2016 Research Report

Protecting Yield & Profitability

Variety Development & Testing

Managing Pests

Soil Health & Soil Moisture Management

NORTH CAROLINA SOYBEAN PRODUCERS ASSOCIATION, INC.

President's Letter

The soybean association realized an exciting objective in Jan. 2016 when it created a new research coordinator position and hired Katherine Stowe to fill the position. Having a research coordinator on staff is an important milestone for North Carolina soybean producers and their checkoff. The new position enhances our capacity to share knowledge and technology produced with soy checkoff dollars with our farmers. The association's relationship with North Carolina State University research leaders will be much more productive thanks to this new position. Most importantly, this new position is about engaging with farmers and listening to their research needs in their communities, and delivering beneficial research projects back to growers through investments of their checkoff dollars.

I would like to thank the soybean checkoff board members who volunteered many hours to plan this position, interview candidates and make this hire. These farmers had a vision for what the association's research effort could become and they acted with a great deal of determination to make it a reality. My sincere belief is that the association's ability to produce and deliver research-based knowledge to its members will dramatically increase with the research coordinator on staff, the board's support for the soy research at N.C. State and work with contractors.

As you read through this research report, please note the project objectives and how the NCSPA board has tried to invest your checkoff money wisely in production agricultural projects. I hope the charts, graphs and information in this report are useful. Learn more about the NCSPA research program by following research news and updates on www.ncsoy.org, on our Facebook page and on Twitter.

I am looking forward to another productive season of research in the field. I am also excited to announce that Stowe is producing a soy scouting guide that will be available in the near future! Be on the lookout for its release.

Sincerely,

Jeff Peed
NCSPA President

50th ANNIVERSARY
North Carolina Soybean Producers Association
1966-2016

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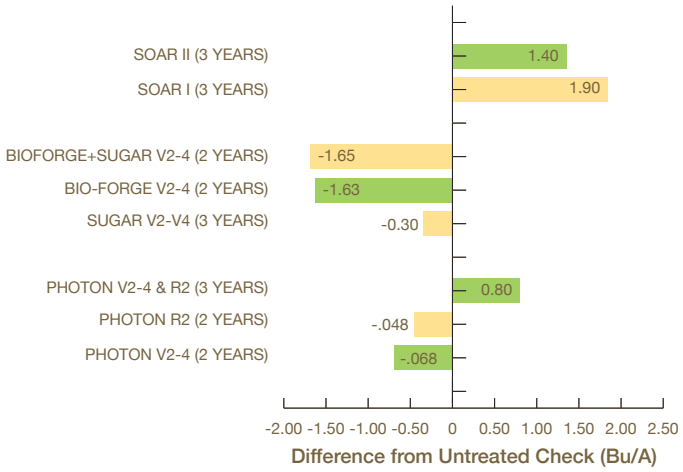
Protecting Yield & Profitability

Foliar Potential Yield Enhancements **J. Dunphy, Crop Science Dept.**

There are numerous foliar products on the market that advertise their ability to increase soybean yield and profits. For many of these products there is little reliable data on their efficacy in local environments, so the soy checkoff funded research in which Dr. Jim Dunphy evaluated many of these products over a three year period to determine how they perform in N.C. Of the seven products tested a few showed small increases in one of the years tested, but the only product that performed consistently was Soar, which produced the greatest yield increase over all three years of testing. Averaged over three years, the Soar I program (Soar Soybean at pre-bloom/early bloom, full bloom and post bloom) resulted in a 1.9 Bu/A increase. A 1.4 Bu/A increase was seen when the Soar II program (Soar Bloom at pre-bloom/early bloom, Soar Soybean at post-bloom) was used. Soar is a proprietary combination of chelated micronutrients and biologicals that requires multiple applications over the season. When deciding to add an additional input to a management program, it is important to calculate the potential return on investment. While a product may provide a yield increase, it still may not be a smart management decision for increasing profitability when taking into account all factors.

YIELD IMPACT OF FOLIAR PRODUCTS

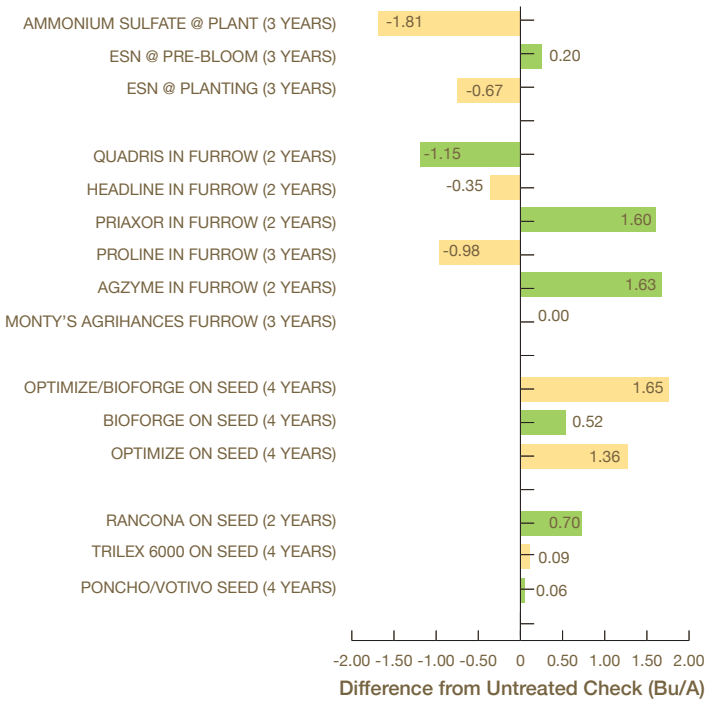


Non-Foliar Potential Yield Enhancements **J. Dunphy, Crop Science Dept.**

Like foliar products, several new non-foliar products are now on the market, claiming to improve soybean yields and profits. To provide growers with information to help them decide whether to incorporate these products into their management programs, Dr. Jim Dunphy evaluated a number of these products over a four year period on behalf of the North Carolina Soybean Producers Association. Both seed treatment and in-furrow products were evaluated, including traditional seed treatments, inoculants, nutrient supplements, controlled release nitrogen and fungicides. Averaged over either two, three, or four years, three products produced a yield increase greater than 1 Bu/A.

Optimize, an inoculant, with or without the nutrient supplement BioForge produced a 1.5 Bu/A increase and AgZyme, a micronutrient spray, applied in-furrow, produced a 1.6 Bu/A increase. Priaxor applied in-furrow was the only fungicide that resulted in a yield increase above the untreated check. Neither the three traditional premium seed treatments, nor the controlled release nitrogen source, ESN, increased yields in the environments tested.

YIELD IMPACT OF NON-FOLIAR PRODUCTS



Protecting Yield & Profitability

Uniformity of Soybean Emergence

J. Dunphy, Crop Science 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 the first seedlings to emerge. It has generally been assumed that later-emerging seedlings would be as productive if they had some growing room away from the earlier-emerging seedlings. If later-emerging seedlings were close to earlier-emerging seedlings, it was presumed they would be less productive. Farmers with record-breaking yield believe uniform emergence is critical to maximizing corn and soybean yields. It is apparent that with corn that it is important to yield for all plants to emerge on the same day. This begs the question of whether the same is true for soybeans.

With funding from the soy checkoff, Dr. Jim Dunphy conducted tests in 2015 in three counties (Onslow, Pasquotank and Robeson), which indicated uniformity of emergence does not appear to be important to soybean yields. This test will be repeated in 2016 to verify or refute whether this preliminary conclusion is correct.

Maximizing Soybean Dryland Yields

J. Dunphy, Crop Science Dept.

Soybean profits are a function of yield, price and cost of production. Growers are limited regarding the influence they have on price, and most growers have already done what they can to limit the cost of production. That means yield is the one component that has the greatest potential for growers. To determine which factors are most important for maximizing soybean yields, the NCSPA sponsored research conducted by Dr. Jim Dunphy to establish a "Cadillac" maximum yield treatment that included many different inputs. Other treatments consisted of subtracting one input from the "Cadillac" treatment at a time to determine the effect of that factor in a high yielding system. Preliminary results suggest a few inputs may result in a significant yield bump.

VARIETY SELECTION

Variety selection is one of the most important management decisions a soybean producer can make. Switching from a "high yielding" variety in the "Cadillac" treatment to an "all-purpose" variety led to a 2.4 bu/A decrease in yield. Growers should also consider disease and pest resistance when choosing which varieties to plant. Choosing varieties with the proper resistance packages may help save money on pesticide applications later in the season.

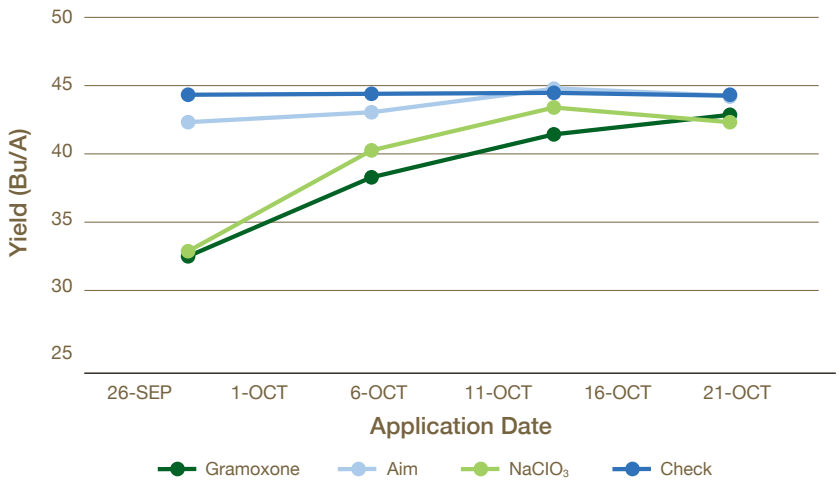
ROW SPACING

While optimal row spacing varies by location, typically planting in narrower rows results in a yield increase. Switching from 15-inch rows in the "Cadillac" study to 30-inch rows resulted in a 6.9 bu/A decrease in yield. Narrower rows allow quicker canopy closure, greater light interception, help block light from reaching weeds and help minimize moisture loss.

SEED TREATMENT

Seed treatments can help protect yield potential by promoting germination and early plant vigor. Both Poncho/VOTiVO and Optimize/BioForge treatments were added in the "Cadillac" treatment. The Poncho/VOTiVO treatment has a biological coupled with a neonicitinoid insecticide. Optimize is an inoculant and BioForge is a 2-0-3 fertilizer. Removing the Poncho/VOTiVO treatment from the "Cadillac" study, resulted in a 2.7 bu/A decrease in yield and removing the Optimize/BioForge treatment resulted in a 1.2 bu/A decrease in yield. The selection of

EFFECT OF HARVEST AIDS ON YIELD ACROSS APPLICATION TIMINGS



Soybean Harvest Aids

J. Dunphy, Crop Science Dept.

At the end of the growing season, N.C. soybean farmers are often anxious to get their soybeans out of the field and into a bin where they will be safe from bad weather. Once soybeans are physiologically mature, nothing good is going to happen to those beans while they remain in the field. There is also sometimes a price premium for being one of the first soybean producers to deliver soybeans to the elevator for sale. Dr. Jim Dunphy conducted tests to compare the yields of soybeans treated with three foliar treatments touted to defoliate soybeans with spraying at weekly intervals. It was hoped the soybeans could be killed early, so the soybeans could be harvested earlier. The research showed that sodium chlorate was as effective as Gramoxone as a harvest aid, but Aim was not. Regardless of when Gramoxone or sodium chlorate was applied, yields were reduced at least somewhat, however waiting until later to spray reduced the reductions in yield.

seed treatments should be based on issues specific to a farm.

FERTILITY

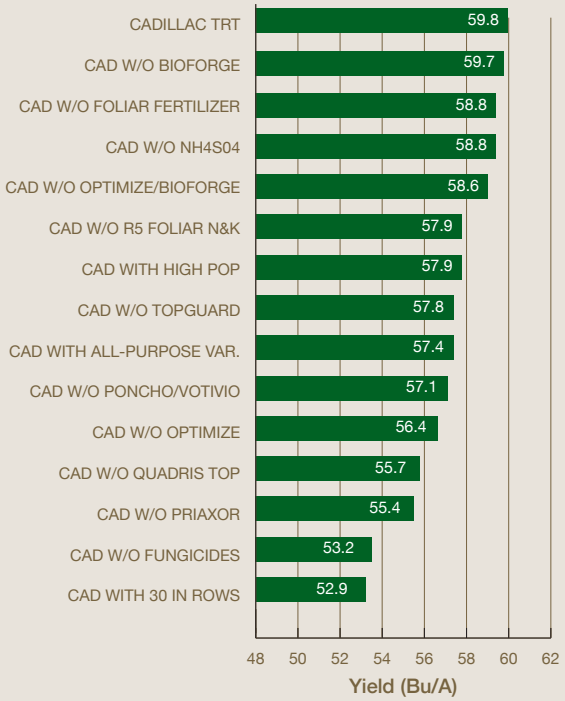
Proper soil fertility is critical to producing a high yielding crop. Soil testing to know what nutrients are limited prior to planting is a basic but important practice. Occasionally in season nutrient additions may be needed, but often times the yield bump they provide does not cover the cost of the product. Removing foliar fertilizers from the "Cadillac" treatment resulted in a 1.0 bu/A decrease in yield.

FUNGICIDES

Foliar fungicides help protect crop yield, most often in cases where the potential for disease development is high. Removing all fungicide applications from the "Cadillac" treatment, led to a 6.6 bu/A decrease in yield. Determining the best time to apply fungicides is important to protecting the crop, but this is difficult to do. Growth stage, weather, variety resistance and past disease development should all be considered when determining if and when to use fungicides.

As management decisions are made for the coming year, the five inputs evaluated in the "Cadillac" study could be considered to potentially increase yield. Incorporating even one or two of these practices into a management plan may provide a yield increase. When deciding to incorporate an additional input, it is critical to consider potential return on investment. This test will be conducted again in 2016 to see if these trends are consistent across years.

EFFECT OF REMOVING VARIOUS INPUTS IN MAXIMIZING DRYLAND YIELDS



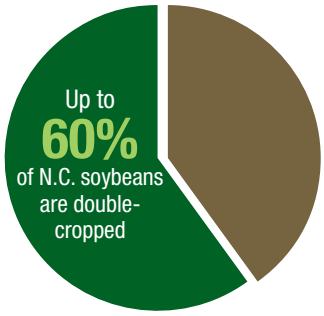
Variety Development & Testing

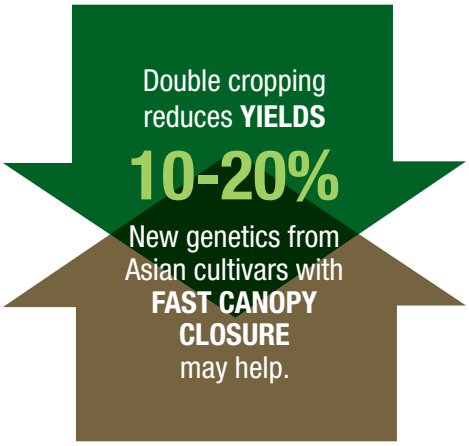
Soybean Variety Development for North Carolina

Researchers at the USDA unit in Raleigh are always working to develop new varieties that meet the needs of N.C. growers. Through the soy checkoff, the North Carolina Soybean Producers Association is able to support these efforts. Current projects include identifying traits in soybean germplasm that will help develop double crop, flood tolerant and drought tolerant varieties.

Double Crop Soybean Varieties for North Carolina **T. Carter, USDA**

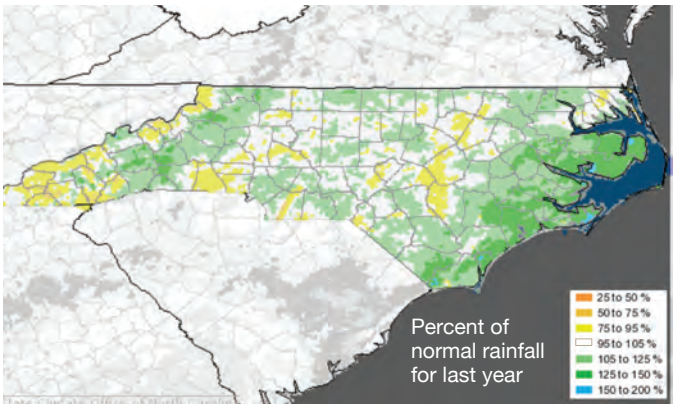
Double-cropped soybeans account for about 50% to 60% of the N.C. crop. Planted after wheat, double-cropped soybeans must make their yield in a growing season that is too short and a with a leaf area that is too small to allow maximum yields, resulting in a 10-20% yield loss compared to May planted beans. New developments in the USDA soybean breeding program at N.C. State University provide hope for boosting the yield of double crop beans. New genetics from Asia have been identified that produce a plant canopy faster than locally adapted varieties. These new fast canopy-closure types have the potential to capture more sunlight early in the season which is needed for higher yields. The fast canopy-closure types of soybeans will be evaluated under the direction of Dr. Tommy Carter to select new soybean types that perform well under double-cropped conditions in N.C. and ultimately help increase yields when soybeans are planted behind wheat.





Flood Tolerant Soybean Varieties for North Carolina **T. Carter, USDA**

Soybean varieties in N.C. do not tolerate wet feet, or more precisely wet roots, 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/A 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 N.C., show promising developments this problem may be overcome. Some soybean varieties have been shown to handle extra water much better than others in the field. New mid-south varieties will be evaluated by under the direction of Dr. Tommy Cater in 2016-2017 to determine if these varieties show a payoff in N.C. fields.



Periods of excessive rainfall & drought are becoming more common in N.C. N.C. State University researchers are working to breed varieties to tolerate these extreme weather patterns.

Soybean Recovery from Drought: A Potentially Important Trait in the Development of Drought Tolerant Varieties

T. Rufty, Crop Science Dept.; T. Sinclair, Crop Science Dept.; and T. Carter, USDA

Periods of extreme weather are becoming more common in N.C. and have significant impact on soybean production. Drought is a major problem to soybean growers and results in soil drying, plant water stress and ultimately can lead to substantial yield losses. As irrigation is not cost effective in many cases, development of drought-tolerant varieties is

an important alternative solution. Recovery from drought conditions may play an important role in a variety's ability to resist drought.

In conjunction with the NCSPA, Dr. Tom Rufty and colleagues are evaluating soybean germplasm for genetic differences in their ability to recover from periods of drought and relating these differences to key physiological processes that drive recovery. Thus far, two lines have been identified that show promise. Progress is being made to understand how soybeans regulate their growth processes during drought stress and recovery so that screening methods can be developed for fast selection of genotypes with superior recovery traits. Ultimately, traits identified in this project may be used to develop drought-tolerant varieties for N.C. growers.

Variety Demos for North Carolina Growers

J. Dunphy, Crop Science Dept.

Six demonstrations of 23 soybean varieties were established across N.C. to let farmers see the most promising varieties currently available. Included were the highest yielding variety overall, the highest when planted in May, the highest when planted in June and the predicted highest when grown in a 20-, a 40- or a 60-Bu/A environment, for each maturity group commonly used in N.C.

VARIETY	MARKETED BY	MG	YIELD (% above the avg yield of all varieties of the same MG)
P 4850 RY	Progeny	4	10.8
SS 4725NS R2	Southern States	4	12.9
P49T80R	Pioneer	4	14.4
32RY55	Crop Prod. Serv.	5	9.3
S55-Q3	Syngenta	5	10.1
SS 5511N R2	Southern States	5	10.2
P 6710 RY	Progeny	6	5.4
USG 76S73R	UniSouth Genetics	6	7.1
S67-R6	Syngenta	6	7.9
S74-M3	Syngenta	7	7.7
P 7310 RY	Progeny	7	8
AG7934	Asgrow	7	9.2

Yield of the top three performing varieties in each maturity group evaluated in N.C. over at least ten locations. Yield is reported as the percent above the average yield of all varieties tested in the same maturity group.

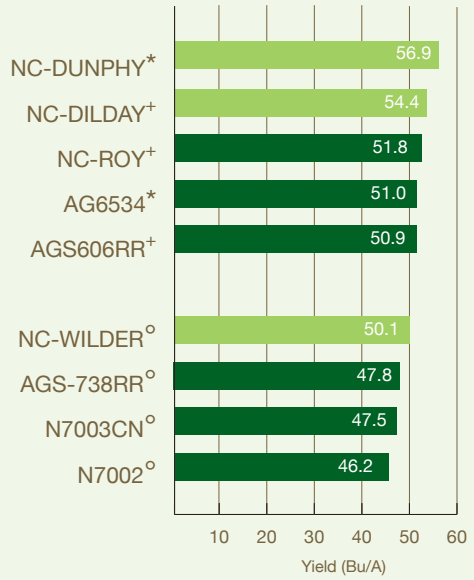
New Soybean Variety Names Honor Soy Leaders

Three new soybean varieties developed with soy checkoff support are soon to be released by N.C. State University and will be named in honor of soy industry leaders.

Breeding line NCC07-8138 is to be released as the early group six variety NC Dunphy, in honor of N.C. State University Extension Specialist Dr. Jim Dunphy.

NCC06-1090 is a late group six and will be named NC Dilday in honor of Hyde County seedsman Marion Dilday.

NCC06-899 is a mid group seven to be named NC Wilder in honor of Jim Wilder, longtime CEO of the North Carolina Soybean Producers Association.



Yield of varieties tested in the USDA Uniform Soybean Tests - Southern States from 2010 - 2014.

*27 environments, °32 environments, +54 environments

How Will Dicamba Drift Affect Non-Dicamba-Resistant Varieties?

W. Everman, Crop Science Dept.

Resistant weed species continue to plague N.C. soybean producers and are one of the primary concerns facing farmers in 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. Although many soybean acres will be planted using one or more herbicide-tolerant varieties, not all acres will be planted with the same technology. The NCSPA sought to investigate how badly off-target dicamba will injure non-dicamba-resistant varieties, so Dr. Wes Everman directed research to evaluate a number of varieties subjected to different dicamba application rates and timings. Preliminary data from year one of the study suggests varieties do respond differently to dicamba rates. In particular, preliminary data suggests group VI varieties may be more sensitive than group V varieties to low rates of dicamba, and greater injury is observed when applications are made at V4 compared to R2. This work will continue in 2016 and final results may help growers with variety selection in the future.

Novel AgChem & Herbicide Combinations for Control of Herbicide Resistant Weeds

J. Burton, Horticultural Science Dept.

Herbicide-resistant weeds are one of the major concerns for soybean growers and the problem continues to expand. Currently, there is a limited selection of registered compounds for weed management and there are no unique herbicide chemistries in development by the major agrichemical industries. An additional way to respond to herbicide resistance might be found in a method that is used in medicine when combating resistant bacteria or cancer, which is drug or chemical cocktails. Research by Dr. Jim Burton on behalf of the soy checkoff considered combinations of different herbicides with three different plant growth regulator (PGR) chemicals, diflufenzopyr (DFF), cyclanilide (CYC) and napthalm (NPA). All combinations were evaluated on Palmer amaranth in a greenhouse setting.

DFF and CYC were found to double the injury of fomesafen (Reflex) and significantly increase the activity of lactofen (Cobra) and aciflurofen (Blazer). All three PGRs caused significant increases in herbicide activity when tested in combination with mesotrione (Callisto). Only CYC increased the herbicide activity when tested in combination with topramezone (Impact) or isoxaflutole (Balance). These results demonstrate that specific combinations of agrichemicals can dramatically increase the phytotoxicity when compared to the activity of the individual compounds alone. Further field testing will be carried out to confirm these results and determine if any plant injury is associated with any of these combinations.

PLANT GROWTH REGULATORS (PGR) IMPACT ON HERBICIDE ACTIVITY

PGR	DFF	CYC	NPA
Mesotrione (Callisto)			
Glufosinate (Liberty)			
Fomesafen (Reflex)			
Lactofen (Cobra)			
Aciflurofen (Blazer)			
Topramezone (Impact)			
Isoxaflutole (Balance)			

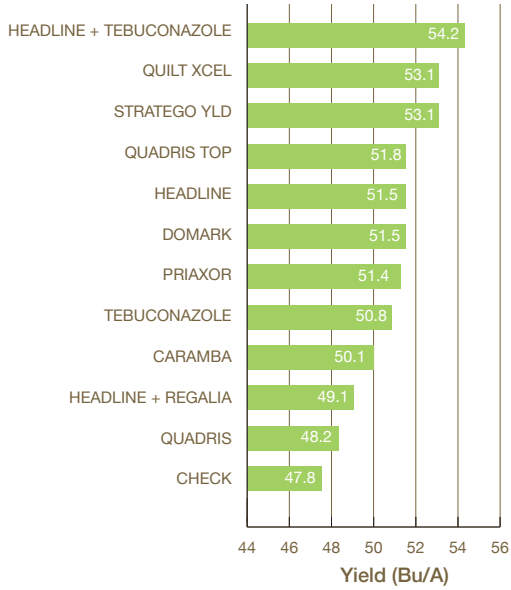
Significant increase No change

Foliar Fungicides: Do They Pay & When?

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

Application of a foliar fungicide can help reduce disease pressure and protect yield potential, but it adds additional input costs to budgets. Are fungicides a smart investment, and if so, when should they be applied? The NCSPA and the soy checkoff sought to answer this question through a group of crop consultants in eastern N.C. who evaluated fungicide product application and timing over the last two seasons. In 2014, 11 different fungicides were evaluated and a yield increase of 3 Bu/A or more was observed in eight of the 11 products compared to the untreated check. In 2015, four products that showed promise in 2014 trials were evaluated at different application times. Treatments included applications of Quadris Top, Stratego YLD and Priaxor at three different times (R1, R3 and R5), and a treatment with Headline applied at R1 followed by tebuconazole and Headline 14 days later. While moderate disease developed in the trials in 2014, little disease developed in the trials in 2015, making product evaluation in 2015 difficult. Lack of disease development in 2015 was likely the result of weather conditions and resistance provided by the variety planted. Because little disease developed, no yield differences were observed between the three products and the untreated check. In addition, no yield differences were observed between the three application times.

2014 FUNGICIDE TREATMENT YILEDS



In an independent study investigating yield increases from foliar products by Dr. Jim Dunphy, seven foliar fungicides were applied at pod development (R3). Three of the seven fungicides tested showed a 2 Bu/A or greater yield increase above the untreated check when averaged over three years. These three, Priaxor, Quadris Top and Stratego YLD were also three of the top performing fungicides in the crop consultant study from 2014, providing more evidence of the efficacy of these three products.

Combining data across years and tests, the answer to whether fungicides pay and when, would be “it depends.” If conditions are conducive to disease development then fungicides are probably a smart investment. If no disease develops, they likely will not result in a return on investment. Growers should consider a number of factors to aid in making an educated decision about whether to apply fungicides including current growth stage, recent weather conditions, genetic resistance of the variety planted, history of the field, disease occurrence and overall yield potential. The more of these risk factors that occur in a field, the greater the chance fungicide applications will be profitable. In addition to these factors, the cost of the treatment and the price of beans should factor into this decision. In years where commodity prices are low, a much higher yield response to the fungicide treatment is needed to cover the cost of the treatment than when prices are higher. More fungicide application trials are being conducted in 2016 to help to continue to answer this question.

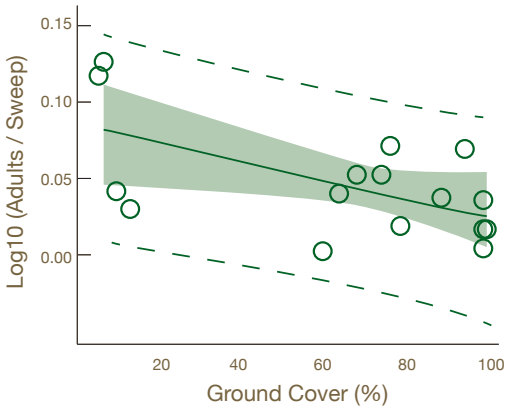
FACTORS TO CONSIDER BEFORE FUNGICIDE APPLICATION		
1	Growth Stage	The most important time to protect yield is during the approximately month long period of pod set and fill (R3-R6). Fungicide applications in early vegetative growth or late in the season (after R6) are typically not recommended.
2	Weather Conditions	Humid, wet weather is the most favorable condition for disease development. Average daily temperatures between 65-80°F and coupled with extended periods of high humidity put you at greatest risk of disease development.
3	Variety Resistance	Knowing the resistance package of the varieties you plant is essential. Varieties with less genetic resistance are more likely to need a fungicide to protect yield. Be aware, a variety may have resistance to one disease but be susceptible to another.
4	Field History	A disease is likely to occur year after year in a specific area so knowing the history of a particular disease in a field is important. Also, soybean debris is a source of pathogen inoculum so disease is more likely in a soybean following soybean rotation.
5	Disease Occurrence	Fungicides are only effective on fungal pathogens such as frogeye leaf spot and Cercospora. Applying a fungicide to treat a bacterial problem is not useful. Also, fungicides are most effective at disease prevention, not stopping the spread of the disease.
6	Yield Potential	Fungicides provide the greatest return on investment in high yield environments. In environments with poor growth and low potential yield, fungicide applications are less likely to be profitable.

Impact of Ground Coverage, Tillage and Row Spacing on Kudzu Bugs in Soybeans

D. Reisig, Entomology Dept.

Soybean trials in Georgia, where kudzu bug was introduced in 2009, have shown this pest can cause an average of a 19% yield loss. The only known effective management tactic is application of broad-spectrum insecticides and pest avoidance by planting later. The identification of varietal characteristics of soybeans that can reduce kudzu bug incidence will provide another management tactic for producers to contend with this yield-limiting pest. In a project sponsored by the NCSPA, Dr. Dominic Reisig evaluated different tillage and row-spacing treatments to determine if either of these factors affected kudzu bug densities. The tillage treatments included tilled, reduced tillage and no-till plots while the row-spacing treatments included 36-inch and 18-inch row plots. Results from the first year of this study indicate lower kudzu bug levels are found in a conservation tillage system with an elevated amount of crop residue on the ground compared to a conventional tillage system. Also, results indicate kudzu bug densities may be influenced by row spacing later in the growing season, but the risk of injury and yield loss associated with kudzu bug at that point in the growing season is not very high. This work will be conducted again in 2016 to further validate these results.

PERCENT GROUND COVER VS. TOTAL ADULT KUDZU BUGS



Refining Palmer Amaranth Management with New Technologies

W. Everman, Crop Science Dept.

New herbicide-tolerant traits in soybeans will give growers a number of options for managing Palmer amaranth in the near future. Dicamba, 2,4-D and HPPD-tolerant soybeans are all likely to be available for the 2017 season. Determining proper use and timing of these herbicides is essential to grower success with the new technology. With funding from the soy checkoff, Dr. Wes Everman evaluated weed management systems using these products over the last three years. Regardless of the product used, the greatest weed control was observed when a combined approach was carried out. Treatments including at least one pre-emergence herbicide controlled Palmer 90% or more, and treatments that included a residual product plus an HPPD inhibitor in the post-emergence application resulted in 100% control of Palmer. Dicamba provided 85% or greater control of Palmer amaranth that was smaller than six inches, but residual activity present in dicamba was effective for only one to two weeks after application. This indicates dicamba weed management programs will require the inclusion of more residual herbicides.

Regardless of the system evaluated, multiple modes of action will be required, and Palmer should be treated when it is less than six inches tall. It is essential growers continue to be timely with post-emergence herbicide applications and use herbicides with residual activity. The addition of new technology may make it tempting to switch to a total post-emergence herbicide program but this research demonstrates that using only post-emergence herbicide control is not as consistent. Re-infestation when herbicides with no residual activity are used is also a great concern. Soybean growers must continue to fight to avoid developing resistance to herbicides by using multiple modes of application and full label rates.

Spray weeds **early**, spray weeds when they are **small** and use **multiple** modes of action.

Soil Health & Soil Moisture Management

Soil Health & Conservation Practices

D. Osmond, Soil Science Dept.

Soil health is becoming an important part of crop production. Improving soil health can increase soil organic matter, thereby increasing yields due to better soil physical properties and improved nutrient cycling. However, increases in organic matter and improvement to soil physical properties are a long-term process, so it is important to analyze different tillage and cover cropping systems to determine if soil properties are actually changed so soybean yields are increased.

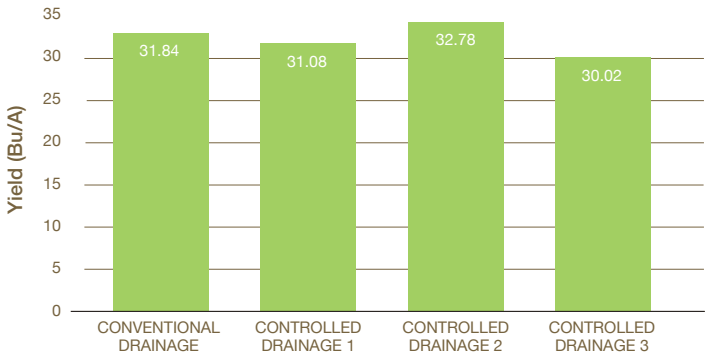
In a checkoff sponsored project, Dr. Deanna Osmond directed work to begin analyzing soil properties across three sites in N.C. Initial soil samples were collected and analyzed at both the Haney lab and Cornell Soil Health Lab. Cover crops were planted in the fall and additional soil physical, chemical and biological measurements will be gathered over the next two growing seasons to provide a more accurate picture of the effect management practices have on soil health. Understanding the impact tillage and cover crops have on soil health will allow growers to make better decisions on what management practices best promote good soil health.

New SMART Water Management System for Soybean Production

G. Chescheir, Biological and Agricultural Engineering

Water management is essential to agriculture production. In N.C.'s coastal plain, agricultural drainage is essential for crop production on 40% of the land. Drainage improves trafficability for timely planting and harvesting, and removes excess water from the plant root zone, eliminating or reducing excess water stress and improving crop yield. A drainage system that has the ability to make real time changes to the water table based on infield feedback and is coupled with surface and subsurface irrigation systems, would be valuable to a grower. Dr. George Chescheir and colleagues have developed an automated water control structure. This SMART system can increase drainage rates during wet periods or add water to the system by sub-irrigation during dry periods optimizing the soil water conditions for the crop. The SMART water management system has been installed on two research sites for field experiments in eastern N.C. through the NCSPA and the soy checkoff. In 2015, no significant yield differences were observed between conventional drainage and the SMART system but this is likely due to the very wet period that occurred during podset. An automatic adjustment of the control level in response to wet conditions may help improve yields, and the system will be tested further in 2016.

EFFECT OF CONTROLLED DRAINAGE SYSTEMS ON YIELD



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