



ATSAF - CGIAR++ Junior Scientists Program

Final Report

Name of student: Emilia Koch

University: University of Hohenheim

Supervisor at University: Prof. Dr. Hans-Peter Piepho

International Agricultural Research Center: International Potato Center (CIP)

Country: Uganda and Peru

Supervisor at IARC: Dr. Bert De Boeck

Start and end date of stay at IARC: 23 Oct 2021 - 30 Dec 2021

Start and end date of remotely supervised project: 01 Sep 21 - 28 Feb 22

Title: Estimation of genetic gains from on-going field trials in sweetpotato for East- and Southern-Africa

Funded by the German Federal Ministry for Economic Cooperation and Development (BMZ)



ATSAF - CGIAR++ Junior Scientist Program

Final Report

**for the Research Stay at the International Potato Center
in Uganda and in Peru, in the Course of the Project:**

**Estimation of Genetic Gains from On-Going Field Trials in Sweetpotato for
East- and Southern-Africa**

1. The Project

In the course of my internship, I visited the research centers of the International Potato Institute (CIP) in Uganda and in Peru from the 10th of October until the 30th of December 2021. During this period, I gained background information and performed research for my master's thesis on the estimation of genetic gains from ongoing field trials in sweet potato for East- and Southern- Africa.

For this purpose, I worked on the reevaluation of a data set, which contains plant breeding trials of sweet potatoes. These trials were conducted from 2009 to 2019. This data set was curated and digitized in the course of the SASHA project, which lasted from 2009 to 2019. It got published in the SweetpotatoBase in 2021.

The final aim of my internship was to obtain genetic gains for sweet potato varieties, which were tested throughout the breeding activities during the SASHA project. In order to attain genetic gains, an estimation of the genetic effect of the genotypes on the respective trait is estimated over the duration of the SASHA project. Genetic gain estimations are important as a base to predict the future crop supply. They will also serve as a key performance indicator in order to evaluate the efficiency of the past breeding efforts and to monitor return on investment.

Due to the COVID-19 situation it was originally thought that I cannot travel. However, after a careful revision of the situation in Uganda and in Peru I was allowed to travel for 6 weeks to each of these countries.

2. Tasks

My CIP supervisors set up a work plan for the internship period in Uganda and Peru, respectively. The time from the 10th of October until the 23rd of November 2021 was spent in Uganda. I was involved in activities for sweet potato breeding, in order to learn about the setup of the breeding projects and their implementation. Thereafter, I went to the CIP headquarter in Peru to work together with my internship supervisor, to finalize the revision of the dataset, and to work on the statistical analysis.

1.1 Tasks in Uganda

The main objectives in the work plan of Uganda aimed to make me familiar with the current breeding program and the breeding projects of the past.

During my stay, I visited the three main research sites in Namulonge, Serere, and Kabale. Throughout these visits, I obtained a deeper understanding of each location's climatic characteristics and the associated difficulties on each site. Each of them is important to observe specific traits. Serere, for example, is in the north and experiences more severe heat periods than other sites. Therefore, drought tolerance and insect resistance can be observed well. Kabale is situated in the west. Due to higher humidity rates at this site, resistances to fungal diseases are frequently more apparent than in other locations. During my visit to the research stations, I was introduced to each of our team members' work and learned how the trials are conducted and evaluated.

After visiting the laboratories for the sensory analysis and after obtaining an introduction to the analysis of the collected data, I was asked to support the team with writing a script for RStudio, an open-source statistics software that can replace the purchase of the Excel Stats license. In addition, I was involved in the modeling of the newly collected data and the process of selecting genotypes for the coming season. This gave me the chance to glean a deeper familiarity with the analysis and methodologies that were used by the local breeders. I worked on open questions considering the correctness and the completeness of the historical trial data. Furthermore, I started to formulate models for each trial design. This work helped me to refresh and expand my skills in RStudio which enabled me to conduct the following computations for my thesis more easily. By working with the different data sets and by attending additional workshops, I got familiar with the use of the SweetpotatoBase and its tools for planning and organizing the trials.

The visit to Uganda allowed me to obtain a holistic impression of the current breeding activities at different sites within one entire season and the different stages of the hybrid breeding process for sweet potato. I had a lot of time to ask questions and to obtain all important information for modeling the historic trial data in the subsequent weeks. I got challenged in a very positive way by being involved in the ongoing data analysis. Dr. Ssali trusted in my skills and involved me in ongoing projects while being open to questions and to giving support if needed. In this way, I got further involved in interacting with the local staff and progressed a lot in my statistical skills.

1.2 Tasks in Peru

The period between the 23rd of November and the 30th of December 2021 was spent at the headquarter of the CIP in Lima, Peru. During this time, I focused on the three main steps to obtain genetic gains.

First, I finished the preparatory work for the data analysis. Subsequently, I used a two-step approach to obtain variance component estimates. In the final step, I model the trend of the genetic gain of each trait over the period of the research projects for each trial and for

different groups of trials, to distinguish the impact of different locations and different research projects on the genetic gain. Moreover, the genetic gain of the past trials are compared to the specifically and more recently conducted genetic gain trials. In this way, the various improvements due to purely genetic and non-genetic factors can be modeled, in order to estimate true variety improvement while avoiding an over or underestimation.

Due to its climatic uniqueness, it is expected that the trials in Kabale have a major impact on the variance. Genetic gains are expected to be moderately low, since the aim of the breeding projects from 2009 to 2019 was to obtain background information on specific questions like how to implement a hybrid breeding system or how to increase cold and drought tolerance. Registration trials were infrequently conducted by external governmental institutions. Specific results will be obtained within the following month.

3. Cultural Impression

Visiting the research sites of the CIP and seeing its projects on the cutting edge of science was really impressive. With a history of conducting agricultural field trials as a research technician, it was a great and highly valuable experience, not only for my thesis project. I saw how field trials were coordinated, was participating in great workshops, saw how knowledge transfer was organized, was introduced to the aims and approaches of the current research projects, and could even contribute to them. The researchers I met were highly skilled, dedicated, motivated, and passionate about their work. I highly enjoyed working together with them and to learn from them. I liked the way how aims and intentions were expressed very precisely and clearly. This helped me to organize and adapt.

It was significant and helpful to me that my supervisors tailored the work plan according to the knowledge needed for my thesis project, to the emphasis of my degree program, and to my aims regarding the work after my studies. I still had many tasks on my program. However, targeting the tasks endowed me to get the most out of my internship and made it valuable and absolutely successful for me.

Observing the workshops and the interaction within the team, I was amazed by the mutual teaching and the openness for questions. I not only felt that the workshop leaders had a true interest in their participants to understand the content, but also the honest desire for them to understand the questions asked and to answer them in a way that supports their learning process. “There is no stupid question” was not just a phrase in our daily work, but a habit.

I experienced a great degree of respect, friendliness, and support throughout the CIP’s staff. I give a lot of credit to the institution for living their code of conduct regarding treating people of different genders equally and for giving them access to the same opportunities. I felt like having the same worth, competence, and access to chances and support within the institute, just as any other person. Certainly, this should go without saying and I still value it as a big achievement.

Good relationships were key to working together and cooperating. There were not a lot of European people in the research institutes. In Uganda for example, there were none and it took me a little time to warm up and to get in contact with the people. By reading cultural guides and putting thought into these questions it worked out very well.

Of course, a central key is to do the utmost to invest in harmonic relationships and I needed further adjustments. For example, regarding my wardrobe, I got some traditional dresses for wearing in the office in Africa. I investigated time in learning basic Swahili and Luganda and to be able to greet and to ask everyone in their common language how they were doing. In Peru, people were a little more open right from the beginning, but even there, I needed the patience to warm up. The relationship got much better as my Spanish improved. After a while, people started to enjoy showing me a museum or joining for lunch. Interpersonal relationships were highly important, but as in Germany, it needed time to build them. Even if I engaged in some degree of interaction with my coworkers. Still, we were all very careful. Many people were scared and traumatized from losses due to COVID-19. Many people were careful to interact with me. This was understandable. In this way, I could enjoy having a lot of time for myself to work on my thesis.

On the other hand side, a friend from India once described his culture as “serviceful”. *Serviceful* in the way of how we take care of other people and how we support them in their wellbeing. His stories helped me to observe the behavior of the people around me from a new point of view. There is a similar pattern in Uganda and in Peru. My coworkers were *serviceful* in the way they supported me with advice or brought me to the most important shops. In this way, I was introduced to the local cuisine and to the kindest lady I could encounter for getting an African dress tailored. Mirroring, bringing the favorite treat of the team for arrival or bringing a little chocolate for Christmas also helped to get in contact. Even in COVID-19 times, it was possible to greet each other and to have a short coffee once a week in the open air. Maybe one might consider the description of a *serviceful* culture as normal, as it was an essential part of many parts of the world. However, I experienced different cultures, where this behavior would be seen as an intrusion into someone’s life.

The security situation in my host countries was different from the one in Germany. Accordingly, I received introductory workshops, which equipped me with a basic idea on how to move around and what to be careful of. My work colleagues were very supportive, too. I got brought to the right pharmacy, to obtain the malaria medication. Also, I was advised to not have my cell phone too close to the window, if I am sitting in a vehicle, or to not wear jewelry when walking in roads with busy traffic. These hints were truly important for me. However, I found that there is a fine line between supporting someone to be secure and to rise fear of leaving their own apartment. However, with a lot of care and patience towards myself, this problem solved itself.

I experienced the importance of having good contacts and a community. Moving alone was not common and even considered dangerous in times. Having a community that supports each

other was not just a nice thing. It was essential. It was interesting to experience how Ugandans harbored a fair amount of distrust, even towards the friends that they surround themselves with. Peruvians were not as extreme but followed a similar pattern.

The Ugandan culture was newer to me compared to the South American. I have spent time in Africa before and listened to experiences of friends from Germany who have been there and of study mates, who originated from the respective country. This helped me tremendously to manage daily life.

Besides the fine differences, which I pointed out previously, I observed even more similarities. People in most countries of the world value friendliness, respect and want to feel knowledgeable. Therefore, we might all not be as different, as we think. It solely depends on the perspective and our choice to either focus on the differences or on the similarities. As for me, I personally prefer the last one. This, in combination with some degree of adaption to the local culture, was the most successful way for me, towards finding a common ground. It was important to build friendships, to work well with my colleagues, and to successfully strive in our projects.

Working with datasets, to some degree, is a relatively independent task. The problems that are encountered were not very predictable, since I am new to the CIP and just learning about the history of the data that I am working with. I needed frequent conversations and asking the right questions to find out the necessary background knowledge of how the trials were created, and the data was digitized. I needed to really understand why, in order to model it correctly. Analyzing 10 years of research data brings surprises in each step. Working closely with the field biologists, listening to their experiences, and knowing who to ask were essential. A lot of the things they mentioned on the side were useful and gave me an idea of what to be careful of in the analysis.

My deadlines were not rigidly defined. This situation, in combination with the new work environment, made me progress a lot in disciplining myself, investing in healthy routines, and good organization. I scheduled weekly review meetings with my supervisors to obtain feedback and make myself track progress and set clear aims.

I experienced a highly respectful work atmosphere, friendliness, sharing of experiences, and good introductions to the project. People were open and available for questions. There has been a high-security awareness, as well as a true interest in my wellbeing. I really like working in an international research environment, because I feel like fitting in very well. The more I travel for work, the more I enjoy it and at this point, I can even imagine living abroad for an extended amount of time, for example in the course of a PhD.

I thank everyone who contributed to and supported me during my stay abroad.

Emilia Koch



Pictures of the research site in Namulonge (first line), the work in the fields in Kabale (second line) and the team (third line).