

Nebraska Soybean Board Year-End Summary Research Report Form for Multi-Year Projects

Please use this form to summarize the practical benefits of your research project and what has been accomplished. Your answers need to convey why the project is important and how the results will impact soybean production.

Note that this form must be submitted with the 4th Quarter Report in all multi-year projects.

Project # and Title: Teasing Apart the Genetic Complexity of Soybean Seed Development 21R-24-1/3 #708 **Principal Investigator:** Marc Libault

Year of Multi Year: 2 of 3 (example: Year 1 of 3, Year 2 of 2)

1. What was the focus of the research project?

The goal of this project is to establish a clear picture of the activity of all the soybean genes in each cell composing the plant. Having such a resolution will change our approach regarding the functional characterization and use of the soybean genes to enhance various aspects of soybean biology.

2. What are the major findings of the research?

The analysis of the activity of the genes from 136,000 cells isolated from various soybean organs: the seed (i.e., heart-globular, cotyledon-stage, early maturation, and mid-maturation stages), mature nodules, root, true leaves, trifoliolate leaves, floral buds, shoot apical meristem and the green pods (minus seeds) revealed a total of 170 different cell types characterized by their unique way utilizing their DNA sequence. We functionally characterized many of these cells types based on the activity of unique genes. We are currently conducting a comparative analysis of these results to identify the unique and shared genetic programs between all these different cell types and provide a completely new understanding of soybean genomics.

3. Briefly summarize, in lay terms, the impact your findings have had, or will have, on improving the productivity of soybeans in Nebraska and the U.S.

This project will have a profound impact on soybean productivity. It will help identify the genes that contribute to soybean development. Considering the strong focus of this project on seed development, we will gain a deep understanding of the role of the soybean genes and their co-expression during seed development and protein/oil accumulation. This resource will allow soybean researchers to develop more accurate synthetic biology strategies to enhance soybean yield and oil/protein quality.

4. Describe how your findings have been (or soon will be) distributed to (a) farmers and (b) public researchers. List specific publications, websites, press releases, etc.

The findings will be distributed to farmers via the creation of a website and by an upcoming presentation at the Nebraska Certified Crop Advisors Program (Kearney, NE on February 16, 2023).

Regarding public researchers, our results are shared via the participation of the PI in the Plant Cell Atlas community (more than 1,000 researchers are part of this community); via the presentation of the results at conferences and Universities (10 oral presentations during this reporting period), through the sharing of the data with selected researchers (upon signing a data transfer agreement), and will be more broadly shared with the scientific community via our website.

5. Did the NE soybean checkoff funding of your project, leverage additional State or Federal funding support? Please list sources and dollars approved.

The data generated from this NSB project was included in two research proposals. The first proposal was submitted to the NSF-Plant Genome Research Program (3 years, \$1,500,000; started in July 2021). The second proposal was submitted to the USDA-AFRI Foundational and Applied Science Program (3 years, \$626,827; started in March 2022). Our data and expertise also led to the participation of the lab in the development of a \$30,000,000 NSF grant proposal to create a new center. One of the missions of this center will be to improve soybean crop biology.

Please submit this completed form to the Agriculture Research Division, jmcmahon10@unl.edu, based on the reporting schedule given to you. If you have any questions, please call Jen McMahon at the Agricultural Research Division (402) 472-7082.

Please check your information before submitting the form.

Submit by Email