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ATSAF - CGIAR++ Junior Scientists Program Final Report

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Interaction with ATSAF and CIAT

Overall, my experience with the ATSAF Junior Scientist Program was very good. I am happy with the interaction and support I received from both sides. I learned a lot from working remotely in an international team. There were some challenges of course. The different time tables and especially the different time zones made it sometimes difficult to arrange meetings and to take part in the interviews that were part of my master thesis. Nevertheless, it worked out well most of the times. In the beginning I found it difficult to understand the structure of the research team and to know who was responsible for what and whom to address with what kind of questions or requests. I also found it difficult to keep track what was happening in the different areas of the research project. The research team communicated and shared documents and information through Microsoft Teams and other platforms. As an external student I did not have access, therefore, things had to be shared via email for me and I could only take part as a guest in the online meetings. I believe this made the communication a bit more difficult and I had to rely on colleagues to create the online meetings for example.

Language was also a small challenge as all communication with the research team and also with the experts I interviewed took place in Spanish but the rest of my research was in English. Sometime this was confusing but not too hard to handle as I speak both languages on a good level. Overall, I found this aspect positive as it helped me to improve my Spanish skills regarding the technical jargon in my study area.

A very positive site of working with CIAT was that the organization is closely linked with different actors in my study area. Therefore, they were able to provide me with contacts to very knowledgeable experts for my interviews.

Pandemic Situation and Research Process

The situation with the Covid-19 pandemic had a huge impact on the process of my master thesis. Originally, I had planned to travel to Peru and to conduct focus group interviews with smallholder farmers. But traveling was not possible most of the times and due to the rapidly changing situation it was also not easy to plan ahead. Due to this and also due to the fact that I did not find it responsible to travel to remote rural regions during the pandemic I had to change the original plan.

For me the change of the original plan took away a bit of the enthusiasm and motivation for my research. I was looking very much forward to have a direct interaction with the cocoa producers and to better understand the reality of their lives. I fell that my research could have been a lot better if a direct and personal interaction with the farmers would have been possible. It is much different if you can talk face to face with someone, and if that person can even show you the things related to the research on the farm. As the farmers would have been more difficult to reach via internet, I intervened local experts instead. This was very different but still successful and satisfying as they were very familiar with the local realities and worked very closely with the local farmers.

I also struggled a lot due to the social isolation during the pandemic. I felt less motivated and was in a worse mood than usually. I missed the direct interaction with my peers. I believe that little chat and exchange during lunch and coffee breaks for example is very fruitful. You can exchange experiences and give each other tips for the research process or just have a relaxing break together that gives you new motivation for your work. I just realized during the pandemic how important this kind of exchange is and how much it motivates me. In the later stage of my thesis writing, I actually took place in a self-organized online format that brought together people in the process of thesis writing in order to create a space for exchange. That was helpful but could still not replace the direct interaction.

Apart from the pandemic there were some difficulties during the research process regarding the data acquisition. CIAT made available some basic data for a Cost-Benefit-Analysis for me. The aim was to get additional data from a literature review and with the help of expert interview in order to complement the basic data and to be able to compare different climate smart practices for cocoa farming. Nevertheless, this did not work out as planned because

there was almost no literature that provided concrete numbers and the experts were also hesitant to give concreate measures. Therefore, my results are of a rather qualitative nature.

Preliminary results

As the data analysis is not finished yet, therefore the described results are only preliminary. The first part summarizes the results from the literature review and the second part the results from the expert interview. In the thesis the results are discussed in further detail and the findings from literature review and expert interviews will be compared.

There are different climate smart practices that can make cacao systems more resilient to the expected climatic changes. These include for example shade trees, improved varieties and mulching. Although these practices provide several benefits the adoption rate remains low to medium. There are several institutional and financial challenges that inhibit a wide uptake of climate smart practices by smallholder farmers. The implementation of the practices is often costly, labour intensive and requires specific knowledge at the same time the effectiveness of the measures is likely to differ. Based on a literature review 8 relevant climate smart practices were identified that can be summarized in four mayor categories: shade management, soil management, water management and the management of varieties. The different practices and their costs and benefits are summarized in the following table:

Practice	**Benefits**	**Costs**
Shade management: Fruit trees	income diversification Improved soil parameters erosion control and reduced leaching improved microclimate increased biodiversity regulation of pests and pathogens improved system resilience improved food security (additional food crops)	additional workload additional knowledge needed competition with main crop possible increase of pests and diseases possible reduced (short-term) productivity seedlings

Shade management: Timber	income diversification Improved soil parameters erosion control and reduced leaching improved microclimate increased biodiversity regulation of pests and pathogens improved system resilience	additional workload additional knowledge needed competition with main crop possible increase of pests and diseases possible reduced (short-term) productivity seedlings
Soil management: Organic fertilizer	improved soil parameters erosion control and reduced leaching reduced external inputs improved resilience to abiotic stresses increased plant growth increased production	additional knowledge needed additional workload Soil analysis Transport of inputs?
Soil management: Cover crops	Improved soil parameters erosion control and reduced leaching improved humidity reduced external inputs suppression of weeds	competition with main crop additional workload additional knowledge needed seeds
Soil management: Mulch	suppression of weeds Improved soil parameters erosion control and reduced leaching reduced evaporation reduced external inputs	additional workload additional knowledge needed Soil analysis Transport of inputs?
Water management: Irrigation	yield increase increase water availability improved drought tolerance	additional workload additional knowledge needed Additional material costs
Water management: drainage	Erosion control Reduced runoff	Additional workload Additional knowledge needed
Variety management: Multiclonal systems	higher yield higher cocoa quality resistance against diseases improved system resilience	additional workload additional knowledge needed clones

As a result of the interviews with regional experts, it is concluded that most of the climate-smart practices identified are not in common use in the San Martin region in Peru. However, experts recommend the implementation of not one, but a combination of practices adapted to the local context of cocoa management and to create ecosystem resilience to climate change. The experts also underlined the importance of finding local solutions and adapting the practices to the local conditions. Additionally, the need for effective communication on

the benefits of the practices and providing clear incentives for their use was identified. The experts stressed in this context that the practices need to provide not only environmental but also economical benefits for the farmers in order to be implemented. The following table summarizes the main results from the expert interviews:

Practice	Application in the region	Benefits	Costs	Barriers
Shade management: Fruit trees	rare	- Shade benefits physiological development - Improvement of soil characteristics - Additional income (selling of fruits) - Climate resilience, mainly against droughts	- Additional work for pruning	- Lack of market access - Pests and diseases through excessive shade
Shade management: Timber	Sometimes	- Additional income (selling of timber) - Improvement of soil health - Climate resilience, mainly against droughts	- Additional work for pruning - Seedling costs are usually covered by projects	- Benefits are mainly long term - Legal problems to sell the timber
Soil management: Organic fertilizer	Sometimes	- Improve soil and plant characteristics, health and resilience - Increase water and nutrient availability - Improved productivity - Favorable conditions for beneficial organisms - Increased ecosystem resilience - Recycling of organic material on the farm	- Additional workload for pruning - Additional workload for fertilizer preparation and application	- Lack of knowledge and technical assistance - Benefits appear only long term, compared to conventional fertilizer - Lack of access to efficient organic products
Soil management: Cover crops	rare	- Erosion control - Avoid evapotranspiration, increase soil humidity and water availability - Avoid growth of weeds - Legume cover crops provide nitrogen - Habitat for pollinizers	- Little additional workload for planting and maintaining	- Associated with non-desired animal - Makes use of machines more difficult
Soil management: Mulch	Very frequent	- Increased soil organic matter and nutrient availability - Increased water retention - Avoid growth of weeds - Habitat for pollinizers	- No relevant costs	- No relevant barriers

Water management: Irrigation	Very rare	- Higher and more continuous harvest - Reduced workload for fertilization and phytosanitary control - Increased climate resilience regarding droughts	- Very high installation costs - Increased workload for pruning	- Lack of irrigation system adapted to the local conditions - Lack of infrastructure - Lack of financial capacities and lack of access to credit
Water management: drainage	rare	- Avoid flooding and erosion - Increased climate resilience regarding string rainfalls	- Additional workload for implementation of canals	- High distance to runoff possibilities - Very extensive flooding areas
Variety management: Multiclonal systems	rare	- Possibility to sell to special markets with higher prices - Improved quality of cocoa beans - Increased resistance to biotic and abiotic stresses - Increased system resilience	- Additional knowledge needed to adapt the management - Additional workload for pruning	- Lack of knowledge how to manage multiclonal systems - Lack of market access that provide higher prices