NC SOYBEAN PRODUCERS ASSOCIATION

2022 RESEARCH REPORT

PROTECTING YIELD & PROFITS | VARIETY DEVELOPMENT & TESTING

PEST MANAGEMENT | NUTRIENT MANAGEMENT

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President's Letter

In agriculture, as in life - change is the only constant. In the 12 months since the NCSPA published its last research report, the biggest change impacting North Carolina's farmers has been in the price of inputs. As one of growers biggest variable costs, and a cost category that already had built-in momentum due to tariffs, price increases for nitrogen (up 100% since June 2021) and phosphorous (up 50%) have perhaps garnered the most attention. Not to be outdone, we've also seen 75% increases in the price of diesel and prices for critical chemistries like Roundup triple over the same period.

The silver lining for fertilizer, fuel, and Roundup is that high prices have rationed demand to the point that the products are available, for a cost. In the case of other critical products, like Dicamba, we've seen the regulatory winds shift precluding its use for key functions like late season over-the-top applications.

The common thread for all of these inputs is that products once taken for granted, can become uneconomical or even unavailable in short order. On the supply side, the NCSPA seeks to ease constraints by advocating for free trade of key inputs, pointing out the market distorting effects of industry consolidation and being a champion of sound science to ensure farmers continue to have access to critical tools at fair prices. On the demand side, the Association through its substantial research investment, seeks to give growers the information they need to optimize the use of key inputs as well as constantly evaluate new production systems so growers don't become beholden to one product or approach. In the pages of this year's Annual Research Report, you'll read summaries evaluating the management of resistant weeds in the absence of auxins, a re-evaluation of phosphorus fertilizer recommendations and performance measures on foliar fungicides among others, that all speak to giving growers options and maximizing their returns on crop inputs.

Dr. Jim Dunphy (NCSU), Dr. Rachel Vann (NCSU) and Dr. Katherine Drake Stowe (NCSPA)

While 2022 has ushered in change for our farms it has also brought change to the North Carolina Soybean Producers Association. In April, Dr. Katherine Drake Stowe, the Association's Research Coordinator, accepted a new position within the national soybean checkoff as head of the newly formed US Soybean Research Collaborative. Katherine joined the NCSPA in 2016 and in her six years with the Association kept North Carolina soybean research on a solid trajectory during a period of tremendous change – technologically, as digital tools in agriculture have come into their own, but also within the context of change at NCSU and the NCSPA. Katherine's talents will be missed. We wish her the best in her new role and do so knowing she's built a solid foundation upon which our next Research Coordinator can make the role their own.

Sincerely,

David Heath
President, NCSPA

Valuation for Differentiation of NC Soybean Meal in Poultry and Livestock Feed Formulation

E. Oviedo

In the face of growing global demand for protein, protein concentration in oilseeds has been declining since the mid-1990s. This has been true across commodities - declining protein in canola, has been especially pronounced, for instance – and in the case of soybeans, across regions. Since 2000, the average protein concentration of soybeans grown in Brazil has declined by 1.5 percentage points, in the US it has declined by 1.75 percentage points, while in Argentina it has declined by over 3 percentage points (Figure 1). Within the United States, the regions with the biggest declines also happen to be the large production regions, namely the Eastern and Western corn belt. While no one is exactly certain for the reasons behind this decline, one reasonable hypothesis is that a singular focus by seed companies on yield has come at the expense of seed composition.

With declines in protein across the board, more production regions around the world are struggling to meet the threshold for Hi-Pro (47.5% crude protein) soybean meal. Below this threshold, meal and bean prices can be docked considerably. While protein concentration has been falling in North Carolina beans, generally speaking the state's growers have a positive story to tell. The rate of decline in North Carolina is slower than elsewhere in the country and today our crude protein concentration (based on USSEC survey data) is at the higher end of the spectrum nationally (Figure 2).

In 2021, the NCSPA decided to look into North Carolina soybean quality characteristics further, benchmarking meal made from North Carolina beans against key production regions around the world - not just for crude fat and crude protein, but for key, limiting amino acids and energy. The results were encouraging, with the tests confirming North Carolina's position as a producer of high protein and high fat soybeans but also demonstrating that meal made from NC beans was higher in key limiting amino acids, like methionine for poultry and lysine for hogs (Figure 3). For 2022, Dr. Oviedo and his team will be resampling beans from NC and competing regions to provide another year's worth of quality data. This data will be fed into a Least Cost Formulation software used by feed compounders to translate quality measurements into a metric of cost, demonstrating the potential savings to be had for livestock producers by sourcing high-quality soybeans from North Carolina.

Figure 1. National soybean protein levels over time

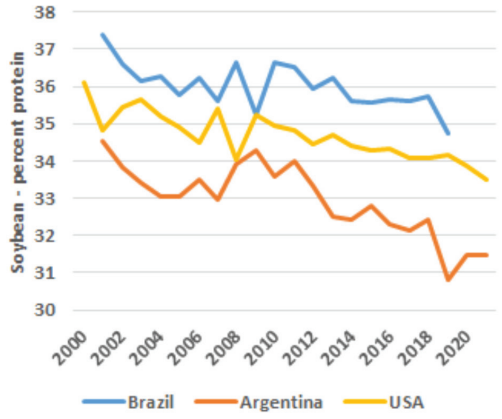


Figure 2. Regional US soybean protein trends over time

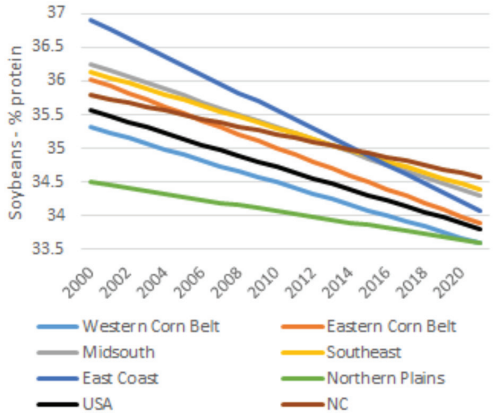


Figure 3. Compositional analysis of meal made of soybean from select locations

NUTRIENT	UNIT	NORTH CAROLINA	E. CORN BELT	W. CORN BELT	BRAZIL	ARGENTINA
Crude Protein	%	48.23	46.38	45.74	47.35	45.84
Crude Fat	%	2.7	2.21	2.33	2.38	1.9
D-Methionine Poultry	%	0.57	0.55	0.55	0.56	0.55
D-Lysine Hogs	%	2.6	2.56	2.52	2.61	2.51
ME-Poultry	Kcal/kg	2135	2168	2189	2059	2165

KEY FINDINGS

Evidence suggests North Carolina grows soybeans that are not just higher in crude protein and oil, but also higher in key limiting amino acids like methionine and lysine. The NCSPA is exploring opportunities to translate these findings into new opportunities for North Carolina growers.

Supplemental Fertilization Strategies for High-Yielding Soybeans in North Carolina

L. Gatiboni

Over the past five years, average soybean yields in North Carolina (37 bu. per acre) have lagged average US yields (50 bu. per acre) by 25%. While tougher agronomic conditions and a seed-industry focus on the Midwest contribute a great deal, some of the gap can also be explained by soybean's historical role in North Carolina as a rotational crop rather than a mortgage maker. A key focus of NCSPA's research program in recent years has been exploring ways to transition soybeans from a rotation crop to an engine of profitability on the farm. In many fields across North Carolina, we see soybean yields in excess of 70 bushels suggesting there is untapped potential in advancing average yields.

In 2021 the NCSPA began funding a three-year study exploring whether supplemental fertilization, beyond NCDA recommended levels, could be employed to increase North Carolina yields. Specifically, the study is evaluating supplemental fertilization strategies at planting (starter N, S &P) and during reproductive stages (N and micronutrients). These supplemental fertilization strategies will be compared with the standard fertilization program recommended by NCDA&CS using an economic analysis.

In the first year of the study, four trials were established in Union, Pender, Washington, and Columbus counties. As expected, there was a significant difference between the locations, as the locations selected for the trials were deliberately chosen in different regions with different soil types. Data analyzed for three locations (Beaufort, Union, and Pender County) indicated no significant differences in yield between any treatments. Only one location (Columbus County) showed differences among treatments, with a slight advantage of using NPS fertilizers at planting. However, this was the site with the lowest phosphorus index, which explains this result. In three locations, soybean nodulation was evaluated with one location showing significantly lower nodule count and weight in treatments with N fertilization compared to those without N fertilization.

The results from this first year show that the supplemental fertilization strategies tested were not efficient in increasing yield at most locations and the nitrogen use can negatively affect nodulation. A second year of evaluation will help to clarify these results.

Specific implications for Phosphorous

Based on this and other complimentary studies, some older and some more recent, the Interagency Soil Test Phosphorous Committee, comprised of researchers from NCSU and NCDA concluded that critical levels for phosphorus (P index) are too high. Work done specifically on soybeans throughout the 1980s and 1990s established critical P indices averaging 25 in sandy soils, while similar studies on corn and wheat established indices of 10 in piedmont soils – both suggesting a P index of 50 provided a safety factor that was more than adequate.

More recent analysis has shown that North Carolina has the highest P fertilizer recommendations of all southern states in soils with P Indices > 15 (Figure 4). Between 2017 and 2019, the state's average P Index was 137 for 712,000 soil samples analyzed by NCDA&CS – suggesting that most NC soils were not only P sufficient, but that P was being accumulated to levels that were uneconomical with potentially deleterious environmental impacts.

With these findings, the Phosphorous Committee took the step of recommending that no fertilizer be used on soils with a P Index greater than 50, changing the P2O5 recommendation equation to the relationship illustrated in Figure 5.

Figure 4. Rates of P fertilizer recommended for grain crops in select southern states

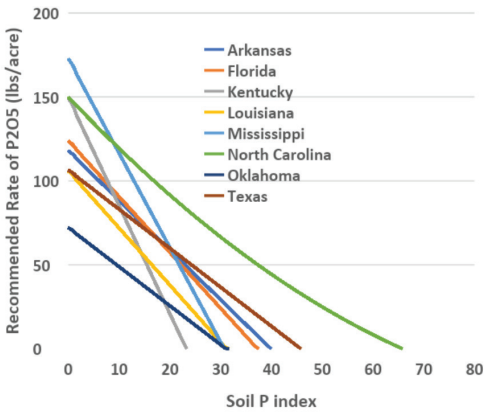
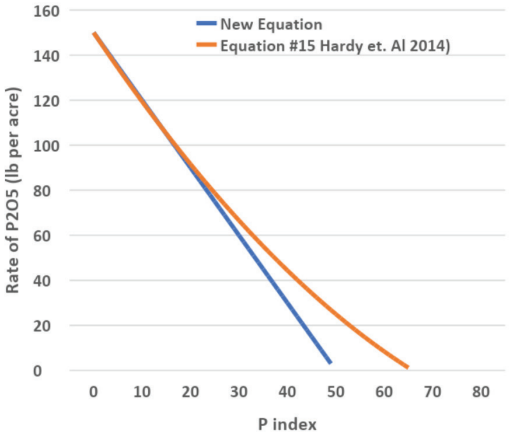
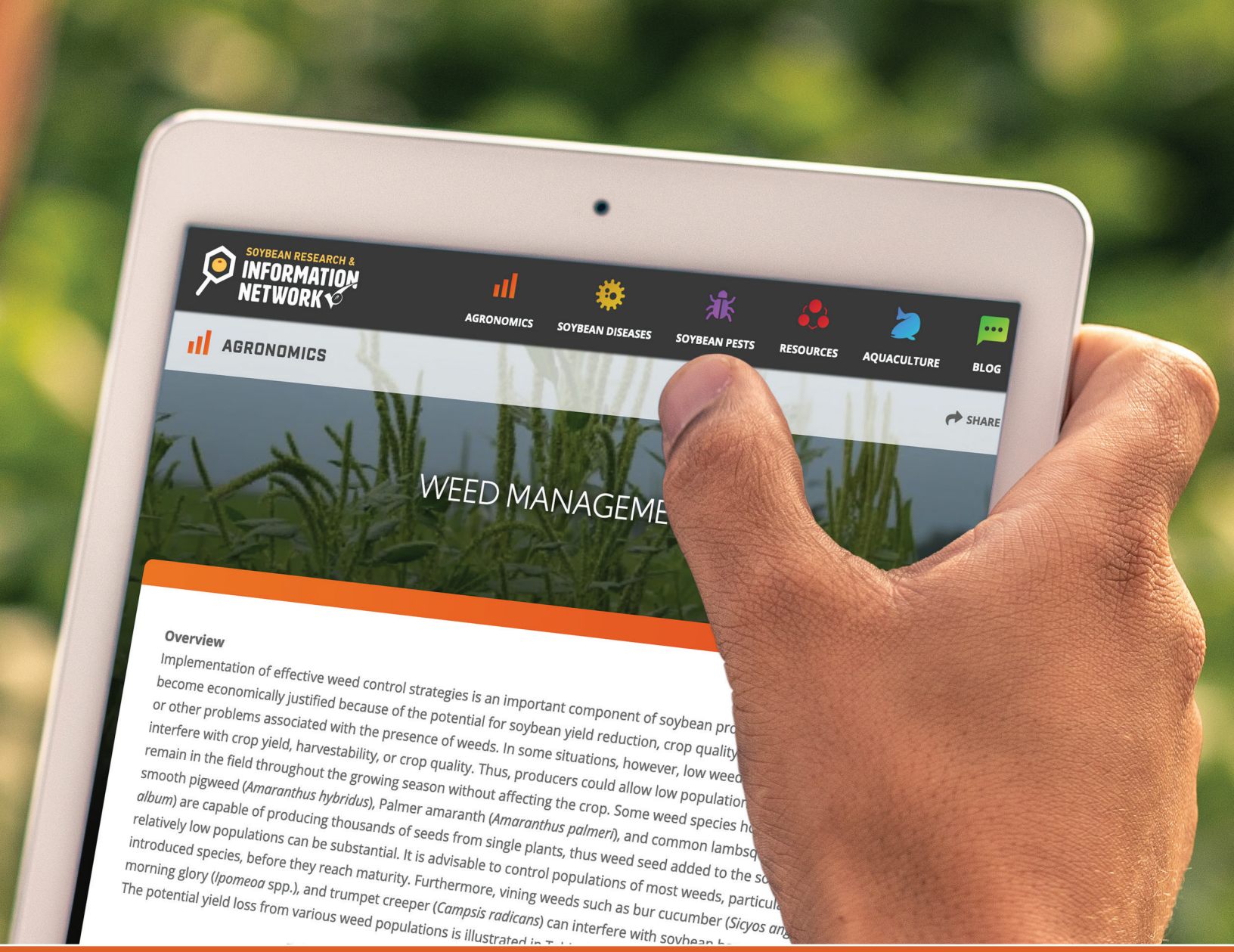


Figure 5. Rates of P fertilizer recommended for grain crops in NC using old and new equation



KEY FINDINGS

- Early data suggests supplemental fertilizer strategies do not increase yields and in the case of nitrogen, may negatively affect nodulation.
- NCDA's phosphorous fertilizer recommendation equation has been altered to recommend that no phosphorous be applied on soils with a P index greater than 50.



ONE LESS THING TO WORRY ABOUT.

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

soybeanresearchinfo.com

Funded by the soybean checkoff

SOYBEAN RESEARCH & INFORMATION NETWORK

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Impact of Poultry Litter on Soybean Yield and Quality

S. Kulesza

Suppliers for key agricultural inputs have increased prices significantly over the past two years. In the case of fertilizers, price increases have been further exacerbated by tariffs on imports from key suppliers and, more recently, disruptions of trade flows caused by the war in Ukraine. The net effect for farmers has been severe with Phosphorous fertilizer prices doubling and Nitrogen fertilizer prices tripling over the past 18 months.

North Carolina is the third largest turkey producer, fourth largest broiler producer and eighth largest producer of laying hens in the United States. In the past, managing the manure from these birds was viewed as a challenge but in today's high-price fertilizer environment, there has been growing interest in evaluating the efficacy of poultry litter as a fertilizer. Poultry litter in North Carolina is abundant and low-cost, with prices ranging from $0-$20 per ton plus an additional $15 per ton for trucking.

In a multi-year study, NCSU evaluated the impact of nitrogen fertilizer applied inorganically or organically as poultry litter. Across two years and three sites, there was no positive yield response from N application to soybean. In 2019, there was no response to additional N, whether applied as inorganic N or poultry litter, and in 2020, there was a negative response to increasing inorganic fertilizer rate at one location (Plymouth), with no response to the addition of poultry litter. Application of inorganic N resulted in a reduction in plant population in 5 of 6 site years of the study. Through this research, we've been able to establish that litter, as a source of nitrogen, is best utilized in other crops, unless there is a need for phosphorus.

KEY FINDINGS

Evidence from this study suggests that poultry litter should only be applied to soybean as a phosphorus, potassium, or micronutrient fertilizer. There is no value to the addition of nitrogen, whether through inorganic nitrogen or poultry litter application.

Managing Resistant Weeds in the Absence of Auxin Herbicides

W. Everman

Because of its propensity to drift, auxin herbicides have been under tremendous scrutiny over the past several years. While the NCSPA advocates for sound science and availability of auxins for use in soybean for years to come, it also behooves the industry to explore alternative regimes for broadleaf weed control in soybeans. Two years into a three-year project, NCSU researchers have established that North Carolina soybean producers have options for managing broadleaf weeds in the absence of auxin herbicides.

Generally speaking, there needs to be heavy reliance on residual herbicides applied PRE and Early POST, although sequential POST applications of Liberty following a PRE herbicide can also provide excellent Palmer amaranth control when timely applications are made. The best performing treatments in terms of yield and Palmer amaranth control at the last rating date consisted of two PPO-inhibiting herbicides applied sequentially - 1) Fierce applied Preemergence followed by Flexstar Late Post (V6) and 2) Prefix at V2-V3 followed by Flexstar at V6. While these remain effective regimes currently, they are not ironclad given PPO-resistant Palmer amaranth, waterhemp, redroot pigweed, and common ragweed have already been identified in the state.

Figure 6. Herbicide programs that provide 90% or more Palmer Amaranth control

PRE	Early Post (V2-V3)	Late Post (V6)	PRE	Early Post (V2-V3)	Late Post (V6)
N/A	Prefix	Liberty	Boundary	Prefix	Liberty
N/A	Prefix	Flexstar	Boundary	Prefix	Liberty
N/A	Liberty	Liberty	Boundary	Warrant Ultra	N/A
Fierce	N/A	N/A	Boundary	Warrant Ultra	Liberty
Fierce	Liberty	N/A	Boundary	Warrant Ultra	Flexstar
Fierce	N/A	Flexstar	Boundary	Liberty	Liberty
Fierce	Prefix	N/A	Boundary	Liberty	Flexstar
Fierce	Prefix	Liberty	Authority	Prefix	N/A
Fierce	Prefix	Flexstar	Authority	Prefix	Liberty
Fierce	Warrant Ultra	N/A	Authority	Prefix	Flexstar
Fierce	Warrant Ultra	Flexstar	Authority	Warrant Ultra	Liberty
Fierce	Liberty	N/A	Authority	Warrant Ultra	Flexstar
Fierce	Liberty	Liberty	Authority	Liberty	N/A
Fierce	Liberty	Flexstar	Authority	Liberty	Liberty
Boundary	N/A	Flexstar	Authority	Liberty	Flexstar

KEY FINDINGS

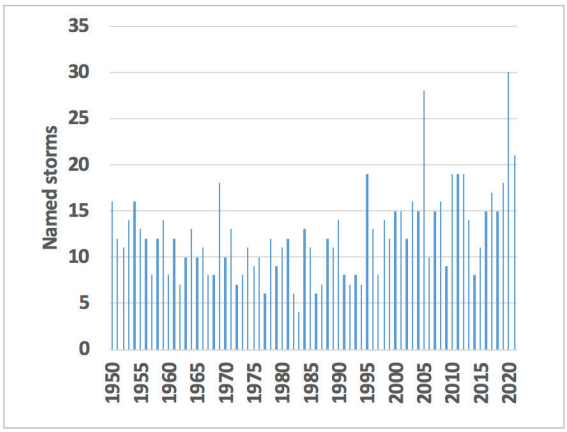
If auxins were no longer available, there are a number of regimes that effectively control broadleaf weeds in soybeans. Unfortunately, some of the most effective programs involve PPO inhibiting herbicides and noxious weeds with resistance to this mode of action have already been identified within the state.

Flood Tolerant Soybean Varieties for North Carolina - Building on Success

B. Fallen, A. Locke

Flooding is just one of many natural occurrences with which growers must contend. It can lead to reduced yield, as the standing water and water-logged soils deprive plants of the necessary light oxygen and carbon dioxide required for growth. Symptoms of flood stress in soybeans can range from reduction of nitrogen fixation within the root nodules, chlorosis and necrosis of the leaves, defoliation, stunting, and the most severe – plant death. In areas prone to flooding, the yield loss that occurs from this environmental stressor can be just as detrimental as drought.

Figure 7. Named storms in the North Atlantic



Across North Carolina, flooding is becoming more prevalent due to rain and storm surges associated with more frequent hurricanes (Figure 7) as well as poor water management on some government owned lands. In 2018, North Carolina farmers were reminded of the devastating effects of flooding when soybean yields were reduced by upwards of 1/3 across many of the state's coastal counties.

A hallmark of the research program at USDA's Nitrogen Fixation Unit in Raleigh, has been its development of varieties more resilient to extreme weather events. In 2021, the NCSPA began funding a study measuring flood response at germination and at the V1 growth stage across 15 genotypes. For both aspects of the study, fields with surrounding berms were flooded to 1.5-2.5 inches of standing water.

In the case of germination, rates were recorded 14 days after the release of flooding ranging from 0 to 32 hours in duration. At 0 hours, germination rates (Diagram 8) were fairly uniform, averaging 95%. By 32 hours of flooding, however, significant differences in performance across genotypes emerge with germination rates ranging from 31%, at the low end, to the 59% registered by N05-7380.

To evaluate impacts at the V1 growth stage, plots were exposed to flooding durations ranging from 0-10 days, with biomass then measured during the R1 growth stage (Figure 9). Impacts of flooding at V1 were more consistent across genotypes with mean biomass loss ranging from 23% to 33% and as a result, genotypes with more biomass at the control (0 days) also tended to have more biomass after 10 days of flooding conditions. Notably, the N05-7380 genotype exhibited the greatest resiliency to flooding exposure at both germination and the V1 growth stage as well as comparing favorably in visual ratings of flood stress.

Figure 8: Seed germination rates at four flooding durations across 15 genotypes

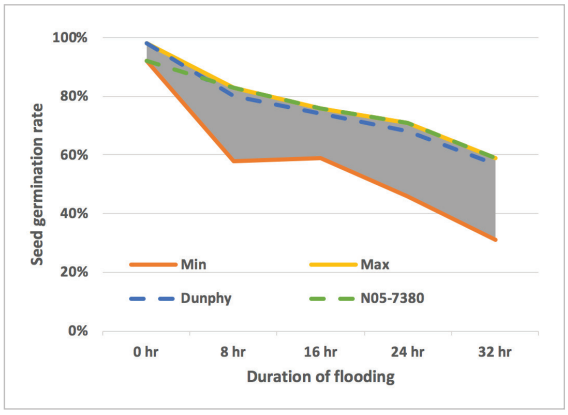
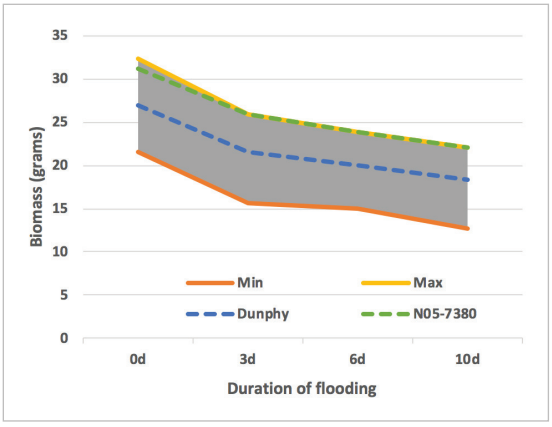


Figure 9: Recorded biomass at three flooding durations across 15 genotypes



Despite the observed differences between flood tolerant and susceptible genotypes, all studied genotypes were incapable of establishing plant stands large enough for optimal yield when flooding was imposed for longer than 8hr during germination. While the genotypes with the highest level of flood tolerance did not perform at the desirable level for germination, vegetative or reproductive growth when subjected to flooding, they did continually outperform the susceptible varieties. These results suggest that the genotypes identified as flood tolerant can be used in future efforts to improve resiliency during these crucial growth stages and overall improve yield under flood conditions. For 2021, seeds were not planted early enough to evaluate flooding impacts on yield. For 2022, however, yield impacts will be evaluated.

KEY FINDINGS

- There are significant differences across genotypes in the face of flooding exposure at both the germination and vegetative growth stages
- A few lines showed promise in withstanding flooding conditions & these lines can be used to continue breeding for improved resiliency

Leveraging Real-Time Insect Traps and Data Analytics to Improve Corn Earworm Risk Prediction

A. Huseth & D. Reisig

On average, corn earworm, is the top insect pest in North Carolina. As such, the NCSPA devotes a fair amount of its research bandwidth to better understanding the pest and related management strategies. Beginning in 2020, NCSU deployed a network of 21 pheromone traps for corn earworm across five counties in eastern North Carolina with the goal of predicting spatiotemporal variation in the timing of corn earworm activity adjacent to soybean and other crops. NCSU researchers observed considerable spatial variation among locations in both 2020 and 2021 and no significant difference in corn earworm activity between years by location (Figure 10). These results suggest that specific environments in the soybean agroecosystem are at greater risk of corn earworm infestation – a finding that could ultimately aid in the development of a risk prediction model which, in turn, could be useful in allocating scouting and spraying decisions.

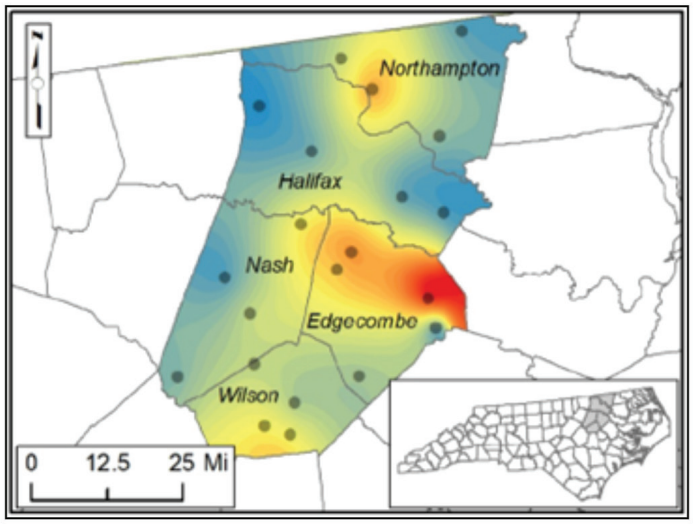


Figure 10. Average corn earworm activity over two-year period

Progress on the development of new automated traps including an improved sensor array, weatherproofing and an IR sensor was delayed in 2021 due to Covid related shortages from manufacturers abroad. As these supply chain issues abate, NCSU researchers have spent the winter of 2021-22 lab testing the instruments in anticipation of a larger rollout to support the risk prediction model in 2022.

KEY FINDINGS

There are specific environments in the soybean agroecosystem that are at greater risk of corn earworm infestation – a finding that could ultimately aid in the development of a risk prediction model which in turn could be useful in allocating scouting and spraying decisions.

Will the Increased Planting of Indeterminate Soybean Varieties Extend the Time Corn Earworm Can Infest Soybeans?

D. Reisig & R. Vann

Whether it is for managing work flow at harvest, superior performance in high-yielding environments or the ability to get beans out of the field in advance of hurricane season, indeterminate soybean varieties have grown in popularity with North Carolina farmers in recent years. Recognizing that the longer flowering period of indeterminate varieties may make them more susceptible to Corn Earworm (CEW), the NCSPA commissioned a second project on this pest to determine whether CEW treatment thresholds, most of which had been based on work with determinate varieties, needed to be revisited, particularly when planted in a double crop situation.

To begin re-evaluating thresholds, NCSU researchers established plots at four locations, two in the Coastal Plain and two in the Blacklands. Consistent with low levels of activity observed in the rest of the state, all four locations received CEW pressure below threshold levels in 2021. Consistent with results observed in full season varieties (2019 and 2020), no discernible differences in CEW pressure were observed between determinate and indeterminate varieties at later planting dates. Similarly, no variation in egg-laying patterns, up and down the canopy, were observed between determinate and indeterminate growth habits.

KEY FINDINGS

At this time, CEW thresholds should remain the same for both determinate and indeterminate varieties, regardless of whether they are full-season or double-cropped.

Evaluating UAV (drone) Use for Within Season Management Decisions in North Carolina Soybeans

R. Austin & R. Vann

Many soybean growers are interested in the use of satellite and drone-based imagery for use in on-farm decision support. However, as these new products and services develop, confusion abounds as to the best and most beneficial uses for the technology. To better understand the applications and value of on-farm imagery, the NCSPA has funded research aimed to identify the most promising and potentially profitable uses for these technologies.

Imagery between satellites and drones were both visually and analytically compared. Yield maps provided by collaborating soybean growers are being used with imagery-based establishment estimates and computer-generated stand-counts to better understand the financial impact of poor stand establishment on yield. Reported pest and disease outbreaks were also analyzed using satellite and drone imagery with commercially available products and services (Figures 11 & 12). This information is helping assess the value of the imagery in scouting soybeans and directing within-field scouting activities.

Initial data indicate that drone-based stand counts have clear advantages over traditional methods used to estimate stand establishment, but results are sensitive to the algorithm and training of the prediction model. When considering either scouting and monitoring fields using satellite-captured imagery, the inconsistency in cloud-free images can limit their utility when dependable and repeatable image source is required to support a time-sensitive decision (e.g. a corrective action for disease or pest concerns). In comparison, using drones to proactively scout fields provides consistent imagery for decision support but field size is an important factor that impacts the time and resources required to arrive at an imagery-guided decision. Regardless of the imagery source, the disease and pest concerns required on-ground expertise to diagnosis, however the drone imagery was able to identify the relative severity and within-field location and extent of the problem areas.

This project will continue in the 2022 growing season with a focus on the accuracy of commercially available stand count algorithms and their ability to support replant decisions. Additional field trials are also planned to test the use of drone imagery in identifying, differentiating, and counting problematic weed species in well-established soybean stands.

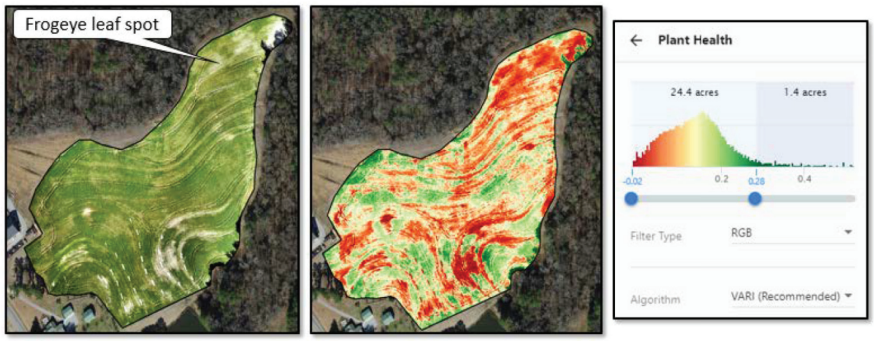


Figure 11. Outputs from a cloud-based solutions provider (Drone Deploy) illustrating the original true-color (RGB) drone imagery and a derived 'plant health' vegetative index. Frogeye leaf spot was reported in this field and appears 'red' in the derived vegetative index in the middle figure.

Figure 12. Comparison of drone versus satellite imagery of poor soybean stand. Images collected June 17, 2021. Although spatial detail is significantly less pronounced in the satellite imagery compared to the drone imagery, the magnitude and scale of the issue remains identifiable in the satellite imagery. However, at 10 meter ground resolution details are lost and the utility for decision support diminished.

KEY FINDINGS

- Rapid advancements in image classification are expanding the use cases for drone and satellite technology in soybeans. That said, there are still many applications where more ground truthing is required to assist in supervised learning of computer models.
- Satellite imagery offers advantages in terms of cost, frequency and scalability however drone imagery is superior in small fields or in areas with greater spatial heterogeneity

Maximizing Soybean Yield Through Maturity Group and Population Selection Based on Soybean Planting Date

R. Vann

While there may be minor disagreement at the margins, the conventional wisdom holds that to maximize yields, soybeans should begin reproductive growth around the summer solstice. Historically, competing demands of alternative crops pushed soybean planting dates past optimal planting windows. That has changed in recent years, however, as cropping rotations have changed, not only making soybeans an increasingly important engine of profitability on the farm, but also granting growers more bandwidth to prioritize soybean production. This change has manifested itself in a number of ways, with one of the most easily observable being earlier planting dates.

Soybean Extension specialist Dr. Rachel Vann has been evaluating the interplay of planting date, maturity group and population selection on yield dating back to 2019. This study also evaluates how these management factors impact soybean protein and oil content. To carry out this work, research trials were established at 11 North Carolina environments, making this the largest NCSPA funded project currently underway.

Over the three years of data collected to date, clear trends emerge across high-yield and low-yield environments. In high-yield environments, generally early to mid-May planting maximized yield while in lower yield environments planting from late April through late May provided similar yields. Pushing planting past May resulted in yield declines in both yield environments. Planting date and maturity group interact to affect soybean yield, meaning that the same MG is not the best across all planting dates. In *high yield environments*, MG4 and MG5 yielded highest when planted before May. In *lower yield environments*, MG6 yielded the highest when planted before May. At full season planting dates in May, MG5 and MG6 tended to provide the highest yields regardless of yield environment. At planting dates past May, our data so far indicates that growers have flexibility in using MG4-7 regardless of yield environment. Although not illustrated here, protein content was found to be higher in MG5-7 varieties regardless of planting date.

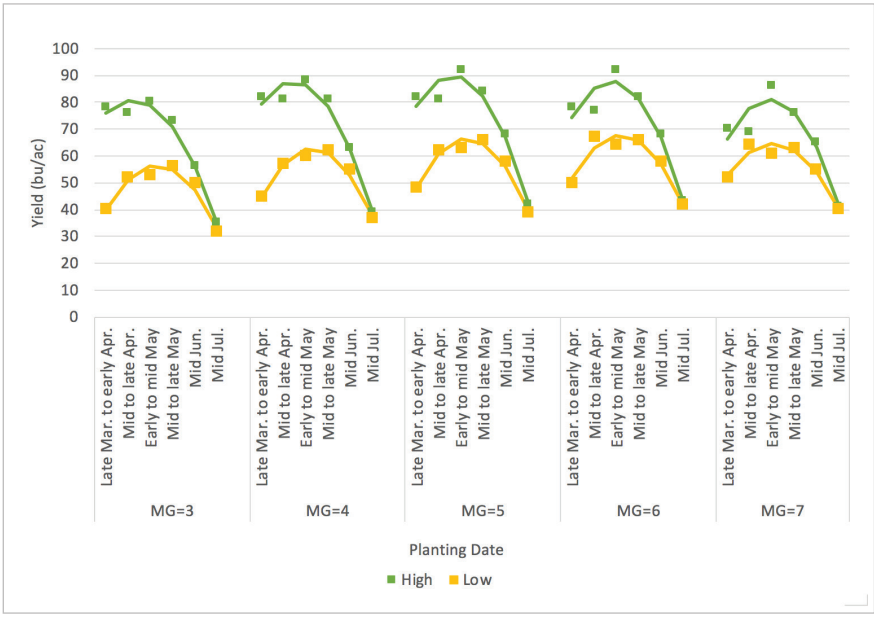


Figure 13. The impact of planting date and maturity group on soybean yield pooled over high and low yield environments from 2019-2021

This research will continue from 2023-2024 in an effort to generate enough data to develop a grower decision support tool that will aid North Carolina soybean producers in selecting the optimal maturity group and seeding rate to use across the diverse soybean planting dates used in this state. With another year of data available, the intent is to also explore how the interaction of maturity group and planting date play out across sites. In the meantime, NCSU and NCSPA staff have been collaborating with RMA to use this data to reevaluate dates of insurance coverage for soybeans in North Carolina.

KEY FINDINGS

- Across maturity groups and yield environments, yields are typically maximized through late April to mid-May planting.
- Optimal maturity group varies based on planting date and yield environment.
- Protein content was found to be higher in MG5-7 varieties regardless of planting date.

What Foliar Products Will Narrow the NC Soybean Yield Gap?

R. Vann

Recent analysis of North Carolina soybean yield contest entries dating back to 2002 has established foliar fungicide use as a critical factor in maximizing yields. In 2021 the NC State Soybean Extension Program evaluated a variety of foliar fungicide treatments with several goals that included to (1) evaluate currently available foliar fungicides, (2) compare these to older fungicides, (3) compare multiple application timings to single applications to determine the impact on yield and seed quality and (4) evaluate foliar fungicide impact on soybean yield in diverse yield environments.

To carry out this evaluation, plots were established at four diverse yield environments across the state (Figures 14-17). Figure 18 illustrates how 11 foliar applied fungicides performed across these four locations measured on yield and, in two locations, on seed stain. Squares shaded in darkest green are indicative of the product outperforming the control while those shaded in red indicate underperformance.

Figure 18. Yield response, by fungicide, across four sites and various levels of disease pressure

Site	Edgecombe	Union	Washington	Yadkin
Pressure	Heavy	Heavy	Minimal	None
AproachPrima_R3	45.7	39.2	57.2	53.7
Delaro_R1	47.9	42.3	65.4	59.3
MiravisTop_R3	**52.5**	39.0	58.0	57.3
Priaxor_R1	42.9	35.5	58.9	51.5
Priaxor_R1_R3	48.2	**34.8**	59.8	60.7
Priaxor_R1_R5	40.8	**36.3**	56.1	55.1
Priaxor_R3	43.0	39.6	55.3	59.3
Priaxor_R3_R5	42.3	39.0	58.8	54.2
Priaxor_R5	41.3	**36.4**	57.7	54.2
Revytek_R3	**55.7**	41.2	61.8	59.7
StrategoYLD_R1	NA	38.1	59.4	56.9
Control	36.1	41.9	58.4	55.6

Bushel change relative to control					
< -5	-5.0 to 0	.1 to 5	5.1 to 10	10.1 to 15	>15

Figure 14. High frogeye leaf spot in Edgecombe County

Figure 15. Heavy late-season cercospera pressure in Union County

Figure 16. Minimal disease pressure in Washington County

Figure 17. No visual disease pressure in Yadkin County

KEY FINDINGS

- Across the board, foliar applied fungicides provided meaningful yield gains when used to combat heavy Frogeye Leaf spot pressure.
- In the case of heavy, late-season Cercospera pressure, only one fungicide translated into yield improvement and even then it was subtle at 0.4 bu. per acre.
- Several newer fungicidal chemistries provided superior disease protection across environments.

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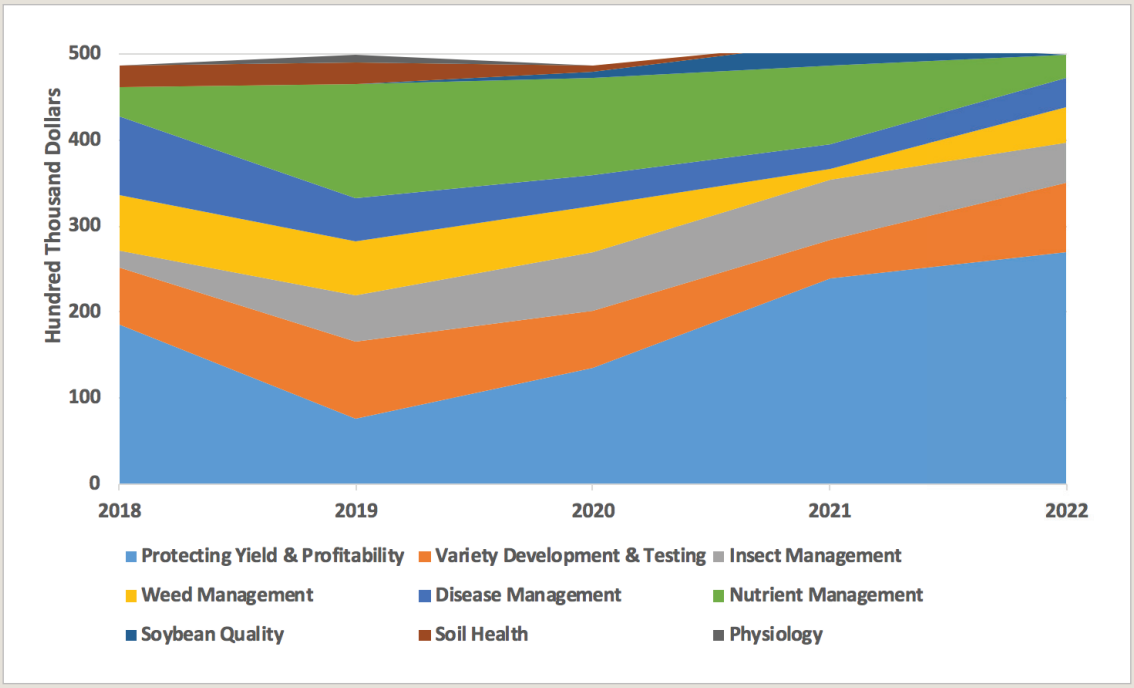
Figure 19. NCSPA 5-yr funding snapshot



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