Confident Hope That Will Not Let Us Down

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One of my favorite bible passages is Romans 5:3-5. These verses are a summary of how we should be striving to grow physically and spiritually. We rejoice in our sufferings because they help us develop perseverance which in turn builds up our character and as we grow in character we seek to achieve the most important attribute of all, confident hope.

So what is confident hope? Confident hope is when you can see past the worse times or even the times when things seem to be going fine and know that, bad or good, you have a future full of promise, peace, and happiness.

Last fall in the midst of our suffering through a disastrous corn crop we had the confident hope that we would see a better tomorrow. Now, as this corn harvest wraps up many have found that their confident hope did not let them down. Outstanding corn yields are common this season rewarding growers who took the chance on growing corn. The issue for corn growers this fall and winter is to further grow their confident hope such that the worries that growers face each year about what choices to make in growing corn are replaced by confidence in those decisions.

That is why the research projects described in this report are so important to you. The outcomes from these projects help growers make confident choices when selecting corn hybrids, seeding rates, applying lower nitrogen rates, controlling weed and disease pests, understanding how to work with soils to provide more water and nutrients to the crop, and information for getting a better price for your corn.

Your investment in research and market development through your corn checkoff dollars allows these researchers to test those ideas and separate those that work from those that don't. Your checkoff dollars are really investments in the priceless value of new ideas that when, used on your farm can make you successful and turn worries into confident hope.

Fall 2025 Newsletter

NCARS/NCCES Code 25-01

The Economics of Water Management Technologies for Corn Production Profitability in North Carolina

Project Leaders:

Nick Piggott
Alexander Trovillion
Chad Poole

Objectives:

This proposed project will examine the economics of whether corn producers in North Carolina can increase profitability and reduce production risk by investing in water management systems that include irrigation, drainage, or a combination of both. This project will explore the questions in the following ways:

1. The project will begin by creating a framework of the investment costs associated with water management systems at the farm-scale level within certain regions of the state. This framework will develop estimates of the installation costs of various drainage systems (e.g. open ditch, tile drainage, or precision grading) and irrigation systems (e.g. center pivot or travelling gun) on a dollar per acre basis.
2. The next phase of the project will then analyze whether these technologies can increase the profitability of corn production in North Carolina. This profitability analysis will require determining the profit-maximizing level of water management, estimating the actual additional profits generated from the technology, and contextualizing these findings by incorporating them in a partial budget analysis.
3. This project will conclude by using DRAINMOD in conjunction with regional agronomic and climatological data from the Non-Irrigated Corn Soil Moisture Network, the NC EcoNet, and the USDA NRCS Web Soil Survey to identify the profit-maximizing level and the magnitude of the additional profits generated from water management for primary growing regions across the state where the data is available.

Project Description & Relevance:

Introduction

It is crucial for corn to receive adequate water at critical stages of the growing season. Much of America's agricultural production is concentrated in the Midweset due to a variety of reasons including consistently favorable precipitation and fertile soils among other factors. By contrast, precipitation in North Carolina has a higher degree of variance, or unpredictability, than in most Midwestern states. Compared to the top three (Illinois, Minnesota, and Nebraska) North Carolina's precipitation variance over the past 30 years has been 13% higher, 23% higher, and 26% higher, respectively. Yet, only a relatively small number of North Carolina growers have adopted water management strategies. In 2022 10.8% of farms used irrigation and 22.64% of farmland was artificially drained.

Rationale

To improve resilience against weather variability, growers can invest in water management technologies such as traveling gun or center pivot irrigation, precision grading, open ditch, or tile drainage. The challenge, however, lies in determining the optimal degree of water management technology that will be useful within the various regions of North Carolina given the state's variable weather patterns.

Another key consideration is the profitability of these investment, which is directly related to the payback period, or how long it will take to recover the initial investment costs for these systems. Growers face considerable investment costs when looking to install water management technology. The actual costs vary widely depending on the system's size, location, water source requirements, and other factors which makes it difficult to pinpoint a single representative per-acre cost. Therefore, a range of costs might be more appropriate to reflect this heterogeneity.

Irrigation has been shown to increase yields by up to 124% while drainage systems can boost yields by between 71% and 112% depending on soil characteristics and management strategies.

By evaluating the profitability of irrigation, drainage, or a combination of both, this project aims to help farmers in North Carolina make informed decisions about which water management strategies will maximize profitability in their growing region given the investment costs of the water management technology to achieve yield increases and comparable yield stability to the Midwest.

Agronomic vs. Economic Optimization

The research trials conducted on the TAWM site in Plymouth, NC play a pivotal role in advancing the understanding of key inputs for row crop production. Specifically, the Corn Hybrid Water Stress Trials investigate the role of irrigation and drainage in optimizing corn yield. These trials provide invaluable agronomic insights by identifying the water management levels that achieve the agronomic optimum at a fixed population and fertilization rate.

Building on the agronomic findings, economic optimization includes cost alongside yield as a parameter to be optimized within a profit function. Doing so evaluates the improvements to yield balanced with the associated costs, thus identifying the profit-maximizing level of water management.

Optimizing Corn Production: Balancing Population, Nitrogen, and Water for Economic Sustainability

Project Leaders:

Chad Poole
Chadi Syade
Ron Heiniger
Nick Piggott

Objectives:

The goal of this research is to determine the optimal corn seeding and N fertilization rates for high yielding corn under no water management limitations and to evaluate the economic sustainability of corn production within certain regions of the state.

The specific objectives are to:

1. Determine the optimal corn population for flex and non-flex corn genetics in an ideal soil water environment for corn
2. Determine the optimal N fertilization rate for flex and non-flex corn genetics in an ideal soil water environment for corn.
3. Investigate the difference in water needs at different final plant populations
4. Continue the effort to document water stress throughout the state and gather hydrologic data from each growing region. The non-irrigated statewide corn soil moisture network at eight sites will continue to be monitored
5. Measuring economic sustainability and risk reduction of corn production for water management technologies within certain regions of the state.

Project Description and Relevance:

The push for higher corn yields and yield breaking records in NC has never been greater. The Water Resiliency Hybrid Test Trials have demonstrated over the last four years the importance of managing water stress throughout the growing season with effective and timely management of irrigation and drainage infrastructure. Both excessive and dry stress have greatly impacted corn yields across all genetic lines. Data has shown a positive increasing linear relationship in nitrogen use efficiency in high yielding environments where excessive and deficit soil water conditions can be controlled in a timely fashion through drainage and irrigation.

The current hybrid stress trials are using a fixed N rate of approximately 200 lbs/a and a planted population of 34,000 across all environments. The goal of this proposed study is to evaluate flex and non-flex genetics at multiple populations and variable N rates under optimal soil water conditions to develop predictive water use and N use curves. Doing this would also determine the correct combination of population and N use to be pinpointed in both ideal and less than ideal environments.

Determining the Optimal Population, N Fertilization Rates, and Water Needs for Flex and Non-Flex Corn Hybrids Under Optimal Soil Water Conditions

This study will be conducted at the Total Ag Water Management (TAWM) facility at the Tidewater Research Station in Plymouth. The TAWM's infrastructure can be utilized to manage subsurface water tables and surface water applications to create different levels of water stress, as demonstrated in the current water stress trials (2021-2024).

Spray Drones for Management of Burcumcumber and Morning glory in Corn

Project Leader:

Charlie Cahoon

Objectives and Description

1. **Burcucumber Management in Piedmont Corn Production**
   Burcumcumber is a troublesome vining weed species native to the northeastern US. Vines can reach 15-25 feet and can cause significant yield loss and severely interfering with harvest. Research on management of this troublesome species in North Carolina.
2. **Spray Drones for Management of Burcucumber and Morning glory in Corn**
   Morning glory and burcucumber species are particularly troublesome in corn production. Their ability to emerge late in the season, climb adjacent corn stalks and proliferate once corn starts to dry down making harvesting a nightmare. Facing corn overrun with these species, many farmers attempt pre-harvest herbicide application to desiccate the weeds. Traditionally, their only options for such applications have been a ground sprayer, airplane, or helicopter. Agricultural spray drones may offer farmers another option to desiccate morning glory and burcucumber and facilitate successful harvest.

   Experiments will be established at two or more sites per year. Treatments will include Aim, Aim plus glyphosate, and paraquat applied with the agriculture spray drone compared to the same herbicides applied via standard liquid broadcast equipment. Furthermore, Sharpen was recently labeled for pre-harvest use in corn. This herbicide will be evaluated with and without glyphosate. Visual estimates of weed control will be collected periodically. At the end of the season, weed density will be collected. All plots will be harvested to determine yield.

3. **Large Plot On-Farm Evaluation of Tactics to Manage Multiple-resistant Italian Ryegrass**

   Multiple resistant Italian ryegrass is prevalent throughout North Carolina. Furthermore, the NC State Weed Team has identified Italian ryegrass resistant to paraquat, glyphosate, ALS-inhibitors, and ACCase-inhibitors in the southern Piedmont. Through small plot research, the NC State Weed Team has identified cereal rye, used in combination with fall residual herbicides a viable tool to manage this weed. However, it is the researcher's belief that large-plot grower demonstrations of the utility of these tactics are needed to spur adoption across the state.

The NCSU Weed Team will identify and secure several fields naturally infested with multiple-resistant Italian ryegrass, and will collaborate with the growers to secure cover crop seed and/or residual herbicides. The entire field/farm will be planted to a cereal rye cover crop with half of the farm receiving a residual herbicide application 1-2 weeks after cover crop planting. Only a small area of the field will be left fallow and without a residual herbicide for comparison. Italian ryegrass control will be monitored into the following spring.

NCARS/NCCES Code: 25-05

Effect of Soil Fertility Management on Deep Root Growth and Root Mortality

Project Leaders:

Luke Gatiboni
Josh Heitman
Amanda Cardoso
Edrem Ozlu

Objectives:

* Build capacity in the Crop and Soils Department to study plant root growth in field experiments by purchasing a non-destructive in-situ root scanner.

* Evaluate the effect of soil fertility management on corn and soybean root growth

Project Description and Relevance:

The root system of plants is often referred to as their 'hidden half', playing a crucial role in water and nutrient uptake. Currently, the capacity to evaluate how various treatments and management practices is lacking.

In this project the researchers seek to acquire a non-destructive in-situ root scanner. In 2025, the equipment will be used to evaluate the effect of treatments like gypsum, Epsom salt, lime, and in-furrow quick lime on the plant root growth throughout the growing season.

Rationale & Justification:

In North Carolina, farmers are encountering increasing challenges due to more frequent drought occurring during the growing season. Two of the last four years the rainfall was below the requirement for adequate plant growth during the spring and early summer. Investigating and validating soil management strategies aimed to enhance crop resilience to droughts could provide farmers with alternative methods to alleviate plant stress during periods of suboptimal water availability. Root evaluation plays a crucial role in studies related to plant resilience in droughts.

Expected End Products

The capacity of evaluating root growth should be enhanced throughout the growing season. The monitoring will focus on root growth and mortality rates at various soil depths in two trials, corn and soybean, exploring the effects of soil fertility amendments. Ultimately, the primary objective is to strengthen the Crop and Soils Department's ability to study root growth in future research initiatives.

The NC Soybean Producers Association is sharing in half the cost this project.

NCARS/NCCES Code: 25-06

Continuing Investigations Into Cultural Methods for Managing Plant-parasitic Nematodes in Corn

Project Leader:

Adrian Gorney

Project Description and Relevance:

The overarching goal of this project is to add to our knowledge of cultural management options for plant-parasitic nematodes (specifically stubby-root and sting nematodes) in North Carolina corn production. The researchers seek to build upon datasets initiated in 2024 under the following objectives:

1. In the greenhouse, confirm the host status of common cover crops to the stubby-root nematode, in order to identify cover crops that are non-host and may be used in rotation with corn production.
2. In the field, evaluate the impact of corn planting date and soil temperature on severity of damage due to sting and other nematodes, and assess how soil temperature impacts population densities of sting and other plant-parasitic nematodes.
3. Share results and findings with producers and other stakeholders through Extension presentations and through nematode management factsheets/publications.

Project Description and Relevance:

Field Sting Nematode Study:

In 2024 a field study was conducted to evaluate the impact of planting date and nematicide application on corn yield and sting nematode counts. Very few sting nematodes were counted in soil samples collected at harvest from across the trial, potentially due to dry weather conditions in the late summer. However, it was found that that was a numerical increase in corn yield in the later planted corn, but this was not strongly associated with soil temperatures at planting.

Here, it is proposed to continue the study of how soil temperatures (achieved through different planting dates) impacts infection by sting nematode in the field. Additionally, the work would be expanded by quantifying the effect of soil temperatures on other plant-parasitic nematodes that may be encountered (such as root-knot, lesion, or stubby-root)

Greenhouse Stubby Root Nematode Study:

In 2024 twelve different cover crops were evaluated for their reaction to the stubby root nematode (Trichodorus and Paratrichordus spp). From this initial study, it was found that hairy vetch, oilseed radish, velvet bean, and flax on average supported higher subby-root populations than the other cover crops evaluated, suggesting that these cover crops may not be ideal to use in fields with known high populations of stubby root nematode. The greenhouse trial will be repeated to confirm findings and generate a larger dataset with this nematode.

NCARS/NCCES Code: 25-07

Expansion and Reformatting of "Beans Gone Wild" Pilot to Include Corn

Project Leaders:

Daisy Ahumada
Rachel Vann

Objectives:

The goal of this project is to expand on the existing database of "Beans Gone Wild", which focuses on problems in soybean production, to include corn, and potentially other key commodities.

Project Description and Relevance:

The goal of this project is to expand on the existing database of "Beans Gone Wild", which focuses on problems in soybean production, to include corn, and potentially other key commodities. This expanded database will serve as a centralized, public-facing resource where corn stakeholders can access and contribute current data on corn diseases, pests, and other production problems. The expansion of the database will require a change in the domain name (proposed name: "Root Cause Reports"), changes in the format of the database, and a dedicated technician, under the supervision of Daisy Ahumada, to maintain the expanded database.

The expanded database will foster collaborative knowledge sharing among corn stakeholders, allowing quick reporting and access to crucial corn problem information.

NCARS/NCCES Code: 25-08

Evaluation of Biological Controls for Mycotoxins in North Carolina Corn

Project Leaders:

Daisy Ahumada
Dominic Reisig
Ignazio Carbone

Objectives:

Determine efficacy of *Aspergillus* biocontrols in suppressing mycotoxin accumulation

Project Description and Relevance:

The project will assess the efficacy of *Aspergillus* biologicals in reducing ear rot pathogens, minimizing mycotoxins, and improving corn yields in North Carolina. The objective is to evaluate various biological treatments for mitigating the impacts of insect feeding and mycotoxin production across two field locations.

The application of non-aflatoxigenic strains of *Aspergillus flavus* is currently the most viable strategy for managing aflatoxin in commercial corn production. Previous studies have demonstrated the effectiveness of these strains (IC6542 and IC6486) in reducing aflatoxin levels, often outperforming AflaGuard, a commercially available non-aflatoxigenic biocontrol. However, prior research primarily utilized inoculated corn kernels as the delivery method. To optimize this

technology for commercial use, this study will investigate alternative application methods and their potential impact on product efficacy.

Three application methods will be tested, each delivering approximately 10^{12} CFU's of *A. flavus* strains: IC6542 and IC6486

- Granular application: inoculated corn kernels
- Spore solution: Pelleted conidia dissolved in water.
- Spore + carrier solution: Pelleted conidia combined with a clay mineral carrier and dissolved in water.

These methods will also be evaluated under two conditions: plots with caged corn earworms (to simulate insect-injured corn). Applications will be conducted at VT, with sequential biweekly assessments. At harvest, data will be collected, and corn samples will be analyzed for aflatoxins and fumonisin to determine treatment efficacy.

NCARS/NCCES Code: 25-09

How Does Drought Influence Corn Earworm Feeding and Ear Compensation in Corn?

Project Leaders:

Dominic Reisig
Daisy Ahumada
Chad Poole

Objectives:

To explore the interaction of drought and corn earworm feeding on corn in North Carolina

Project Description and Relevance:

Multiple data sets show that corn earworm feeding in not yield-limiting in timely-planted corn but can cause yield loss in late-planted corn, especially when fall armyworm is also present. Corn earworm feeding is usually confined to the ear tip, and the plant compensates by increasing kernel weight at the base of the cob.

Published literature suggests that corn earworm feeding behavior is either unaffected or reduced in drought-stressed corn; however, the potential impacts on yield have only been assessed in South Texas.

Unlike previous research, and anecdotaly, PI Reisig has noticed that drought-stressed corn seems to be more affected by corn earworm. This could be because the ears are smaller, and stress makes the ear less able to compensate for feeding. Work in other crops (e.g. cotton) has shown that corn earworm moths prefer to oviposit in crops with sufficient nutrients and water. This might mean that corn earworm moths avoid laying eggs in droughty corn. However, pupae survival might be higher in areas with sandy and droughty soils. Therefore, corn earworm populations might be lower, higher, or the same in droughty fields compare to other moisture situations.

This research seeks to test the interaction of drought and corn earworm feeding on corn in North Carolina.

1. A non-Bt hybrid corn will be planted in the greenhouse and manipulate watering using a drip system to create droughty and adequate water treatments, splitting these by infesting half the corn with earworm using lab-reared insects. The corn earworm feeding will be measured, yield components (row number, kernel number, kernel weight from top, middle and bottom of cob), and yield for each ear.
2. This will be coupled with a field experiment at Upper Coastal Plains Research Station using a non-Bt hybrid (DKC68-39 RR), a Bt racehorse hybrid (performs well in optimal conditions; DKC68-35 VT2P (similar background to DKC68-39), and a Bt 'flex' hybrid (ear size is not fixed; DKC67-44 VTP) randomizing drip irrigation for droughty and adequate treatments. Corn earworms will naturally infest the field trial.
   The number of corn earworm eggs will be counted daily as they are laid on silks during R!-R2. Corn earworm feeding will be measured at R5. Yield components will be measured at harvest (row number, kernel number, kernel weight from top, middle and bottom of the cob) and yield. Samples of aflatoxin, fusarium and fumonisin levels will also be measured.
3. Finally, corn hybrids will be evaluated in the water management plots maintained by Dr. Chad Poole at the Tidewater Research Station. At this site subsurface drainage systems will operate to simulate dry, adequate and wet conditions. Corn will be measured for earworm feeding, yield components and yield.

Potential impacts include modifying recommendations for planting non-Bt hybrids with good genetic yield potential, and more nuanced recommendations for fields with good moisture retention capacity.

Notice of Annual Meeting

The Corn Growers Association of North Carolina will conduct their annual meeting on January 15, 2026 at the Greenville Convention Center in Greenville, North Carolina at 3:00 pm. All corn growers in the state are welcome to attend!

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