

# 2015 Research Report

## President's Letter

**T**his report is about the research funded using soy growers' Checkoff dollars. The projects were selected by soy growers because of their potential to benefit farmers. Some projects have immediate impact in the current growing season

and some projects may provide a future benefit months or years from now. All these projects were conducted using state-of-the-art science to address production challenges identified by farmers and researchers.

Research projects are funded by the soy Checkoff annually and generally run for three years. The agronomic projects tend to focus on foliar and non-foliar yield enhancements, variety selection, stress resistance, weed and insect pests, and row spacing / seeding rate. The soy Checkoff has in the past funded work that is not about production agriculture, for example a project on soy-based textiles in the College of Textiles at N.C. State University. Sometimes the projects build underlying scientific knowledge that will one day advance the soybean industry, as with a project on soy genomics. In all cases, these projects were selected for funding because they promise to deliver knowledge and technology to North Carolina soybean growers to help them be more productive and profitable.

**NOW IT IS YOUR TURN.** What do you want to see included in our soybean research? Between now and October 1, 2015, tell us about production challenges and on-farm experiences that we can address through the soybean Checkoff. Email us your suggestions at [ncsoy@ncsoy.org](mailto:ncsoy@ncsoy.org) or call us at 1-800-839-5700.

We take research seriously and we are looking to improve how we identify and deliver it to our members. These are your soy Checkoff dollars at work, and we value your input.

Jeff Peed  
NCSPA President

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The next generation of North Carolina soybean farm leadership, including president of the board of directors Jeff Peed of Beaufort County (top row, third from left)

# Projects With Immediate Impact

## Foliar and Non-Foliar Yield Enhancements

Soybean producers are interested in new products that claim to improve soybean yields. Producers want to know whether they will in fact improve yield and profit, and retail dealers want to know what products will be in high demand. Dr. Jim Dunphy, the Extension Soybean Specialist at N.C. State University, conducted yield enhancement trials to examine the efficacy of foliar, seed applied and in-furrow treatments.

Dunphy established replicated field trials in Greene, Johnston and Pamlico counties to compare yields of soybeans treated with foliar products. He ran similar experiments in Jones, Lenoir and Pasquotank counties to test non-foliar treatments. Of 18 foliar products tested over two years, four (Quadris Top, Priaxor, Soar I and Soar II) produced yield increases of 2 bushels per acre or more. Quadris Top and Priaxor are combinations of fungicides applied when pods are starting to form. Soar I and Soar II require multiple applications of proprietary products.

10 seed applied or in-furrow treatments were



tested over two years. Although none increased yields by more than 1 bushel per acre, three products tested for the first time in 2014 showed yield increases of 1.5 bushels per acre. These were Rancona (seed treatment), Agzyme (in-furrow) and Priaxor (in-furrow.)

## Twin Row Soybeans

Twin row planters are becoming more popular and farmers want to know what they can expect from soybean yields planted with twin rows seven to 10 inches apart compared to other more traditional row spacing. Dr. Jim Dunphy conducted a three year study to answer this question. The study concluded that soybean planted in 15 inch rows yielded nearly 5 bushels per acre more than beans planted in 30 inch rows. Soybean planted in twin rows would yield about 2.5 bushels per acre more than in 30 inch rows, and about 2.5 bushels per acre less than in 15 inch rows. The conclusion is that 15 inch row spacing is the top yield producer. However, even by switching from wide rows to twin rows, producers could realize a yield increase, and if they are switching from a seed drill to twin row planters, they could also realize a seed cost savings.

## Impact of Ground Cover, Tillage and Row Spacing on Kudzu Bug Activity

Dr. Chris Reberg-Horton and Dr. Dominic Reisig investigated the impact of ground cover and tillage on kudzu bug. They employed different tillage regimes behind a cereal rye cover crop, including beans behind crimped and rolled rye, beans behind rye stubble and beans in conventional tillage. Kudzu bug population densities were light across the state in 2014. However, kudzu bugs clearly preferred beans planted in conventional till, consistent with previous results from 2012 and 2013.

To investigate the impact of row spacing on kudzu bug activity, Reisig planted drilled beans in eight inch or narrower rows and wide row (38 inch) beans. Although kudzu bug population densities were light across the state in 2014, more

kudzu bugs per plant were found in drilled beans than in wide-row beans.

The concept of planting early beans on field margins as a trap crop for kudzu bug was tested in three fields each in Wayne and Johnston counties. The main crop of soybean was planted in the field during the recommended planting dates. Kudzu bug densities were compared between fields with and without early beans planted in the field margins. As expected, kudzu bug infested the early-planted border strips before appearing in the field interior in the trap crop fields. However, kudzu bugs did move into field interiors, and in a few cases exceeded threshold triggering a spray. This experiment will be replicated in 2015.

# Projects With Immediate Impact

Beginning in 2014, the soybean association partnered with a group of agronomists from industry who are experienced in working with North Carolina farmers and agribusinesses to diversify its research capabilities. The agronomists are familiar with the problems growers face on a daily basis and with the choices that growers make in selecting agronomic inputs, and they experimented with popular inputs in soybean production systems. Companies represented included Tidewater Agronomics, Fowler Crop Consulting, McLawhorn Crop Services, Protech Advisory Services, and IMPACT Agronomics.

## Do Seed Treatments Pay on Soybean in North Carolina?

What is the value of the numerous seed treatments applied to soybean, do they have merit, and why should seed treatments be used? The soybean board asked a team of agronomists and crop consultants to run experiments on common seed treatments.

Growers typically use molybdenum to enhance nitrogen fixation and inoculation of bacteria to aid in nodulation, as well as fungicides to help maintain seed viability and quality during storage. As seed treatment technology progressed, various fungicides were found to help with early plant establishment where soil borne diseases such as pythium, rhizoctonia and others were a problem. Today the soybean producer is faced with many choices of products that can be placed on the seed. These range from fungicides, insecticides, biostimulants, root growth enhancers, proteins, micronutrients, cellular development products and other numerous materials. Most of these seem to have merit with particular production strategies. Growers

have access to excellent seed treatment facilities to apply these products, but this project evaluated if they worth the investment.

### TRIAL SUMMARY:

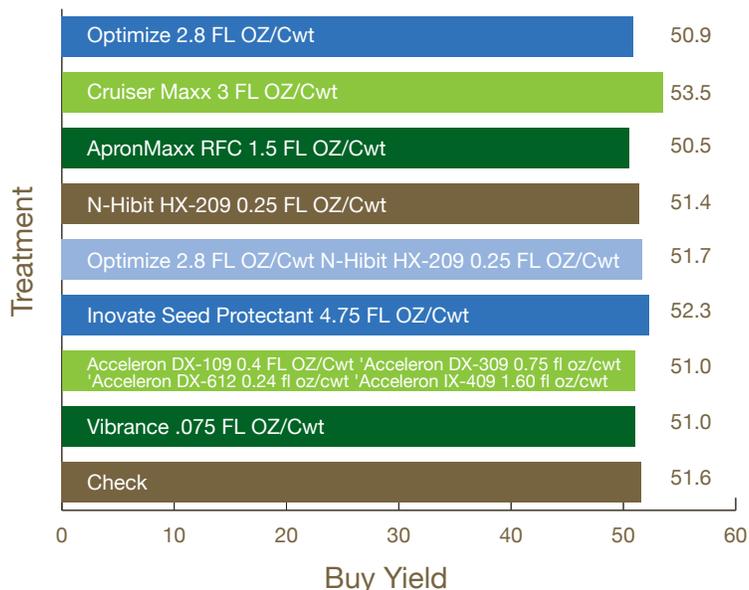
Twelve seed treatment materials were included at five locations in eastern North Carolina. Two locations were in the lower coastal plain region (Belvidere and Pantego) and three were in the upper and southern coastal plain (Garysburg, Ayden and Lumber Bridge). Each trial contained the same treatments and was conducted with the identical randomized complete block design. The variety used for the study was Pioneer 95Y40. All trials were planted in early May using a full season production strategy.

In four of the five trials there were no differences that created concern or interest with plant stand, vigor, test weight or yield response to treatment. In the trial at Ayden, there was a difference noted with positive influence in plant vigor observed in some treatments. These did not translate into yield increases above the check. In the Lumber Bridge trial, there were differences found affecting test weight that were of interest. These also did not translate into yield increases above the check.

In all individual trials, and in the grouped combination of all five trials, there was no increase that was significant above the check. Slight increases were noted, but nothing in the test indicated that investing in any of the seed treatments tested was of benefit. This is not conclusive due to only one year of experimentation, but it is suggestive.

This data also supports the recommendation that neonicitinoid seed treatments are not generally useful in soybean production in N.C. The recommendation is that growers be smart and save this technology for use in other crops, such as cotton, where the benefits are potentially greater. Utilization of an insecticide as a soybean seed treatment will likely only create further resistance problems in N.C. and the southeastern production area of the U.S.

Seed Treatments, Average Yield Across Locations



## Do Fungicides Pay on North Carolina Soybean?

Another project was undertaken by agronomists to understand the value of receiving plant health benefits from certain products, including triazole-based foliar fungicides and combinations of available chemistries, and the utilization of new chemistries to increase yield, protect yield and control diseases including strobilurin-tolerant frog eye leaf spot.

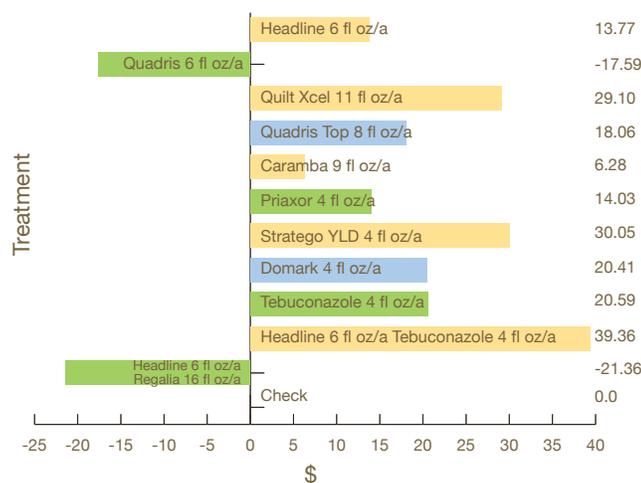
Foliar fungicide treatments recommended to growers in 2014 were compared at five locations in eastern North Carolina (Belvidere, Pantego, Garysburg, Ayden and Lumber Bridge). Each trial was conducted as a randomized complete block design, with data collected on disease incidence, green stem at harvest and overall yield. Pioneer 95Y40 was planted at all locations representing a full season production program. The initial Belvidere planting was lost to deer damage, and as an alternative the treatment was placed in an even stand of DG37RY47 soybeans with similar planting date. The Belvidere, Pantego and Garysburg locations experienced an infestation of frog eye. The Ayden and Lumber Bridge locations experienced a low infestation of frog eye and at Ayden, a moderate level of Cercospera. All treatments at each location were applied at R3.

The combined data at all five locations provides an excellent view of foliar fungicide value in the 2014 crop. Green stem levels did not cause problems at harvest. Economic analysis applied to the final yield indicates cost and income per acre per treatment.

Three treatments, (1) Headline plus tebuconazole, (2) Quilt Excel, and (3) Stratego YLD show the highest statistical yield gains above the check. One treatment, Quadris

Top, shows a higher statistical level of green stem as compared to all treatments.

**Do fungicides really pay for themselves in N.C. Soybean production?**



## Combating Soybean Cyst Nematode

Soybean Cyst Nematode is the most destructive pathogen of soybean in the United States. The only effective crop protection products have been banned due to their risks. Alternatives to combat SCN are currently being studied in this project at North Carolina State University using biological agents to attack SCN. Dr. Steve Lommel and Dr. T.L. Sit discovered viruses present in SCN populations across the state. Lommel and Sit propose that by targeting these viruses for destruction and possibly by encouraging the viruses to attack their SCN hosts, a safe and novel management strategy for SCN may be found.

## Identifying Varieties Resistant to Kudzu Bug

Trials have shown that kudzu bug can cause an average 19% yield loss in soybean. This is alarming because kudzu bug has been present in the Southeast only since 2009 and there is much still unknown about the pest. The goal of this project was to identify factors in soybean varieties that preserve yield in the face of these increasing insect pressures.

The only known effective management tactic is the application of broad-spectrum insecticides and avoidance by planting later. Another possibility is to identify soybean varieties that kudzu bug doesn't tolerate well. Dr. Dominic Reisig identified two lines, Vance and N7103, as consistently unattractive to kudzu bugs. The mechanism that causes kudzu bugs to avoid these lines is unknown. In the greenhouse, Reisig found two lines that were moderately resistant to soybean aphid to also be resistant to kudzu bug.

The next step is to understand the resistance mechanism so they can be incorporated into breeding programs.

## Diagnostic Support for Cooperative Extension Agents

Knowing what caused unusual plant growth or development can help farmers and their county agents better understand production problems and take action to prevent them from recurring. Unfortunately the N.C. State University Plant Diagnostic & Insect Clinic and the N.C. Department of Agriculture & Consumer Services Agronomic Lab cannot provide these services to agents at no cost. The N.C. Soybean Producers Association stepped up to fund a project to keep these vital services free of charge for county agents.

## Auxin Transport Inhibitors Increase Herbicide Activity on Weeds

Herbicide resistant weeds are challenging, and in some production systems there is a real danger of weed species developing resistance to all known modes of action. One solution is to develop mixtures of products that enhance weed control when combined. One promising lead is the herbicide product Distinct, which is a combination of dicamba and the auxin transport inhibitor diflufenzopyr (DFF). DFF is not the only auxin transport inhibitor. Dr. J.D. Burton investigated whether other auxin transport inhibitors also improve the activity of a herbicide. So far, he has determined that the impact varies depending on the combination of products. This promising development will lay the groundwork for further experimentation.



## New Technologies for Weed Control Field Day

With new herbicide-resistant seed technology to be available to growers in coming years, attention has turned to stewardship of new product formulations to control drift and volatility. The new double-stacked seed traits offer resistance to more than one herbicide. More than 300 people attended a field day funded through the Checkoff and led by N.C. State University Extension Weed Specialist Wes Everman, to learn new herbicide technologies, proper tank clean out and measures to reduce physical drift and off-target injury.



## Variety Demonstrations Show Top Performers

North Carolina Cooperative Extension Service conducted 10 variety demonstration plots in counties around the state in a project funded by the soybean Checkoff. The plots spotlighted 21 of the most promising soybean varieties, including the highest yielding variety overall in the N.C. Official Variety Trials, the highest when planted in May, the highest when planted in June, and the predicted highest when grown in a 20-, 40- or 60-bushel per acre environment for each maturity group commonly planted in North Carolina. Variety selection is important to overall profitability. If producers switched just 1% of the state's soybean acreage to a variety that yielded just one bushel per acre higher than the current variety, statewide farm gate profits would increase by \$637,000.

## Finding the Drought Recovery Trait in Soybean Genetics

Dr. Tom Ruffy is a plant physiologist at N.C. State University. Ruffy received project funding from the NCSOA to identify key traits that can be used by plant breeders to generate new drought tolerant cultivars. The project seeks to find the genetic differences in soybean's ability to recover from intermittent drought, which occurs during most growing seasons.

In the first year of this three year project, Ruffy was successful in isolating key physiological responses that can be used to show differences in recovery rates and was able to identify advanced genotypes. For example, he identified a variety from Japan, Geden Shirazu, that showed an ability to take up water quickly and to re-establish leaf expansion and initiation of new leaves faster than other genotypes.

## Wild Soybean Holds Clues to Improve Amino Acid Composition

Most people think about crude protein as a measure of soybean quality, but amino acid composition has more impact on soy for feed and food. Seed storage proteins account for 40% to 60% of the total protein in soybean. The genetically diverse wild soybean plant, a native of Asia, may reveal variations in genetic sequences that improve soy for use in feed and food. Dr. Earl Taliercio of the USDA Nitrogen Fixation Unit in Raleigh is researching altering the genetics by which the soybean plant encodes the seed storage proteins. The hope is this would enable plant breeders to increase the levels of the sulfur containing amino acid lysine to improve the nutritional value of soy or disrupt the immunogenic regions of the seed storage protein, and reduce the allergenicity of soy. Even industrial uses of soy may be improved by indentifying seed storage proteins that improve soy as an adhesive product.

## Soybean Harvest Aids

Once soybeans are physiologically mature, meaning that all the dry matter that will go into the seeds is already there, then nothing else needs to happen to those soybeans while they remain in the field. In this case, there may be times when a harvest aid is useful for improving profits, for example by getting beans out early to take advantage of a price premium.

Dr. Jim Dunphy conducted replicated field tests in Johnston, Wayne and Wilson counties to compare the yields of soybeans treated with any of three defoliant products sprayed at weekly intervals. The goal was not only to compare the three products, but to try to determine when it was safe to defoliate soybeans. The products were Gramoxone, Aim and sodium chlorate (NaClO<sub>3</sub>). The individual county data was pooled in an attempt to shed light on inconsistent results and overall, the clear result was that Gramoxone and sodium chlorate were more effective at killing the plant, and reducing yield if sprayed too early than Aim. Although yields were unexpectedly not impacted any more by the second application date (approximately 16 days after stage R6) than by applications on any later dates, the yield impact for all three of the latest dates was still evident. Over the last three application dates, yields were 2.6 to 3.5 Bu/A lower with Gramoxone, and 2.1 to 3.7 Bu/A lower with sodium chlorate, than when no desiccant was applied.

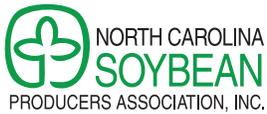
## Looking for the Stress Gene in Wild Soybean

Cultivate soybean (*Glycine max*) offers a very narrow genetic base, raising some concern about where to turn for the future sources of genetic diversity for yield, quality and stress tolerance. One solution is to look to soybean's wild cousin. Wild soybean is substantially more genetically diverse and is a likely source of genetic traits for improving yield, composition and stress tolerance. In this project funded by the soy Checkoff, Dr. Earl Taliercio identified traits for improved ozone tolerance and germination at low temperature in wild soybean, and is making crosses with cultivated soybean. The progeny from these crosses is being examined for agronomically valuable traits like stress resistance. This genetic diversity may unlock yield and profit when it makes its way to farmers' fields.

## Puerto Rico is a Valuable Breeding Site for North Carolina Varieties

Did you know that many soybean varieties intended for North Carolina were developed in part on the island of Puerto Rico? Two USDA scientists, Dr. Tommy Carter and Dr. Earl Taliercio, use the USDA winter nursery in Puerto Rico to double the speed of soybean variety development. That's because Carter and Taliercio can grow two crops in one year, one in N.C. in the summer and one in Puerto Rico in the winter. All the varieties the USDA has released for N.C. growers, including NC-Miller, NC-Roy, NC-Raleigh, N8101, N7002 and others spend some time in the sunny, frost-free winter nursery. The North Carolina Soybean Producers Association has supported winter nursery breeding programs for a number of years, and beginning in 2014, the association supported an N.C. State undergraduate intern to assist with the breeding program and gain experience in tropical agriculture with soybean.





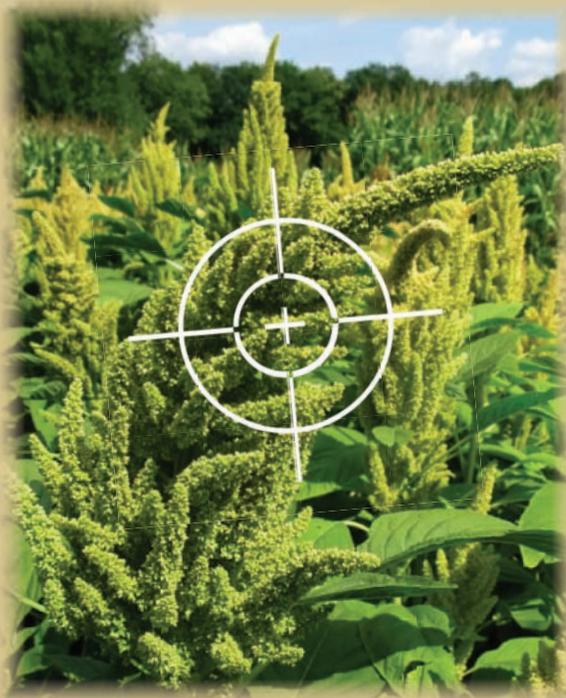
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For more information on Weed Free N.C., visit [www.weedfreenc.com](http://www.weedfreenc.com).