Maryland Soybean Board

Soybean Sampler

FY21 RESEARCH REPORT

Checkoff Research Makes Progress Amidst Pandemic

Soybean checkoff-funded research by all states can be found at the Soybean Research and Information Network (SRIN). Articles provide insight on research findings and link directly to the study for details.

www.soybeanresearchinfo.com

Want to know the latest on growth products? Wonder what herbicides have shown results? Search and track the latest on soy research topics.

Through its mission, the Maryland Soybean Board works to maximize the profitability of Maryland soybean producers by investing Maryland checkoff funds for research, marketing and education. The research focus is to fund projects to ensure that soybean farmers have the the most current information to protect their crops and the environment.

"From the national perspective, for every dollar farmers invested in the soy checkoff, soybean farmers received an estimated $12.34 in added value," stated Belinda Burrier, USB Director and MSB Chair. "In addition, locally we are also seeing results from research which will improve our profitability while also improving our soil health. These findings are made available to other states to maximize the value of the checkoff in improving our viability throughout our soy community."

For the latest growing season, the COVID-19 pandemic caused delays in research, as facilities were shut down and researchers had limited tools available to continue their work. However, much was accomplished as described in this report.

Growers are in demand for field trials where the latest research is put into practice and evaluated on farms across Delmarva. Contact the MSB office for opportunities.

Effects of Planting Population on Yield in Full Season Soybeans

✓*University of Maryland Extension, $5,635, Kelly Nichols, knichols@umd.edu*

The current soybean planting population recommendation for full season soybeans in Maryland is 140,000 plants per acre (ppa). However, this recommendation is based on research conducted in the early 2000s on initial Roundup Ready® varieties in minimum tillage systems (Kratochvil, Pearce, & Harrison, Jr. 2004). Today, farmers have switched to no-till soybean production and have access to the second generation of Roundup Ready® soybeans as well as many newer varieties.

To analyze if the recommendations are applicable for today's products, soybean population plots were planted on four University Research and Education Centers (REC) and on one farm in Carroll County. Planted populations were 50, 80, 100, 120, 140, and 160 thousand plants per acre. Stand counts were taken prior to harvest; this number of plants present in the field at harvest time was converted to a percent of the planted population. The average percent of planted plants at harvest across all populations was 56% (Wye), 63% (Upper Marlboro), 70% (Carroll), 75% (WMREC), and 86% (Beltsville). Even though some sites had a low survival rate, this did not correlate to a lower yield. Within each site, stand counts were fairly consistent across the planted populations. Planted population was not significant; one population did not lose more plants compared to another planted population.

The following yield ranges were seen at each of the sites: 59-63 bu/A (Beltsville), 52-56 bu/A (Carroll), 65-68 bu/A (Upper Marlboro), 67-71 bu/A (WMREC), and 66-80 bu/A (Wye). Yield was not statistically significant between planted populations, indicating that for these sites, a lower population could have been planted and yield could have been maintained. At four out of the five sites, the highest net per acre was at a lower population than the lowest net per acre. The highest net per acre was at the planted populations of 80,000 (Wye), 100,000 (Carroll), 120,000 (Beltsville and WMREC), and 140,000 (Upper Marlboro). The lowest net per acre varied across the five sites.

Yield results indicate that optimum yield can still be achieved at lower population. Based on this research, the planted population at the five sites in 2020, as well as two sites from 2019, could have dropped their populations down between 80,000 and 120,000 plants per acre, and still maintain optimum yield as well as an acceptable net amount per acre.

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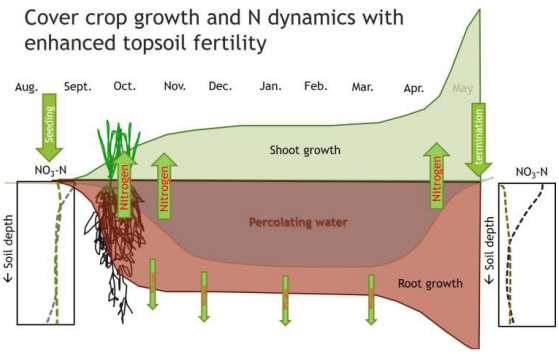


A cover crop planted in early September into a low nitrogen topsoil along with a small amount of fertilizer propels root growth through November into depths surpassing water percolation and immobilizes a large amount of soil NO3-N compared with the small amount leached. Diagram by R Weil (2020)

Developing an Interactive Web App for Calculating Soybean Crop Budgets

✓University of Maryland Extension, $8,067, Alan Leslie, aleslie@umd.edu, Benjamin Beale and Shannon Dill

Cost of production is very important when making decisions related to the farm enterprise and grain marketing. A new, interactive, online application has been developed to allow farmers to easily compare the economics of different potential crop production strategies, which can help guide important decisions that need to be made ahead of the next planting season. This application expands upon the existing University enterprise crop budgets to include costs associated with herbicide programs available with new soybean varieties with novel herbicide tolerances now on the market. An enterprise budget uses farm revenue, variable cost, fixed cost, and net income based upon producer and farm supplier data to provide a clear picture of the financial health of each farm enterprise.

The app incorporates as much data in as much detail as possible, packaged in a user-friendly and intuitive format for farmers to identify combinations of production inputs that would lead to the highest profits.

The app will continue to incorporate new functions and economic data, and have revisions based on input from users. The new crop budget tool can be found at: *https://awleslie.shinyapps.io/budget_4/*

Fertilizing Cover Crops – Do You have to Put Some in to Get More Out?

✓University of Maryland Environmental Science and Technology, $22,570, Ray Weil, rweil@umd.edu, and Jim Lewis

Under Maryland conditions, small fertilizer applications may stimulate cover crops to provide improved net water-quality, soil-conservation, carbon and soybean yield benefits. Currently, fertilizing cover crops in fall with Nitrogen (N) is not allowed by the Maryland cover crop program. In this project, the extent of nitrogen-deficient cover crops and whether small nitrogen applications in fall can increase cover crop benefits in winter and spring is being determined. Also a practical in-field nitrate-test is being developed to determine where nitrogen fertilization of cover crops is justified. The overall goal is to greatly enhanced effectiveness of Northeast cover cropping, especially where manure application is rare and/or soil texture is coarse.

At Beltsville, one experiment was conducted on a field with a loamy sand soil and the other on a field with silt loam to silty clay loam soils. The main plots were three cover crop treatments: 1) a no-cover control (weeds only), 2) a rye cover at 120 lbs. seed per acre, and 3) a three-species mixture (3-way) of 4 bs. /acre of forage radish (rad), 70 lbs. rye, and 15 lbs crimson clover (clover). These plots were sub-dived into subplots with three levels of N fertilizer applied after corn harvest: 0, 15 and 30 lb/acre of N as UAN solution.

Preliminary observations were made of cover crop response to N fertilizer application. There were trends towards higher biomass with N application, but the N effect was significant only for the rye cover crop. The greatest N response was seen on the silty soil for the rye cover crop. A similar Fall biomass data response was seen for the 3-species mix on the sandy soils.

The lack of a stronger response may be due to the late timing of the N application, after the interseeded cover crops had been growing for several months without any applied N. By the time the N was applied in mid-October there were not enough growing degree days left in the season to allow the cover crop plants to take advantage of this soil fertility boost. Therefore, next year the N will be applied to the interseeded cover crop at early corn senescence instead of waiting until after corn harvest, a difference of about 5 weeks or 500 growing degree days.

Study the Occurrence and Distribution of Viruses Infecting Soybean from Delmarva

✓University of Maryland Eastern Shore Agriculture, Food and Resource Services, $7,420, Behnam Khatabi, bkhatabi@umes.edu

This project provides an update on the relevant viruses infecting soybeans in Maryland. Both serological and molecular tests were established to study the occurrence and distribution viruses infecting soybean. In total, 78 soybean samples were collected showing virus-like symptoms on Delmarva in 2019. Each sample was treated individually and virus infections were checked by Enzyme-Linked Immunosorbent assay (ELISA) assay. In parallel, the samples showing a positive result in ELISA testing, were subjected to RNA isolation and Reverse transcription polymerase chain reaction (RT-PCR) amplification using a different combination of primers. Based on preliminary data, different viruses were identified, including Soybean vein necrosis virus (SVNV), Soybean mosaic virus (SMV), Alfalfa mosaic virus (AMV), Tobacco ringspot virus (TRSV). Among the identified viruses, SVNV was widely spread across Maryland, which may cause a problem for growers. SVNV symptoms are difficult because the disease often occurs in combination with other diseases, like Cercospora blight.

Phosphorus Runoff from No-till Soils – Do Cover Crops Make it Better or Worse?

✓*University of Maryland Environmental Science and Technology, $20,072, Ray Weil, rweil@umd.edu*

While cover crops can provide many benefits to the farmer, the Maryland cover crop program is primarily focused on the reduction of nitrogen (N) loading to the Chesapeake Bay. However, water quality is related to both nitrogen and phosphorus (P). Cover crops can be an important tool for increasing P availability and crop yields in the phosphorus-deficient soils found in many parts of the world where there has been little application of P. Cover crop mechanisms that cycle P and make soil P more soluble and plant–available may also allow high productivity on Maryland farms with lower levels P fertilization. This could be part of a long-term strategy to make farming more sustainable both economically and environmentally.

In this research, data is provided on how selected cover crop practices impact the loss of phosphorus by surface runoff in a corn-soybean production system. Two main tools were used to measure cover crop impacts on phosphorus runoff from no-till fields, namely the portable Cornell rainfall simulator and the semi-permanently installed mini runoff weir.

The cover crop treatments that were tested in 2020-2021 for impact on P (and nitrogen) in runoff from no-till fields were:

- Cereal Rye
- Three-species mix of Radish, Rye and Crimson Clover
- No cover crop control

In May 2020, excellent stands of both corn and full-season soybean were established. Rye and a mixed species cover crop were drill-interseeded into the corn in June. The cover rye and mixed cover crops were air-seeded into soybeans at early leaf drop or the cover crops were drilled immediately after harvest. Runoff was collected and analyzed from 15 runoff-producing events.

The nitrate-N concentrations were about 100 times as great as the phosphate-P concentrations in the same samples. The most notable trend was a reduction in both N and P concentrations over time. This trend was similar to what was found in the 2019-2020 cover crop season and suggests that the greatest nutrient losses occur with the first few storm events after crop harvest in fall. Cover crops had little to no effect on the phosphate-P concentrations in the runoff water or on the volume of runoff. However, the runoff from the no-cover plots was higher in nitrate-N than the runoff from either of the cover crop treatments. The runoff from harvested soybean plots was significantly higher in both phosphorus and nitrogen than in runoff from harvested corn plots.

Soil cores were taken around each erosion weir and analyzed for both nitrate-N and phosphate-P. The trend for both nitrate-N and phosphate-P to be higher in runoff from soybean compared to corn residue plots is further supported by the soil extraction data. There were no effects of cover crop treatments, but there was more soluble phosphate and nitrate in the surface soil layer from plots with soybean residue than in plots with corn residue. This result suggests that the soybean crop and residue concentrated more nutrients on the soil surface than did corn, or that microbes decaying the corn residues immobilized (tied up) more of both nutrients than did the microbes decaying the soybean residue.

Finally, as with the 2019-2020 data, it is also notable that there was no detection of any increase in phosphate-P in the three-species mix cover crop that included forage radish, even after the radish was severely damaged and some plants killed by cold temperatures in January-February 2021.

Novel Resistance to Cercospora Leaf Blight and Purple Seed Stain of Soybean

✓*University of Maryland Eastern Shore Agriculture, Food and Resource Sciences, $14,700, Behnam Khatabi, bkhatabi@umes.edu, and Burt Bluhm*

Soybean diseases are major production constraints. In the U.S., soybean yield losses due to disease are estimated to average 11% annually. Identifying and deploying resistance to multiple soybean pathogens is a highly cost-effective and environmentally friendly approach for sustainable soybean production. Cercospora (a group of fungal pathogens) are consistently among the top ten disease yield robbers in Maryland soybean production. This project evaluated soybean genotypes to identify novel resistance to Cercospora pathogens and screened promising new germplasm to identify and map soybean resistance genes to frogeye leaf spot (FLS) and Cercospora leaf blight (CLB).

Two field trials including 64 selected soybean cultivars have been conducted at two locations, including University of Maryland, Lower Eastern Shore Research and Education Center (LESREC) and UMES, to evaluate the soybean cultivars against foliar disease. All selected soybean accession previously exhibited resistance to Phytophthora sojae. In addition, some of the popular varieties have been cultivated and explored for resistance or susceptibility to frogeye diseases. In the 2020 growing season, little disease progression was seen, however, some of the lines were highly susceptible to frogeye leaf spot under field evaluations. The same soybean accessions are being screened in Arkansas to compare data between states at the same time.

The second goal of this project was to identify, characterize and distribution of soybean Cercospora leaf blight and purple seed stain in Maryland. Surveys are being run to collect samples from different fields in distinct geographical regions of Maryland. Late-season problems with Cercospora disease were observed on the Eastern Shore.

Fungal isolation is underway in the laboratory from soybean showing frogeye symptoms. So far, 11 fungi have been isolated. While sample collection was delayed due to the pandemic, the screening process was accelerated to identify Cercospora leaf blight based on the fungal isolates under greenhouse condition in UMES. The goal is to identify a new source of resistance among the tested soybean accessions to be used as parents in future breeding programs.

Managing Herbicide Resistant Common Ragweed Emergence and Growth in Soybean

✓*University of Maryland, $9,413, Sarah Hirsh, shirsh@umd.edu*

Common ragweed (*Ambrosia artemisiifolia L.*) collected in 2019 on the Lower Eastern Shore of Maryland (Somerset, Worcester and Wicomico counties) was found to be resistant to glyphosate (group 9) and cloransulam (Firstrate; group 2 "ALS Inhibitors") herbicides. Furthermore, three -way resistance to glyphosate, Firstrate and fomesafen (Reflex, group 14 "PPO Inhibitors") was found for samples from Dorchester County, MD and Kent County, DE. This research assessed management strategies for reducing herbicide resistance common ragweed.

To determine the effect of delayed cover crop burndown on herbicide resistant common ragweed emergence and growth, the effect of three different cover crop termination timings (early April, early May, or at soybean planting) on common ragweed population was assessed. Untreated ragweed populations were significant at all three sites, averaging between 20 and 30 ragweed plants per m^2 by June. Overall, a single herbicide application at planting that included a residual herbicide provided very good control of common ragweed at each site.

Second, to determine the effectiveness of various residual herbicide products and timings on herbicide resistant common ragweed emergence and growth, the effectiveness of six various residual herbicide products on common ragweed emergence and growth was assessed. No differences were found among residual herbicides or between a herbicide application with versus without a residual herbicide in the current study.

The study findings are relevant to help Maryland soybean growers to manage herbicide-resistant common ragweed. Research found that delaying cover crop termination and providing just one herbicide application at soybean planting time can improve herbicide-resistant common ragweed control. Using just one pre-emergent herbicide application would also result in fewer input costs. No

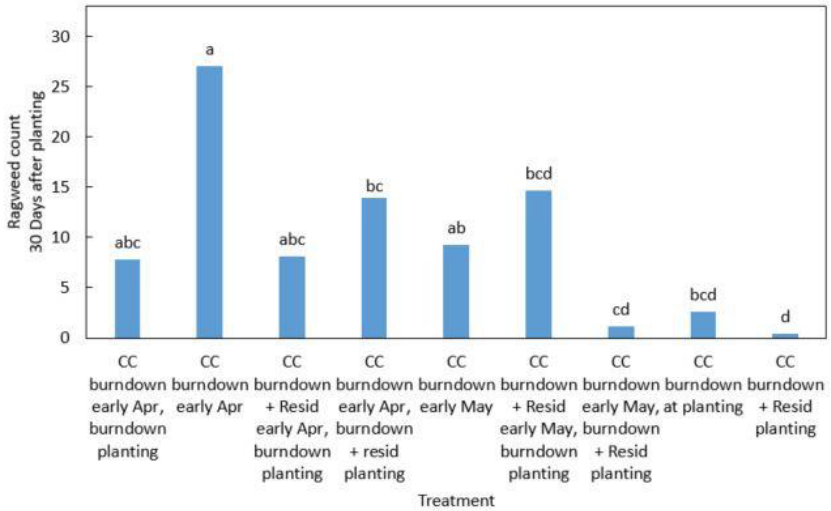


Figure 1. Ragweed count 30 days after soybean planting. Data is the average of Kingston, Rehobeth, and Snow Hill site--years. Different letters indicates statistically significant different ($p < 0.1$) for data with a transformation of ln (0.1 + count).

Identification of New Sources of Resistance/Tolerance of Sclerotinia sclerotiorum among Soybean Germoplasm Showing Resistance to Phytophthora sojae

✓*University of Maryland, $19,488, Kathryne Everts, keverts@umd.edu, and Behnam Khatabi*

Although the most practical and reliable method to control Sclerotinia stem rot (SSR) is to use disease-resistant varieties, only limited sources have been reported showing moderate resistance against the SSR in soybean. To date, 195 lines have been tested for resistance to SSR in greenhouse trials. Tested lines were identified based on their resistance to P. sojae, and also through a search of national programs to select lines based on their potential resistance to S. sclerotiorum.

The research was successfully continued despite the pandemic, although the greenhouse work was delayed by approximately two months to accommodate the restrictions on working on campus. The greenhouse test of lines/cultivars for resistance/tolerance to Sclerotinia sclerotiorum began in December at the University of Maryland College Park Research Greenhouse where current temperatures are conducive for Sclerotinia stem rot inoculations. The lines were inoculated with isolates of S. sclerotiorum, SS29, a highly aggressive isolate and SS2, a less aggressive isolate, when they reached the appropriate growth stage. Inoculation was done by placing a plug of mycelium grown on agar on the tip of stem of the plant using drinking straw. Disease measurement will be done by measuring the lesion length of the stem of each plant using a scale/measuring ruler. A total of 207 soybean lines including the checks (Williams 82, susceptible and NKS1990, resistant) were planted in the greenhouse. These lines allow researchers to repeat all previous tests and validate results, replicating each line three times.

Several promising lines have been identified, and data analysis this year is expected to confirm the preliminary results for lines PI 398249, PI 96983, PI 398666, and V945152 and others that were resistant/tolerant to S. sclerotiorum.

(left to right) Mature Palmer amaranth plant; Palmer amaranth starting to flower; Mature palmer amaranth in soybean field

Evaluating Novel Herbicide Tolerant Traits in Maryland Soybean Systems

✓University of Maryland Extension, $7,850, Benjamin Beale, bbeale@umd.edu and Alan Leslie

Herbicide resistant weeds such as Palmer amaranth (*Amaranthus palmeri*) pose significant challenges to Maryland soybean farmers. Previous studies over the past several years have examined various combinations of PRE and POST herbicides using existing herbicide tolerance technology, and have provided farmers guidance in managing this weed species. In recent years, numerous additional herbicide tolerant traits have been introduced, including RR2 Xtend (dicamba, glyphosate); RR2 Xtendflex (dicamba, glyphosate, glufosinate); LibertyLink (glufosinate); LibertyLink GT27 (glufosinate, glyphosate, HPPD); and Enlist E3 (2,4-D, glyphosate, glufosinate). These platforms offer greater flexibility and additional postemergence options that can be incorporated into an integrated weed management program. However, this gives rise to additional questions about the ability to tank mix various contact and systemic products and the effect on weed control and soybean performance.

A field experiment was conducted in St. Mary's County, MD in a field infested with glyphosate and ALS resistant Palmer amaranth. A randomized complete block, split-plot design was used to test 15 herbicide treatments and two application timings with four replicates (including a non-treated control). Herbicide treatments included each active ingredient targeting Palmer amaranth (glufosinate, dicamba, 2,4-D) alone, and in combination with sethoxydim and glyphosate to control grass weeds. Treatment protocol included a clean burndown program (paraquat) followed by application of a weak residual (S-metolachlor). Soybeans with Enlist and Xtendflex traits were planted, with dicamba and 2,4-D applications separated by an appropriate border.

Initial results indicate that all tank-mix combinations tested provided adequate control of emerged Palmer amaranth, with no apparent antagonism, and no effect of application timing. Glufosinate alone provided weaker control of grass weeds than glyphosate or sethoxydim, and there appeared to be an antagonistic interaction between glyphosate and glufosinate in tank-mixes.

A team of Extension faculty comprised of Michael Flessner and Vijay Singh from Virginia Tech, Mark VanGessel from the University of Delaware, and Kurt Vollmer and Ben Beale from University of Maryland, collaborated to offer a two-day virtual training on integrated weed management. Farmers indicated the program had a value of $4.50 per acre and crop advisors indicted a value of $3.33 per acre.

The program was recorded and posted to the GROW website: *https://growiwm.org/mid-atlantic-workshop-on-herbicide-resistance-went-virtual-this-year/*

Strategies for Reduced Herbicide Input and Herbicide Resistant Weed Control in Soybean

✓University of Maryland, $8,361, Kurt Vollmer, kvollmer@umd.edu

To control weeds throughout the growing season in no-till soybeans, multiple herbicide applications are needed. With the continued development of herbicide-resistant weeds, there is a need to integrate non-chemical tactics with existing herbicide programs. This project evaluated potential "rescue treatments" for larger common ragweed and cereal rye cover crop management in order to reduce herbicide inputs.

First evaluated were single and sequential applications of Liberty, Enlist One, and Reflex applied alone or in tank-mixes when applied to common ragweed greater than four inches tall. Data showed that sequential applications containing Liberty or Enlist One were needed to achieve maximum control of larger common ragweed compared to single applications.

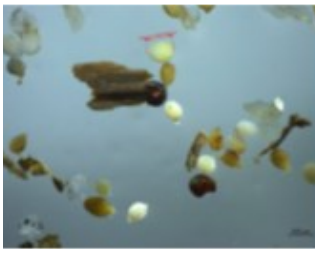
The second study evaluated the effects of delaying cereal rye termination in combination with one-, two-, and three-pass herbicide programs. Results from this year showed that the effects of cover crop management were independent of herbicide program. Winter annual weed and giant foxtail control was greater when cereal rye termination was delayed, regardless of herbicides used or herbicide application timing. Henbit and yellow woodsorrel control improved 59% and 70%, respectively, when termination was delayed until at least 2 weeks before planting. Delaying cereal rye termination until planting improved annual bluegrass control 44% compared to terminating cereal 2 weeks before planting, and 76% compared to terminating cereal rye 4 weeks before planting. Terminating cereal rye at planting improved giant foxtail control 10% compared to terminating cereal rye 2 weeks before planting, and 16% compared to terminating cereal rye 4 weeks before planting. Preplant herbicides followed by one or two additional applications controlled giant foxtail better than preplant herbicides alone, regardless of whether or not a residual herbicide was used.

This year's data illustrates the importance of making timely herbicide applications and the benefit of incorporating non-chemical tactics into a weed management program. Additional research will confirm these results and identify consistent treatments.

Efficacy of Seed Treatments to Manage Soilborne Pathogens of Soybean

✓*University of Delaware Plant and Soil Sciences, $5,878, Alyssa Koehler, akoehler@udel.edu, and Jake Jones*

Soybean cyst nematode (SCN) (*Heterodera glycines*) is consistently ranked among the top destructive soybean pathogens across the United States and is the most significant nematode pest affecting soybeans in Delaware and the Eastern Shore of Maryland. A survey was conducted across DE and MD in 2019 that found SCN present in 57% of sampled fields. SCN has been present in Delaware since 1979 prompting growers to rely on resistant varieties, primarily using the PI88788 resistance source. However, additional control strategies are needed as SCN populations have begun reproducing readily on these once resistant cultivars.



Cream to pale yellow colored SCN females under microscope magnification following root blasting.

A five-replication field trial was conducted in 2020 to evaluate two soybean nematicide seed treatments, ILEVO (fluopyram) and Saltro (pydiflumetofen), compared to non-treated plain seed, for stand emergence, control of SCN, and yield differences. Both seed treatments increased speed and percent of germination. Saltro treated plants yielded the highest, at 36.4 bushels per acre, but there were no statistically significant yield differences among treatments.

In this trial, Saltro was the most effective at reducing cysts per plant and had the lowest numerical SCN populations at the end of the season. Further replications of this experiment will be conducted in 2021 to confirm preliminary results.

Evaluation of Miravis Neo for Soybean Production

✓*University of Maryland Extension, $4,869, Andrew Kness, akness@umd.edu*

Adepidyn is a new fungicide from Syngenta, marketed under Miravis Top for soybeans, and combines active ingredients from FRAC groups 3 and 7. The product is touted for having superior management of foliar diseases of soybean, reduced risk of fungicide resistance, and plant health benefits to bump yields even in the absence of disease. In this research project, the effectiveness of this fungicide on yield, plant health, and stay-green properties on full season soybeans has been evaluated through replicated field trials.

The 2020 growing season at Wye and WMREC were very different. Wye received 47 inches of rain from May 1-November 1, 2020, while WMREC revived 19.8 inches over that same timeframe. Wye plots also had a severe infestation of herbicide-resistant marestail that likely lowered the yield potential and affected the severity and incidence of FLS. All fungicide treatments significantly reduced FLS severity at both locations. All fungicide treatments affected NDVI by keeping the plants greener for longer, as well as increased the occurrence of green stem.

For the second year in a row, a significant increase in yield was observed from fungicide-treated plots at the higher yielding, early planted trial location, with Miravis treatments performing significantly better than Priaxor, and Priaxor performing better than the untreated control. No yield differences were detected at WMREC, likely due to the very low and poor yields because of droughty conditions. Disease was not likely the major yield-limiting factor.

Combined 2019 and 2020 data reveal a significant 6-9 bushel increase in yield with the Miravis treatments, and a 3-5 bushel increase in yield with Priaxor. Based on this data and data from other institutions, Miravis may benefit soybean production by providing protection against common foliar diseases of soybean and help increase yields under early planted, high yield potential soybeans.

Planting Green – Extending the Growing Season to Get More Payback from Cover Crops

✓*University of Maryland Environmental Science and Technology, $24,000, Ray Weil, rweil@umd.edu*

The aim of this research is to provide information about cover crop management from one of doing the minimum to qualify for payments to managing for maximal cover crop benefits for soil health and profitability. University research has shown that a longer cover crop season can effectively capture soluble nitrogen left deep in the soil and provide cover to adequately control overwinter erosion, which can promote soil health, water conservation and crop yield.

To establish the early planted cover crops for this experiment, both corn and soybean crops were established in 30-in wide rows in Early May on three sites at the University of Maryland research station near Beltsville. In late June, a Penn State University-style inter-seeder drill was used to establish two types of cover crops in the young cash crop stands. The two cover crops established were a three-way mix of radish, crimson clover, and rye and a single species cover crop consisting of just cereal rye. Stand counts of the cover crops were done to document this difference in seeding effectiveness. Overall, the cover crops interseeded in June did not affect the yield of either corn or soybeans in October in either the fine-textured or the coarse-textured field experiment.

The cover crop growth and condition were monitored during the winter. The percent green groundcover in each field for each cover crop treatment just before the mid-kill date showed that the three-species mix had produced significantly more green cover (and biomass) on the sandy soil than the other treatments. Also, as expected, the no cover control had less green cover than either cover crop on both soil. When averaged across all cover crop treatments, nitrate-N was about three times as concentrated under soybean residue and under corn residue. However, all values for nitrate-N were quite low, being less than 1 mg/L (1 ppm).

The cover crops were terminated and soybean planted into the plots that had corn in 2020 and corn planted in the plots that had soybean in 2020 in early May into green living cover crops. The effect of cover crop kill date will be determined for rye, three-way mix and no-cover (weedy) treatments, looking at plant nitrogen, early growth, soil water and temperature, weeds, slugs, pests, and yields.

Aerial Application of Pesticides and Cover Crop Seeding Using Drones

✓*University of Maryland Extension, $3,186, Andrew Kness, akness@umd.edu, and Erika Crowl*

Drones are becoming increasingly popular in agriculture for not only imagery, but product application. The first application studied in this project was to evaluate the spray coverage achieved with drone application in soybean. Two different drones were used to apply water to standing corn and soybeans in fields located in Harford County, MD. Corn was planted on 30-inch rows and at the R4 growth stage during application. Full season soybeans were planted on 15-inch rows and at R6 during application.

It is generally recommended that droplet density should be between 20-30 droplets/cm^2 for adequate insecticide application, between 20-40 droplets/cm^2 for herbicide application, and at least 50 droplets/cm^2 for fungicide applications. Based on these assumptions, tested drones have the capability to deliver densities at or over 20 droplets/cm^2 in the upper canopy, which may be adequate for herbicide or insecticide applications. However, a greater density of droplets needs to be achieved for adequate fungicide application. Previous research has shown that flight velocity plays a significant role in droplet density and spray coverage (Hunter III et. al., 2020). Spraying slower would likely improve coverage and efficacy of fungicides applied via drones, which will be an area of future research for this project.

In the second part of this grant research, an evaluation about how effective drones are at seeding cover crops and if they can deliver seed at the appropriate rate to establish a sufficient cover crop. Recent interest has been generated in using drones to seed cover crops into agronomic crops in small, irregularly shaped fields with rolling terrain or those fields otherwise not suitable for aerial seeding using a fixed-wing aircraft or helicopter.

A cover crop of radish was flown on to a 26 acre standing corn field in Baltimore County at the rate of 16 pounds of pure live seed per acre using a HSE-TTA drone equipped with a spin spreader capable of carrying 40 lbs. of seed. The field was an excellent candidate for this trial because of its irregular shape, rolling terrain, and close proximity to power lines and wood lines. Corn grain was harvested on September 15, 2020 and cover crop establishment was measured on October 21, 2020 by counting the number of radish plants per square foot in a one square foot area at 20 random locations across the field. The average cover crop plant population in the field was 3.1 plants/ft^2, with a minimum of 0 and maximum of 6. Radish plants averaged five inches in height at the time of rating.

Canopy density was calculated using the Canopeo© application for smartphones (canopeoapp.com). Images were captured at 20 random locations across the field at a height of 2.5 feet above the ground and percentage green canopy was calculated by the Canopeo software. Average canopy coverage was 39.1%, with a minimum and maximum value of 20.3 and 53%, respectively.

Aerial establishment of cover crops is heavily influenced by soil moisture availability. August and early September saw sufficient rainfall in the region, contributing to conducive conditions for cover crop establishment. This data, representing only one field and one environment, demonstrate the potential that aerial seeding a radish cover crop with drones may be an effective method for establishing cover crops in these challenging fields. Future work will be done to replicate and gather additional data so that we can fully understand the feasibility of seeding cover crops with drones.

Unedited image (top) and percentage canopy cover image (bottom) calculated by Canopeo® software showing 31% coverage.

Evaluation of Growth-Promoting Products for Soybean Production in Maryland

✓*University of Maryland Extension, $6,000, Andrew Kness, akness@umd.edu*

Soybean farmers have had many new products come on the market in recent years touted as growth-promoting products intended to help growers attain high-yielding soybeans. Many of these products contain growth regulators, hormones, humic acids, carbon, sugars, and/or fertilizer. This research project evaluated some of these products to assess their effect on soybean growth and yield, and to compare them to equivalent treatments of fertilizer and an untreated control. Evaluated products and fertilizer applications included: Take Off ST (seed treatment), Take Off Foliar LS (liquid solution), Monty's K28 Liquid Potash, Monty's Liquid Carbon, and Monty's Agri-Sweet, Seed+ Graphite, and Crop+.

Results showed that Take Off ST treated seed significantly improved soybean emergence over the non-treated control, Monty's Carbon, and Seed+ treatments at WMREC but not WYE; the same trend was observed in 2019. Soil type and planting time could be influencing this trend in the data, as in 2020 and 2019, WMREC trials were planted first and into cooler soils. These data indicate a possible benefit to Take Off ST when soybeans are planted into similar soil types and/or early in the season when soils are cooler.

NDVI and canopy height ratings indicate no difference between treatments and suggest that these products do not influence these plant characteristics. Yields were above average at WYE and below average at WMREC due to summer precipitation. WYE saw record rainfall in August, which made for prolific flower and pod production while WMREC received just over an inch rain for August, causing flower drop and pod abortion.

For a second year in a row, no statistical differences in grain yield between treatments was observed. Interestingly, even though Take Off ST improved emergence at the WMREC location, it did not translate into an improvement in yield. This is likely due to the fact that soybeans can compensate for reduced stands by branching, setting more pods, and making more seeds per pod and larger seeds. None the treatments affected grain moisture or test weight.

Latest Checkoff Investment in Research

The farmer-led Maryland Soybean Board awarded 13 grants totaling $156,753 in checkoff investment for 2021 production research to provide growers with the most current information to protect their crops and the environment.

"Through the funding of these projects, we aim to fulfill our mission of increasing the profitability of Maryland soybean farmers," said Maryland Soybean Board Research Chair Josh Appenzeller. "The projects selected for funding address local issues that will positively impact farmer's operations."

Research projects receiving 2021 funding:

University of Delaware

✓ Field Evaluation of Resistance Sources for Management of Soybean Cyst Nematode, Alyssa Koehler, $6,180

University of Maryland

✓ Efficacy of Herbicides, Timing and Tank Mixes on Novel Herbicide Tolerant Traits, $7,371, Benjamin Beale

✓ Evaluating Drone for Cover Crop Seeding and Pesticide Applications, $3,474, Andrew Kness

✓ Evaluating Earlier Planting Dates for Increased Soybean Yields, $9,767, Nicole Fiorellino

✓ Evaluating Soybean Variety Performance and Response to Deer Grazing, $8,258, Luke Macauley

✓ Evaluation of Growth-Promoting Products for Soybean Production in Maryland, $4,795, Andrew Kness

✓ Fertilizing Cover Crops: Do You Have to Put Some In to Get More Out?, $21,344, Ray Weil

✓ Phosphorus Runoff from No-Till Soils – Do Cover Crops Make it Better or Worse?, $17,337, Ray Weil

✓ Planting Green – Extending the Growing Season to Get More Payback from Cover Crops, $21,130, Ray Weil

✓ Salt Tolerance in Soybean, $19,363, Naveen Kumar Dixit

✓ Soybean Fungicide Efficacy, Profitability, and Pest Resistance Over Time, $13,098, Andrew Kness

✓ Strategies for Controlling Herbicide Resistant Common Ragweed in Maryland, $13,245, Sarah Hirsh

✓ University of Maryland Soybean Variety Trials – Check Varieties, $11,391, Nicole Fiorellino

Soybean Checkoff Research Field Day

Local farmers and industry professionals are invited to join the MARYLAND SOYBEAN BOARD on AUGUST 11 at the WYE RESEARCH & EDUCATION CENTER to learn about checkoff-funded research and enjoy a SNAKEHEAD FISH FRY AND BARBEQUE DINNER.

Research to be featured includes a spray drone demonstration, use of forage soybeans to control deer damage, evaluation of growth-promoting products, variety trials, cover crops, and weed management. CEUs are available.

Although this is a FREE event, pre-registration is encouraged:
https://msbfieldday2021.eventbrite.com

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