKUA FORIWAA KWARTENG: THE ESSENCE OF DATA QUALITY CONTROL

Akua Foriwaa Kwarteng is FERARI's Agronomy and Crop Science Assistant. Akua understands the crucial role data quality control plays to ensuring the accuracy and reliability of research findings. "The significance of maintaining data integrity in agriculture field research cannot be overstated, as it forms the foundation for informed decision-making and contributes to advancements in the agricultural sector. The reliability of our results depend on the accuracy and consistency of the data we collect. Any inconsistencies, errors, or biases in the data could lead to misleading conclusions and misguided recommendations," she explains.

The validation process involves meticulously checking for missing values, outliers, and inconsistencies in the dataset. Automated algorithms and manual checks are used to identify and rectify any errors or discrepancies. "By performing these data cleaning procedures, I ensure that the data used for analysis is reliable and accurate," Akua says. "Rigorous statistical analysis is conducted on the cleaned data to draw meaningful conclusions. Descriptive statistics, hypothesis testing, and regression models are employed to analyse the data and identify significant trends or relationships. By applying appropriate statistical techniques, I ensure the validity and reliability of our research findings."

Akua's experience with data quality control in agricultural field research (FERARI) reaffirms the importance of maintaining data integrity. By implementing standardized protocols, providing training, conducting calibration exercises, performing data validation and cleaning, documenting procedures, and conducting rigorous statistical analysis, she ensures the accuracy and reliability of the data collected during field trials. She is pleased with FERARI's commitment to good data quality control practices. "It not only enhances the credibility of research findings but it also contributes to informed decision-making and advancements in our agricultural sector. Going forward, I am committed to upholding data quality control principles in all my future agricultural research endeavors." ◼
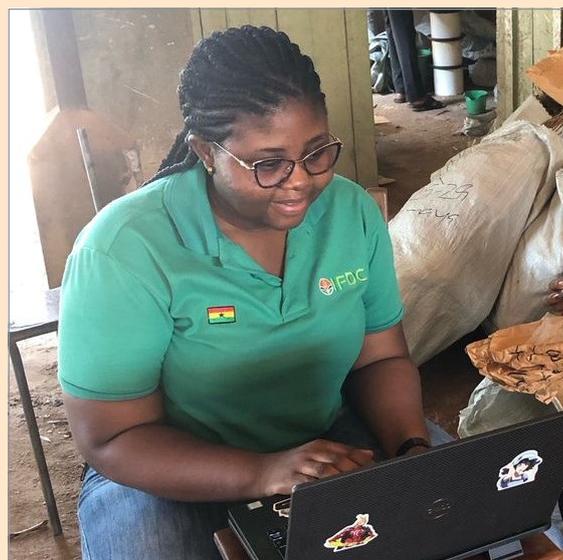
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BENJAMIN DONKOR: FERARI MODELING AND MAPPING

Benjamin DONKOR is a Crop-Soil Simulation Modeling and Mapping Scientist with the FERARI program. He joined FERARI in February 2023 and has been contributing to the output of the program. He focuses on the assessment of crop model's adaptation for simulating maize, rice and soybean yields in Ghana.

According to Benjamin, crop models are tools that can aid in better understanding of crop performance in response to the interaction between genotype, management and environment (G x M x E). "The uniqueness of FERARI's approach in modeling and mapping is its innovative approach towards identifying and understanding critical gaps in crop yields and drivers of crop yields," he further added.

Benjamin is currently calibrating and validating LINTUL crop model for simulating potential and water-limited yields of maize, rice and soybean in Ghana. After successful calibration, the model is expected to explain the causes of the yield gaps identified. Specifically, parameterizing the LINTUL model to accurately make crop predictions for Ghana and determine its suitability for adoption in estimating future predictions for policy formulations. According to Benjamin, "working with FERARI this few months has been a great experience and expects his contribution to the project to improve food security through right fertilizer application (source, rate, time and place)." ■

FERARI MASTERS STUDENT INTERNS: ANASS ABUKARI NEINDOW & EDWARD KYEI

Over the years, our master student interns have successfully graduated from the various public universities in Ghana. Their research works that were engineered and co-supervised by the FERARI team have received wide commendation from the universities and the examiners of such research outputs. Recently, two FERARI interns, Edward Kyei of the University of Cape Coast and Anass Abukari Neindow of the University for Development Studies, achieved milestones in their studies and have earned our warm congratulations.
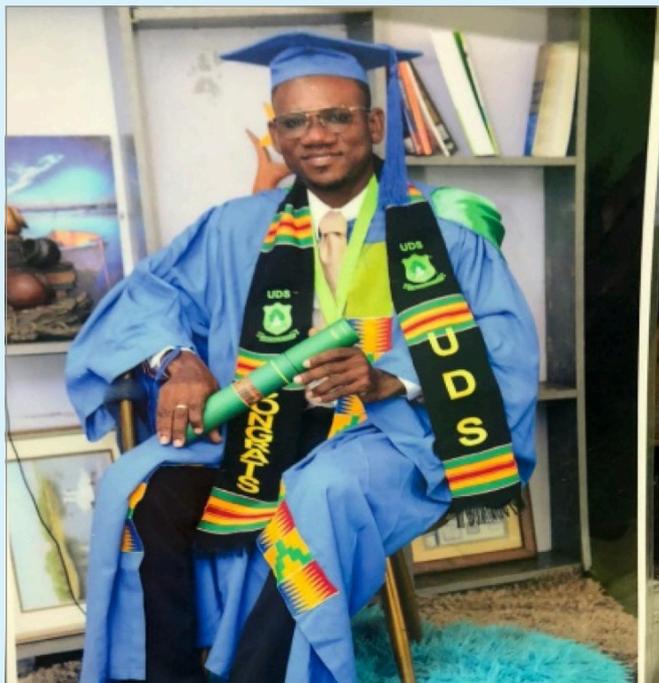
Anass Abukari Neindow of the University for Development Studies graduated in MPhil. Agricultural Economics. His research delved into the farming systems and farm investment decisions of maize farmers in the Guinea savannah and Transitional zones of Ghana.

According to Anass, "the guidance, supports, and supervision provided by FERARI was impactful and I am forever grateful to the program. More importantly, the guidance provided during the analysis and discussion of my research data, and the chronological presentation of the thesis write-up can never be forgotten. I have acquired a lot of knowledge and skills in research through the FERARI internship opportunity granted me, and very useful and insightful experiences to draw on in my future career."

Anass concluded from his research, "to increase the adoption of sustainable agricultural practices and to increase maize yield, it is recommended that the farmers cultivate maize under crop rotation system on large-scale with high labor investment."

Edward Kyei studied Agricultural Economics from the University of Cape Coast and has successfully defended his research thesis, which analysed the soybean value chain and market intelligence among farmers in northern Ghana.

Edward reflected, "the internship provided by IFDC-FERARI was an excellent opportunity. It paved the way for me to do independent research and to practically learn more about research, for which I have gained experience that will significantly contribute to my academic and professional careers in the future."

The examination committee on Edward's research commended him for the good research work on an important crop in Ghana. His research advanced knowledge on soybean production, analysing the soybean value chain and market intelligence in northern Ghana.

Overall, Edward found that soybean producers are technically inefficient and the marketing of soybean can be more profitable if the low access to information is improved, particularly on where farmers can sell their soybean and the prices for soybean at different markets. He is convinced that improving the market intelligence available to soybean farmers will enhance their adoption of sustainable soybean production practices.

Most of the other master students with FERARI have far advanced in their research projects and in the coming months they will also draw a close to their work, and we anticipate presenting their achievements here. ◼

▲ *Executives of the Fertilizer platform Ghana meet with Hon. Bryan Acheampong, the Minister of Food and Agriculture of Ghana (middle, in blue).*

MOFA HOLDS DISCUSSIONS WITH FERTILIZER PLATFOM GHANA ON BRINGING BACK FERTILISER TAX EXEMPTIONS

The Ministry of Food and Agriculture (MOFA), has engaged stakeholders in the agriculture sector to bring back tax exemptions on farm inputs, particularly fertilizer. The discussions which had brought on board the Ministry of Finance, were to make the inputs more affordable to farmers since the taxes were usually passed onto the farmers.

Mr. Brian Acheampong, the Minister for Food and Agriculture announced the discussions when the Fertilizer Platform Ghana (FPG), led by Ernest Osei-Assibey, Co-Chair for Public Sector and Richmond

Dogbe Co-Chair for Private Sector, paid a courtesy call on him in Accra. During the call, there were discussions on some salient issues confronting the fertilizer sector in Ghana.

The Minister said he was confident that the exemptions would be re-instituted in the coming weeks so that there would be some relief for farmers. He said the Ministry had taken into consideration all the challenges within the value chain and as a matter of urgency had made significant steps to solve them like fine-tuning the Planting for Foods and Jobs (PFJ).

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