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

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: 1 *of* 3 *(For example: Year 1 of 3, Year 2 of 2)*

1. **What was the focus of the research project or educational activity?**

   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 or impacts of the educational activity?**

   In the first year of this multi-year project, we have generated sequenced, and validated the quality of 22 single-cell RNA-seq libraries generated from various plant organs: heart, globular, and cotyledon-stage seeds (6 replicates); early maturation seeds (2 replicates); late maturation seeds (2 replicates); soybean mature nodules (2 replicates); trifoliate leaf (2 replicates); true leaves (2 replicates); floral buds (2 replicates); shoot apical meristem (2 replicates); green pods minus seeds (2 replicates). As a note, in addition to these samples, we will also include the transcriptome of the soybean root cells, samples currently analyzed for publication.

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 provide the highest resolution possible in the transcriptomic profile of each gene composing the soybean genome. Accessing this information will help understand the role of each gene and gene cluster. 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.**

   Upon analysis, the data generated will be shared with farmers and public researchers in three different ways:
   1) through the publication of research manuscripts in international journals with open access format and presentation in national and international conferences. These manuscripts will provide supplemental information to access the transcriptional datasets.
   2) through the design and development of a dynamic website that fosters scientific advancement through sharing and exchange.
   3) the PI is an active member of the Plant Cell Atlas community (https://www.plantcellatlas.org/). The data will be also shared via the Plant Cell Atlas community.

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

   A subset of 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). The second proposal was submitted to the USDA-AFRI Foundational and Applied Science Program (3 years, $626,827). Both proposals were granted earlier this year.

Please email 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 ARD 2-7082.