

2018 **RESEARCH REPORT**

PROTECTING YIELD & PROFITS

VARIETY DEVELOPMENT & TESTING

NUTRIENT MANAGEMENT

PEST MANAGEMENT





“So how exactly do my checkoff dollars get used?”

That's a question that is expressed from time to time and one that has multiple answers. The board members and staff of the North Carolina Soybean Producers Association (NCSPA) work hard to invest those funds wisely. One key investment is our commitment to research and best management practices.



Did you know that the NCSPA is the only North Carolina commodity organization with a full-time research coordinator? We are fortunate to have such a valuable resource available to our farmers, and your association has invested time, effort and funding into a growing and effective research program.

Our annual Research Report is a compilation of over 20 different completed and on-going research projects that have been undertaken across the state. Each article presents a quick summary of the efforts of university researchers, consultants and staff funded through the checkoff.

This report is just one example of how your association is working to provide timely, relevant and useful tools. In early 2018, we released our first ever Production Guide and that has proven to be a tremendous resource for our farmers. Be sure and get your copy at your local extension office. Or you can download the pdf or e-book version from our ncsoy.org website. You can also sign up to receive our bi-weekly “News Round-Up” email. Follow us on Facebook and Instagram for even more resources.

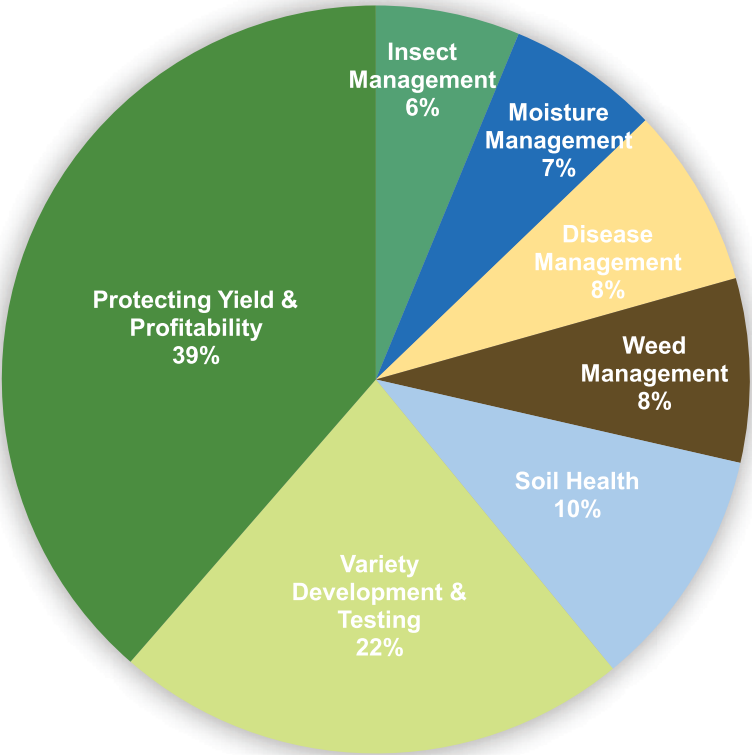
Whether it's through research, outreach or marketing, your checkoff dollars are utilized in ways designed to improve productivity, reduce expenses, increase yields, expand markets and educate the public about the importance of agriculture. For more information or if you have ideas on where and how your research dollars could be utilized, please contact the NCSPA at 919-839-5700 or reach out to Dr. Katherine Drake Stowe at kdstowe@ncsoy.org.

Thank you for your support! We hope this farming season is a successful one for you and your family.

John Fleming
President

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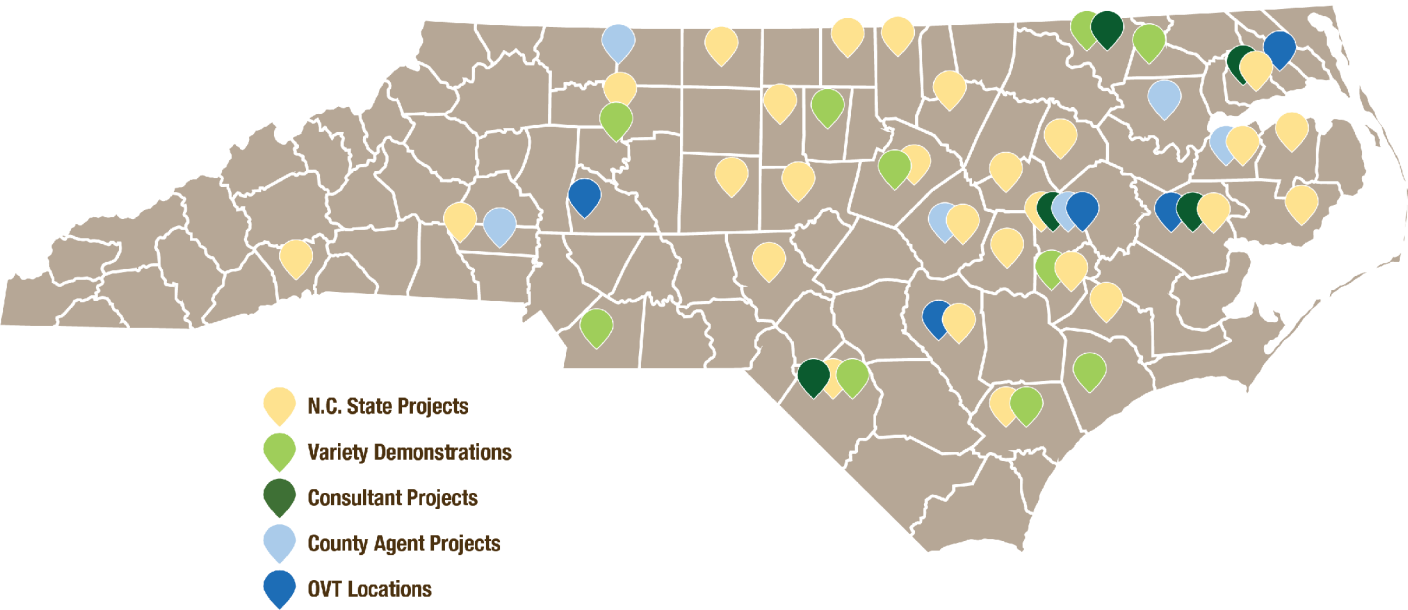


The North Carolina Soybean Producers Association invests in production research through N.C. State University, other universities, private consultants and local extension agents to address the most pressing issues in N.C. soybean production. The goal of these projects is to get growers the information they need to help them make the best decisions for their farm operations. The vast majority of public soybean research conducted in N.C. is funded by the NCSPA and is the biggest investment of checkoff funds.

The Association invests in projects researching a variety of topics shown in the chart to the left and broken out by the percentage they represent of the overall investment.

In addition to funding projects that cover a variety of topics, the NCSPA strives to sponsor projects that are geographically distributed throughout the state. This ensures N.C. soybean producers' production issues are addressed, whether they farm in the rich soils of

the Blacklands, the sandy soils of the Coastal Plains or the clay of the Piedmont. Below is a map of where the projects covered in this report were located in the summer of 2017. Many projects include demonstrations specifically for growers and visits are welcomed and encouraged. For a list of 2018 project locations, email Katherine Drake Stowe at kdstowe@ncsoy.org or call 919-839-5700.





PROTECTING YIELD & PROFITS

Foliar Yield Enhancements

J. Dunphy, NCSU Crop & Soil Sciences Dept.

North Carolina's soybean farmers are presented a variety of products that claim to improve soybean yields and profits. For several years, the NCSPA has utilized checkoff funding to evaluate the efficacy of these products with N.C. State University Extension. Having an unbiased and trusted source evaluate the efficacy of such products is essential to making decisions about what products, if any, should be added to a farm operation.

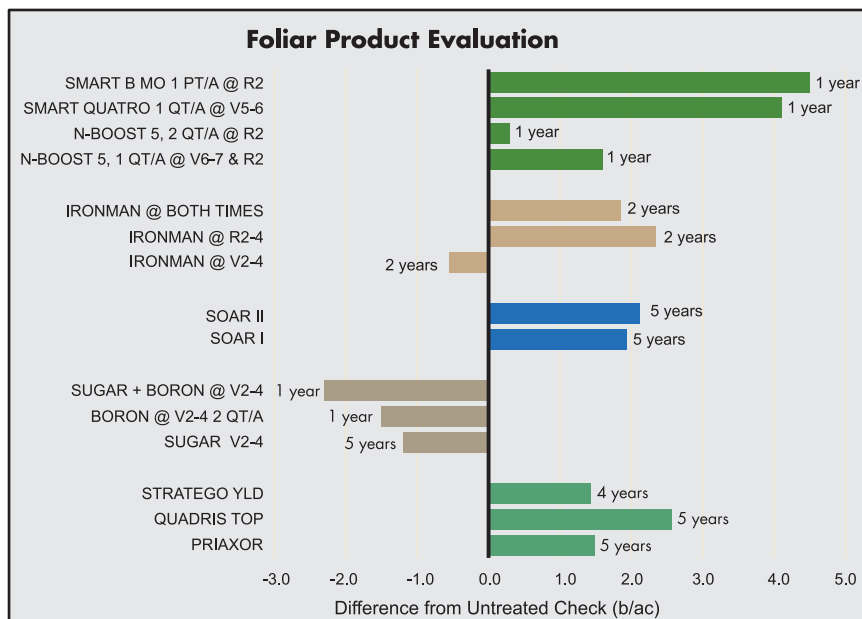
Fungicides and products containing macro- or micronutrients were evaluated in 2017. Since the test has been carried out for many years, various products have been tested a different number of times. The number of times a product has been evaluated is included in the graph to the right. Confidence in the results increases the more times and environments a product has been tested.

All three fungicides tested at full bloom (R2) showed yield increases when averaged over five years of testing. This suggests disease organisms were present near the time of application in many environments tested. There was also a **positive yield increase for the two Soar micronutrient/biological products and the Ironman foliar fertilizer when applied at full bloom (R2).** Four other treatments tested for the first time in 2017 showed a positive response. N-Boost, a foliar N product, performed best when applied in a split application at V6 and R2. Both Smart Quatro, a micronutrient product, applied at V6, and Smart B-Mo,

boron & molybdenum, applied at R2 showed significant yield increases.

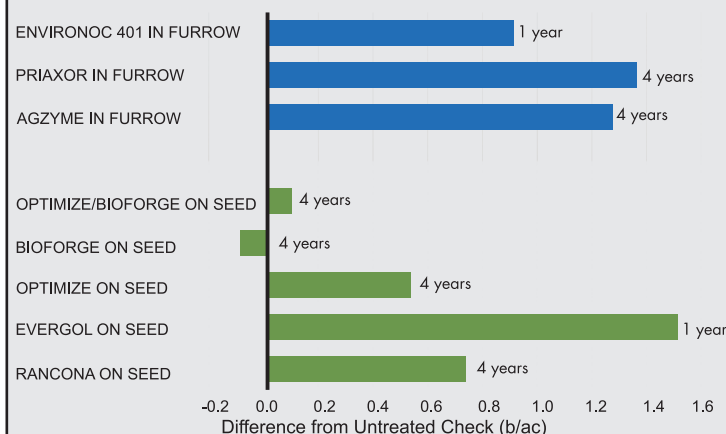
Averaged over five years, **a yield decrease was observed with the addition of sugar at early vegetative stages.** There was also a decrease in yield when Boron was applied at V2 alone or in combination with sugar, but this is based on only one year of testing.

When considering adding inputs to a management program it is essential to look at not only the potential yield increase but also to consider the potential return. The cost of the product as well as the cost of application should be taken into account when deciding which products to use.





Non-Foliar Product Evaluation



Non-Foliar Yield Enhancements

J. Dunphy, NCSU Crop & Soil Sciences Dept.

In addition to foliar products, there are also a number of non-foliar products available to N.C. soybean growers that claim to enhance yields. The association conducted research to evaluate these products through N.C. State Extension as well, including seed treatments and in-furrow treatments.

All three in-furrow products showed a small yield increase.

Priaxor, a fungicide, and Agzyme, a micronutrient, have consistently shown small yield increases over four years of testing.

Environoc 401, a biological, showed promise its first year of testing.

The seed treatments tested with mixed results.

Over four years of testing Bioforge, a nutrient supplement, and Optimize, an inoculant, used alone or in combine, have not shown significant yield increases. The fungicide seed treatments Rancona and Evergol showed a small yield increase, but Evergol should be tested further to confirm year one results. Based on historical data it is difficult to prove the value of a seed treatment, in part because it's difficult to quantify the level of disease and other pests in a field. While seed treatments have proven useful in some situations, they only work if the problem they solve exists.

Having an unbiased and trusted source evaluate the efficacy of products is essential to giving growers information they need to make decisions about what products, if any, should be added to an operation.

Uniformity of Emergence

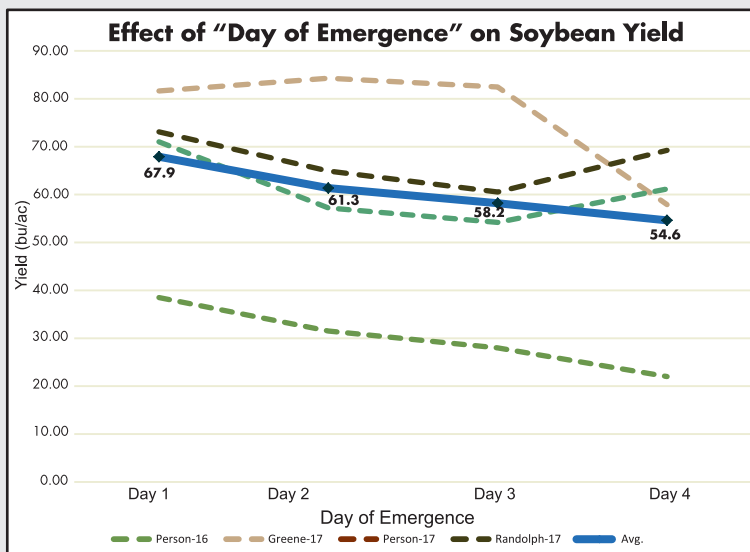
J. Dunphy, NCSU Crop & Soil Sciences Dept.

Planting season is a big deal for farmers. The decisions made during this time period determine yield potential. Dr. Ron Heiniger has shared how important uniform emergence is for corn yield. He recommends getting all corn plants to emerge within the first 24 hours as plants that emerge one or two days later have lower yields.

This raises the question of whether uniformity of emergence is important to maximize soybean yields too. We know soybeans typically emerge over a period of several days, but little is known about whether the seedlings that emerge later are as productive as those that emerge the first day. The North Carolina Soybean Producers Association funded a research project through the soybean checkoff on seedling emergence to find out.

In the project, seedlings were flagged with the day they emerged over a four-day period. Seed produced on individual plants was collected and weighed, and that was converted to an estimated yield, assuming 135,000 plants per acre. There is currently limited data from one location in 2016 and three locations in 2017, **but initial results show that uniformity of emergence may be as important for soybean yields as for corn.**

When averaged over four locations, **there was a 13 bushel per acre difference in plants that emerged the first day versus four days later, which would result in a 20% increase in yield.** Further research will be done to confirm these results and investigate practices that help ensure uniform emergence.

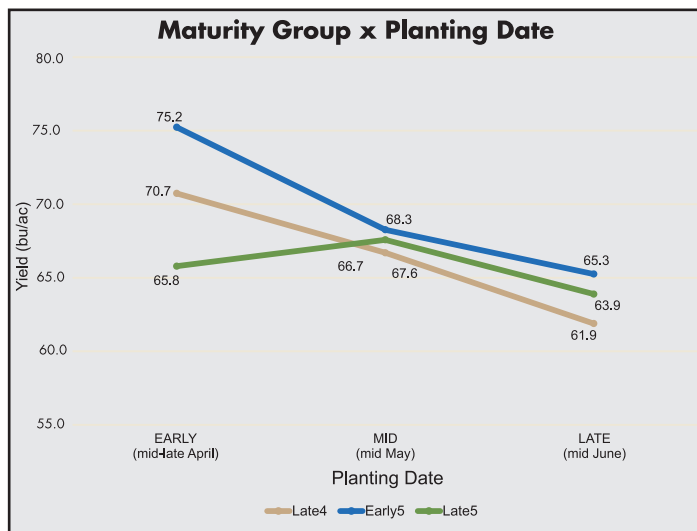




PROTECTING YIELD & PROFITS

Maturity Group Planting Date Interaction

Tidewater Agronomics, Fowler Crop Consulting, McLawhorn Crop Services, Protech Advisory Services and Impact Agronomics



How can soybean producers improve yields on modern soybean varieties? One way may be to alter traditional planting dates and maturity groups. Planting date and variety selection play a major role in determining yield potential in any given year. Many growers have experimented with varieties of different maturity groups and earlier planting dates but still have questions. To start to answer these, the NCSPA sponsored research with a group of crop consultants to evaluate the impact of planting date and maturity group on yield and to determine if planting earlier maturing varieties during the early portion of the planting window could help N.C. growers increase yield.

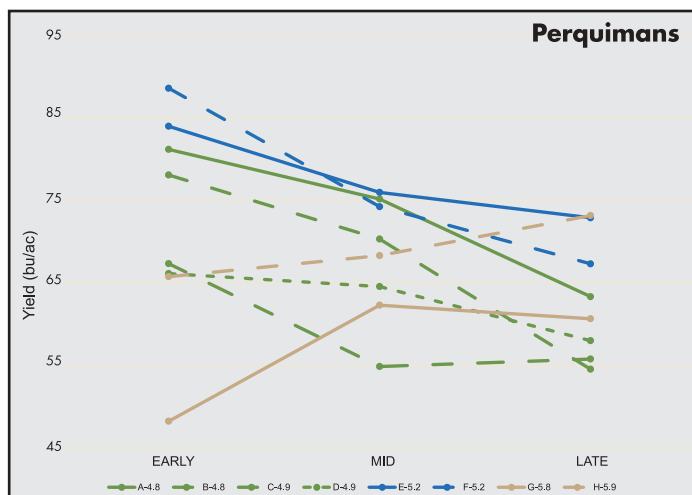
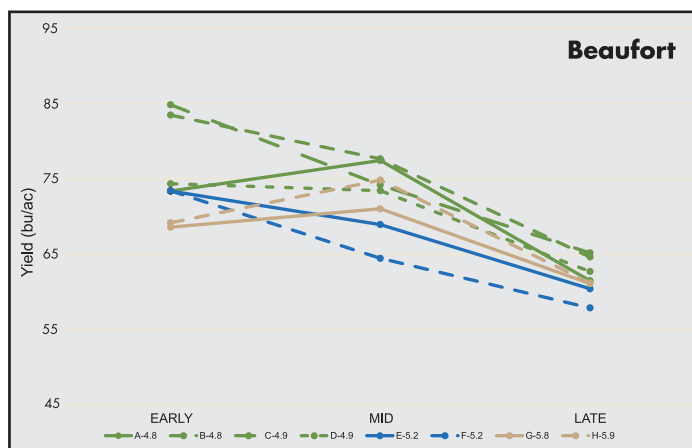
Eight different varieties were selected using results from the 2016 N.C. OVT. High-yielding varieties of eight brands were chosen. This included four "late IV" varieties, two with a 4.8 relative maturity (RM) and two with a 4.9 RM, two "early V" varieties with 5.2 RM and two "late V" varieties with 5.8 and 5.9 RM. The varieties were evaluated at three planting dates. The "early" date was mid- to late April with an average date of Apr. 23, the "mid" date was mid-May with an average date of May 18 and the "late" date was mid-June with an average date of June 17.

When data was combined and analyzed across four locations, results showed a significant impact from planting date in favor of early planting compared to late planting, specifically for the late IV and early V varieties. **Planting in April for the late IV and early V varieties increased yield nearly five bu/ac on average** compared to mid-May and nearly 10 bu/ac compared to mid-June. **For the late V varieties, planting date caused no significant yield response.** Also, the early

V varieties yielded the highest across all planting dates in this combined analysis.

While strong yield increases from planting early were evident when the data was combined from all locations, there are obvious differences between the Tidewater and Coastal Plain locations. A strong planting date effect was observed in the Tidewater region. In Perquimans and Beaufort, early planting tended to increase yield regardless of variety, except for the late V varieties. Yield of the late V varieties was better when planting date was mid-May versus mid-April.

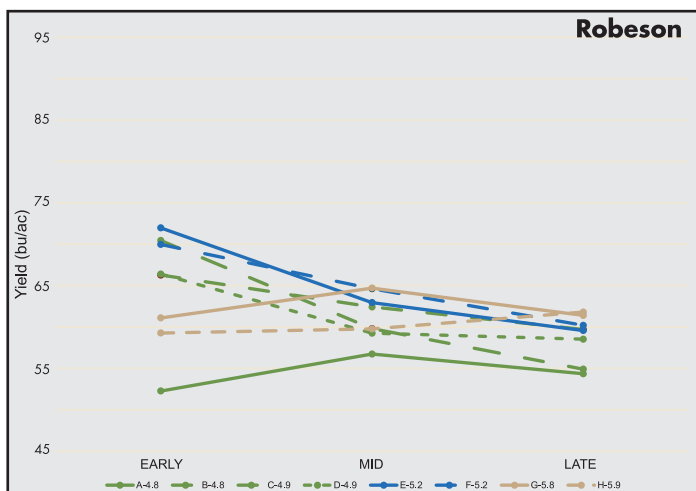
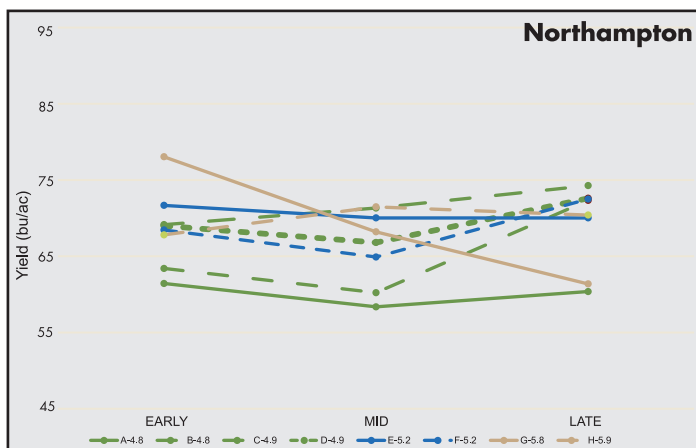
In the Coastal Plain region, planting date did not have as predictable or as strong of an effect on yield. At Robeson, early planting was favored in five out of eight varieties. A strong planting date response favoring early planting was observed in the late IV and early V varieties. In contrast, yields of soybeans in the late V group were strong, but not impacted by planting date. At Northampton, yields were





not strongly correlated with planting date, where in five out of the eight varieties tested planting date had no influence on yield.

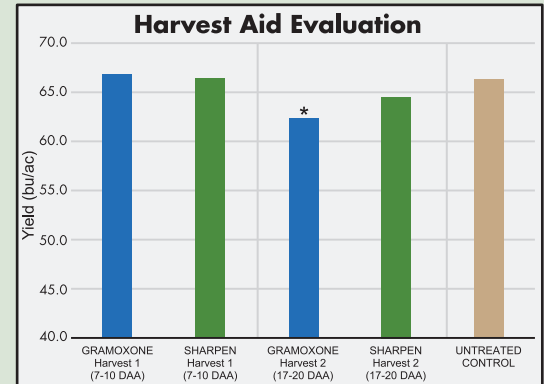
This data **demonstrates there is no “one size fits all” approach to selecting maturity groups and planting dates for N.C. soybean growers.** What works on one farm may not work on the next. In addition to yield, there are a number of other factors to consider when determining planting dates, with one of the most important being whether there is enough time to cut the beans when they reach maturity. In this test, the early planted beans reached maturity in mid- to late September. Earlier maturing varieties will not hold long in the field and must be harvested when they are ready. If timing is not an issue, transitioning some acres to an earlier planting date may be worth consideration. One advantage is risk mitigation. Staggering planting dates may help avoid the impact of drought, heavy rain events or hurricanes on one group that may hit another and also spreads out the harvest window.



Harvest Aids

Tidewater Agronomics, Fowler Crop Consulting, McLawhorn Crop Services, Protech Advisory Services and Impact Agronomics

With the unpredictable threat of tropical weather and the pressures of harvesting large acreage, the question of whether or not to use



chemical application to hasten maturity often arises in N.C. soybean production. Several factors need to be considered when deciding whether the application of a harvest aid makes sense, including avoiding grain loss due to shattering or seed quality decline, pre-harvest intervals and harvestability due to green stem. With funding from the checkoff, a study was conducted to determine the influence of harvest aid application and harvest timing on soybean yield.

Two herbicides, Gramoxone (paraquat) and Sharpen, (saflufenacil) were applied at labeled rates and timings. Soybeans were harvested at 7 to 10 (Harvest 1) and 17 to 20 (Harvest 2) days after application. These desiccants were applied when 70% of the seeds had reached physiological maturity. An untreated check was harvested at the standard commercial harvest time.

The only treatment that resulted in a significant yield loss when compared to the untreated control was harvesting 17 to 20 days after application of Gramoxone. Overall, soybean yields were better at Harvest 1 with either product. Application of Gramoxone resulted in lower green stem levels at both harvest intervals compared to Sharpen, indicating it takes more time for plots treated with Sharpen to reach optimal harvestability.

These results demonstrate **the use of harvest aid products for desiccation can expedite harvest in a way that allows farmers to achieve optimal yields at adequate moisture while harvesting their crop substantially earlier.** In this study, yields equal to the untreated check were attained while harvesting 14-24 days ahead of a normal harvest time, which could be the difference in avoiding a devastating weather event. Although Gramoxone performed best in this study when applied 7 to 10 days before harvest, the NCSPA supports following the 15-day PHI mandated by the label.



PROTECTING YIELD & PROFITS

Maximum Dryland Yield

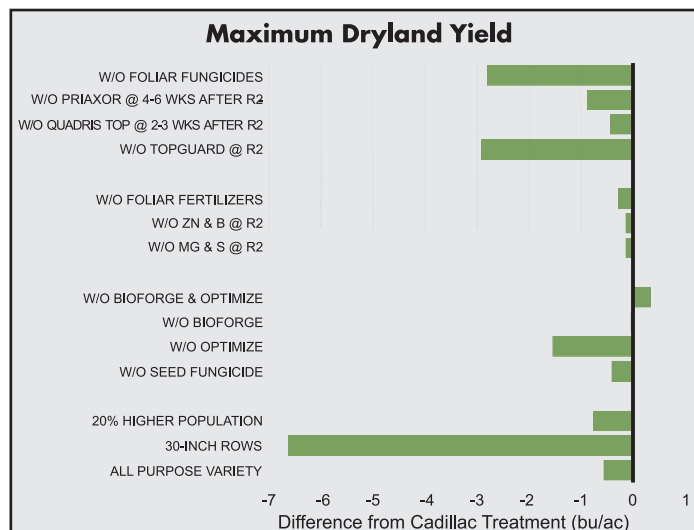
J. Dunphy, NCSU Crop & Soil Sciences Dept.

In order to increase soybean yields in North Carolina, growers must be willing to change the way they manage the crop. For many years soybeans have not been as intensively managed as other crops in N.C., but growers who commit to an intensive systems-approach management style are rewarded with higher yields. To determine which practices and products will result in the greatest yield increases, the NCSU funded research known as the "Cadillac" test through the checkoff.

This research includes a "Cadillac" maximum yield treatment which includes many different inputs (see "Cadillac Treatment" Table). Inputs are then subtracted one at a time to determine the influence of a product or practice in a relatively high-yield, non-irrigated environment. 2017 was the third year of this test, over which time a few practices and products have consistently shown an impact. The **biggest yield impact came from decreasing row spacing, with 15-inch rows yielding over six bu/ac more than 30-inch rows.**

The **next greatest impact on yield was from a foliar fungicide applied at full bloom (R2).** In this test the fungicide was Top Guard, but whether that response is due to TopGuard or the application of any fungicide at full bloom could not be determined from this data. Based on data from the Foliar Yield Enhancement study where the increase was similar regardless of fungicide brand, it is likely most fungicides would provide a yield increase if disease is present.

In the "maximum yield" situation, the Optimize seed treatment, an inoculant, seemed to have a greater impact than it did in other studies. The Cadillac **treatment with Optimize yielded 2.6 bu/ac more than the treatment without Optimize.** This is in contrast to other



recent research with Optimize, which resulted in a small positive impact of less than one bu/ac.

Increasing the population by 20% resulted in a negligible impact on yield of less than one bu/ac, **indicating growers can save money by reducing seed populations to 120,000 seed/ac or lower.** No other treatment tested changed yields by as much as one bu/ac.

Cadillac Treatment
"Contest" Variety (Group 5 or 6)
15-in rows
90K - 120K seed/acre
Fungicide Seed Treatment
Optimize Seed Inoculant
Bio-Forge on Seed
Foliar Fertilizers (N,S,K in 2016; Mg,S,Zn,B in 2017)
TopGuard @R2
Quadris Top @ 2-3 wks after R2
Priaxor @ 4-6 wks after R2

Adopting even one of the proven practices may result in yield increases or cost savings.





Increasing Profits for Mid-Atlantic Double Crop Soybeans

D. Holshouser, Virginia Tech University

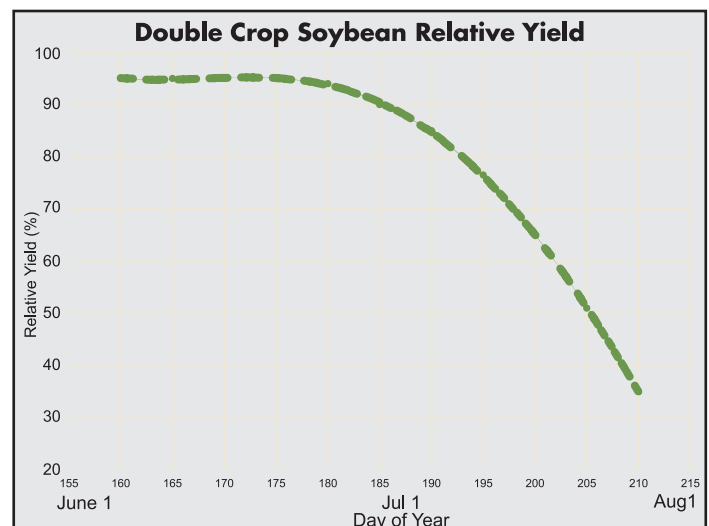
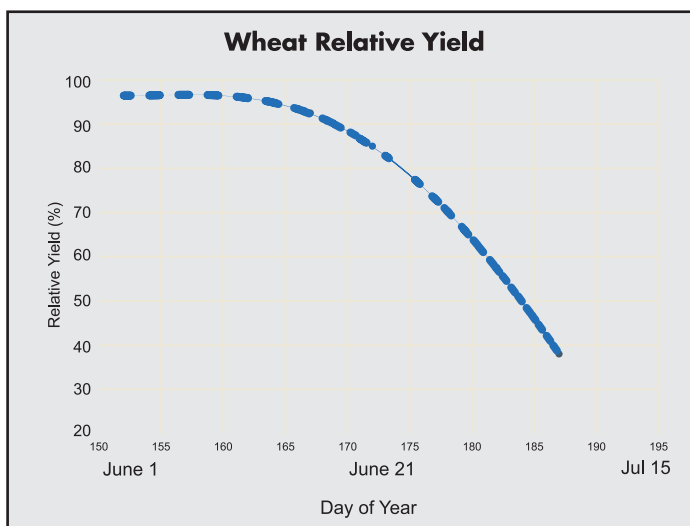
Soybean following winter wheat is the most prevalent double-cropping system in the United States. Double cropping may increase profit, spread out cash flow, ensure global food security by increasing food production and provide environmental benefits via continuous land cover. However, soybean yields less in double-cropping than full-season production systems due to delayed planting. This is largely due to the shorter amount of time for the plant to accumulate sufficient leaf area for maximum yield. To help determine ways to improve yields in a double-crop system, the Association helped fund research across five Mid-Atlantic states to evaluate practices that would lead to earlier small grain harvest without adverse effects on yield and allow for an earlier planting date for double-crop soybeans.



Treatments consisted of five wheat harvest and soybean planting dates beginning when wheat seed moisture approaches 20%. Within each of these treatments, six soybean varieties representing three relative maturities were evaluated.

Wheat yield, test weight and falling number all decreased significantly as harvest was delayed. **Double-crop soybean yield decreased as planting was delayed from early June to late July.** Wheat yield loss with delayed harvest was due mainly to test weight loss. Soybean yield loss with delayed planting was due mainly to the lack of time to develop an optimum leaf area index of 4.0 by the R3 stage to maximize solar radiation interception.

Planting soybean early following high-moisture wheat harvest looks to be a promising management practice for increasing double-crop soybean yield. Furthermore, early wheat harvest resulted in greater wheat yields and quality. But costs may increase, especially if specialized drying is needed. Future efforts will focus on an economic analysis and beginning a discussion with grain buyers to encourage them to purchase high-moisture wheat without dockage.





VARIETY DEVELOPMENT & TESTING

Breeding for Double Crop Varieties

T. Carter, USDA

Double-cropped soybeans account for over 40% of North Carolina's crop. Planted after wheat, double-cropped soybeans must make their yield in a growing season that is too short and with a leaf area that is too small to allow maximum yields. Over the past 35 years southern soybean breeders have tried to rectify this problem by developing varieties specifically adapted to double crop production, but these attempts have all ended in failure.

Although double-cropped breeding was at a standstill in the south, new developments in the USDA soybean breeding program at N.C. State provide hope for boosting yield of double-crop beans. New genetics from Asia have been identified that produce a plant canopy faster than locally adapted varieties and the checkoff funded research to investigate these fast canopy-closure types. It was found that **some of these lines capture more sunlight early in the season and produce a better plant factory, which is needed for higher yields.** The superior lines will be studied further and used to breed lines that will ultimately help growers increase yields when soybean is planted behind wheat.



Breeding for Flood-Tolerant Varieties

T. Carter, 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 bu/ac under those conditions is a challenge even when all other production aspects are ideal. New discoveries in Arkansas and Missouri, where flooding and wet feet are even more common than in N.C., create hope this problem can be overcome. Some soybean varieties have been shown to handle extra water much better than others in the field. The big question for N.C. farmers is will the new Mid-South technology show a payoff in N.C. fields? The NCSPA funded research with the USDA-ARS and N.C. State University to explore the potential of these new flood-tolerant lines. Lines were evaluated at the Tidewater Research Station in Plymouth by flooding 'bermed' blocks with irrigation.



Preliminary data analysis over years revealed significant differences in flooding tolerance among genotypes.

The positive overall results suggest that some of the genetic materials identified as flood-tolerant in the Delta region may be adapted to flooding in N.C. Surprisingly, some N.C.-derived materials also appeared flood tolerant, especially new releases N.C.-Dunphy and slow-wilting USDA N8002. This research provides promising leads regarding flood tolerance in N.C. and sets the stage for initiation of a breeding program in this area.

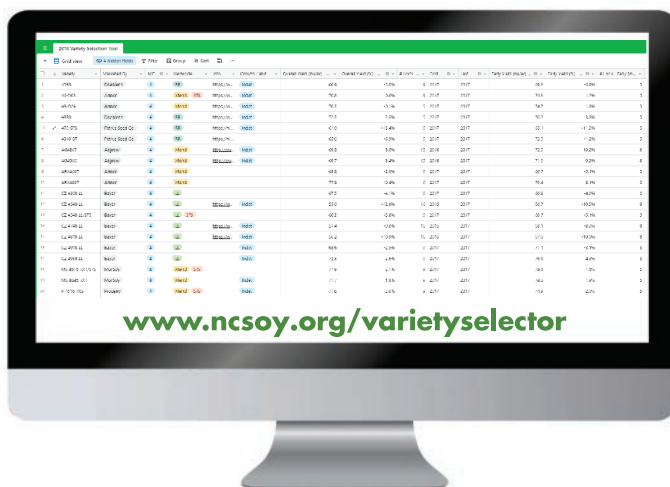
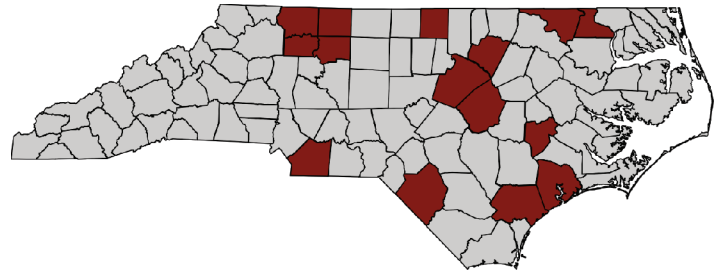


Variety Selection

K. Drake Stowe, NCSPA

Proper variety selection is one of the most important things a soybean producer can do to ensure a successful crop. Comparing the top 10% of soybean varieties grown within a single maturity group at a single location in the OVT to the bottom 10%, there can be as much as a 15 bu/ac difference in yield. Therefore, selecting the right variety for the right environment is essential. But, with more than 200 soybean varieties available to N.C. growers, this can be an overwhelming decision.

Locations of 2017 Variety Demonstrations



To help make this job easier, the NCSPA has developed a **Soybean Variety Selector Database Tool**. The database can be found at www.ncsoy.org. Data was collected from the N.C. OVT (2012-2017) and can be filtered by maturity group, herbicide technology, disease resistance and more.

The checkoff also funded variety demonstrations across 12 different counties where 15 of the more promising varieties available on the market were displayed. **These demonstrations allowed growers to compare different varieties in the field versus on paper.** These tools should help growers to select the best variety for their fields.

Commercial Varieties Screen for Drought Resistance

T. Rufty, NCSU Crop & Soil Sciences Dept.

Summer drought and heat have always been among the top barriers to profitable soybeans in the U.S. and there is an expectation that future summer heat waves and drought cycles will be even more extreme than they are now. Soybean varieties in the U.S. have generally been reported to be drought- and heat-sensitive. Consequently, intermittent and/or terminal droughts can severely reduce yields of soybeans. This is evident in N.C., where yields are often below 35 bu/ac. Because irrigation is not a viable option, the development of drought-tolerant soybean varieties will be necessary for sustainable soybean production in N.C.

The N.C. State University and USDA-ARS soybean breeding programs have developed soybean breeding varieties that are relatively drought-tolerant. This was made possible due to the identification of complex traits, particularly the "slow-wilting" trait, found in those breeding programs' soybean material. In order for these gains to be realized in farmers' fields, these traits will need to be integrated with commercial cultivars. Assessing the current commercial germplasm will be a critical step in this endeavor, so the NCSPA funded work in conjunction with N.C. State, USDA, companies and N.C. OVT to **evaluate 158 commercial soybean cultivars for tolerance to drought**. The research was conducted at the Sandhills Research Station in 2017. The **results are being prepared to post on the N.C. OVT website**. This is one of the first steps in reducing the impact of drought and heat stress on soybean production in N.C.

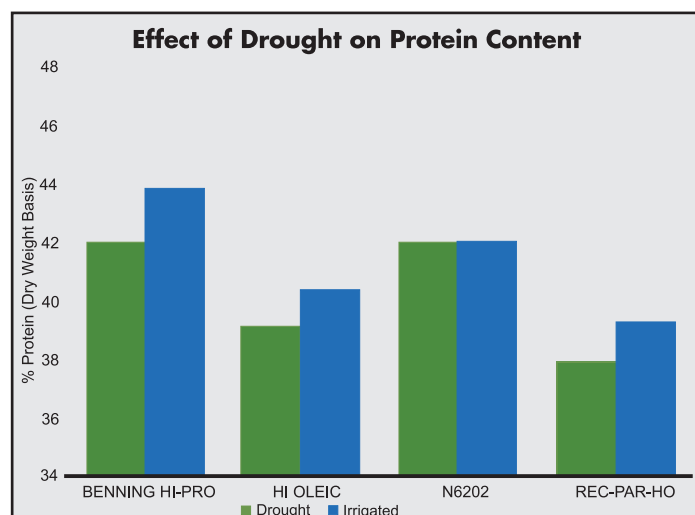
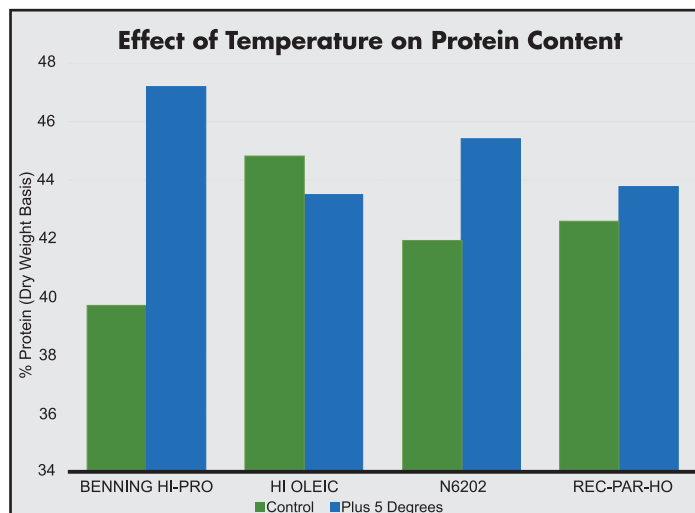


Seed Composition Stability Under Stress

A. Locke, NCDA

The top consumer of soybeans is animal agriculture, meaning soybean meal drives the price of soybeans. That price is directly impacted by the downstream value of soybean meal to livestock and poultry feeders. **Soybean meal boasts an outstanding package of protein, amino acids and energy, but competition from synthetic amino acids and other protein sources is a real threat.** Soybean end users are increasingly seeking specific seed compositions. This means growers are likely to choose varieties with final seed composition in mind in the future. Although seed composition is largely determined by plant genetics, environmental factors can also play a significant role. To ensure profitability, growers need to be able to depend on high-quality seed composition, regardless of the weather during the growing season.

The NCSA funded a project to evaluate the dependability of both high-protein and high-oleic varieties under temperature and drought stress. Various soybean varieties were tested under simulated drought at the Sandhills Research Station and under high temperatures in artificial growth chambers. The results of these studies **suggest that drought and temperature responses in seed composition vary among genotypes, and genetic improvements could be made to stabilize seed composition under weather stress.** The work will continue over the next few years, with the goal of identifying genotypes that can be used to breed for stable seed composition and a better understanding of the physiological process related to seed composition responses to stress.





Cover Crop Study

J. Heitman, NCSU Crop and Soil Sciences Dept.

Conservation tillage and cover cropping are commonly considered to be among the most important aspects of soil health management. Cover crops may be beneficial in increasing soil health by increasing organic matter and nutrient cycling by biological processes. However, regional variation in soil properties and local climates may affect the impacts of using cover crops and it is not clear how long it takes for improvements to be measurable. To start to evaluate the benefit of introducing cover crops into a production system, the NCSPA helped fund a study of long-term corn-soybean rotation under nine different tillage treatments. In the first two years of the study, cover crop biomass was not different between tillage systems. Soil properties and crop yields will be analyzed as the study progresses.

This research will **help growers understand the potential benefits of adding cover cropping to a range of tillage systems for corn and soybean production in the N.C. Piedmont.**



Validation of Soil Test Potassium Recommendations

D. Hardy, NCDA

Potassium (K) deficiency is the most prominent nutrient deficiency in plant tissue samples analyzed by the NCDA&CS and 40% of soil samples submitted are medium to very low for K (KI = 0-50). If recommendations are followed, K fertilizer costs can be a significant part of growers' annual operating expenses at about 20%. However, if K is under-applied and is limited, seed yields are decreased from 5-20%. Two decades have passed since soybean K needs were researched in N.C. In that time, yields have increased and practices have changed. The NCSPA funded a project to evaluate current soil test K recommendations and plant tissue testing sufficiency ranges to ensure N.C. growers receive the best information for cost-effective production and competitive yields.



Photo Credit: Bobby Golden, Mississippi State University

Sites of varying K levels were selected under conventional and no-till production systems to evaluate applications of muriate of potash (MOP) ranging from zero to 200 pounds per acre. The study was conducted over two years and so far, **no yield response to K was found at any site in spite of the fact that some sites were sufficiently low enough to warrant potash recommendations.** Also, **no yield response occurred in plots where tissue samples of plants at early growth or R2 indicated K levels below sufficiency.** However, the addition of 50 pounds of K_2O brought tissue sample levels in those plots up to sufficiency. This study supports the idea **that soil test recommendations appear to be adequate for a range of yield conditions as related to soil types commonly found in N.C.** Further research will be conducted in 2018 to confirm these findings.



Chemical Management of Nematodes in Soybeans

L. Thiessen, NCSU Entomology and Plant Pathology Dept.

Soybean Cyst Nematode (SCN) and Root Knot Nematode (RKN) cause damage to soybeans throughout N.C. Resistance is available for several races of SCN, however there is minimal resistance for races 2, 4 and 5, which are dominant in N.C. Host resistance is also available for some RKN species, but this is primarily only available for Southern RKN. Crop rotation is the best control method for managing nematode populations, but some regions of N.C. lack economical options for crop rotation.

Several chemical and biological products have recently been introduced, but their efficacy under different environmental conditions has not yet been established.

The NCSPA funded research to begin to evaluate some of these products. Seed treatments were assessed in Johnston and Hyde counties. **Seed treatments did not improve yields at either site, nor were nematode populations or damages reduced by the seed treatments.** This study will be repeated in 2018 on several other sites and will include in-furrow/drench applications that may improve the efficacy of chemicals applied.



Aboveground symptoms, largely stunting of plants, associated with nematode infestation in an untreated plot.



Severe galling of roots was observed in all treatments in the Engelhard, NC test site.



Symptoms of FLS



Frogeye Leaf Spot Resistance

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Frogeye leaf spot (FLS) is a fungus that can affect the leaves, seed, pods and stems of soybeans. It is estimated FLS reduced yields in N.C. by 560,000 bushels or approximately one percent in 2014, and in susceptible cultivars yields may be reduced by as much as 30%. The best control is achieved with fungicide mixes containing strobilurins (QoI's – group 11) and triazoles/imidazoles (DMI's – group 3). Resistance to strobilurin fungicides has been confirmed in several states in the Southeast U.S., but the extent of fungicide-resistant populations of FLS has not been assessed in N.C. Through the checkoff, the NCSPA funded research to assess the level of fungicide resistance in FLS in N.C. Isolates were collected from nine N.C. counties and it was found that **resistance was present in FLS populations in all counties tested, suggesting FLS resistance is prevalent across much of the state.** To avoid control failures, producers should **select fungicides that utilize multiple modes of action.** This work will continue in 2018 to better understand the resistance mechanisms in this system.

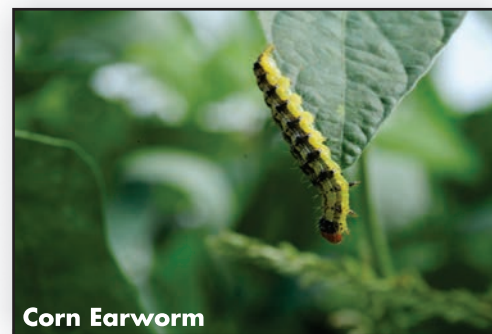


Control of Caterpillar Pests

D. Reisig, NCSU Entomology and Plant Pathology Dept.

Corn earworm and soybean looper are almost always the most expensive insects for N.C. soybean producers. Losses and costs of control for these two insects during 2016 and 2017 were approximately \$50 million each year. Insecticide choice is one of the most critical steps in pest management, but both insects have developed resistance to many insecticides, making insecticide selection difficult. To help growers combat these costly pests, the NCSPA and checkoff funded research to better understand what and where resistance is present across the state. Preliminary results demonstrate that **much of the corn earworm in the Northeast is resistant to pyrethroids and confirmed the presence of chlorantraniliprole (Besiege and Prevathon) resistance in soybean loopers.**

Based on these findings it is **recommended that growers move away from pyrethroids for corn earworm control and avoid Besiege or Prevathon for soybean looper control.**



Corn Earworm

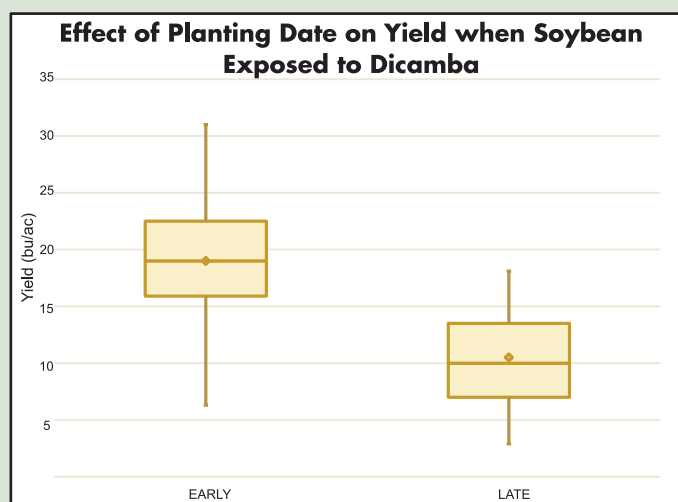
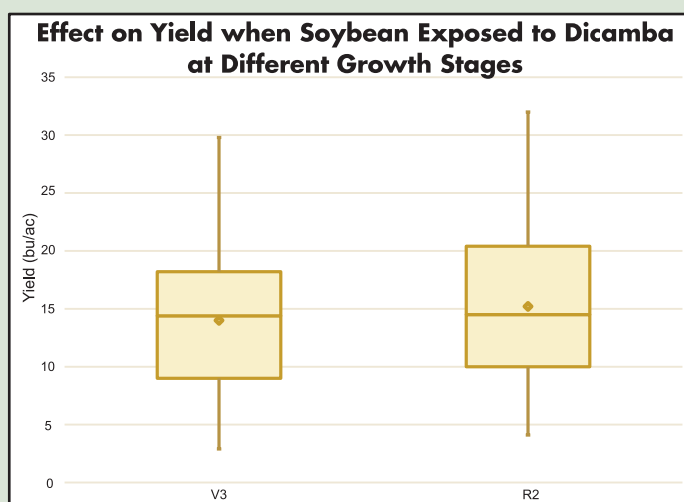


Soybean Looper

Tolerance to Dicamba

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Resistant weed species continue to plague N.C. soybean producers and are one of the primary concerns facing farmers for the foreseeable future. As new herbicide-tolerant soybean technologies are approved, one of the biggest concerns is off-target movement and injury in neighboring crops. In an effort to provide growers with best management practices for auxin use, the checkoff funded research to evaluate how non-dicamba-tolerant soybeans are affected by dicamba. The results of this study show that **soybean response to sub-lethal rates of dicamba are highly variable and will depend more on environment after application than on factors at the time of application.** Yield was primarily affected by application timing or planting date and there were differences in yield due to variety, dicamba rate and application timing, with some soybeans showing greater ability to recover after treatment with higher dicamba rates. **Care should always be taken when spraying dicamba near susceptible crops, and this data supports grower concerns about sub-lethal rates of dicamba,** although total death and significant yield loss occurs primarily when higher doses were sprayed.





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Disease Clinic

L. Thiessen, NCSU Entomology and Plant Pathology Dept.

While most N.C. producers routinely submit soil samples for predictive or diagnostic purposes without a user fee, relatively few producers utilize the diagnostic services available from fee-based laboratories such as the NCDA&CS Agronomic Division plant tissue lab or at the N.C. State University Plant Disease & Insect Clinic. Problem diagnosis is an important tool that cooperative extension agents use in advising producers to select appropriate corrective management approaches. In the absence of such tools, producers are left to attempt diagnosis based only upon visual symptoms that often can be misleading and to correct problems by selecting from numerous potential practices, products and advertising claims. **To help strengthen crop problem diagnosis, the NCSPA funds the analysis of samples submitted by extension agents. In 2017, 73 samples were submitted by extension agents.** These samples were diagnosed with diseases, such as damping off and Cercospora blight, and insect pests, like aphids and stem borers. Management strategies for pests were recommended.