Arbeitsgemeinschaft Tropische und Subtropische Agrarforschung (ATSAF) e.V.
Council for Tropical and Subtropical Agricultural Research

ATSAF Academy
Academy for International Agricultural Research for Development

Junior Scientists Tandems
Final Report

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Start and end date of stay at IARC/ GRI: 15.08.2024 – 15.02.2025
Title: Characterizing crop growth stages from UAV.

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Introduction

The **Career Exploration Stay** at **CIAT Guatemala** was an enriching experience that allowed me to engage in agricultural research, interact with experts in the field, and gain hands-on exposure to innovative agronomic technologies. My stay was part of the **Career Exploration Scholarship Program** by ATSAF, which aims to provide young professionals with practical experience in international agricultural research.

Inside the main project I was involved “Crop Monitoring with Drone Imagery in Highlands and Lowlands” a final report was generated and published with the main results of the monitoring activities, including remote sensing tools, agronomics information describing each assessed site and weather and soil characteristics that properly explain the environment evaluated. From this main project I had the opportunity to take out materials, resources and inputs for my master thesis elaboration “Characterizing corn growth stages from UAV in Guatemala”. The thesis research mainly involve the following topics: UAV (unmanned aerial vehicle) imagery, image segmentation with machine learning and statistical test, all related to corn growth stages.

This report details my activities, interactions with supervisors and colleagues, and key learnings from the experience. While not a technical report, it includes insights gained from my involvement in research projects at CIAT, particularly in **precision agriculture and agronomic monitoring using drones.**

Objectives

The main objectives of my stay at **CIAT Guatemala** were:

- To gain exposure to **advanced agricultural research methodologies**.
- To participate in the **AgriLAC Resiliente** initiative, which aims to improve the resilience of small-scale farmers in Latin America.
- To develop **practical skills in data collection, remote sensing, and GIS analysis** applied to agriculture.
- To collaborate with researchers and farmers in the implementation of **sustainable farming practices.**

Research Activities and Involvement

During my time at CIAT, I was involved in **several key activities**, including:

Field Research and Data Collection

- Conducted **on-site visits** to farms in **Totonicapán and Zacapa**, assisting with agronomic data collection.

- Participated in **drone-assisted monitoring** of maize fields to assess plant health and growth patterns.

Figure 1 Image capture preparation

Data Analysis and Processing

- Assisted in processing **NDVI (Normalized Difference Vegetation Index) data** to evaluate plant health.
- Worked on **GIS-based mapping of monitored plots** using QGIS and Python in Visual Studio.
- Compared vegetation indices across different growth stages of maize crops.

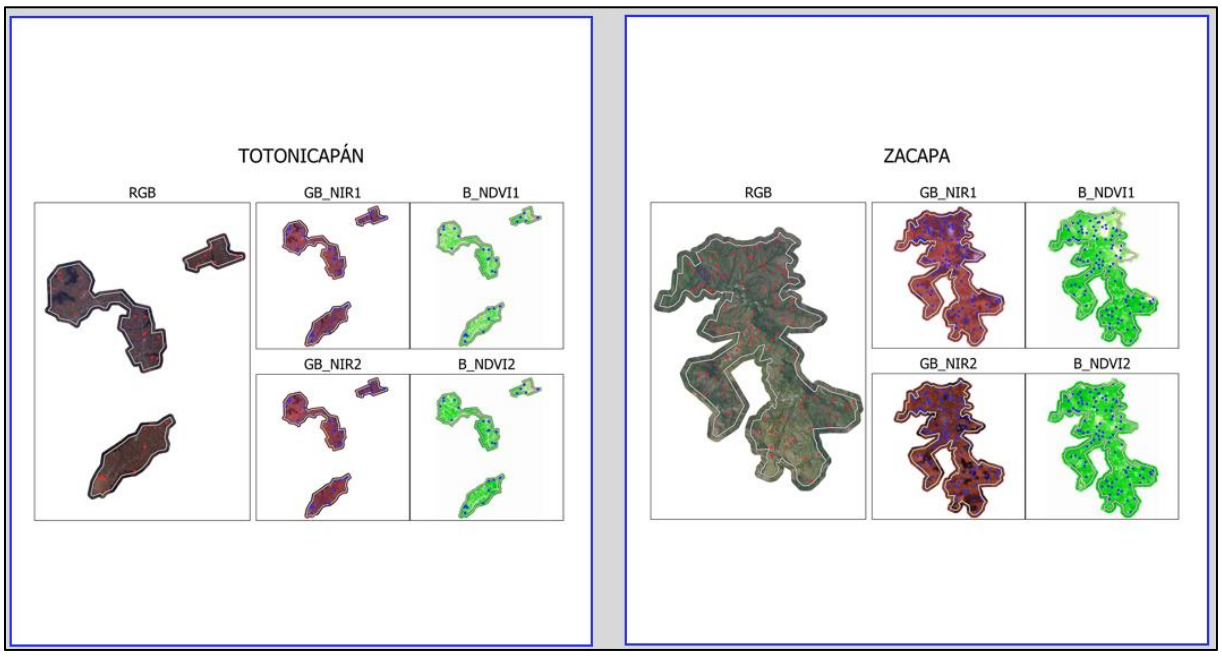

Figure 2 Images from each location

Interaction with Researchers and Local Farmers

I engaged in discussions with CIAT researchers and agricultural specialists to understand the broader impact of precision agriculture, attended meetings with local farmers to discuss their challenges and explore ways to integrate technology into traditional farming practices, and learned about the role of technology adoption in small-scale farming and its potential to enhance resilience against climate variability.

Also Interaction with co-workers was enriching, they are expert in different branches of agronomic field and they exchange a lot of information with me, and I also share my knowledge with them. The supervisor I had there is a friendly and some who really like to share and discuss with everyone about each project, considering every time other opinion. We also talk about what further research would be needed and if I would like to participate, where my answer was absolutely “yes”.

Figure 3 Experience exchange meeting

Key Learnings and Takeaways

Precision Agriculture and Drone Monitoring

- Learned how drones can be used to **collect real-time agricultural data**, reducing the need for manual field inspections.
- Understood the **challenges in implementing drone technology in smallholder farming** due to cost and accessibility constraints.
- Image processing using Machine Learning tools learnt from the master help me to improve the procedure in the place.

Agronomic Insights from Totonicapán and Zacapa

- **Totonicapán:** Higher elevations and cooler climates allow for better crop resilience, but **fragmented land use** presents challenges for mechanization.
- **Zacapa:** Warmer temperatures and limited rainfall make **water management crucial**, requiring sustainable irrigation techniques.
- Each location had a proper description, with the usage of agronomic, weather, soil and remote sensing data. Crops can be tracked across the live cycle and improve each activity in order to increase the yield.

Interaction with Experts and Team Collaboration

Working alongside CIAT researchers gave me insights into the **multidisciplinary approach required in agricultural research.** All main projects I worked with and help in a secondary scale are completely focused to resilience, sustainability and optimization. That gave me the opportunity to realize how I can apply all the tools learnt in the master study into the real world in the region I belongs. Also, collaboration with farmers highlighted the importance of **bridging research with on-the-ground applications.**

Challenges Faced and Overcoming Them

Language and Communication

While Spanish is the primary language spoken at CIAT Guatemala, I improved my **technical communication skills,** scientific language, translation skills and even the usage of local slang, all in Spanish and English.

Adapting to Fieldwork Conditions

Adjusting to **varying weather conditions** was initially challenging but ultimately rewarding. Understanding the **logistics of field data collection** and ensuring proper documentation of data was essential. CIAT offices in Guatemala are located inside another organism called IICA, the relationship between them and I was excellent, even the experience exchenge.

Conclusion and Future Applications

My time at **CIAT Guatemala** was an invaluable experience that deepened my understanding of agricultural research and **precision farming technologies.** The skills I gained—ranging from **data collection and GIS analysis to farmer engagement and interdisciplinary teamwork**—will be instrumental in my future career.

I am particularly interested in exploring how **remote sensing and precision agriculture** can be applied in different agricultural contexts worldwide. This experience has inspired me to **pursue further research in sustainable agricultural innovations** and their role in improving food security.

Acknowledgments

I would like to express my **sincere gratitude to Alliance Bioversity & CIAT in Guatemala**, my **supervisors and mentors**, and the **ATSAF Career Exploration Scholarship Program** for providing this opportunity. Special thanks to the farmers and researchers who shared their insights and made this experience so enriching.