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Junior Scientists Tandems
Final Report

Name of student: Sierra Quinn McKinney
German Research Institution: Technische Universität München (TUM)
Supervisor at German Research Institution : Prof. Dr. Mutez Ahmed
National University (Country):
Supervisor at National University:
International Agricultural Research Center (Country): International Rice Research Institute (IRRI), Philippines
Supervisor at International Agricultural Research Center: Dr. Amelia Henry
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Overview of My Experience at IRRI

This report provides an overview of my research at the International Rice Research Institute (IRRI) in Los Baños, Laguna, Philippines as part of the ATSAF – CGIAR's Junior Scientists Tandem (JST) program. The data collected during my research stay will contribute towards my Master's thesis. This experience gave me the opportunity not only to deepen my understanding of rice research but also to engage in the complete research process—from conceptualization to data collection—while working on a real-world problem.

Designing and Conducting My Own Experiment

One of the most rewarding aspects of this experience was the chance to design and execute my own experiment. Working in a renowned institute like IRRI, I was given the freedom to take ownership of the experimental process, which is rare at this stage in my career. From the outset, I was involved in determining the research questions, selecting the germplasm, and planning the experimental setup.

I focused on investigating root hair density and its role in drought tolerance in rice. This involved making decisions about which rice lines to include, how to induce drought conditions in a controlled and replicable manner, and which physiological traits to measure in response to stress, as shown in Figure 1. Conducting my own field experiment meant managing numerous variables and constantly adjusting to environmental conditions. This real-time problem-solving was a significant learning experience for me, particularly in terms of coordinating logistics, ensuring proper measurements, and troubleshooting challenges such as equipment malfunction or unexpected weather changes.

Figure 1. Examples of some of the methods. From left to right, stomatal conductance using a porometer (AP4), leaf water potential using a Scholander pressure chamber (Soil Moisture), root preparation for root hairs analysis, example root hair picture.

Another valuable aspect of my experience was working with experienced technicians and postdocs, who have been refining their methods over the years. For example, I learned precise techniques for measuring leaf water potential from an expert technician, and I gained insights into the classification of different rice root types from specialists in rice root biology. These interactions not only improved the accuracy of my data collection but also allowed me to benefit from the deep expertise of seasoned researchers.

The independence I was granted throughout the experiment enabled me to make key decisions and navigate the complexities of field research. This included managing replications, addressing plant variability, and applying water stress consistently. Designing a drought experiment required a delicate balance: stressing the plants enough to observe differences between genotypes, while avoiding conditions so extreme that all plants would fail. With the guidance of the experienced research team, I was able to follow their advice while contributing my own observations from the field to ensure a successful drought experiment, as shown in Figure 2.

Figure 2. Example of successful drought treatment. W on the left, DRT on the right.

Learning from Multi-partner Projects at IRRI

Another major highlight of my time at IRRI was learning how multi-partner projects function. I had the unique opportunity to witness how various disciplines—agronomy, molecular biology, breeding and plant physiology—are brought together to tackle the grand challenges of food security and climate change. Projects at IRRI often involve collaborations across departments, requiring the coordination of different areas of expertise to generate solutions for the challenges facing rice production.

For instance, I observed ongoing research efforts focusing on rice growth and yield, sensory quality (taste and texture), and the adaptability of rice to different environments. These

interdisciplinary approaches provided me with an understanding of how rice research is designed not just for scientific discovery but also to meet the practical needs of farmers and consumers. This holistic view, considering everything from agricultural practices to market reception, gave me a clearer picture of the broader impact that rice research can have.

One aspect that particularly stood out to me was the consumer acceptance of new rice varieties. I learned that introducing new varieties to the market is not only about higher yields or drought tolerance but also about how the rice looks, tastes, and feels to consumers who have been eating traditional varieties for generations. The challenge of developing varieties that meet both economic goals and consumer preferences is something that the researchers at IRRI constantly grapple with, and it was fascinating to observe their approach to this problem.

Expanding My Knowledge of Rice Varieties

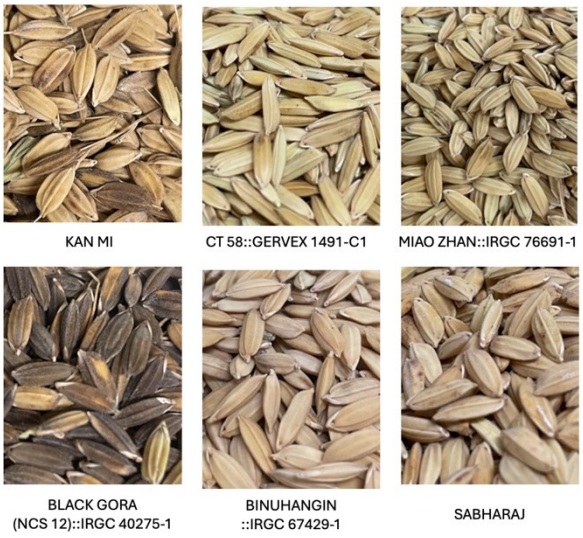

Figure 3. Example of some of the genotypes investigated in during my stay. .

Before my time at IRRI, I thought I had experienced a wide variety of rice, but my understanding deepened significantly after learning about the vast genetic diversity present in natural populations and breeding lines. From the Genebank accessions to the cultivated breeding lines, I observed how different traits are selected and bred over generations. This included seeing the full cycle, from seed storage and germination to growing and harvesting. As shown in Figure 3, the diversity in seed morphology alone is striking.

One of the most eye-opening experiences was visiting the Genebank at IRRI, which stores thousands of rice varieties from around the world. Seeing the enormous diversity of rice plants is humbling and made me realize the incredible potential that exists within this crop for breeding new, more resilient varieties. I was fortunate enough to handle these seeds firsthand, gaining insights into how researchers select and develop lines with desirable traits like drought tolerance, disease resistance, and improved nutrient content.

Investigating Root Hairs Under Drought Stress

With climate change increasing the frequency and intensity of droughts, understanding how below-ground traits like root hairs influence water uptake is crucial for breeding more drought-

tolerant crops. Rice, being a staple food for over 3.5 billion people worldwide, is a critical focus of such research. In my project, I examined 20 different rice lines, 10 genebank accessions and 10 breeding lines, to determine whether root hair density and length differ under drought conditions. Other traits measured included stomatal conductance, leaf water potential, leaf area, total root area, and both shoot and root dry mass. These traits help assess how well different lines tolerate drought based on their root hair characteristics.

Field Research Design

Figure 4 shows the layout of the experimental field. The well-watered (W) control and drought treatment (DRT) sections were separated by a 10-meter buffer zone, with a Davis Weather Station placed in between. Each germplasm was planted in two rows, with replication blocks to ensure statistical validity. Soil moisture sensors like Diviner tubes and tensiometers were installed to monitor water availability and stress in both treatments. My project focused on understanding how these lines, particularly those with greater root hair density, respond to drought conditions.

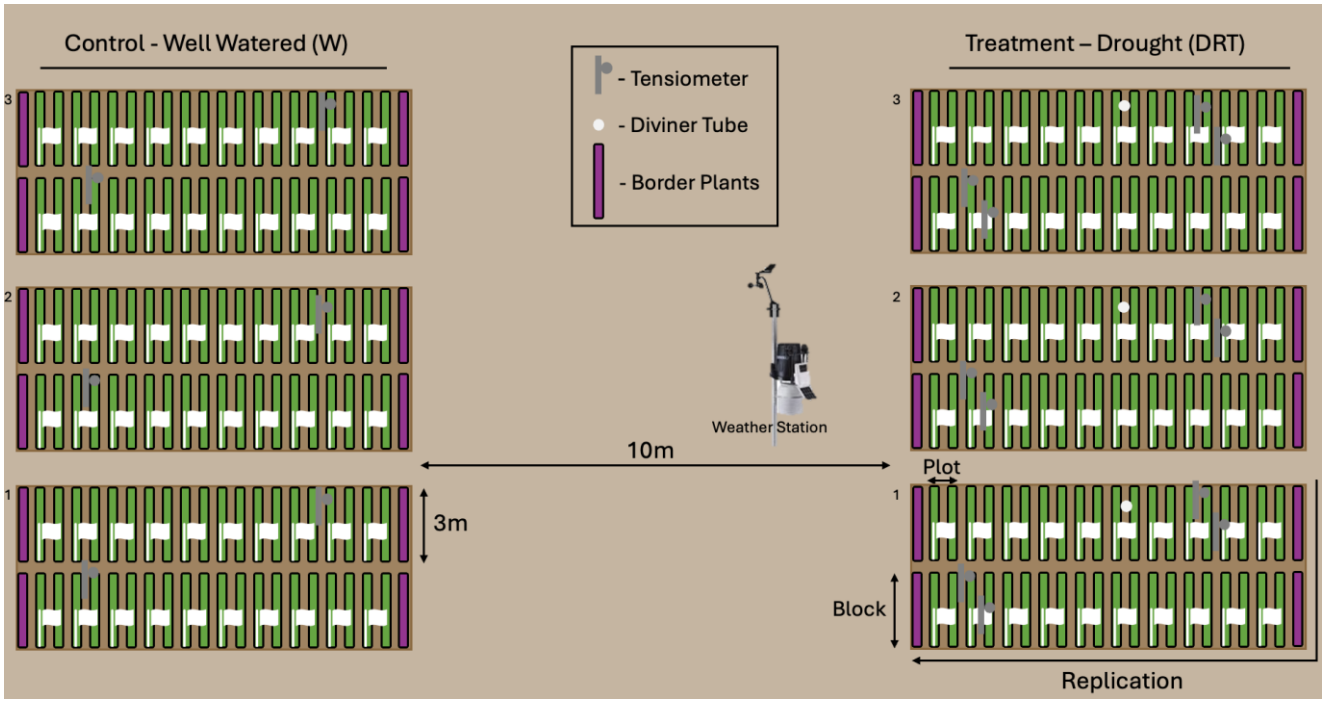

Figure 4. Detailed layout of the field, with the well-watered control (W) on the left and the drought treatment (DRT) on the right, separated by 10m. The Davis Weather Station was in this 10m space. For each germplasm, there are 2 rows (Plot = 3m long, spaced 0.2m wide), and there are 10 germplasm planted in a row (Block), with border plants (purple rectangles). Replication 1 starts from the bottom for both treatments, replication 2 is in the middle and replication 3 is at the top. Diviner tubes (white dots, 0.7m depth) were only installed on DRT and only one depth of tensiometer (grey icon, 15cm depth) was installed on W. The tensiometers on DRT are at both 15cm and 30cm depths.

Personal and Professional Growth at IRRI

Before joining the JST program, I had limited experience working with crops, particularly rice. However, my time at IRRI provided me with invaluable skills and knowledge, enabling me to confidently pursue future projects focused on root-soil interactions of rice plants. I am incredibly grateful for the opportunity to work alongside such talented researchers and to learn from the amazing individuals who helped shape my understanding of rice research, all within the beautiful surroundings of IRRI, as illustrated in Figure 5. This experience has broadened my scientific perspective and strengthened my ability to contribute to crop research. I would like to extend a heartfelt thank you to everyone who made this experience possible, and to all the wonderful people I had the pleasure of meeting and working alongside.

Figure 5. Picture at sunrise at IRRI.