NC SOYBEAN PRODUCERS ASSOCIATION

2021 RESEARCH REPORT

PROTECTING YIELD & PROFITS | VARIETY DEVELOPMENT & TESTING

PEST MANAGEMENT | NUTRIENT MANAGEMENT

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President's Letter

There are a lot of places where you can grow a soybean and when prices are north of $15, farmers will find a way. In North Carolina and nationally, soy acreage is on the upswing as China's ability to levy a trade war has been cut short by the immutable laws of supply and demand for protein. In any year, but especially when prices are high, there is a heavy emphasis on yield because traditionally it has been yield that has put money in growers' pockets. As stewards of your checkoff dollars the NCSPA knows this, and as such, upwards of 75% of our research budget is devoted directly or indirectly to increasing yields. In good times and bad, yields will continue to be an important part of our portfolio given that our competitors are not sitting idly by and the growers of North Carolina need steady improvements to stay in the game.

While it is a joy to be assuming the NCSPA presidency when prices are on the rise, the hard times of the past few years are not too far in the rear view mirror. In the past few years, we have learned that when the Brazilian ***real*** is dirt cheap against the US dollar, it can be hard to compete in international markets and when China then puts their thumb on the scales, it is next to impossible.

In light of that, national soybean organizations like the United Soybean Board and the US Soybean Export Council are taking steps to differentiate US soybeans from international competitors. These points of differentiation range from the superior environmental record and amino acid profile of US soybeans to a best-in-class supply chain and a sanctity of contracts that ensures US beans are delivered reliably and on-time.

While these kinds of considerations have long been used to help the US win market share, for the longest time, end users argued that the cost of Identity Preservation was too high to reward US farmers with meaningfully higher prices. Newer technologies like GPS or Blockchain, however, now make it possible to track the added value of US soybeans back to the farm giving US farmers a chance to benefit from their superior product rather than simply going toe-to-toe in the commodity market with some grower in the Brazilian Cerrado.

As a state with a reputation for high protein soybeans and clean, containerized exports, North Carolina growers stand to benefit from this new way of approaching soybean valuation. As such, in 2020, for the first time in several years, the NCSPA funded a more market-oriented project - specifically looking to determine the implied dollar value of the state's higher protein beans to various livestock species. It is our hope that the findings will help us make our case to international buyers, as well as lead to more candid conversations about quality with customers in the state.

Backing up these research efforts is a deep pool of talent at N.C. State, respected private agronomists and a Research Coordinator to help us make sense of it all. The following pages lay out research highlights over the past year and describe how projects will help lay the groundwork for a competitive North Carolina Soybean industry for years to come.

Sincerely,

David Heath
President, NCSPA

Maximizing Soybean Yield through Maturity Group and Planting Date Selection

Rachel Vann, NCSU

Soybean growers across N.C. plant soybeans in a wide window (March – August) and across a wide range of maturity groups (II – VIII). Most of the recent agronomic research conducted by the North Carolina State Soybean Extension Program has focused on MG V-VI soybeans planted in May or June. Because we have growers that plant soybeans across a wide window, maturity group and seeding rate recommendations for use across a wide range in planting windows are needed. In addition to understanding the impact on yield, understanding the impact on seed damage and composition is also important.

In an effort to help growers understand more about these interactions, the NCSPA is funding a trial to evaluate optimum maturity group and seeding rates across planting dates with the N.C. State Soybean Extension program.

Over the last two years, trials were established at eight locations across the state with planting dates ranging from mid-March through mid-July. A variety from maturity groups II – VIII were planted at each planting date. Within each maturity group and planting date combination, five seeding rates were compared ranging from 75,000 to 175,000 seeds/ac.

Below are observations from the first two years of research combined across environments. Due to the complexity of this research, observations are made for both high yield environments (60+ bu/ac average) and low yield environments (less than 60 bu/ac average).

EARLY PLANTING
(before May)

There is a lot of interest in early soybean planting dates as a mechanism to increase soybean yield in N.C. When planting before May, data from the past two years indicates that in high yield environments, yield was maximized with MG III-V varieties. In lower-yield environments, yield was highest with MG V-VII.

FULL SEASON
(Mid-May)

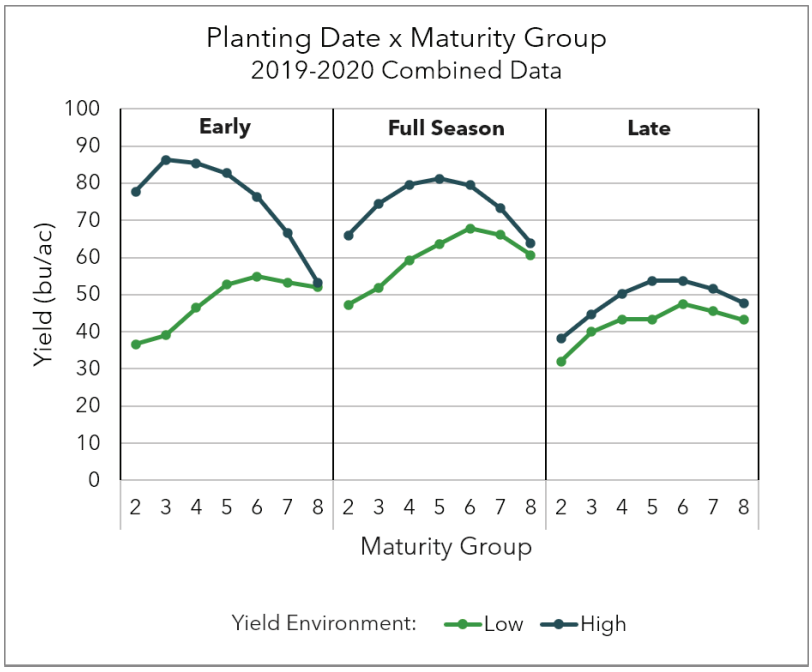
In the standard mid-May full season planting dates, yields were highest with a MG IV-VI variety in a high yield situation. In the lower-yielding environments, the highest yields were observed with MG V-VII varieties.

LATE PLANTING
(mid-June to late-July)

In both the high yield and lower yield environments, soybeans yields were very similar from MG IV-VIII in the later planting dates. Based on these results, growers planting this late have flexibility to use whatever varieties they have remaining seed of, or can get access to, as long as the earliest MGs are avoided.

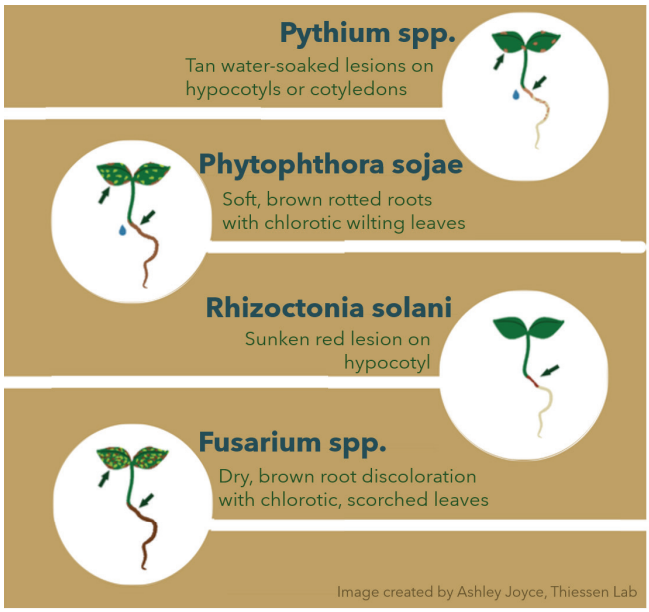
In addition to yield, seed quality is also an important consideration when it comes to planting date and maturity group decisions. In high-yielding environments, data indicates a clear yield advantage to planting earlier maturing varieties. However, this can coincide with some seed quality issues. The early planted, earlier maturing varieties are reaching maturity earlier in the season when hot and humid temperatures often coincide with wet weather. Data over the past few years indicates that seed damage and purple seed stain are most often encountered in soybeans planted prior to May for MGII-IV varieties. To capitalize on the yield benefits of earlier maturing varieties, growers must be committed to timely harvest and season-long scouting in an effort to minimize seed quality issues.

Being strategic about planting date and maturity group selection is one-way growers can work to maximize their yields. These results capture two years of data and thus two very different years of weather patterns. This work will continue in 2021 and beyond to gain a more robust understanding of these interactions across a wide range of environments. The ultimate goal of this work is to provide growers with a tool that will help optimize their maturity group and planting date selection for a given location.



Does Early Planting Justify a Fungicidal Seed Treatment?

Rachel Vann, NCSU



The Soybean Extension Program has conducted research over the past few years to evaluate the effect of various seed treatments on soybean yield. In these trials, it was found that there was no impact of fungicidal seed treatments on soybean yield, but these trials were generally planted from mid-May through early-July with a maturity group V or VI soybean variety with only a few fungicidal seed treatments evaluated. To more robustly evaluate fungicidal seed treatments across earlier planting dates and maturity groups, the NCSPA funded additional work with N.C. State Extension.

Over the last two years, trials were established at six locations across the state. Three planting dates (late March/early April, mid/late April, and mid-May) were compared across three maturity groups (III, IV, V). Fungicidal seed treatments were compared to an untreated control within each planting date by maturity group combination.

All fungicidal seed treatment products evaluated preformed consistently, so the results are pooled across products. In 2019, the use of a fungicidal seed treatments protected yield across plant date and maturity groups at two locations, however, there was no impact on yield in 2020.

Nonetheless, if you broke down the yield protection from the use of a fungicidal seed treatment across the planting dates in both years, there was more protection of both soybean stand and yield at earlier planting dates. Based on this two-year data set, **growers planting earlier than Mid-May should consider the use of a fungicidal seed treatment to protect soybean stand and yield in fields with a history of seedling disease pressure,** as environmental conditions at earlier planting dates can be more conducive to seedling disease development. Because there were no statistical differences between the products tested, these results indicate that the use of any multi-mode of action fungicidal seed treatment would provide similar protection of soybean stand and yield.

Winter Crop Effect on Soybean Production in N.C.

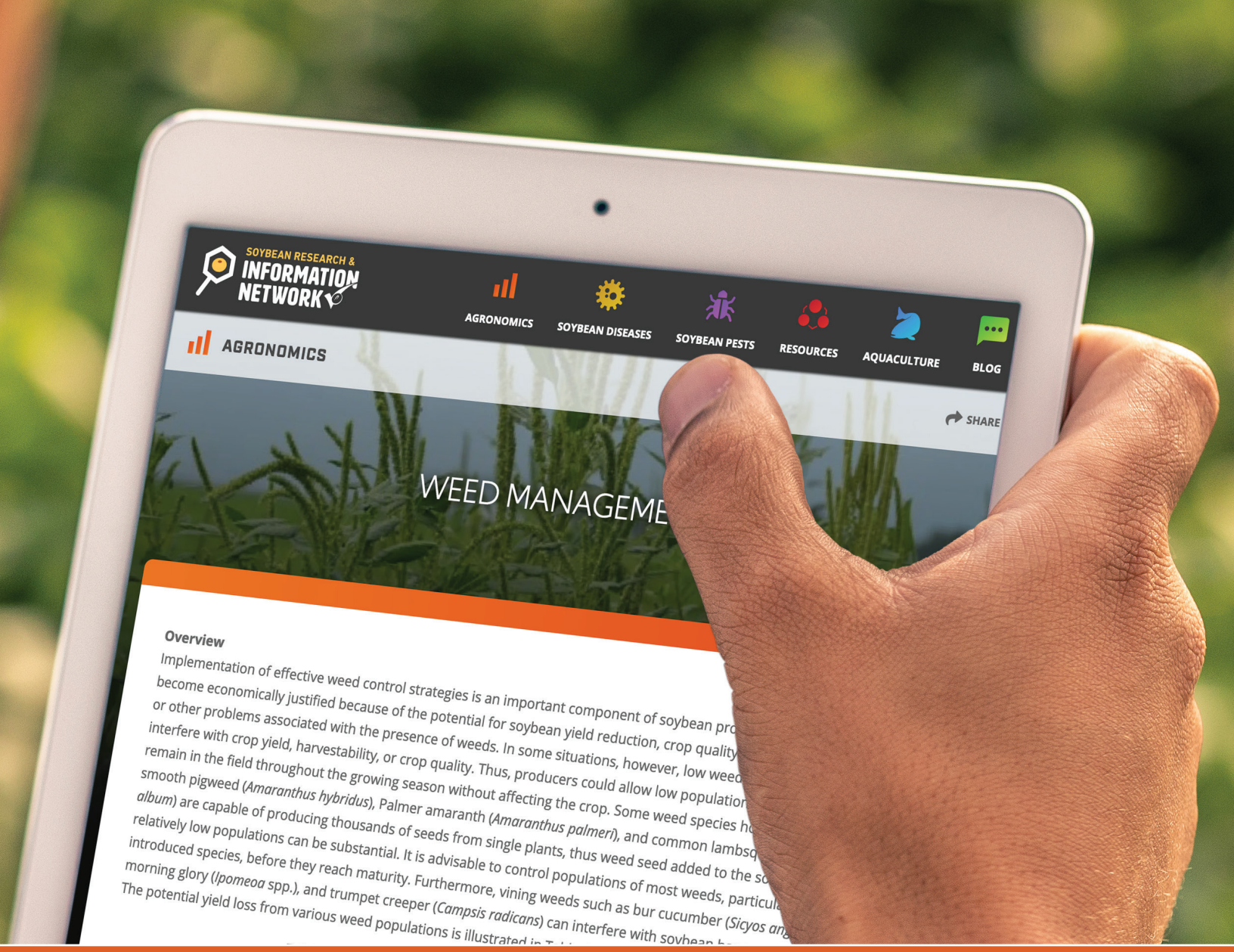
Rachel Vann, NCSU

Producing a winter crop before soybean is a common practice in North Carolina. Traditionally, wheat has been the primary winter crop grown in the state prior to soybean, however, other emerging winter crop scenarios include rapeseed and cover crops. With new winter crop scenarios increasing in popularity across the region, an investigation of the rotational impact of these species on soybean and optimal soybean MG use is merited.

The NCSPA funded research with the N.C. State soybean extension program that was conducted in five environments across North Carolina in 2019 and 2020. The treatments evaluated included cereal rye as cover crop, cereal rye/crimson clover as cover crop mixture, May fallow, wheat for grain, rapeseed for grain, and a June fallow. Soybeans with MGs III, V, and VII were evaluated.

The cereal rye and cereal rye/crimson clover mixture cover crop treatments produced the most biomass across all environments but sometimes soybean stand was reduced behind these cover crops. Rotation impacted soil temperature and soil moisture across most environments at planting and soybean growth stage V2. Nitrogen dynamics were typically impacted by rotation but not MG. Despite observed differences in soybean stand, soil temperature, soil moisture, and nitrogen dynamics between the various rotational scenarios, soybean yield was typically similar between the rotations highlighting the complexity of these rotations and their impact on soybean yield.

Ultimately, the impact of winter crop rotation on soybean yield is extremely complicated due to various biotic and abiotic factors happening simultaneously. **This data suggests soybean producers in North Carolina have flexibility in winter crop rotations without impacting soybean yield** but further investigation into the influences of pest management in rotations should occur.



ONE LESS THING TO WORRY ABOUT.

Herbicide-resistant weeds cost soybean farmers time and money, impacting profitability. Fortunately, your state soybean checkoff is on the job with research projects to help you adopt the best management practices to preserve crop-protection technologies and enhance the overall sustainability of your U.S. soy crop. To learn more about weed management, visit:

soybeanresearchinfo.com

Funded by the soybean checkoff

SOYBEAN RESEARCH & INFORMATION NETWORK

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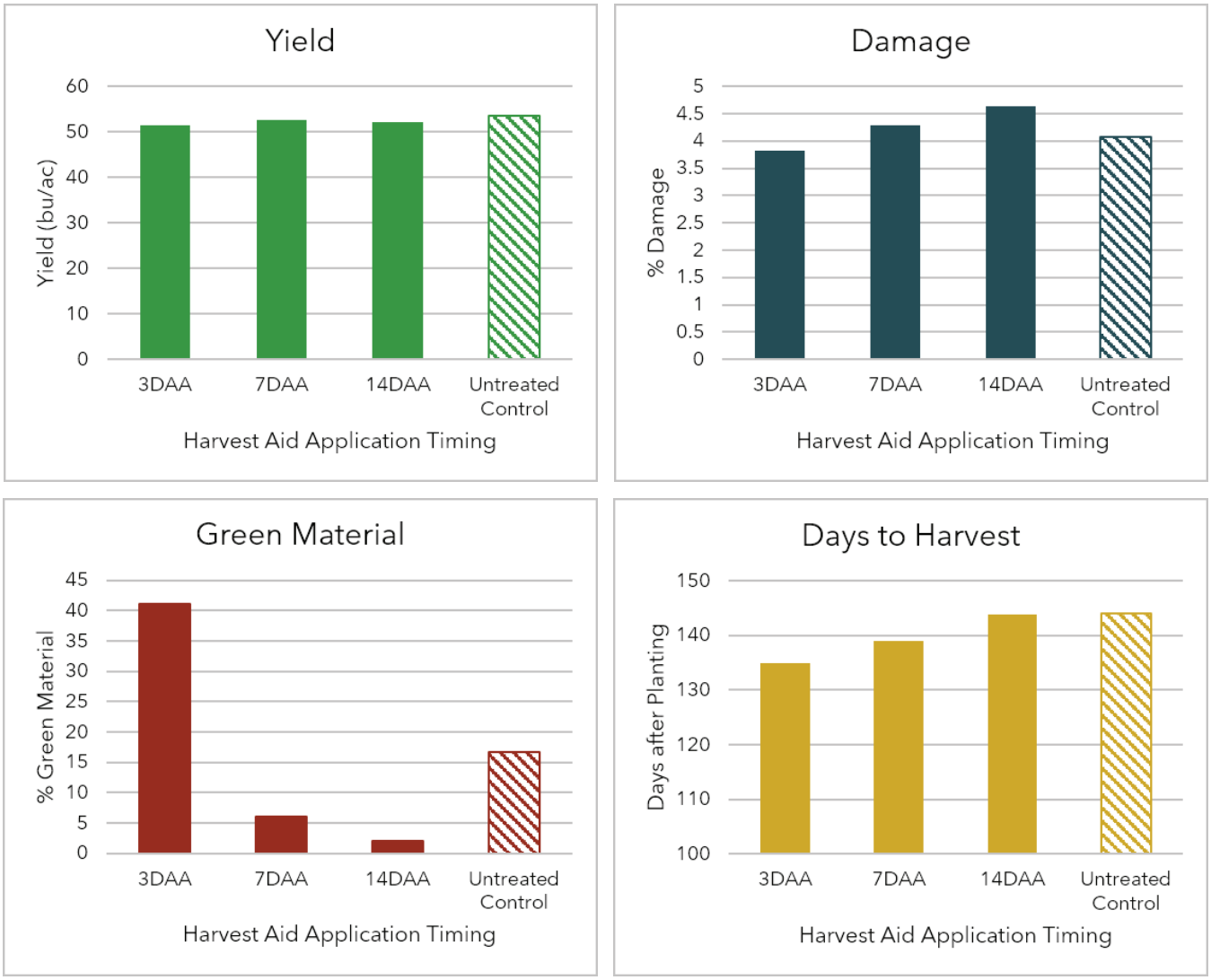
Impact of Desiccant Applications on Early Maturing Soybeans

North Carolina Soybean Producers Association, Tidewater Agronomics, Fowler Crop Consulting, Protech Advisory Services, Impact Agronomics

One of the challenges growers have faced over the last few years is poor seed quality in early planted/early maturity group soybeans. Weather definitely has a large impact on our seed quality - the excessive moisture in early September of 2020 reminded us of that - but growers across our state have also been slowly altering their management practices over the last 5-10 years which may be contributing to more challenges. One of the questions the NCSPA set out to answer this year is whether harvest aids help with seed quality.

To help answer the question, work was carried out at four sites across the state, two in the Tidewater region and two in the Coastal Plain. Three different products were evaluated – Gramoxone, Sharpen, and Defol 5, and plots were harvested at three different timings – 3 days after a harvest aid application was made (DAA), 7 DAA, and 14 DAA. All harvest aids were applied when defoliation reached 65% (approximately R7). An untreated control was also included in the study, which did not receive a harvest aid application. It was harvested at maturity (which was at about the same time as the 14 DAA harvest at all locations).



CONCLUSIONS

We see that **while harvest aids did not impact damage and purple seed stain at the R7 timing they were applied in this trial, they may be useful for other reasons, like reducing the amount of green material present and speeding up the time to harvest.** We also saw no differences in the three products tested regardless of the characteristic evaluated, **suggesting any of these three products could be used successfully.** These products all have different labels and slightly different modes of action, so there could be a time when one is more beneficial than another.

While we weren't able to provide a solution to the seed quality issues with this trial this year, we are looking forward to continuing this work in future years.

YIELD

We know that a harvest aid will not increase your yield, but there are concerns that applying it too early may negatively impact yield, so while the focus of this work was on seed quality, yield was evaluated as well. Across all timings and products, there was no significant difference in yield compared to the untreated control. **This suggests that at the approximately R7 timing used in this trial, yield was not significantly impacted by the application of a harvest aid.**

DAMAGE

The hope was this work would identify a product and harvest timing combination that reduced damage in harvested beans, but unfortunately that was not the case. When looking at percent damage pooled across all locations and all products, there were no significant differences between the treatments and the untreated check. Also, there were no significant differences between the three products tested. **More research needs to be carried out to determine the best fit for harvest aids on impacting soybean quality.**

GREEN MATERIAL

One motivation of using a harvest aid is to reduce green material to aid in harvest efficiency. A significant difference in percent green material (stem and leaves) was found between the harvest timing treatments. Waiting seven days after application to harvest versus three days reduced the percent green material from 40% to 5%. There were no differences in product, suggesting any of these products would be appropriate to help reduce green material at harvest. **This data suggests a harvest aid can be useful for reducing green material, especially if you are able to wait at least seven days after application before harvest.**

DAYS TO HARVEST

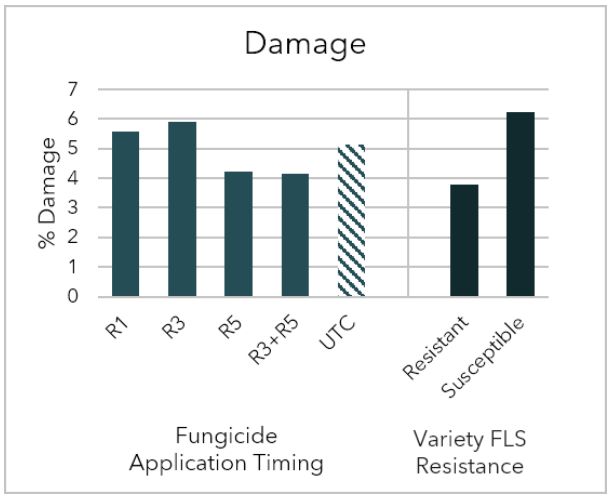
Another common reason to use a harvest aid is to reduce the days to harvest. Applying a harvest aid and harvesting three days after application saved about 10 days compared to the untreated control. The 7 DAA timing saved five days compared to the untreated control. **This data confirms a harvest aid can help reduce the days to harvest.** Saving five to ten days can make a big difference for a grower who is up against a weather event like a hurricane or low-pressure system.

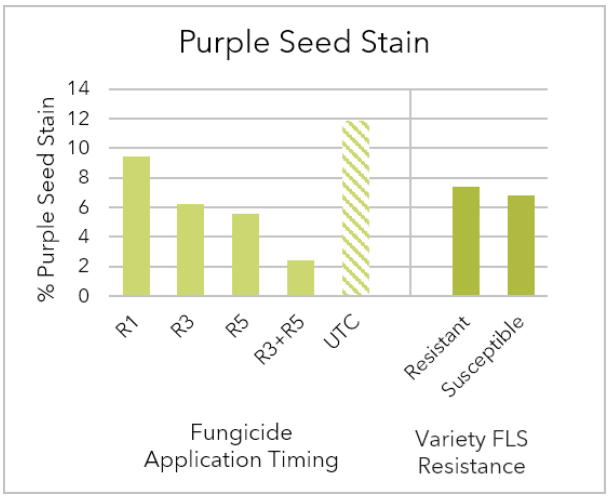
It is important to remember to follow the label for any product used. The work done here was for experimental purposes, and therefore some of the combinations tested were not on-label, but we wanted to be able to compare across products.

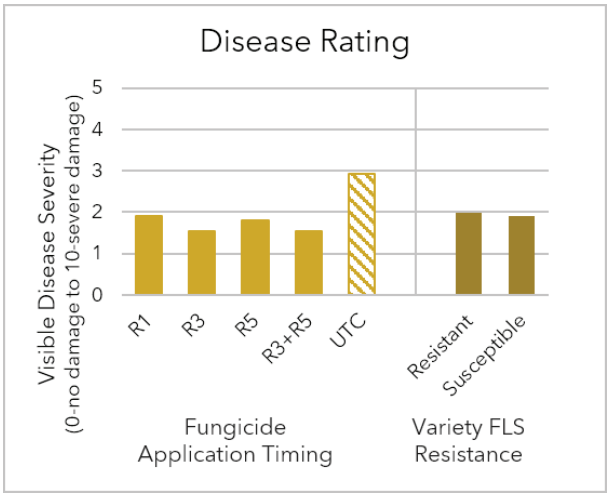
Impact of Fungicide Applications on Early Maturing Soybeans

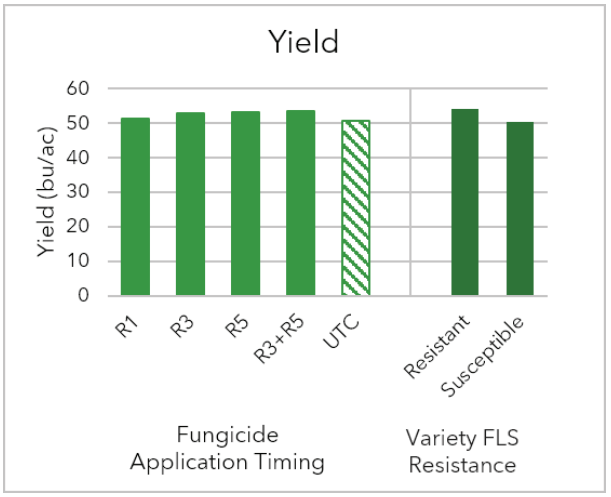
North Carolina Soybean Producers Association, Tidewater Agronomics, Fowler Crop Consulting, Protech Advisory Services, Impact Agronomics

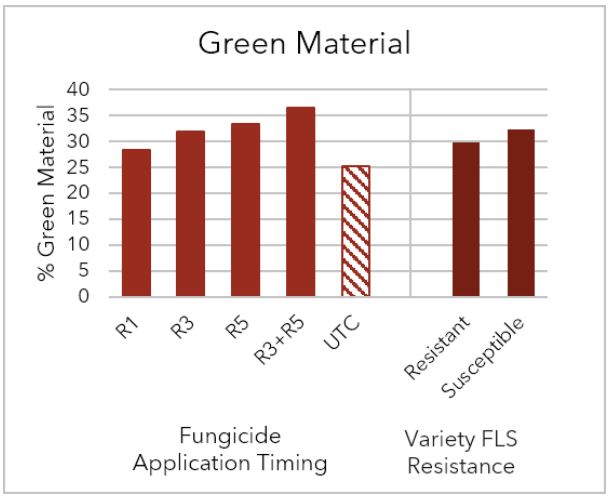
In addition to harvest aids, another question the NCSPA set out to answer this year is whether a fungicide application helps maintain seed quality. To help answer this question, we carried out work at four sites across the state, two in the Tidewater region and two in the Coastal Plain. Two different varieties were evaluated – a late group 3 that was Frogeye Leaf Spot (FLS) susceptible and a late group 3 that was FLS tolerant, with four different fungicide timings –R1 (beginning of flowering), R3 (beginning of pod development), R5 (beginning of seed fill), and R3+R5. An untreated control was also included for both varieties, which did not receive a fungicide application.











CONCLUSIONS

In looking at all the data combined, we see that **a late-season fungicide application (R5) may be useful for reducing damage, particularly purple seed stain in soybeans.** While a fungicide application did not impact yield in this study, it does **highlight the importance of variety selection and the importance of selecting varieties with disease resistance packages,** as the FLS resistant variety yielded higher than the FLS susceptible line.

The issue of seed quality is complex, and this data demonstrates there are many factors that contribute to increased damage/ reduced seed quality. This work will be continued in 2021 to help shed more light on actions growers can take to improve their seed quality.

SEED DAMAGE

Looking at the effect of fungicide timing, no statistical difference in timing was observed, but it is interesting both treatments with the late-season fungicide application (R5) had the lowest percent damage. Looking specifically at the effect of variety on seed damage, the FLS resistant variety had a significantly lower percent damage when compared to the susceptible variety. These same trends hold when looking at the interaction between variety and fungicide timing.

Based on this data, we can't confidently say a late-season fungicide application will or will not help protect against seed damage but it's likely it does provide some protection, although more evaluations are needed. **However, this data does underscore the importance genetic resistance plays in combating disease, and the importance of selecting the right variety for your environment.**

PURPLE SEED STAIN

Unlike overall seed damage, there was no individual effect of variety on purple seed stain, but there was a significant impact of fungicide timing. The combination of an R3+R5 fungicide application significantly impacted the percent purple seed stain present compared to the untreated control. While the R3+R5 application had the overall lowest percent purple seed stain, both the R3 and R5 applications were also significantly lower than the control, **suggesting that a late-season fungicide application (after R3) does indeed help reduce purple seed stain.** Purple seed stain isn't an issue for all growers, as elevators do not automatically dock for it, but it is a concern for any beans being exported, which is why it was included in this analysis.

FOLIAR DISEASE RATING

There was no significant difference in the presence of visible foliar disease when comparing the FLS resistant and susceptible varieties. However, there was a significant difference for both treatments that included an R3 application compared to the control.

While visible disease ratings do not tell the complete story and yield is an important component to the decision of whether to apply a fungicide, **this data does suggest that an R3 fungicide application may be useful in minimizing the visible impact of foliar diseases, at the very least.**

YIELD

While the focus of this work was seed quality, yield is still an important factor for decision making. Despite significant differences in disease ratings compared to the untreated control, surprisingly no significant differences in yield were present when it came to fungicide applications compared the untreated control.

But, there was a significant difference in yield when comparing the FLS resistant variety to the susceptible one. This trend was persistent across all fungicide applications, but not with the untreated control, which is interesting. We would have expected a fungicide application to have a greater impact on the yield of a susceptible variety, than a resistant one, but this was not the case in this evaluation. There is the possibility that the difference observed in yield between these varieties has nothing to do with the presence of foliar diseases but is just an inherent difference in the overall yield potential between the two. However, both varieties used were evaluated in the N.C. OVT in 2020 and the FLS susceptible variety actually yielded significantly higher than the FLS resistant variety, which is the opposite of what we see here. **It is possible that the difference observed in yield between these two varieties is a result of the resistant variety being able to perform better in an environment with disease pressure, but more evaluations are needed to further validate this observation.**

GREEN MATERIAL

Green material – the percent of stem/leaves that were still green just prior to harvest – is an important concern for harvest efficiency. Not surprisingly, there was a greater percentage of green material in all four of the fungicide treatments compared to the untreated control, with that percentage increasing the later the application was made. There were no significant differences in varieties, although, across all treatments, the FLS resistant variety had a little less green material compared with the FLS susceptible variety. **Other studies have indicated the potential of fungicides to increase green material/green stem and these results confirmed what we've seen in other trials.**

Screening Wild Soybean Germplasm for *Meloidogyne enterolobii* Resistance

Adrienne Gorny, NCSU

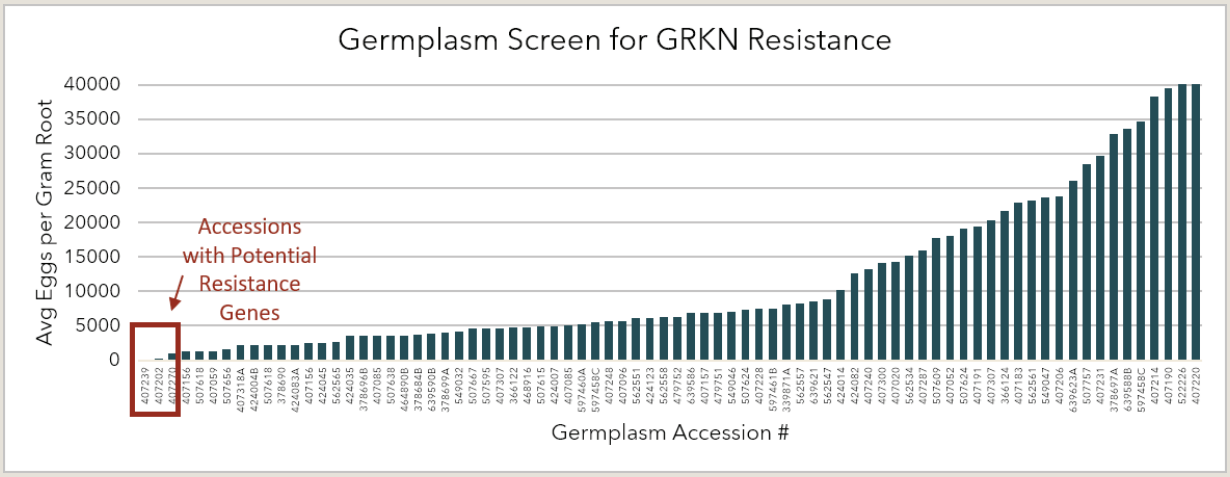
The guava root-knot nematode (GRKN, ***Meloidogyne enterolobii***) is a soilborne pest invasive to North Carolina. It is particularly aggressive and has a wide host range including soybean, cotton, tobacco, and numerous vegetables. It causes root galling, root damage, and can reduce yield.

Trials looking at nematicides in sweet potato and tobacco have shown that fumigants are the most effective way to control GRKN. However, this type of control is not feasible for soybean production given the expense associated with fumigation. Host resistance (immunity of the plant to infection) is used to control other species of root-knot nematode, such as the Southern root-knot nematode but, this host resistance is unfortunately not effective against GRKN.

The goal of this project was to look at wild soybean varieties as a place to discover new pools of host resistance to GRKN. Although these wild soybean varieties are not viable for commercial production, these wild varieties have highly diverse genetic makeup, making them a good place to look for new resistance to GRKN. If resistance to GRKN is found in a particular wild soybean line, that line could be studied further, with the goal of harnessing it and incorporating its resistance genes into commercial soybean varieties through breeding.

With funding from the NCSPA, 91 wild soybean varieties were evaluated. From these, three varieties showed significantly less root galling and lower counts of GRKN eggs per root system. The number of eggs per root system is often used as a measure of how resistant the plant is to nematodes – a lower number of eggs means stronger resistance (greater immunity).

This is a good result and we are excited by the findings. The three varieties are currently being re-tested and this information will be passed along to soybean breeders, who may use it to determine if the resistance can be included into new commercial varieties. Although we realize it does not provide short-term management recommendations, **this work lays the foundation for long-term management of GRKN in soybean by looking for genetic resistance to this troubling pest.**



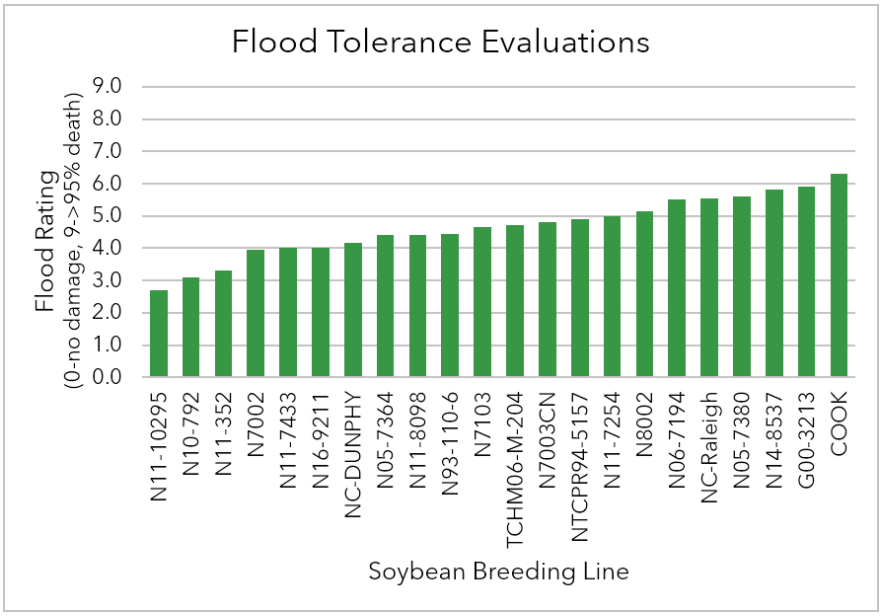
Flood Tolerant Varieties for N.C.

Ben Fallen, USDA

Soybean varieties in N.C. do not tolerate wet feet – or more precisely wet roots – very well. When farmers experience excessively wet springs and summers, especially in the eastern and northeastern part of the state, chronic wet roots cause slow grow-off, poor leaf color, and spindly plants. Getting yields greater than 45 bushels/acre under those conditions is a challenge, even when all other production aspects are perfect. New discoveries in Arkansas and Missouri, where flooding and wet feet are even more common than in North Carolina, offer hope that this problem can be overcome. Some soybean varieties have been shown to handle extra water much better than others in the field and new Mid-South varieties appear to be even better than the existing stocks.

The big question for North Carolina farmers is, "will this new Mid-South technology really show a payoff in our N.C. fields?" Given that the past three seasons have been very wet in N.C., we certainly hope so! The NCSPA is joining forces with the USDA-ARS and N.C. State University to explore the potential of this new flood tolerance technology. The outdoor laboratory for flood tolerance research in N.C. is the Tidewater Research Station. Results thus far have revealed that several breeding lines developed by the USDA Soybean Breeding program have good levels of flood tolerance.

These newly identified materials are on par and perhaps better than flood tolerant material from the Delta. Two high-yielding flood tolerant breeding lines are proposed to be released in 2021 from USDA in N.C. USDA breeding lines N11-352 and N10-792 have been identified over the past three years as high yielders in MG VII regional trials across multiple environments. These lines also appear very flood tolerant in multiple years of testing in N.C. In 2020, N10-792 and N11-352 received two of the lowest flood scores, indicating they were the most flood tolerant lines evaluated. Both breeding lines were developed through multiple cycles of breeding and selection for improved yield in the tidewater area of N.C. **Other promising lines have also been identified that when flooded for seven days can yield up to 60% of the yield when grown under non-flooded conditions.** By contrast, yields of currently available soybean varieties can be just 20-30% of the yield of when grown under non-flooded conditions.



Molecular Approaches to Combat Drought and Heat Stress

Anna Locke, USDA

Summer drought and heat are one of the primary limitations to soybean yield in N.C. and there is an expectation that future summer heat waves and drought cycles could be even more extreme than they currently are. Researchers are working to lay the groundwork now to identify genes involved in these processes, so breeders can use that information to breed more resilient soybean varieties for N.C. growers.

Two projects were funded by the NCSPA to investigate the genes involved in combating drought and heat stress. The first involves identifying genes involved in heat stress tolerance and the second focuses on seed quality responses to drought stress.

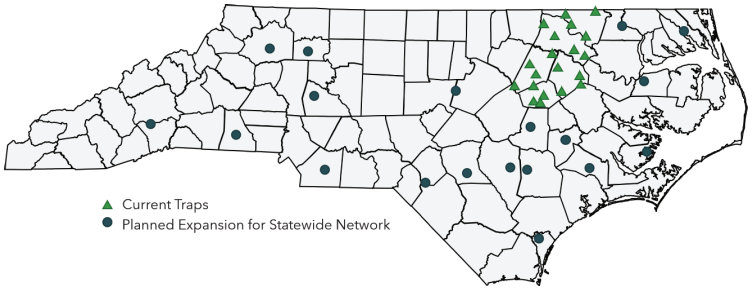
Genetic variability in soybean heat stress responses is poorly understood, and the logistical difficulties of heat stressing plants in a controlled experiment outdoors limits conventional breeding strategies for improving heat stress tolerance. In this project, **predictive modeling is being used to link molecular markers with improved heat stress responses in a variety of soybean genotypes.** The project is using data generated in growth chamber experiments as well as heated, open-air field plots. Differences in heat stress response among soybean genotypes grown in the field were measured, and these data will help identify molecular markers that can be used in soybean breeding.

Soybean varieties vary in their seed protein content and in drought responses. Drought typically lowers yield, but some varieties have more stable seed composition than others. Project two is investigating the interaction between drought responses, nitrogen metabolism, and seed protein. Most genotypes tested had increased seed protein when they experienced severe drought, suggesting **it may be possible to mitigate seed protein reduction through soybean breeding.**

Although we realize this work does not provide short-term management recommendations, this work lays the foundation for long-term solutions to combat heat and drought stress in soybeans.

Building a Smarter Pheromone Trap

Anders Huseth, NCSU



Data-driven solutions to predict pest population outbreaks are an increasingly important component of contemporary Integrated Pest Management (IPM). A prime opportunity to implement an automated solution exists with the cotton bollworm (corn earworm) in North Carolina. Cotton bollworm has been the target of black light and pheromone trapping networks across the eastern US for decades. Information generated by these networks has been communicated to growers through traditional extension meetings and digital resources (e.g., blogs, twitter, and websites). Although the information indicates corn earworm activity, the lag time between observation and data availability prohibits accurate deployment of scouting and remedial measures. Through innovative sensor design targeting corn earworm, this project takes a first step toward addressing the communication disconnect between growers and risk.

Insect pheromone traps were retrofitted to log moth catches and environmental conditions in real-time. Pheromone traps are made of two metal mesh units: a cone and a cylinder trap: the moths travel up the cone until they pass through the narrow tip, at which point they are caught in the cylindrical trap. The prototype uses an InfraRed (IR) sensor system at the cone tip to count moths as they enter the trap. Through multiple iterations of lab and semi-field testing, the first automated prototype was developed and deployed at Central Crops Research Station in Clayton. The trap automatically counted moths and was accurate within 2.5 moths of the true count. After improvements, 25 automated insect traps were built in the winter of 2019-2020. Traps were deployed throughout eastern North Carolina during the summer of 2020 to monitor corn earworm populations in space and time. Future funding from the NCSPA will allow the project to expand across the state. **Access to real-time corn earworm data will improve the management of this pest with the goal of reducing pesticide use in multiple crops.**

Corn Earworm Thresholds for Determinate & Indeterminate Soybeans

Dominic Reisig, NCSU

More soybean producers are planting indeterminate soybean varieties in North Carolina. The majority of these are planted early (prior to mid-May) and are at less of a risk for corn earworm infestation than later planting dates; however, it is possible that some of these indeterminate soybean varieties will be planted in the window where they are at risk. Although the current corn earworm threshold is based on work done with determinate soybean varieties, two years of study has given no rationale for applying a different threshold to indeterminate varieties. Additional experiments in 2021 and 2022 will hopefully bolster this finding.

As a reminder: current recommendations for treating corn earworm include:

Prior to bloom: *Threshold is 30% defoliation prior to blooms.*

Once Blooming: *Only treat earworm in blooming soybeans if they are present at the podding threshold levels and if the plants are stressed.*

Podding: *Corn earworm management is critical once there are pods on the plant. The threshold calculator can be found in the N.C. Soybeans App or on the N.C. State Soybean Extension Portal.*

**Current recommendations encourage growers to avoid chlorantranilprole products (Besiege and Prevathon) in soybeans to preserve it in cotton and to prevent increasing resistance to these products in looper populations. Instead growers should use Blackhawk, Intrepid Edge, or Steward to control corn earworms in Soybeans.*

Effect of Poultry Litter on Soybean Yield & Quality

Stephanie Kulesza, NCSU

Over the past few decades, the poultry industry has grown dramatically in N.C., which has increased the supply of poultry litter for farmers to utilize as a fertilizer source. While poultry litter has traditionally been applied to corn and/or wheat within a rotation that includes soybean, some producers are applying litter specifically for soybean production.

Unfortunately, there is little information available regarding the optimal rate of poultry litter applied directly before soybean. Because of this knowledge gap, the NCSPA funded a study which aims to determine the optimum application rate for poultry litter prior to soybean to help farmers maximize yield while minimizing the potential for nutrient accumulation and/or nutrient loss to the environment.

Poultry litter is a great source of macro and micronutrients for soybean production. **The use of poultry litter as a nitrogen source produced yields comparable to that of inorganic fertilizer.** While higher nitrogen in the biomass of soybean was found as nitrogen rate was increased, this did not correlate with yield. In fact, we saw a slight decrease in yield with increasing inorganic nitrogen rates at two locations. More research is needed to fully investigate the optimal rates of poultry litter in soybeans.

Recalibration of Phosphorus and Potassium Recommendations for High-Yielding Soybeans in North Carolina

Luke Gatiboni, NCSU

High-yielding soybeans fields – those producing more than 60 bu/ac – require excellent management and are exporting more nutrients than average-yielding fields. There is uncertainty if the current recommendations of phosphorus (P) and potassium (K) fertilizers for North Carolina are adequate for high-yielding fields. We applied rates of P and K on two on-farm, high-yielding soybean fields and on three long-term trials at research stations in North Carolina. Three out of five trials yielded more than 60 bu/acre and the results showed that there was no response of soybean to P and K fertilization when the P-I and K-I index were greater than 50. **This means the current recommendations presented in the "Crop Fertilization Manual" are adequate even for high-yielding fields.** Our producers can keep using the current fertilizer recommendations, even in high-yielding fields, and they will not run short of nutrients. The results of this project will help farmers avoid unnecessary application of fertilizers, cut costs, and increase their profits.

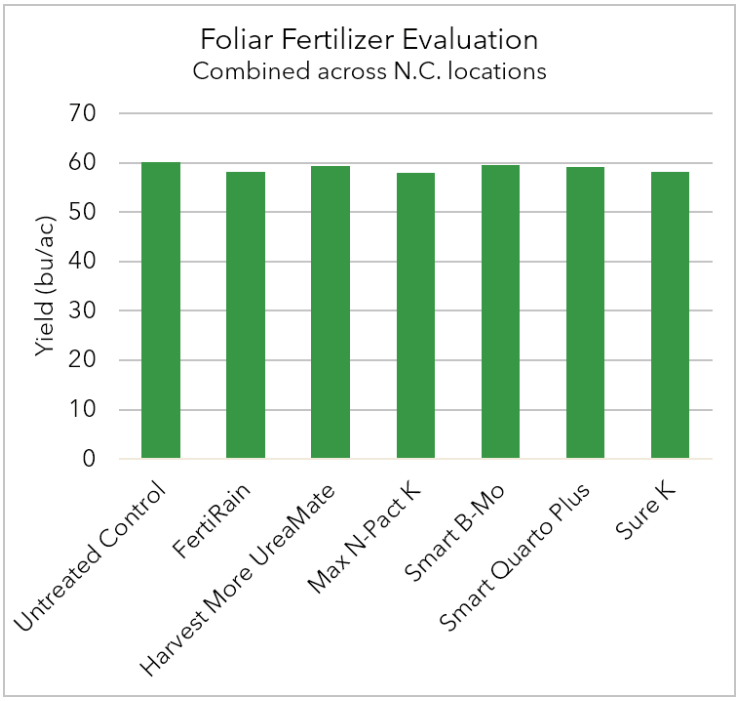
Determining Yield Impact from Foliar Feeding

Rachel Vann, NCSU

Many soybean growers are interested in the use of foliar fertilizers and multitudes of products are marketed to growers. Growers often use these products while applying fungicides and/or insecticides during early soybean reproductive development. However, with low profit margins, the effect of foliar fertilizers on soybean yield and economic return is important to understand.

Several commonly recommended foliar fertilizer products across the United States were evaluated to determine their impact on yield applied at soybean growth stage R3 (beginning pod). All products were applied at this timing based on common fungicide and/or insecticide application timing where these products are often co-applied.

Research has now been conducted over two years (2019 and 2020) at seven North Carolina locations and 46 locations across the United States. Based on this data, generated across the United States capturing many yield environments, no impact on soybean yield of the evaluated foliar fertilizer products applied was observed. In fact, when data was pooled across the seven environments tested in N.C., the untreated control actually yielded more than any of the treatments with foliar fertilizers. **Without an impact on soybean yield from these products, the likelihood of a consistent on-farm ROI from investing in these products is unlikely.** We would recommend growers invest in soybean management areas that have been proven to have a consistent impact on yield.



Product	Nutrients Supplied	Application Rate
FertiRain	N,P,K,S,Mn,Fe,Zn	3 gal/ac
SureK	N,P,K	3 gal/ac
HarvestMore Ureamate	N,S,B,Mn,Zn	2.5 lbs/ac
Samrt B-Mo	B,Mo	1 pt/ac
Smart Quarto Plus	S,B,Mo,Mn,Zn	1 qt/ac
Maximum NPact K	N,K	1.5 gal/ac
Untreated	--	--

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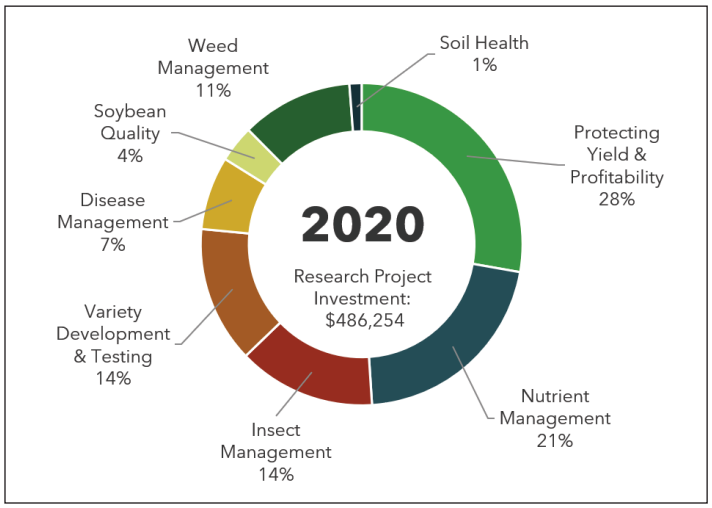

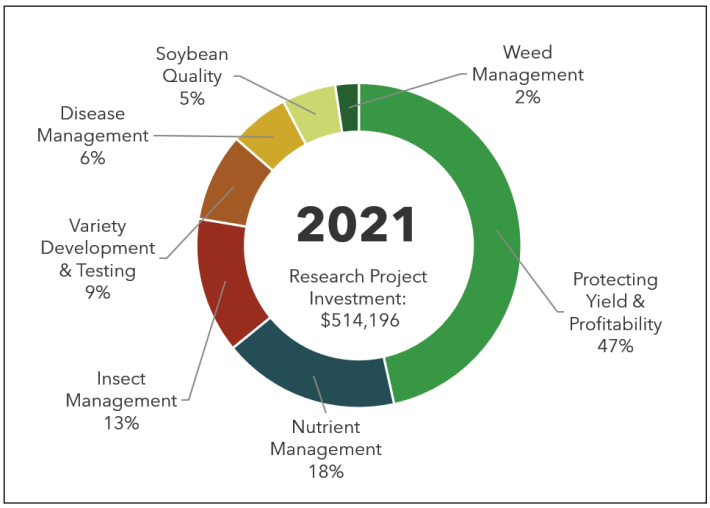

For more information about this research and other projects funded by your soybean checkoff dollars, visit **ncsoy.org**.