

# Summary Report

**Applicant:** Tom De Swaef

**Title:** Connecting hydraulics and growth dynamics in maize leaves.

**Host institution:** Cornell University

**Host collaborator:** Prof. dr. Abraham Duncan Stroock

**Dates:** 4 April 2022 - 29 July 2022

I declare that my report can be posted on the Co-operative Research Programme's website.

## 1. What were the objectives of the research project? Why is the research project important?

The over-arching aim of the proposed research stay was to improve the current basic understanding of how leaf hydraulics relate to leaf growth in maize. Thereto, we planned measurement campaigns in the greenhouse and growth chamber, thereby using continuous recordings of the environmental conditions and leaf elongation rate, along with leaf water potential measurements using the novel AquaDust technology. These data could then be used to validate a model of leaf growth which links the hydraulics to the growth.

Beyond the scientific objective, the proposed project also aims to get insight in the potential of AquaDust as a high-throughput phenotyping device, and to set the basis for an extended collaboration between the research teams of the host and the applicant.

The research project is important because increasing evidence points towards the fact that plant growth is not limited by carbon availability through photosynthesis, but rather by hydraulic or nutrient constraints to which growing sinks are exposed. This demonstrates that research should target these sink constraints for improving crop productivity.

The novel AquaDust technology as a minimally disruptive tool to measure water potential has some potential for medium-to-high throughput plant phenotyping. This could be of great significance for identifying drought tolerance traits and breeding for drought tolerant crops. The evaluation of AquaDust as such a tool was an additional objective.

## 2. Were the objectives of the fellowship achieved?

Or are they on the way to being achieved?

If not, for what reasons? (The data or research is still ongoing or being analysed; technical reasons (e.g. equipment not working, adverse weather conditions, unexpected results, etc.; other reasons?)

Objectives were partly achieved. I managed to have some successful runs with the AquaDust system. However, the AquaDust system is still in a developmental phase and requires some skill to produce meaningful and reliable results. The acquisition of these skills took longer than initially foreseen. Furthermore, the optical hardware components were not working properly, and (as it is still a very novel device) it took some time to find out what was causing the failure. This, however, provided the opportunity to learn the functioning of the optical components of the system and troubleshooting procedures.

Finally, a COVID-19 infection reduced the presence in the lab by merely two weeks. While this has limited the time available to work on experiments, I could spend this time working on the model development.

## 3. What were the major achievements of the fellowship? (up to three)

- Practical improvements towards higher throughput and simpler execution of the measurement protocol
- Development of a leaf growth model for grass, based on ontogeny and hydraulics

#### **4. Will there be any follow-up work?**

- o Is a publication envisaged? Will this be in a journal or a publication? When will it appear?
- o Is your fellowship likely to be the start of collaboration between your home institution and your host?
- o Is your research likely to result in protected intellectual property, novel products or processes?

- Part of the practical improvements have been filed for potential patent application
- The hydraulic model will be presented in a scientific publication (submission foreseen end 2022)
- A first informal collaboration will be set up in the next months. Formal collaboration depends on future suitable project calls.

#### **5. How might the results of your research project be important for helping develop regional, national or international agro-food, fisheries or forestry policies and, or practices, or be beneficial for society?**

Please express this in terms of environmental/food security/food safety/economic/health (human and livestock and plant) benefits, etc.

The benefits are situated in the 'food security' category. Our work will contribute in a better understanding of plant growth under conditions of limited water, and identify traits for more drought resilient crops.

#### **6. How was this research relevant to:**

- o The objectives of the CRP?

Food security is substantially threatened by intensifying and more frequently occurring dry spells. Therefore, it is necessary to develop crops and crop systems that can better cope with these droughts.

- o The CRP research theme?

The CRP research theme for which the proposal was submitted was "Managing natural capital". More specifically, my research focused on water. Identifying new traits that allow plants to save water while maintaining productivity, can result in major water savings.

#### **7. Satisfaction**

- o Did your fellowship conform to your expectations?

Yes. Apart from the difficulties encountered, it was much better than expected, thanks to the host, who involved me completely in the day-to-day routine and meetings.

- o Will the OECD Co-operative Research Programme fellowship increase directly or indirectly your career opportunities? Please specify.

This research stay abroad in a new environment, has taught me more than scientific skills alone. It has sharpened my critical thinking and has taught me to think more entrepreneurially.

I expect that this grant will also be an added value to my CV, for acquiring more research funds.

- o Did you encounter any practical problems?

From the administrative point of view the host institute has supported me very well. The only difficulty I encountered, was getting the VISA (J2) for my wife. We actually had to get married to arrange the VISA.

- o Please suggest any improvements in the Fellowship Programme.

I think the scholarship fee is appropriate to cover the expected expenses, if you are alone. However, in my case, I brought my wife and children, and this proved to be much more costly.

#### **8. Advertising the Co-operative Research Programme**

- o How did you learn about the Co-operative Research Programme?

The ILVO research coordination team e-mailed the call to all scientific staff members.

- o What would you suggest to make it more "visible"?

Promote via ResearchGate, LinkedIn or other professional social media

- o Are there any issues you would like to record?

No