

ADVANCING RESEARCH

Delaware Soybean Board Funds Research to Benefit Growers

In FY22, the Delaware Soybean Board (DSB) approved funding for eight research projects that aim to increase yields, control weeds, and manage pests for Delaware soybean farmers. These grants, totaling \$50,188, are funded through the soybean checkoff program, where farmers collectively invest in research, promotion, and consumer and industry information to benefit all soybean farmers.



"With our investment in these projects, we aim to maximize profitability of First State growers during these challenging and unprecedented times," says Cory Atkins, Chair of the Delaware Soybean Board. "Facing the rising cost of fuel and crop inputs, we are exploring production practices that will increase efficiency and bottom-lines."

CORY ATKINS, DSB CHAIR

New Projects for 2022

- Environmental factors promoting natural suppression of slugs in soybean, Dr. Michael Crossley, University of Delaware, \$7,500
- Visualization of Economic Damage Thresholds and Interaction of Nematode Populations following use of Winter Cover Crops, Alyssa Koehler, Ph.D., University of Delaware, \$5,818
- Evaluating Earlier Planting Dates for Increased Soybean Yields, Jarrod O. Miller, Alyssa Koehler, and Cory Whaley, University of Delaware, \$5,650
- Soybean Row Spacing and Planting Rate Effects on Litter Decomposition, Jarrod O. Miller, University of Delaware, \$5,513
- Management of Herbicide Resistance in Palmer Amaranth, Naveen K Dixit, University of Maryland Eastern Shore, \$9,536
- Evaluating Deer Preferences for Soybean Varieties and Soybean Response to Deer Herbivory, Luke Macaulay, James Lewis, and Nicole Fiorellino, University of Maryland, \$9,896
- Cover Crop Selection and Termination Implications for Slugs – Year 2, David Owens, University of Delaware, \$3,604
- Exchangeable Cation Uptake by Irrigated and Rainfed Soybeans, Jarrod O. Miller, Amy Shober, and Jake Jones, University of Delaware, \$2,671

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PEST MANAGEMENT

Cover Crop Selection and Termination Implications for Slugs

David Owens, University of Delaware

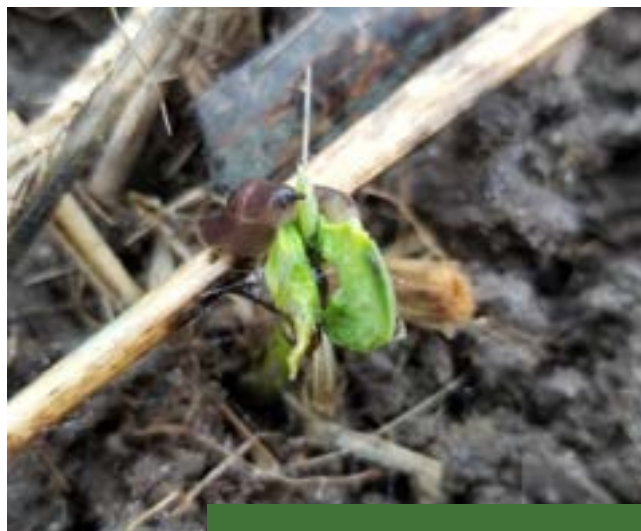
Cool, wet spring weather in 2020 contributed to widespread slug injury to corn, soybean, and even sorghum. The adoption of cover crops and no-till or conservation-tillage, together with high soil surface residue, particularly after a corn crop, favors slug populations. There has been much recent interest in how cover crops and cover crop management might influence slug damage to the cash crop.

In field and laboratory experiments, slugs demonstrate feeding preferences among plant species. Delayed cover crop termination has been suggested as a means of retaining beneficial predators in a field and giving slugs alternative food sources to concentrate on rather than the cash crop. It is possible though that some cover crop species may be more nutritious and therefore be more stimulating to slugs than others. Delayed cover crop termination also results in greater biomass which can provide favorable slug microclimates. Some of this residue could be incorporated through vertical tillage.

Previous work in Delaware showed a reduction in slug activity following vertical tillage in fields without late cover crops. Vertical tillage also had limited impact on beneficial insects. The objectives of this proposal were to build on that research by examining vertical tillage in delayed-termination cover crop plots, as well as examining cover crop species for their impact on slug population.

Three sites in Sussex County were selected and sown with tillage radish, crimson clover, barley, and rye. Plot sizes were 60-ft by 100-ft. At each site and in each plot, two shingle traps were placed to monitor slugs for the fall. The shingles were deployed October 27-28, 2021. Tillage radish winter-killed at all sites. No significant differences among cover crop species and slug populations at any site. A slight increase in slug activity was noted at one site in the late termination plots vs early termination plots overall. The first juvenile gray garden slugs were observed in Lewes on March 18, 2022. At the Lewes site, slug populations gradually decreased throughout the early spring, but increased during the month of May to a peak on May 25, 2022. The Harbeson site similarly peaked on May 20, 2022.

This project is being repeated for the 2022-2023 growing season, with winter canola replacing tillage radish in the cover crop mix. Terminations will be done earlier in the spring in 2023. Check back with us next year for more results.



Slugs have become a major pest in no-till soybeans in the Mid-Atlantic. Credit: Cory Whaley, University of Delaware Extension

Delayed cover crop termination has been suggested as a means of retaining beneficial predators in a field and giving slugs alternative food sources to concentrate on rather than the cash crop. Delayed cover crop termination also results in greater biomass which can provide favorable slug microclimates.

PLANT DISEASE

Evaluation of aggressiveness among Diaporthe species isolated from Mid-Atlantic Soybeans

Alyssa Koehler, University of Delaware

Fungal pathogens can be very damaging to soybean production reducing both yield and quality. Environmental conditions can increase disease severity and favor the spread of certain pathogens. In the Mid-Atlantic, we continue to observe extreme weather events and periods of prolonged rainfall, that lead to widespread fungal infection and reduced seed quality.

Worldwide, Diaporthe associated diseases are responsible for more yield and quality losses to soybean production than any other single fungal pathogen or species complex. Field sites across DE and MD were surveyed during 2019-2020 to document which soilborne pathogens are most commonly observed across the region. From this work, Diaporthe longicolla was found to be the most abundant species of the Phomopsis/Diaporthe complex, but D. ueckerae and D. aspalathi were also collected. Little is known on the differences in relative aggressiveness or yield impacts among these species.

Building from isolates collected in the 2019 and 2020 fungal survey, project objectives included: 1) Assess the aggressiveness of Diaporthe isolates collected from Mid-Atlantic soybean fields. 2) Estimate potential yield effects of Mid-Atlantic Diaporthe isolates. 3) Share research findings through extension events and use findings to inform future management trials.

This project was the first work to investigate differences in Diaporthe isolate aggressiveness within the Mid-Atlantic region and to estimate yield effects across species. Improved understanding of each species will aid in variety selection and determining if additional disease management steps could be economically viable.

In this trial, D. longicolla was shown to have the highest disease severity on all varieties screened. The newly identified D. ueckerae had higher disease severity than D. aspalathi in two of the varieties screened. These findings highlight the importance of continuing to understand

pathogen dynamics and distribution of Diaporthe species to inform management decisions.

Findings from this project were shared through the University of Delaware's Weekly Crop Update which reaches over 700 growers, consultants, and stakeholders and provides a platform to discuss disease concerns and other production issues. Data will be discussed during the 2022 Delaware Ag Month soybean session and at other spring training meetings.

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Soybean plants with foliar symptoms of Diaporthe. Credit: Alyssa Koehler, University of Delaware

CROP MANAGEMENT

Evaluating Earlier Planting Dates for Increased Soybean Yields

Jarrold Miller, University of Delaware

The start of indeterminate soybean reproductive stages depends on or the detection of the length of night. As nights become longer, soybeans are triggered to begin the reproductive or “R” stages of maturity. Due to this, later planted beans do not have as much time to develop biomass, or leafy growth. Additional photosynthesis from leaves and nodes for pod production can mean additional yield with more time to grow. Soybean producers on the Delmarva would like to know whether planting soybeans earlier will improve yields with a longer growing season, or incur penalties from diseases and wet fields.

At the Carvel Research and Education Center in Georgetown, DE, a group IV soybean was planted on three different dates: April 12th, April 28th, and May 10th, 2021. This was the second year of this study. Tissue and soil samples from each plot were sampled at R1-R2 to observe any differences in nutrient uptake, while bi-monthly drone flights were performed over the growing season. Yield was collected at the end of the growing season using a plot combine.

Similar to 2020, we observed no yield differences, but our absolute yields were 20 bushels lower in 2021. The earliest 2021 planting date (April 12th), had reduced emergence in some rows, where cooler wet weather and slightly deeper planting along those rows may have caused seeds to rot in the ground. It is possible that if these beans had survived, differences in yield may have been present. Otherwise, two years of this project at Carvel have not shown any advantage to planting earlier, outside of spreading field work across spring hours.

Like the 2020 study, aluminum (Al) concentrations were lower in the tissue with later plantings, which cannot be easily explained. Aluminum was tied to lower yields across all tissue samples, so why more Al would be available or taken up with earlier planting should be elucidated. This may not occur on all soil types, but Delmarva soils have plentiful Fe and Al that can hamper yields and be taken up by plants.

Other interesting trends included Na, which was higher in the latest planting, along with Mg. Manganese was tied to both higher yields and the later plantings. Calcium was borderline deficient, and relationships probably determined by previous plot soil concentrations, while Mg was higher in the tissue with the final planting, similar to 2020.

Continued page 8

Two years of this project at Carvel have not shown any advantage to planting earlier, outside of spreading field work across spring hours.



Planting date timing study trials at the University of Delaware Carvel Research Center are answering farmer questions and raising new ones about soybean growth patterns and nutrient uptake. Credit: Jarrold Miller, University of Delaware

CROP MANAGEMENT

Getting the Most of Enlist Soybean for Weed Control in Delaware

Mark VanGessel, University of Delaware



Mark VanGessel, University of Delaware Extension weed specialist, urges growers to consult the updated 2022 Mid-Atlantic Weed Control Guide for weed control information. Credit: University of Delaware

Enlist One tank mixed with glyphosate or Liberty provided excellent weed control.

Enlist soybeans are resistant to 2,4-D, glufosinate, and glyphosate herbicides. With resistance to three different herbicide modes of action, these soybeans provide more flexibility for weed control options than were previously available. While 2,4-D could be used as a pre-plant herbicide, applications were not permitted within 7 to 15 days prior to planting and at lower use rates.

Due to the concern of 2,4-D off-target movement and limited availability of Enlist research projects; UD Weed Science has not had as many opportunities to test Enlist soybeans as Xtend soybeans. Research in the mid-West over the past 2 to 3 years have shown that volatility of 2,4-D choline (the salt formulation in Enlist herbicide) is at a much lower risk than dicamba (in Xtendimax or Engenia). Physical movement (drift with small droplets and wind) is still a concern, but volatility may not be as much of a concern. Evaluating tank mixtures of glyphosate and glufosinate, or glufosinate plus 2,4-D is needed to understand the strength and weaknesses of these mixtures.

The first objective was evaluating the utility of Enlist versus Xtend soybeans for burndown weed control. The second objective evaluated various tank mixes with Enlist One for postemergence weed control. There was no clear differences between Xtendimax and Enlist herbicide programs for no-till burndown in this study. Xtendimax slowed the growth of Palmer amaranth and Morning glory, but the control not as consistent or as effective as a preemergence herbicide.

Enlist One applied by itself to Palmer amaranth plants was not adequate to provide complete control. Enlist One programs need to be applied to Palmer amaranth plants at four inches tall or less. Enlist One can reduce grass control from postemergence grass herbicides and should not be tank mixed if grasses are big. Enlist One tank mixed with glyphosate or Liberty provided excellent weed control.

This information has been presented at UD Carvel Research Farm Field Day in August 2021, Delaware Ag Week, and incorporated into the MidAtlantic Weed Management Guide.

PLANT DISEASE

Exchangeable Cation Uptake by Irrigated and Rainfed Soybeans

Alyssa Koehler, University of Delaware

Although Ca, Mg, and K are all exchangeable nutrients that are considered plant available, soil chemistry and plant root interactions result in different uptake and bioavailability. Within the soil, Ca and Mg can move with soil water or by diffusion, while the lower K concentrations do not readily move with soil water. The objectives of this study were to sample center pivots in their dry corners and irrigated regions and compare soil nutrient levels and nutrient uptake in the leaf tissue for potential. To do that, soybean fields 10 center pivots in Delaware were sampled in irrigated and dry corners. Upper leaf tissue and soil samples were obtained at the R2/R3 growth stage and tested for soil characteristics and nutrient contents.

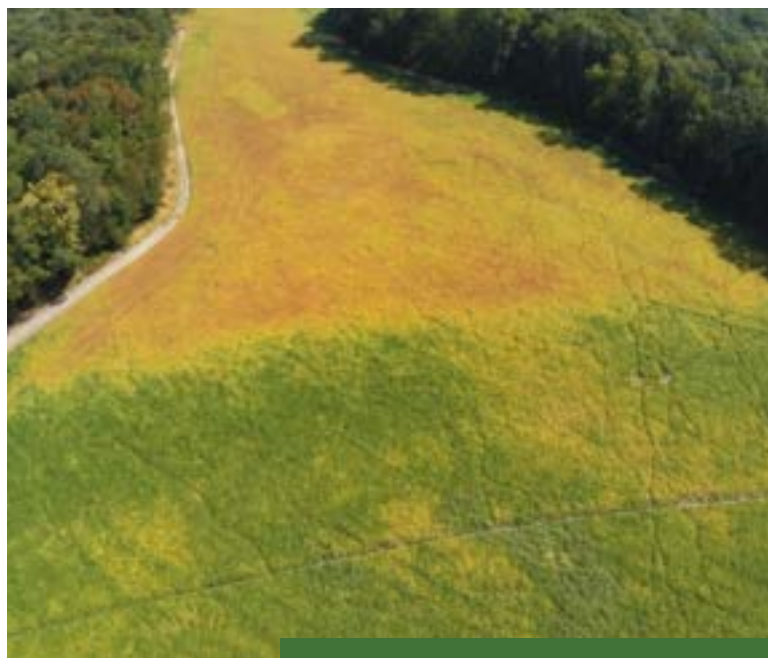
Irrigated soybeans had higher concentrations of N, P, Fe, and Na in the upper leaf tissue, with K and Cu being slightly higher, but not statistically significant. This is not necessarily an issue for yield, as all measured leaf tissue nutrients were within their sufficiency ranges, except Ca which was just below the 0.8% threshold in both rainfed and irrigated soybeans.

Nitrogen also had no significant negative correlations in irrigated fields, with concentrations above threshold values (5.7%), so its possible N was not limited in these scenarios and would not produce negative correlations with other elements. This was not the case in rainfed samples, where N uptake was inversely correlated to Ca, Mg, and Al uptake, potentially due to stress when moisture was limited.

Greater Na concentrations in both irrigated soil and tissue samples was most likely related to salts in irrigation water, with Na having very few relationships to other elements in leaf tissue samples. Iron was also higher in irrigated tissue samples but had more correlations to tissue nutrients in rainfed samples. This may mean that Fe uptake occurred with higher soil moisture but was not related to any other nutrient uptake. Alternatively, Al uptake in rainfed beans may also reflect excess uptake, but under stressed conditions, where it positively correlated with many other tissue nutrients, but had no positive correlations with irrigated soybeans.

All these relationships are based on 2021 rainfall, which was sufficient for most of the early summer in Delaware, and not deficient until late July. It is certainly possible to have different relationships in doughtier years, which includes greater differences (lower N, P, and K in rainfed) between regions or fields with different moisture contents.

Within the soil, Ca and Mg can move with soil water or by diffusion, while the lower K concentrations do not readily move with soil water.



Irrigated and rainfed dry corners in a Delaware field. Credit: Jarrod Miller



Delaware Soybean Board



Current fiscal year
checkoff investment
in production research

\$50,188



TOP RESEARCH FUNDING AREAS

- Plant Nutrition
- Weed Control
- Insect and Disease Control



RECENT INNOVATIVE RESEARCH PROJECTS

- Evaluating Earlier Planting Dates for Increased Soybean Yield
- Can Slug Egg Hatch be Predicted?
- Approaches for Palmer Amaranth Control
- Reducing Deer Damage to Soybeans Using Forage Soybean as Biological Fencing



TOP THINGS FOR FARMERS TO KNOW ABOUT CHECKOFF DOLLARS INVESTED IN RESEARCH

The Delaware Soybean Board funds soybean research to support the viability and profitability of soybean farmers in Delaware. Research objectives include increasing average soybean yield, providing information to manage weed and pest threats to the soybean crop, and delivering information to allow Delaware soybean farmers to continue to be good stewards of the land.



TOP AREAS OF RESEARCH CRITICAL TO THE FUTURE OF DELAWARE'S SOYBEAN PRODUCTION

- Increase Yield
- Best Production Practices
- New Technology Adoption
- Pest Control



SOYBEAN RESEARCH &
**INFORMATION
NETWORK**

Sweet Success

ONE OF THE BIGGEST SUCCESS STORIES IN DELEWARE AS A RESULT OF RESEARCH

A project building from cover crop and herbicide application research is exploring management strategies to improve control of tough weeds, including Palmer amaranth and glyphosate-resistant horseweed. Cover crops help reduce nutrient loss, and termination timing research will equip them to maximize the weed control value of cover crops at the same time.

SOYBEANRESEARCHINFO.COM

Funded by the soybean checkoff



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Michael Scuse

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USB REPRESENTATIVE Cory Atkins

USB ALTERNATE Robbie Emerson

DSB STAFF

Danielle Bauer Farace

Executive Director

Danielle@desoybeans.org

(443) 812-4526

Sandy Davis

Financial and Compliance Coordinator

SDavis26@verizon.net

(410) 742-9500

Ese Jessa

Marketing Specialist, Delaware

Department of Agriculture

Ese.Jessa@delaware.gov

(302) 698-4592

DELAWARE SOYBEAN BOARD

P.O. BOX 319

SALISBURY, MD 21803

WWW.DESOYBEANS.ORG



@Delaware SoybeanBoard



@delaware_soybean_board



Photo: United Soybean Board

Earlier Planting Dates Continued

Two years of this study have shown that planting date can affect nutrient concentrations within the tissue, although they fall within the range of sufficient for most samples.

It should be noted that many of these relationships tend to change with each study we have performed, so leaf tissue Mg being higher for the May 10th planted soybean may not be the case in different regions, maturity groups, or management conditions. It is more interesting that nutrient concentrations differ by planting date for the first two years of this study, which may be the case in many other soybean fields. When attempting to manage nutrient concentrations (macro and micro), planting date should be kept in mind when comparing two fields for uptake.

