

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: #701 Soybean Breeding & Genetics Studies for Nebraska **Principal Investigator:** George Graef

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

1. What was the focus of the research project?

This project involves research and development to (1) Produce high-yielding soybean varieties adapted to Nebraska and the Midwest;
(2) Develop germplasm and cultivars for use in specialty markets
(3) Produce germplasm and cultivars with improved compositional quality
(4) Evaluate and develop germplasm and cultivars that are resistant to iron deficiency chlorosis, soybean mosaic virus, bean pod mottle virus, phytophthora root rot, soybean cyst nematode, and sudden death syndrome (SDS).

2. What are the major findings of the research?

See attached

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.

See attached

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.

We share our performance data with companies and germplasm suppliers, who request information on our new soybean lines, as well as Nebraska Foundation Seed/Husker Genetics and NuPride/NCIA. The data for advanced lines in regional tests is shared with all public researchers through the USDA Uniform Soybean Tests Northern States, the SCN Regional Test. Seeds of new soybean lines have been shared with other universities, USDA programs, and companies through MTAs and license agreements for both direct commercialization and for use in their breeding programs.

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

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

Soy Breeding Year End Report Oct 2022 – This page needs to be included with the pdf file for the Soybean Breeding & Genetics Year End Report.

2. Major Findings

- We grew over **54 increase plots** for new lines that entered 2022 regional testing, **16 new variety purification blocks**, and **6 new breeder seed increase blocks**. The purification blocks and breeder seed increases are for advanced lines that remain at the top of regional test performance and will likely be released/commercialized as new soybean varieties. In addition, Foundation Seed/Husker Genetics is growing four other new lines in Foundation Seed production.
- **Licensed 14 lines to 5 different companies** during 2022.
- Shared more than **26 new soybean lines** with superior yield, disease resistance, and seed composition traits with **11 companies** during 2022. The lines were made available through Material Transfer Agreements. Companies follow up with license agreements for commercialization and breeding use.
- Worked with UNL NUtech Ventures and a major US company to provide information, data, and seeds of **40+ lines** for evaluation from our long-term work with improving soybean seed protein concentration and yield.
- Submitted 24 new high-yielding SCN resistant lines to the SCN Regional Tests for 2022
- Advanced 21 superior high-yield, SCN resistant lines in the 2022 SCN Regional Tests.
- Submitted 30 new high-yielding lines to the 2022 USDA Uniform Soybean Tests.
- Advanced 14 superior lines in the USDA Uniform Soybean Tests Northern States for 2022 tests.
- Results from the 2022 regional tests will be summarized after harvest is completed at all locations.
- Continued long-term research projects for increasing soybean seed protein concentration. I started these selection programs in 1988 and we now have soybeans that consistently produce seeds with 60% protein on a dry matter basis.
- Continue to identify important new traits and strategies for improving yield, quality, and stability to enhance profitability for Nebraska soybean farmers.

3. Impact

Direct impacts to soybean farmers from this breeding program exceed \$100 million per year. That is the value of seeds that farmers grow and sell from their farms from varieties developed from this program. That \$100 million per year does not include the value to processors, contributions to the vitality of smaller, independent and family-owned seed companies, and contributions to the vitality of the rural communities that those processors and seed producers serve. It also does not include value through contributions to varieties developed by use of these lines in other breeding programs. So the overall annual impact of this breeding program alone is substantial, both economically and in terms of contributions to genetic diversity, alternative marketing options, control of herbicide resistant weeds through rotation and use of herbicides with different modes of action, and overall value and contributions to ROI for US soybean farmers.

The progress in yield is important because we continue to develop and select from our Nebraska environments top-yielding lines for Nebraska that yield significantly better than the high-yield checks. Their performance holds up over years in Nebraska and is superior across the northcentral region, as shown by the Uniform Soybean Test results. We beat the top commercial lines in third-party trials. With our multi-location evaluation program at high-yield farm sites in Nebraska, we identify high yield potential and are able to make significant gains in yield with each breeding cycle. Our high-yield lines are used by other programs as parents, and thus contribute to increasing genetic gain and expanding the genetic base in those programs as well. In addition, with nearly 5.5 million acres of soybean in Nebraska, our program remains unique in that it develops soybean varieties specifically adapted to Nebraska production environments.

Our seed composition results are important because we have shown that 60% seed protein concentration and 26% seed oil concentration are obtainable, the lines were used to expand the NIR calibrations available to researchers throughout the US, and we are following up with more detailed evaluation of the extreme seed compositions and effects on yield and other important agronomic traits. The multiple, large populations, recently evaluated as part of graduate student research projects, have produced hundreds of lines with increased total protein and oil together, with reduced carbohydrates in the seeds. Results from multi-location yield tests of extreme lines show we have recovered increased seed protein and seed oil, with no negative relationship with yield in these populations. That is significant, especially for soybean producers in the western soybean production areas where seed protein tends to be lower, and 60% or more of soybean production enters the export market.

We also have developed a collection of some of the most IDC-tolerant soybean lines available. Together with improved yield and seed composition, resistance to IDC will improve productivity and value on millions of soybean production acres. Many of our high-yield lines have other resistances, like phytophthora root rot, SCN, SMV, and BPMV as well.

4. Distribution of findings

We share our performance data with companies and germplasm suppliers, who request information on our new soybean lines, as well as Nebraska Foundation Seed/Husker Genetics and NuPride/NCIA. The data for advanced lines in regional tests is shared with all public researchers through the USDA Uniform Soybean Tests Northern States, the SCN Regional Test. Seeds of new soybean lines have been shared with other universities, USDA programs, and companies through MTAs and license agreements for both direct commercialization and for use in their breeding programs. Results from our research are published in peer-reviewed journals.