

2019 Research Progress Report

Project Title: Development of High Yielding Soybean Cultivars with Enhanced Seed Composition and Pest and Pathogen Resistance for Georgia Growers

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Period: Jan 1, 2019 to Dec 31, 2019

Soybean cultivars and germplasm:

Three Roundup Ready 2 yield lines: G13-2842R2 (MGVI), G12-2062R2 (MGVII), and G13-2114R2 (MGVIII) exceeded the yield of commercial checks for 5-17%, respectively. These lines also possess resistance to soybean cyst nematode, root-knot nematode and frogeye leaf spot. We plan to submit applications for release. Meantime, we are backcrossing the RR2 Xtend traits into these lines with 3 generations per year using marker technology.

Two LibertyLink lines G15PRL-989 and G15PRL-953 yielded commercial checks for 100-116%. These lines also possess resistance to soybean cyst nematode, root-knot nematode and frogeye leaf spot. We plan to submit applications for release this year.

Soybean line G11-7013 was approved for release as a germplasm. In the USBDIV-7 Tests across 30 environments over four states, G11-7013 yielded 92.7-103.5% of elite check mean across five years and has significant exotic germplasm in its pedigree. It also possess soybean cyst nematode race 3, root-knot nematode and stem canker resistance.

New RR2Y, LibertyLink, and Conventional High Yielding Soybean Lines:

A total of 42 high-yielding RR2Y, conventional and LibertyLink soybean lines were advanced to USDA Southern Uniform Tests/Prelim Uniform Tests in maturity groups 6, 7, and 8. All these lines have resistance to southern root-knot nematode and race 3 of SCN. Based on the performance of these lines in 2019 tests, top performing lines will be submitted for approval of release or advanced to a subsequent year of testing (complete yield testing results are not available yet)

New herbicide tolerance technologies, RR2 Xtend and Enlist E3:

To provide soybean growers with advanced herbicide-tolerant trait technology for better weed control, with assistance from Innovation Gateway and Georgia Seed Development, we have accessed to RR2 Xtend technology from Bayer and Enlist E3 technology from Corteva and MS Technologies in spring 2019. This will provide Georgia soybean growers with the opportunity to use the efficient and cost effective herbicide technology against glyphosate-tolerant weeds. We have made 15 crosses with our best elite lines in the summer of 2019 and in 2020, we plan to backcross these new traits into our top 7 best elite lines with 3 generations per year using the state-of-art DNA marker technology.

Soybean pipeline materials:

Based on 2018 yield data, 68 top performing RR2Y lines, 34 LibertyLink Lines, 34 conventional lines have been advanced to the second year of yield tests at three locations in GA, SC, LA or NC in 2019. We also advanced 476 high-yield RR2Y, 272 LibertyLink 102 high oleic and 578 conventional lines into our first year yield trials at two locations, Athens and Plains in 2019. These lines are resistant to Southern root-knot nematode and race 3 of soybean cyst nematode. Harvest has been completed and we are in the process of analyzing the yield data. In the summer of 2019, in addition to the 15 crosses for RR2 Xtend and Enlist E3 technologies, we have formed 9 RR2Y crosses, 10 LibertyLink crosses, 36 conventional crosses, and 25 crosses for other breeding objectives. Over 10,000 rows of lines at different generations were planted for evaluation and selection in 2019.

Marker-assisted breeding:

In 2019, we were able to use SNP markers developed in-house to select for SCN and RKN resistance in early generations (F_2 , F_3 , or F_4). We have also used SNP marker assays to select for the traits, such as high oleic, low linolenic, protein content, drought tolerance, and rust resistance for introgression into elite soybean lines.

Impact of GACC Funding Support:

Funding from GACC has resulted in commercialization of RR2Y and LibertyLink soybean cultivars with improved quality and pathogen resistance and release of soybean germplasm. We have developed strong pipeline materials using RR2Y and LibertyLink technologies. The funding has allowed us to utilize the Puerto Rican nursery for two generation advancement, molecular tools for early generation selection, and introgression of new traits into our varieties. The funding also allowed expansion of our capacity of yield trials by reducing one year of yield testing prior to cultivar release. The funds from GACC have been well spent or encumbered for salary, winter nursery, and lab and field supplies.