

# 2017 Research Report

Protecting Yield & Profitability  
Variety Development & Testing  
Managing Pests  
Nutrient Management  
Soil Health  
Moisture Management

## President's Letter



**H**elping North Carolina soybean farmers increase yields and profits is a core mission of the North Carolina Soybean Producers Association. One of the primary ways the association does this is by investing in production research to address challenges facing N.C. growers. The board of directors has worked hard over the last few years to make sure projects relevant to N.C. growers are funded and get the information into the hands of growers around the state.

The purpose of this report is to inform you about the research supported by your checkoff dollars and provide you with the outcomes of projects to help you make decisions on your farm. There are a variety of project types funded by the NCSPA and your checkoff (shown in the chart below) to meet the needs of the state's soybean growers. This is challenging because of the wide variety of environments, pests and production practices our growers face, but we are committed to helping all growers be more productive and profitable.

The best way to stay up-to-date on the latest research and agronomic information available is to visit [www.ncsoy.org](http://www.ncsoy.org). There have been many enhancements made to the website over the last year, including an updated Grower Resource section and a weekly Field Report research post on the blog, as well as copies of any recent publications created such as the new North Carolina Soybean Scouting and Field Guide and a Management Matters brochure series.

I encourage you to think about the information presented in this report, and how it can be put to use on your farm where applicable. Of course, if you have any ideas about what you would like to see included in soybean research or how you prefer to receive such information, please share it with Katherine Stowe, the NCSPA's research coordinator, at [kdstowe@ncsoy.org](mailto:kdstowe@ncsoy.org) or 919-839-5700.

Best of luck this season,

John Fleming  
NCSPA President

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### FUNDING BREAKDOWN



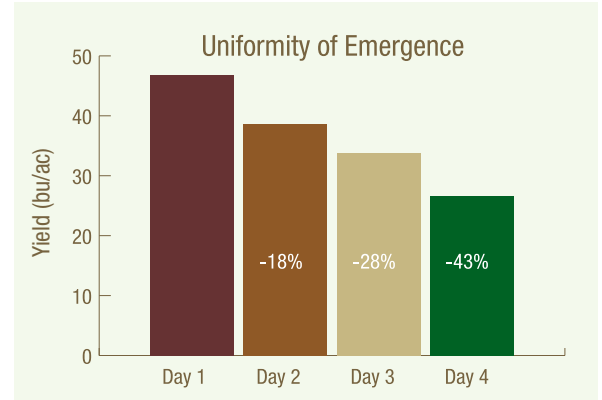
- 6% INSECT MANAGEMENT
- 6% WEED MANAGEMENT
- 7% SOIL MOISTURE MANAGEMENT
- 9% SOIL HEALTH
- 11% DISEASE MANAGEMENT
- 16% NUTRIENT MANAGEMENT
- 20% PROTECTING YIELD & PROFITABILITY
- 25% VARIETY DEVELOPMENT & TESTING

# Protecting Yield & Profitability

## Uniformity of Soybean Emergence **J. Dunphy, NCSU Crop and Soil Sciences Dept.**

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. Dr. Ron Heinniger has produced data showing that corn plants that emerge on the second or third day are not as productive as plants that emerge the first day. The checkoff funded a research project to test if the same is true for soybeans.

In 2015, the first year of testing, it did not appear that uniformity of emergence was important to soybean yields but this was tested again in 2016. Data from 2016 suggests results from 2015 may be atypical, and plants that emerge on the second, third or fourth day after the first plant emerged yield less than those that emerge on the first day. More tests are being carried out in 2017 to verify these results.



## Soybean Dry-land Maximum Yield **J. Dunphy, NCSU Crop and Soil Sciences Dept.**

Soybean growers must be willing to focus on increased agronomic management of the crop in order to increase soybean yields. To help growers determine which practices will result in the greatest yield increases and the greatest return on investment, the association has funded research through the checkoff called the “Cadillac” test. The test includes a “Cadillac” maximum yield treatment which includes many different inputs along with other treatments that subtract one input at a time. This tests the influence of these practices/inputs in a relatively high-yielding, non-irrigated environment.

Year two of the test was conducted in 2016. In addition to the determinate varieties (maturity groups V and VI) that were evaluated in 2015, indeterminate varieties (maturity groups III and IV) were added to the study in 2016. A few products and practices have consistently shown an impact over the course of the study:

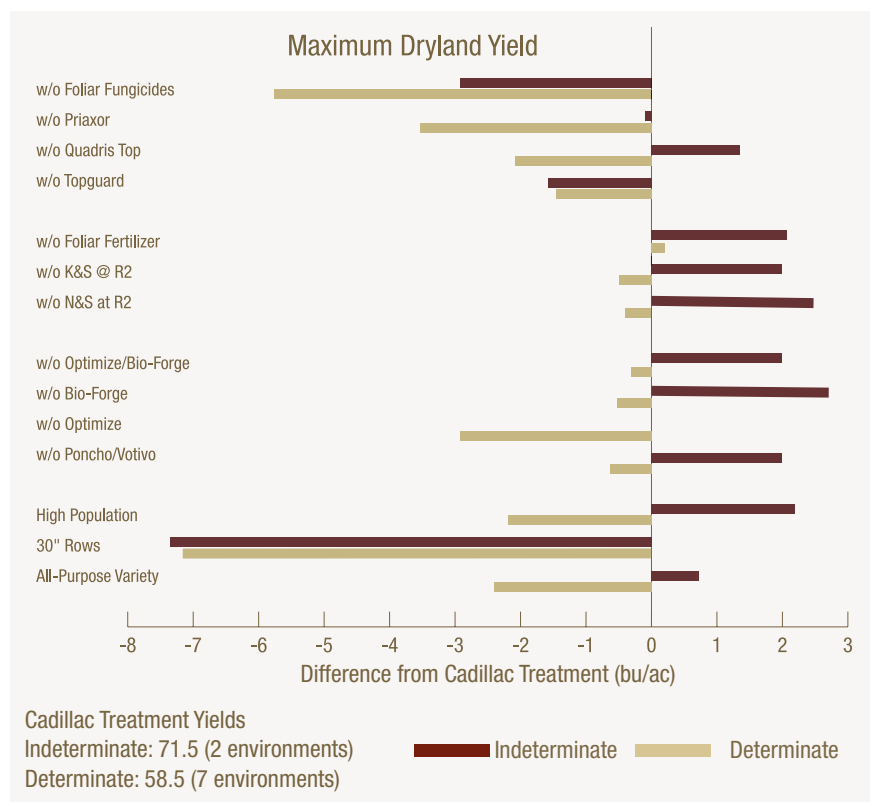
- Row width has the greatest impact on yield, with 15-inch rows yielding seven bu/ac more than 30-inch rows with the same treatments in both determinate and indeterminate varieties
- The application of foliar fungicides also resulted in a significant impact on yield. Compared to the “Cadillac” treatment, yields were reduced by 5.5

CADILLAC TREATMENT	
15 in rows	
May planting date	
120K seed/acre	
Poncho/Votivo + Seed Fungicide	
Optimize Seed Inoculant	
Bio-Forge on seed	
11 gal/ac 12-0-0-26S in row @ R2	
15 gal/ac 0-0-25-17S in row @ R2	
Topguard Fungicide @ R2	
Quadris Top Fungicide @ +14-21 days	
Priaxor Fungicide @ +35-42 days	

bu/ac (determinate) or 2.8 bu/ac (indeterminate) if no foliar fungicides were applied.

- The use of the inoculant Optimize increased yields by 2.8 bu/ac in determinate varieties, but no increase was observed for indeterminate varieties
- Increasing the plant population did not increase yields and reduced them by 2.1 bu/acre for determinate varieties, but a yield increase was observed when plant population was increased for indeterminate varieties

Incorporating even one of these practices may result in yield increases and are worthy of consideration. This test will be conducted again in 2017 to verify these results.



# Protecting Yield & Profitability

## What a Shovel Can Tell Us About Yields

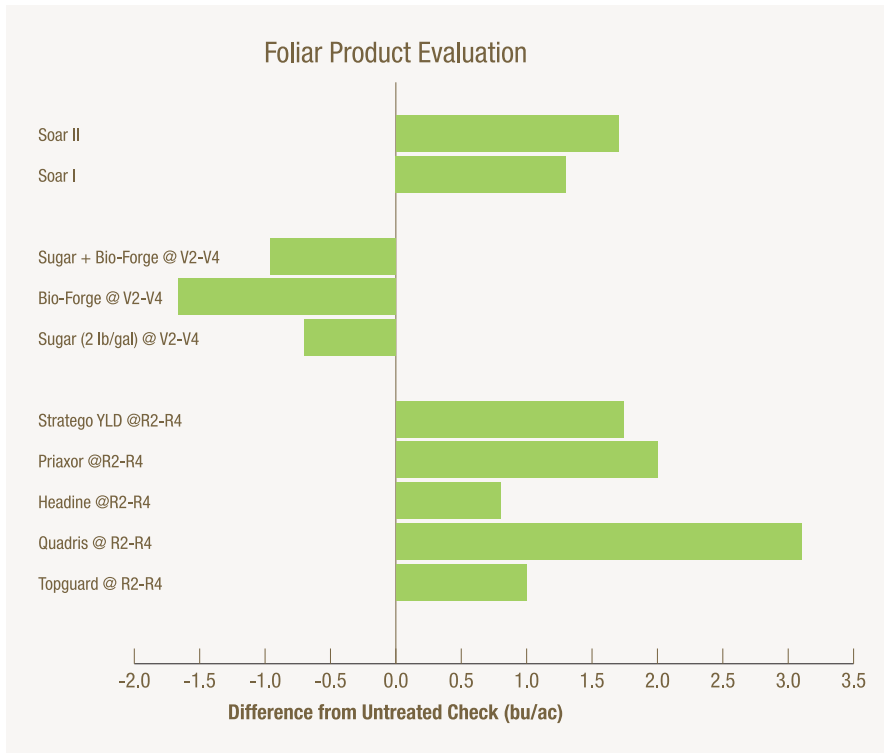
R. Wells, NCSU Crop and Soil Sciences Dept. and  
R. Zobel, USDA

The observation of soybean root systems could provide growers with insights into the sustainability of their crop and give an indication of potential yield. A routine assessment of root system development using only a shovel can alert the grower to problems before they are visible in the shoot so they can be corrected before significant yield loss occurs. The checkoff supported research to follow soybean root development patterns. The weather in 2016 allowed for comparisons in root development with too much or too little water. Soybeans were observed to develop novel root systems when the plants were subjected to flooding conditions. Upon completion of the project after the 2017 season, the researchers will be able to provide growers with a series of images to demonstrate what to expect when they observe roots in the field.



## Foliar Yield Enhancements

J. Dunphy, NCSU Crop and Soil Sciences Dept.



The Soar I program was 2 qts/ac of Soar Soybean Mix at pre bloom, full bloom and post bloom. The Soar II program was 2 qts/ac of Soar Bloom Mix pre bloom and 2 qts/ac of Soar Soybean Mix post bloom.

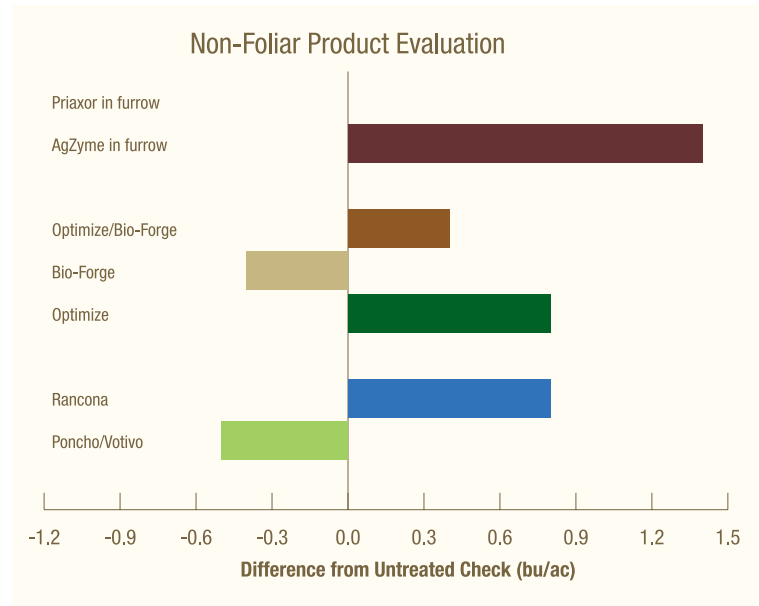
North Carolina's soybean farmers have many options of products that can be applied to soybeans to try and improve yields and profits. For several years, the NCSU has funded research to evaluate the efficacy of these products. Having these products evaluated by an unbiased and trusted source is essential for growers to make decisions about whether to utilize these products or what to utilize.

In 2016, fungicides and products containing macro- or micro-nutrients were evaluated. Over four years of testing, all fungicides evaluated showed a positive yield response. A positive response was also seen for the Soar micronutrient/biological products. No yield response was observed for the Bio-Forge or sugar treatments. However, 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. In the environments tested, the only product that resulted in a positive return on investment was the Quadris Top application. Remember fungicide applications should only be applied when the potential for disease development is high.

## Non-Foliar Potential Yield Enhancements

J. Dunphy, NCSU Crop and Soil Sciences Dept.

The association also funded research to evaluate non-foliar products to provide growers with information about which, if any, of these products they should incorporate into their operations. Products tested included a fungicide seed treatment (Rancona), a fungicide in-furrow (Priaxor), an insecticide + biological seed treatment (Poncho/Votivo), a nutrient supplement seed treatment (Bio-Forge), a nutrient supplement in-furrow (AgZyme) and an inoculant (Optimize). Averaged over three years of testing, the product that provided the highest yield increase was AgZyme applied in-furrow. Several other products showed a positive yield response, including an inoculant and a fungicide seed treatment, but these yield responses were less than one bushel per acre. These results show that it is important to consider the expected return on investment before adding a non-foliar product to a management plan.



## Variety Development & Testing

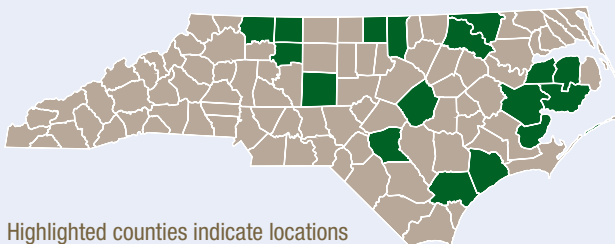
### Variety Demonstrations

J. Dunphy, NCSU Crop and Soil Sciences Dept.

Variety selection is one of the most important management decisions a soybean grower can make. Selecting the right variety for the right environment is essential, but with more than 200 soybean varieties this can be an overwhelming decision. To help farmers find the best varieties, the checkoff funded demonstrations of 17 varieties across 11 counties. These varieties were some of the highest yielding varieties in the 2011-15 Official Variety Tests (OVT). For more information on variety selection, visit the Variety Selection section of our Grower Resources page (<http://ncsoy.org/resources/variety-selection/>).



There can be as much as a  
**15 bu/ac**  
difference  
in varieties grown in the  
same field



Highlighted counties indicate locations of variety demonstrations in 2016.

## Support for the Winter Nursery in Puerto Rico

T. Carter, USDA

Developing a soybean variety requires at least eight seasons of soybean production. The first five seasons are needed to crossbreed the parental stock and develop true-breeding progeny. Three more years are required to yield test the progeny in North Carolina and identify the highest yielding for release. Normally, eight seasons of breeding would take eight years. However, the process can be shortened by two years by growing soybean crops in North Carolina's off-season from Nov. through Apr. at the USDA winter nursery in Puerto Rico. The association has provided funds for the USDA winter nursery for many years and all varieties released by N.C. State University have been grown there.

In early 2017, a group of NCSA directors and staff visited the Puerto Rico research facility to learn more about the variety development process. One of the interesting things the groups saw was artificial lighting used in the fields. Day length during the growing season is much shorter in Puerto Rico than it is during the summer in the U.S. The short days cause the plants to flower too early, and only grow about a foot tall. Parking lot-style lighting is used to simulate longer days so the plants grow to a normal height.



## Soybean Recovery from Drought

T. Ruffy and T. Sinclair, NCSU Crop and Soil Sciences Dept. and T. Carter, USDA

Episodic drought is becoming more common in North Carolina and is characterized by periods of little to no rainfall followed by a rain event. As irrigation is not cost-effective for the majority of soybean growers in the state, the development of drought-tolerant varieties is an important alternative solution. To develop drought tolerant varieties, it must be understood how different soybean varieties recover from periods of drought stress. Research sponsored by the NCSA evaluated drought recovery in soybean varieties. The project identified physiological traits advantageous to drought tolerance and two potential breeding lines that can recover faster from drought. The traits and lines identified can now be used to develop drought-tolerant varieties for N.C. growers.

## Double Crop Soybean Varieties for North Carolina

T. Carter, USDA

Double-cropped soybeans account for about 50% of the soybean acreage in N.C., but they typically yield 10-20% less than full-season crops because they don't have time to maximize leaf area and yields. The USDA soybean breeding program at N.C. State University is hoping to boost yield of double-crop beans by using new genetic sources. The checkoff funded research to evaluate new fast canopy-closure breeding lines from Asia. The Asian lines produce a canopy faster than locally-adapted varieties and could have the potential to capture more sunlight early in the season to increase yields. 25 lines were evaluated for percent canopy closure in wide-row (17 inch) and ultra-narrow row (4.5 inch) spacing. Lines identified to have faster canopy closure will be used to develop new varieties for double-crop growers in N.C.



## “With extreme weather

becoming more common in N.C., the NCSPA has sought to fund research to help varieties withstand some of these conditions.”

-Isaac Boerema, NCSPA board Research Committee Chairman



## Flood-Tolerant Soybean Varieties for North Carolina

T. Carter, USDA

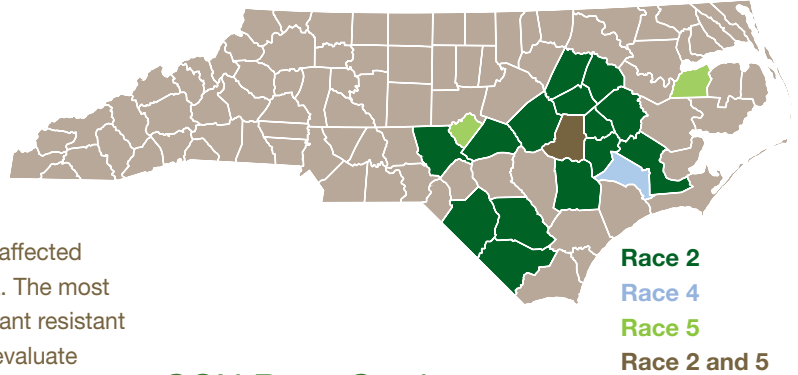
While rainfall is generally desirable for soybean production, excess rain can harm crop performance. North Carolina growers have seen a few wet seasons recently, specifically 2013 and 2015, and soybean yields suffered because of this. Soybean breeders in Arkansas and Missouri, where flooding is more common, have released several soybean varieties with enhanced flood tolerance. The USDA breeding program at N.C. State University is hoping these new mid-South varieties have potential for N.C. growers.

The lines are being evaluated in a project funded by the NCSPA and the checkoff at the Tidewater Research Station in Plymouth by flooding 'bermed' blocks with irrigation. Water is added to allow standing water to cover the main stems to a depth of about five inches for six days. Preliminary data indicates a few lines show promising results in terms of seed yield when subjected to flooding conditions. This project will be continued to identify lines that could be useful to N.C. growers.

## Stem Canker Resistance

J. Dunphy, NCSU Crop and Soil Sciences Dept.

In 2015, southern stem canker severely affected whole fields on a few farms in North Carolina. The most effective way to manage stem canker is to plant resistant varieties, but little testing had been done to evaluate stem canker resistance in soybean varieties available to N.C. growers. To provide growers with information on stem canker resistance, the NCSA funded a project in 2016 to evaluate 14 varieties with seed company ratings from susceptible to very resistant. In the project, very little to no stem canker was detected in the test locations compared to 2015. Where the disease did develop, it was observed in varieties rated as susceptible to stem canker, which would lead one to conclude the company ratings are probably accurate. This test is being repeated in 2017 to confirm that conclusion.

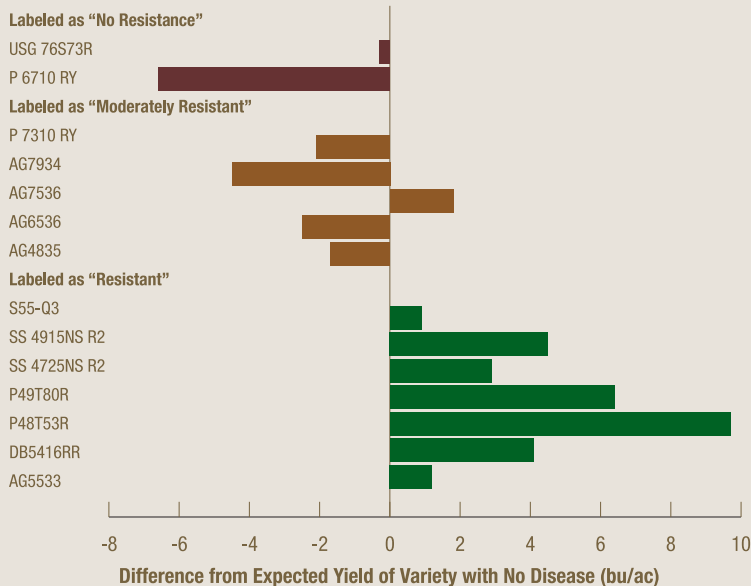


## SCN Race Study

T. Whaley, NCCES and C. Jernigan, NCDA&CS

Soybean cyst nematode may be one of the widest spread problems for soybean growers. While there are resistant varieties, the resistance will only work for races for which the variety has resistance. To know what races are in a field, a race survey is required. The last SCN race survey completed in North Carolina was in 2010, so this project completed a SCN race study with a group of county agents and regional agronomists in the central coastal plain region. 30 samples were collected across 18 counties. **Race 2** was the predominant race as it was found in 87% of the samples. **Race 4** (10%) and **Race 5** (3%) were also seen. These findings suggest that host resistance currently available to producers may not adequately manage current races as few varieties have race 2 resistance. Therefore, rotations with a non-host crop or chemical treatment remain the best options to effectively manage soybean cyst nematode in most soybean fields in the state. These results provide some information about the SCN races found, but a more comprehensive survey including more soybean producing counties will be required to more accurately identify the prevalence of current races and determine if other races exist.

Stem Canker Effect on Yield



## Soybean Problem Diagnosis Support for Cooperative Extension

L. Thiessen, NCSU Entomology and Plant Pathology Dept.

While most North Carolina producers submit soil samples for predictive or diagnostic purposes when no user fee is charged, relatively few producers utilize diagnostic services available from fee-based laboratories such as the NCDA&CS Agronomic Division

plant tissue lab or the N.C. State University Plant Disease & Insect Clinic. Problem diagnosis is a necessary tool to take appropriate corrective measures. To help with crop problem diagnosis, the NCSA pays for soybean samples submitted to the Plant Disease & Insect Clinic

by cooperative extension agents. In 2016, these funds allowed 26 county agents to submit 45 samples for problem diagnosis. A wide assortment of disease, insect and cultural problems were diagnosed from these samples so action could be taken.



## Identifying the Mechanisms of Kudzu Bug Resistance in Soybeans

D. Reisig, NCSU Entomology and Plant Pathology Dept.

If left unchecked, kudzu bug can reduce soybean yields by as much as 60%. In North Carolina during 2013, it caused an estimated \$3.5M in soybean loss and cost of control. The only currently effective management tactic is to spray broad-spectrum insecticides. Developing soybean varieties resistant to kudzu bug would greatly benefit soybean growers. Work began in 2016 to identify the mechanisms of kudzu bug resistance in soybean varieties with funding from the checkoff. This research identified factors important for host plant resistance that could save millions of dollars to soybean producers and help reduce insecticide use if incorporated into commercial breeding programs.



## Fungicide Timing

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

If, when and how often to apply fungicides are questions all soybean growers face. To help answer these questions the NCSU sponsored research with a group of crop consultants in eastern North Carolina. The group evaluated four different fungicide products at three different timings across five locations.

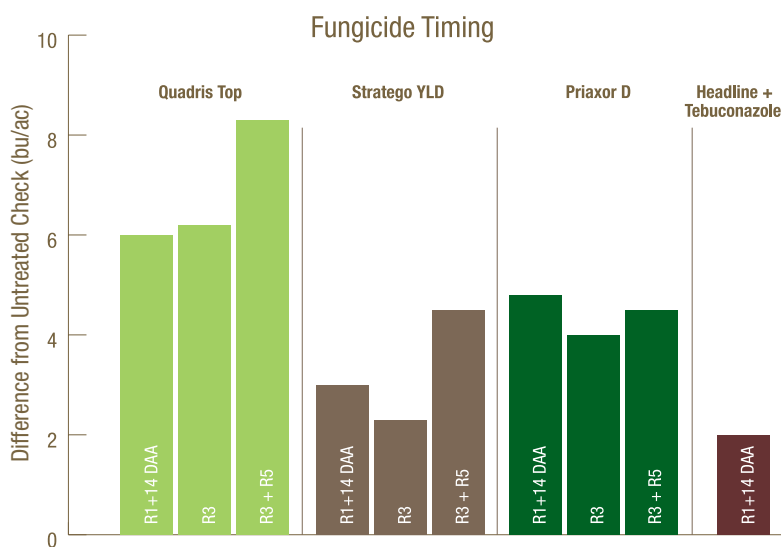
Disease severity varied across locations, but at locations with moderate frogeye leaf spot (FLS) pressure the disease became prevalent in R3-R5. Compared with the untreated check (UTC), all but two of the fungicide treatments significantly improved yield. However, there was no significant difference between the different fungicide products. When comparing yield among treatment timings of the same product, no statistical differences were observed between timings, but the R3+R5 application tended to have the highest yields for each product.

After statistical and economic analyses, the optimal fungicide regime was Quadris Top SB applied at R3, earning the grower \$34.36 per acre above the UTC. The runner-up was sequential applications of Quadris Top SB applied at R3 and R5, earning the grower \$31.82 per acre above the UTC. In contrast, the highest negative loss-on-investment of -\$35.50 resulted from application of Headline followed by Headline plus Tebustar.

It is widely believed that application of fungicides containing strobilurin can increase green stem percentage at harvest. This study supports that such a relationship does exist, and that prolonged greenness can contribute to increased yield. Across all treatment timings, plots treated with Quadris Top SB were on average 5.9-7.4% greener at R7 than plots treated with

any other fungicide. This observation corresponds with highest green stem ratings observed in 2015 occurring in plots treated with Quadris Top at R3.

This study does not support the practice of multiple fungicide applications. Although substantial profit was observed following two applications of Quadris Top SB at R3 and R5, results show this is not always the case and may be a risky investment. A strong relationship was seen between FLS control and increased yield. That is, the greatest yield increases from fungicide treatments were observed in locations that had the greatest disease pressure. If conditions are conducive to disease development then fungicides are probably a smart investment, but if disease pressure is minimal the application is not likely to be profitable.



# Nutrient Management

## Soil Test Potassium Recommendations to Optimize Soybean Yield

D. Hardy, NCDA&CS and C. Croizer, NCSU Crop and Soil Sciences Dept.

Soil testing is one of the best ways to determine if fertility levels are adequate. Most soybean growers take advantage of the services provided by the NCDA&CS soil testing lab, but soil test recommendations for growing soybeans in the state have not been updated in over 20 years. The NCSU sponsored research with the NCDA&CS to evaluate current soil test Potassium (K) recommendations to determine if current soil test recommendations are still adequate. 2016 was the first year of testing and was carried out at eight locations across the state. In the first year of the study, no yield response to K was observed across eight sites tested. This is good news as it suggests current soil test K recommendations are adequate. The test will be repeated in 2017 to confirm these initial findings.



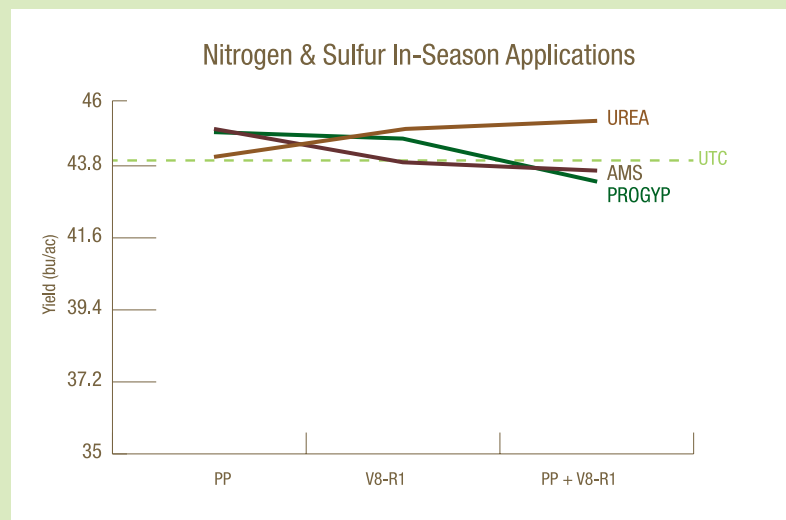
## Nitrogen & Sulfur In-Season Applications

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

Unlike most other crops, soybeans can obtain their own nitrogen (N) through N fixation. N fixation is the process by which the soil bacteria, *Bradyrhizobium*, form an intricate relationship with soybean plants. The bacteria obtain sugars from the soybean, and in return the soybean plant obtains N from the bacteria. Because soybeans can fix their own N farmers have typically taken a hands-off approach to N fertilization, but the production of high-yield soybeans has increased interest in the application of N to soybeans recently. Some data suggests that the application of 30-50 lbs of N per acre could result in a yield increase. To test this claim, the association funded a study to evaluate applications of AMS (150 lbs/ac), urea (70 lbs/ac) and ProGyp (200 lbs/ac) at pre-plant, V8-R1 or a split application between the two.

Based on results from five locations in 2016, none of the products tested at either application time resulted in a significant increase in yield when compared to the untreated check (UTC). While some products did give a yield boost at certain timings, there was no consistent benefit from a single product or from a single application time. In these tests, like many others conducted over the last few years, there was little response to supplemental N. This was likely because yields were restricted below 60 bu/ac by

factors other than limiting N (disease, nematodes, weather, etc.). The application of supplemental N might provide a yield benefit for soybeans in high-yielding environments, but only where yields would be expected to be above 60 bu/ac. In areas where expected yields are below 60 bu/ac, it may be better to skip the N application and invest the savings elsewhere, such as in a good inoculant or other seed treatment.



## Soil Health and Conservation Practices: Testing with Local, Long-term Information

D. Osmond, NCSU Crop and Soil Sciences Dept.

Soil health has become a major focus of the USDA-NRCS and many soybean producers will be encouraged to follow soil management guidelines associated with the soil health philosophy. Improving soil health can increase soil organic matter, soil physical properties and improve nutrient cycling, which should theoretically increase yields. Improving soil health is a long-term process and there are many challenges to measuring soil health. To bring greater attention to these challenges, the NCSPA is funding a project to evaluate how agronomic management across different regions of North Carolina affect soil properties, how different soil testing labs rate different soils and how soil testing data correlates with crop yields. Results thus far indicate that a broad standard for measuring soil health is not currently applicable to soils and agronomic systems in the southern U.S., and that soil health testing should be adjusted to account for differences in regional soils. Results from year one of the study, 2016, show no consistent differentiation in soil properties based on tillage. Work on this project will continue in 2017.



“More N.C. farmers are considering **cover crops** to be more sustainable, and the NCSPA thought it was important to study practices that would result in the highest yields.”

*-Curtis Furr, NCSPA board Research Committee member*

## Cover Crops in Corn-Soybean Rotations

J. Heitman, NCSU Crop and Soil Sciences Dept.

Cover crops have been gaining in popularity in North Carolina over the last few years. They may help to increase soil health by increasing organic matter and nutrient cycling by biological process. To evaluate the benefit of cover crops for N.C. soybean growers, the association

funded research through the checkoff to examine the effects of introducing a winter wheat cover crop into a long-term corn and soybean rotation in a piedmont soil, with a range of tillage approaches (disking, chisel plowing, moldboard plowing, and no-till). In the first year of the study the lowest-

yielding treatment was a moldboard plow with or without a cover crop, while the highest-yielding treatment was a chisel plow with a cover crop. All no-till treatments yielded the realistic expected yields for each soil type. This study continues in 2017 with the corn rotation.



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## Moisture Management

### New SMART Water Management System for Increased Yield and Quality

G. Chescheir and C. Poole, NCSU Biological and Agricultural Engineering Dept.

Water management is essential to soybean production in North Carolina, especially for many Blackland growers. A drainage system with the ability to make real-time changes to the water table based on in-field feedback that has surface and subsurface irrigation systems would be valuable to a grower. The checkoff is funding a test of a new SMART water management system which allows for automated water controls by managing drainage outlets coupled with surface and subsurface irrigation systems. It is an economical system that will maximize water use and energy savings using existing irrigation and drainage systems.

The study compares conventional drainage (drain outlets continuously opened) to controlled drainage (drain outlets adjusted to a fixed time schedule) to the SMART water management system (combination of drainage and subirrigation based on water table feedback). Preliminary results of the study show crop yield and water conservation benefits of the SMART system. Researchers are also in the process of developing management guidelines for optimizing soybean production using the SMART water management system with an agro-ecosystem model. Acceptance of the SMART drainage water management system by producers would be greatly enhanced if it were a cost-shared management practice and the possibility of including the SMART system as part of cost-share programs is being pursued.

