

NORTH MISSISSIPPI RESEARCH AND EXTENSION CENTER

ANNUAL REPORT

2024



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MS AGRICULTURAL AND
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THE NORTH MISSISSIPPI RESEARCH AND EXTENSION CENTER (NMREC) listens to stakeholders' concerns in order to conduct research and implement solutions to the everyday challenges faced by Mississippians. This annual report highlights some of the many research projects and extension programs conducted by faculty and staff in 2024. Research sponsors, stakeholders, and volunteers made valuable contributions and are appreciated for their continued input and support.

As part of the Mississippi State University Division of Agriculture, Forestry, and Veterinary Medicine, NMREC supports the missions of the Mississippi Agricultural and Forestry Experiment Station (MAFES) and the MSU Extension Service. NMREC works to improve the lives of citizens by responding to their needs through collaboration in conducting and sharing innovative agricultural research; offering practical education for individuals, families, and youth; and serving communities and businesses. As one of four Research and Extension Centers strategically located in the state, NMREC expands upon efforts conducted by the main MSU

campus, facilitates research in different soil types and climates, and provides local education and technical assistance to Mississippians.

Researchers based in North Mississippi conduct programs in agronomy, horticulture, animal science, and forestry. NMREC includes four MAFES research locations:

- **Northeast Mississippi Branch Experiment Station (Verona)**
 - *Agronomy Unit*
 - *Horticulture Research and Education Unit*
- **Prairie Research Unit (Prairie)**
- **Pontotoc Ridge-Flatwoods Branch Experiment Station (Pontotoc)**
- **North Mississippi Branch Experiment Station (Holly Springs)**

Please visit mafes.msstate.edu/branches/northhome.php to contact NMREC or any of its research locations.

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DRIVING INNOVATION AND COMMUNITY IMPACT THROUGH RESEARCH AND EXTENSION AT THE NORTH MISSISSIPPI RESEARCH AND EXTENSION CENTER

JANE PARISH

IN 2024 the faculty and staff of the **North Mississippi Research and Extension Center** (NMREC) focused our efforts on agronomic crops, sweetpotato, horticulture, beef cattle, and forestry research to address important needs in North Mississippi and beyond. **Mississippi Agricultural and Forestry Experiment Station** (MAFES) scientists and staff engaged in research projects and Extension programs targeted to provide relevant technical assistance to our stakeholders. Extension specialists developed and shared research-based information in a variety of ways including hosting field days, providing individualized technical guidance, and expanding online educational resources. The primary focus has always been, and continues to be, aligning our expertise and efforts with the needs of North Mississippi to deliver information that truly benefits end users.

During the year, NMREC added staff to our Verona-based research and Extension team. **James Shannon** started work as an Extension Specialist focused on forestry in January 2024. Mr. Shannon had previous experience as an Extension Agent and agricultural science teacher and brings much needed expertise to assist forest landowners in our region. Additionally, a new faculty member, **Dr. Misbah Munir**, joined our research faculty in November 2024. Dr. Munir is based at the North Mississippi Research and Extension Center in Verona with 100% MAFES research responsibilities. Dr. Munir is a plant pathologist

who will focus research efforts on various crops important to North Mississippi.

Sweetpotato research and extension programs continued to attract national attention with implementation of the Mississippi State University led multi-state collaborative CleanSEED Project, a competitive grant from the U.S.D.A. National Institute of Food and Agriculture to address virus, pest, disease problems, and improve the sustainability of U.S. sweetpotato seed programs. This work was in addition to a diverse portfolio of sweetpotato and row crop research that covered topics including real-time detection of skinning damage on sweetpotato storage roots and the effects of plant growth regulators on sweetpotato slip production. Frequent interactions with growers and industry collaborators helped direct and inform future sweetpotato research efforts.

Dr. Lorin Harvey, who is an assistant professor in Plant and Soil Sciences based at the Pontotoc Ridge-Flatwoods Branch, represented Mississippi agriculture on a national stage as an appointee to the specialty crop subcommittee of the U.S.D.A.'s National Agricultural Research, Extension, Education and Economics Advisory Board. In this role, Dr. Harvey and others on the board advise the U.S. Secretary of Agriculture and provide reports and recommendations to Congress's appropriate agricultural committees.

Research highlights at the Northeast Mississippi Branch in Verona included

agronomic and horticultural research. Agronomy research covered important topics such as soil nutrient management, cover crop use, and soybean iron deficiency chlorosis. Both the Northeast Mississippi and Pontotoc branches were contributors to the MAFES Official Variety Trials programs for major row crops in the region including corn, soybean, cotton, peanuts, and wheat. Mississippi youth were offered the opportunity to participate in agronomy science projects through 4-H experiential learning, led by NMREC team members. Horticulture research in 2024 focused on applied studies to explore how nitrogen application rates affect tomato productivity and the impact of supplemental lighting on greenhouse lettuce production.

Forestry projects were another key focus in 2024. A survey of the Mississippi log trucking industry and an evaluation of the influence of Mississippi log trucking business attributes on liability insurance premiums were conducted. At the Verona station, a research trial to evaluate different Christmas tree species native to the area as well as different tree management practices entered its fourth year of implementation.

Beef cattle research at the Prairie Research Unit investigated various management approaches to improving reproductive and other performance outcomes in cow-calf and stocker cattle production. MAFES researchers studied the impact of postweaning stair-step nutritional methods on the reproductive development and productivity



of beef heifers. Nutritional management research projects included a study focused on assessing mineral consumption patterns on pasture. A novel system of evaluating maternal behavior immediately after calving and its production implications was also researched at the Prairie station.

The annual North Mississippi Producer Advisory Council was hosted by the Center in February 2024 to engage with stakeholders and gain insights into current and emerging research and education needs for a wide range of agricultural commodities in this region. Throughout the year Extension specialists and MAFES scientists shared up-to-date agricultural science with stakeholders. Several field days and workshops were held at North Mississippi MAFES stations in 2024 to showcase current information on agricultural production systems in the region. This provided growers, producers, allied industry, and community members opportunities to see research in progress firsthand and learn the results of completed research trials along with guidance on how to apply these discoveries to make more informed management decisions for their farms, businesses, and homes.

A signature Extension focus during the year was the statewide Mississippi Master Gardener training program based out of NMREC which offered self-paced online training options to expand program accessibility and reach. The program was available to anyone with an interest in improving horticultural knowledge and offered opportunities

for volunteer service in local communities. In 2024, active program participation continued to be vibrant with Mississippi Master Gardeners across the state reaching 155,386 contacts in local communities and contributing 74,207 volunteer hours valued at nearly \$1.9 million. Horticulture education at the Center included hands-on workshops such as pruning training in the demonstration orchard at the Northeast Mississippi Branch Experiment Station and the inaugural Greenhouse Vegetable Short Course hosted in Verona in 2024. Educational events were routinely held in the Magnolia Botanical Garden at the Northeast station including a second year of the Fall Garden Fest that brought a large crowd to the garden in October 2024. Self-guided tours in the Magnolia Botanical Garden are available year-round.

New in 2024, the NMREC collaborated with the Mississippi Department of Transportation to begin participating in the Adopt-a-Highway program to expand our service portfolio and help our local community. The Center adopted a 1-mile stretch of Mississippi Highway 145 South in Lee County. The team held its first litter pick-up of this section of highway in November 2024 and will continue with quarterly pick-ups moving forward. Uniquely, the team, which is led by James Shannon, is working to sort and quantify the litter and then recycle the scrap metal, aluminum, #1 plastic, and intact glass collected. The first litter pick-up collected 327 pounds of litter which included

36% of recyclable materials. The team will provide data to the Mississippi Department of Transportation on recycling totals to help inform educational efforts.

Research projects, Extension programs, and service efforts that matter and are put into action by the NMREC were made possible by the financial support of numerous funding agencies and organizations and by MAFES and MSU Extension. This annual report is intended to provide an overview of some of these efforts. Additional research projects and Extension programs are ongoing and under development with expanded programming on the horizon for 2025. Faculty and staff are available throughout the year to share further details of projects and programs upon request. These experts also help agricultural producers and the public with technical expertise in agronomy, horticulture, animal science, and forestry. Thank you for taking time to learn more about our 2024 discoveries and educational resources.

AGRONOMY





EVALUATION OF COVER CROPS AND NITROGEN MANAGEMENT IN CORN CROPPING SYSTEMS OF THE MISSISSIPPI BLACK PRAIRIE REGION

BY AMEE BUMGUARDNER, DILLON HORN, DOUG MESSER, MALLIE RIVENBARK

COVER CROPS have been an important topic in crop production in recent years. However, they have not been as widely adopted in the Black Prairie region of Mississippi. Management decisions are important due to the potential loss of cash crop yield, change in planting date and immobilization of nitrogen (N). Nitrogen is one of the most limiting factors in crop production. Nitrogen availability may be negatively impacted by cover crops due to a high carbon-to-nitrogen (C/N) ratio, which may cause N immobilization creating the need to add supplemental N to the cash crop. The current project seeks to determine the agronomic effects of cover crops on N availability to the following cash crop by providing information specific to practices and soils found in the Black Prairie region of Mississippi. The objectives of this research were to 1) determine the effects of cover crop species on ammonium-N ($\text{NH}_4\text{-N}$) and nitrate-N ($\text{NO}_3\text{-N}$) availability, and 2) Evaluate N uptake differences within the corn cropping system.

This project was conducted at the NMREC in Verona, Mississippi on a Catalpa silty clay loam and evaluated the effects of cover crop species and N rates on corn grain yield, agronomic N use efficiency (ANUE), soil inorganic N, and leaf tissue N concentrations. The cover crops were planted on 11/9/2023, sampled for biomass on 3/21/2024 and chemically terminated on 4/1/2024. The corn variety Dekalb 67-44 was planted on 4/22/2024 at 32,000 seed ac^{-1} on 38-in row

spacing. The experimental design was a split plot with the cover crop species as the whole plot and the N rates as the subplot. The treatments were four cover crop species (fallow, cereal rye, crimson clover, and mix) and four N rates (0, 100, 200, 250 lbs N ac^{-1}) knife injected as urea ammonium nitrate (UAN; 32-0-0) and were replicated four times for a total of 64 plots at 35 ft in length. Soil samples were collected prior to fertilizer application and at 45 and 90 days after planting (DAP) and analysis was conducted at Waters Agricultural Labs in Vicksburg, MS.

Cover crop biomass weights were 1650 lb ac^{-1} for the rye species, 1052 lb ac^{-1} for the mix and 268 lb ac^{-1} for the clover. Nitrogen content in the cover crop biomass was greater in the clover than in the mix and rye species. The rye cover crop ($11.8 \text{ kg N ha}^{-1}$) assimilated greater N than the clover (4.2 kg N ha^{-1}) and the mixed (9.9 kg N ha^{-1}). Nitrogen, phosphorous and potassium leaf tissue concentrations were above their respective critical level. However, there were visual signs of N deficiency. The three N rates of 100, 200 and 250 lb N ac^{-1} had greater grain yields than the control within the fallow plots (Figure 2). Within the mixed species cover crop the grain yield was greater than the control when 200 lb N ac^{-1} was applied. The 100 lb N ac^{-1} had the greatest ANUE within the fallow and rye compared to the 200 and 250 lb N ac^{-1} (Table 1). The limited biomass production from the crimson clover is most likely why it had no effects on yield. When planting cover crops it is important to manage what

cover crop and how much N is applied for optimal yield.

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Table 1. Agronomic N use efficiency as affected by cover crop species and N rates. The same letter within cover crop species is not different at $P < 0.05$ by Fisher's protected LSD.

CC Species	Nitrogen (lb ac^{-1})	ANUE (lb)
Fallow	100	21.70 a
	200	9.20 b
	250	8.02 b
Rye	100	18.82 a
	200	5.13 b
	250	2.57 b
Clover	100	-6.03
	200	2.04
	250	2.94
Mix	100	3.52
	200	8.55
	250	2.52

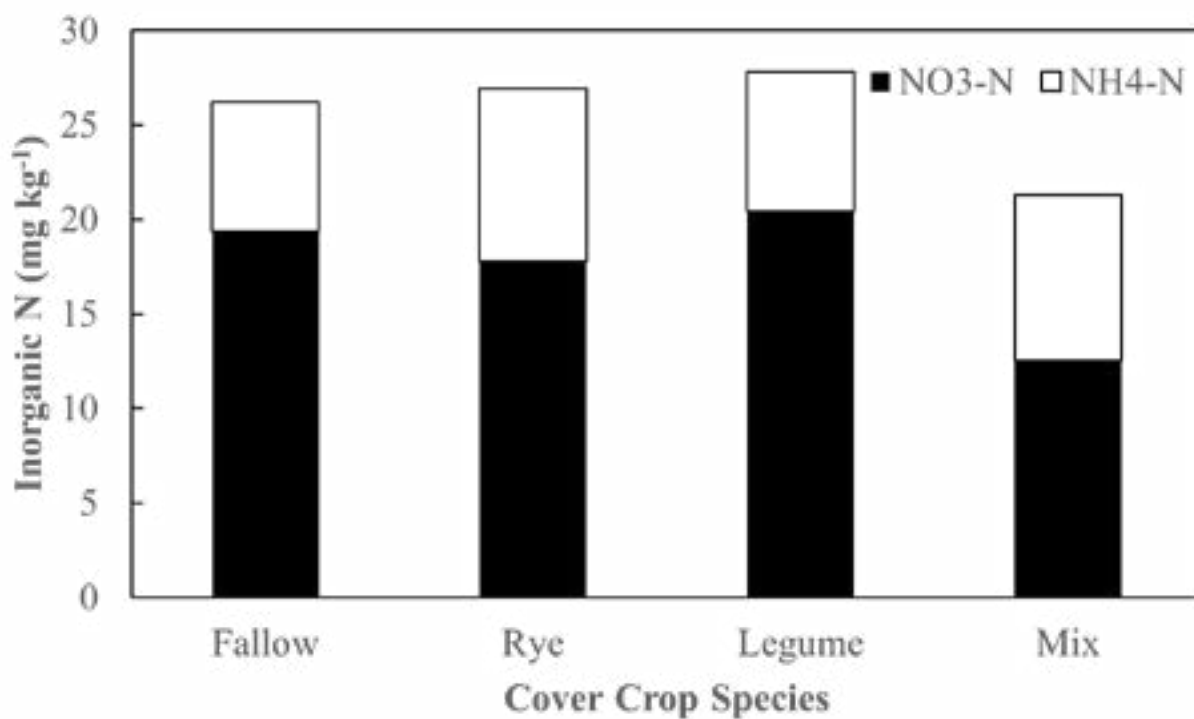


Figure 1. Preplant soil inorganic N (NH₄⁺-N and NO₃⁻-N) content in 2024 across all depths (0-6, 6-12 and 12-24).

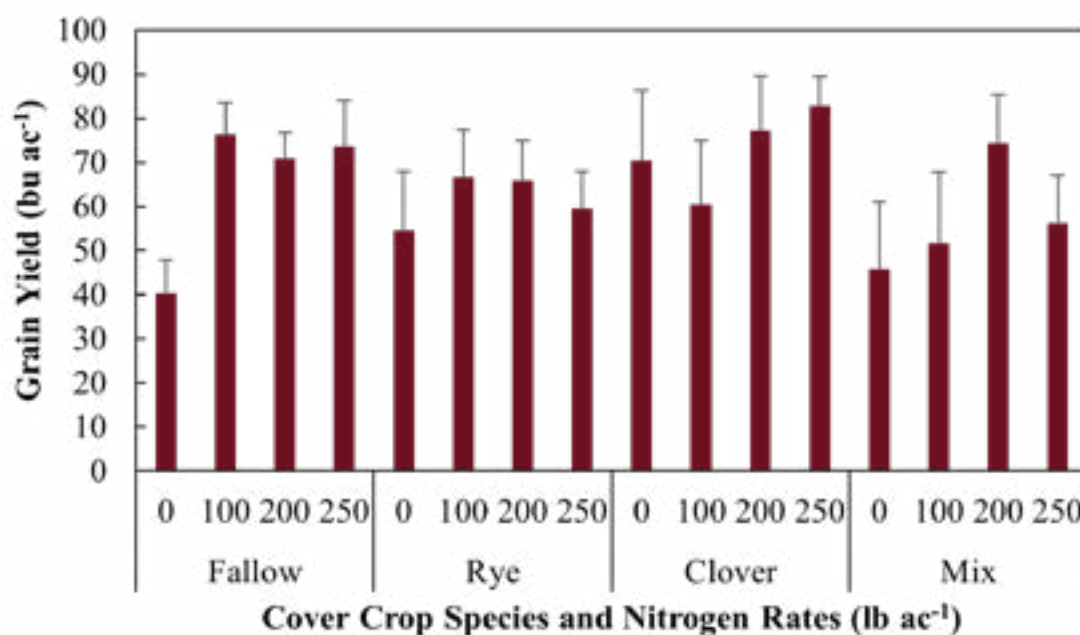


Figure 2. Corn grain yield in 2024. The same letters within cover crop species are not different at $P < 0.05$ by Fisher's protected LSD. The asterisk represents significance from the control at $P < 0.05$ by Fisher's protected LSD. The vertical bars represent the standard error of the mean.

EVALUATION OF BUILD-UP NUTRIENT MANAGEMENT STRATEGIES FOR PHOSPHORUS AND POTASSIUM

BY VAUGHN REED AND AMEE BUMGUARDNER

THE OBJECTIVE OF THIS STUDY is to evaluate build-up nutrient management strategies for both phosphorus (P) and potassium (K) in a long-term field experiment. This study was implemented in spring 2023, and will continue over 8 growing seasons. The first four years of the study will be devoted to applying 4 rates of P and K in a corn-soybean rotation, and in the following four years, make no fertilizer application, but continue to draw down soil test values. We expect to find that with higher application rates early on, we will increase residual soil test values from year to year, but towards the end of the four years of applications, we expect to see the rate of increase from year to year to decrease until we have saturated the soils ability to hold P and K. On the final four years of the project, we expect to see draw down of nutrients, but higher applications in the first few years will hold onto nutrients longer.

In the 2024 growing season, we did not see any yield responses with either application of P or K fertilizer (Figure 1). Without a yield response, we did expect to see a buildup of soil test values with larger applications of nutrients. Figures 2 and 3 display the soil test P and K values from the three sampling timings taken from this study. We did see an overall

increase in soil test P values over the three timings, however, it wasn't consistent with application rates, as even the check plots (receiving 0 lb ac⁻¹ P fertilizer) increased. This displays some of the year to year variation in soil test values not always discussed. There was very little impact on soil test K values over the three timings.

In general, researchers like to report positive results from the applications of treatments in studies. However, in this study, the benefit is to not see any positive response. This location had optimum soil test values, and we would not expect to see positive yield responses. Not seeing difference in yield from any P or K application

suggests that our recommendations were accurately depicting nutrient availability, and we did not decrease yield by not applying nutrients. The lack of consistent increases in soil test values from either P or K applications over 3 sampling timings suggest that applications of P and K above current soil test recommendations (in this case above no application) would most likely not be increasing residual soil test values, and therefore, we are not "building up" fertilizer storage for later. Most likely, the application is being lost to the environment, or being converted into unusable forms that will not be available to plants.

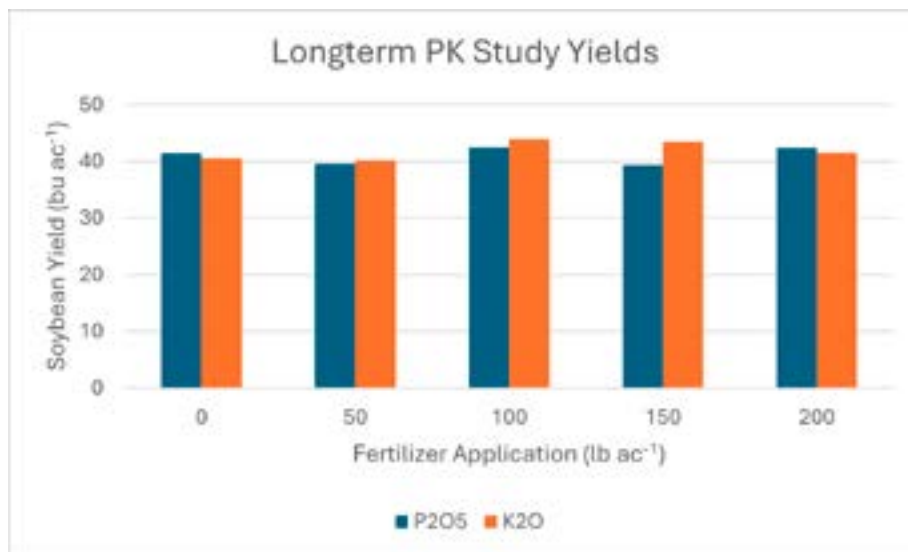


Figure 1. Soybean yields from longterm phosphorus (P) and potassium (K) study at North Mississippi Research and Extension Center station (NMREC) in 2024. There were no significant yield responses this year.

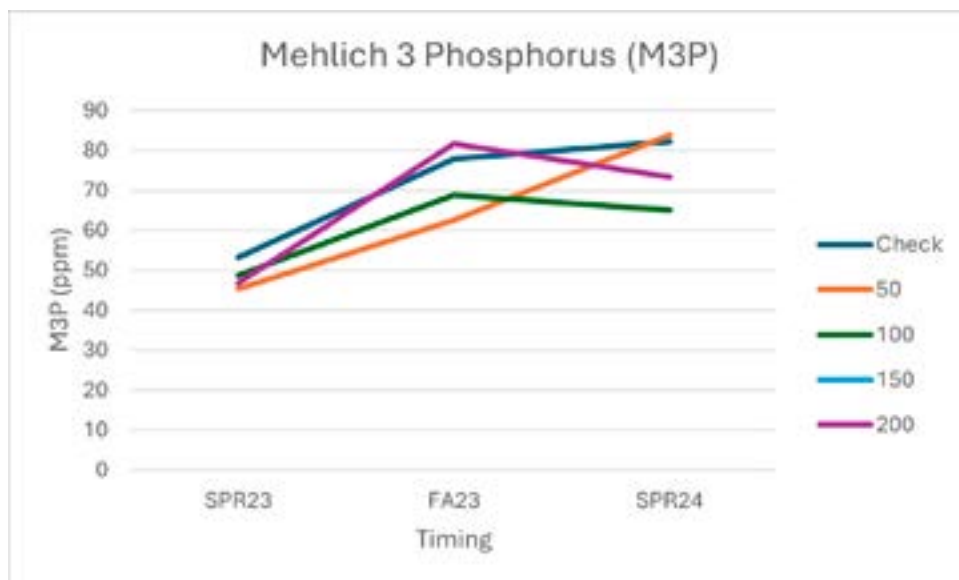


Figure 2. Buildup of Mehlich 3 extractable phosphorus over 3 timings (1.5 growing seasons) at different application rates (P_2O_5 lb ac⁻¹).

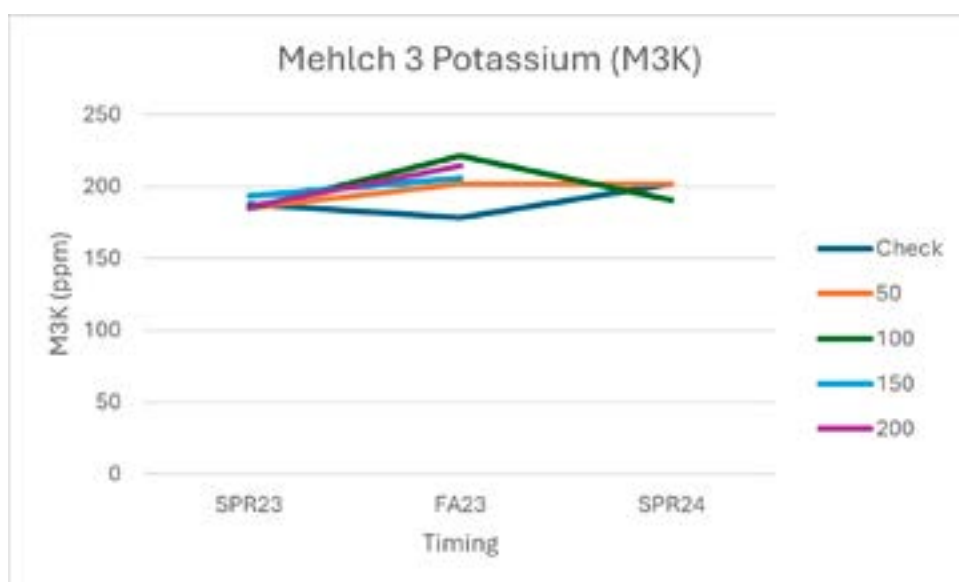


Figure 3. Buildup of Mehlich 3 extractable potassium over 3 timings (1.5 growing seasons) at different application rates (K_2O lb ac⁻¹).

PLANT SCIENCE PROGRAMS FOR YOUTH EARNS NATIONAL RECOGNITION

BY BILL BURDINE, GINA WILLS AND DARRELL BANKS

AGRONOMY IS THE STUDY of field crops grown for food and fiber and the major field crops in Mississippi are soybeans, corn, cotton, and rice. The programs available to youth are Soybean Science Experiments, Plant Science Day Camp, Agronomy Bowl, and Seed Judging. The goals of these projects are to provide STEM opportunities where youth become interested in agriculture science and learn about careers available in today's industry. Most youth do not realize how agriculture helps develop innovative technologies and the multitude of careers available. The project is supported by a grant from the Mississippi Soybean Promotion Board and was a 2024 National Finalist for Excellence in Youth Programming by the National Association of County Agricultural Agents.

Agronomy Science Experiments

Approximately 80 to 100 youth participate each year and experiment kits provided include seed, pots, and other supplies. Participants learn the scientific method and how to develop a hypothesis, design an experimental plan, collect data, draw

conclusions, and submit a report. Reports are scored by agronomists and top individuals receive awards. This is the most popular of the plant science contests. Studies are conducted at home and youth develop their own experiments. The only requirement is experiments must include soybean plants. Youth are encouraged to think big and to be creative. The 2024 winners conducted outstanding experiments and researched topics on: irrigation using saltwater, artificial light spectrums, and carbonation effects on growth.

Agronomy Day Camp

Day Camps are hosted at MAFES branches for youth between 12 and 18 years old and highlight many careers in agronomy and related disciplines. Camps combine classroom and field tours that show various technologies and career options. Topics include crop production, physiology, nutrient management, pest management, uncrewed aerial vehicles (drones), and water quality management. The highlight at all camps is each youth gets to fly a drone.

Agronomy Bowl Competition

This team contest is restricted to senior 4-H members and teaches knowledge that agronomists use daily. Being a bowl competition, teams 'buzz' in and the quickest to buzz is allowed to answer. Questions are true/false, multiple choice, and fill in the blank. The Agronomy Bowl is a fun way to form friendships, learn with people sharing similar interests, and prepare a resume for college and beyond.

Seed Identification and Judging

This contest offers an introduction to the components of seeds, identification of 50 crop and weed seeds, and how to correctly judge the quality of seeds. Youth may participate as individuals or as teams.

Related Publications

P3595 Agronomy Projects for 4-H and Youth
P3596 4-H Agronomy Bowl
P464 4-H Seed Judging
P1397 4-H Seed Identification



Figure 1. Designing and prepping the experiment.



Figure 2. Mixing different saltwater solutions.



Figure 3. Planting soybean seeds to an exact depth.



Figure 4. Ready to apply different saltwater treatments.



Figure 5. High salt concentrations were detrimental to soybean growth.

A photograph of a sweet potato field. The plants are green and leafy, growing in rows. Blue markers are visible in the soil between the plants. The background is a blurred field of more sweet potato plants under bright sunlight.

SWEETPOTATO



REAL-TIME NON-INVASIVE DETECTION OF SKINNING DAMAGE ON SWEETPOTATO STORAGE ROOTS

BY YICAN YANG, NUWAN K. WIJEWARDANE, LORIN HARVEY, AND XIN ZHANG

SWEETPOTATO IS CONSIDERED one of the most important food crops globally. However, its delicate, thin skin is highly susceptible to damage from mechanical impacts, which can reduce its quality, shorten its storage lifespan, and ultimately affect its marketability (Figure 1). Since consumers often base purchasing decisions on the appearance of sweetpotatoes, particularly the extent of skinning or other visible surface defects, minimizing visible defects like skinning is essential for maintaining their appeal.

To address this issue, our research uses a non-invasive, advanced computer vision model called YOLOv8-seg to identify common skinning defects on sweetpotato storage roots (Figure 2). In simple terms, computer vision is a branch of artificial

intelligence (AI) that enables computers to interpret and process visual information, similar to how humans do. YOLO, which stands for “You Only Look Once,” is a deep learning model designed to quickly and accurately detect objects and specific features in images. Our study uses one of the latest versions of this model, called YOLOv8-Seg, which has been enhanced to detect and analyze the extent of surface damage on sweetpotato storage roots.

Our improved YOLOv8-Seg model achieved high accuracy, with an F1 score (a measure of accuracy) of 82% and a mean average precision of 0.77. These results show a 9% improvement in accuracy and a 14.9% increase in precision compared to the previous version of YOLO, underscoring the

enhanced effectiveness of the YOLOv8-Seg model. This advancement means the model has a good performance at detecting and categorizing damaged areas on sweetpotatoes, allowing producers to identify and quantify these defects more effectively.

In summary, our advanced model enables the non-invasive detection of surface damages, contributing to improved handling and quality control practices. These findings represent a valuable step forward in using AI to support the agriculture industry. By helping producers assess and manage skinning damage, this model offers a practical tool for helping to minimize quality losses due to skin damage, maintain sweetpotato quality, improve storage life, and ultimately supporting the product’s marketability.



Figure 1. Freshly harvested sweetpotatoes with naturally visible surface skinning defects.



Figure 2. YOLOv8 model segmenting results showing good performances at detection of sweetpotato skinning areas.

ASSESSING THE EFFECTS OF PLANT GROWTH REGULATORS ON SWEETPOTATO SLIP PROPAGATION

BY KERINGTON BASS, LORIN HARVEY, BI GUIHONG, RICHARD HARKESS, AND KELSEY HARVEY

PLANT GROWTH REGULATORS (PGRs) are natural and synthetic compounds that control plant growth, development, and reproduction. To test the potential benefits of PGRs in slip production and sweetpotato slip's sensitivity to these chemicals, greenhouse trials were conducted at Mississippi State University between 2023-2024. Virus-tested, two-node sweetpotato slips of Beauregard (B-14) were obtained from the Mississippi Agriculture and Forestry Experiment Station's Pontotoc Ridge-Flatwoods Branch. The slips were transplanted into trays and arranged randomly on a single greenhouse table with three replications. There are 14 trays per greenhouse table, each representing a different PGR and concentration, with the addition of a control group that received a water treatment.

Trays were treated with three anti-gibberellins: TopFlor (flurprimidol 0.38%), Piccolo 10 XC (paclobutrazol 4.0%), and Concise (uniconazole 0.055%), as well as one Auxin, Advocate (Indole-3-butyric acid 20%). The following rates were applied at a volume of 30 mL on each tray: flurprimidol at 20, 60, and 120 mg⁻¹, paclobutrazol at 30, 60, and 120 mg⁻¹, uniconazole at 10, 20x1, 20x2, and 30 mg⁻¹, and Indole-3-butyric acid (IBA) at 250, 500, and 750 mg⁻¹. Several growth parameters were collected weekly, such as plant height, stem diameter, number of nodes, and chlorophyll content. At the conclusion of the trials, leaf area and fresh and dry weights of the slips and roots measurements were collected. The data was analyzed using a mixed-effects model in SAS at a P-value of <0.005. Overall, the

PGRs did not affect the number of nodes, fresh weight, dry weight, or leaf area, no matter the type or rate of the chemical. In contrast, the majority of the treatments did increase the amount of chlorophyll in the slip leaves, with all flurprimidol and several uniconazole treatments being the most notable, with the greenness of the leaves increasing by 7-15% (Figure 1). For plant height, slip sensitivity to the PGRs can only be observed with the uniconazole treatment 20mg-1x2 when an additional application was made, resulting in a 42% reduction in plant height (Figure 2). In conclusion, PGRs do have potential for use in sweetpotato slip propagation depending on grower needs, and future studies will focus on how these PGRs might improve slip survival rate when moving from the greenhouse to the fields.

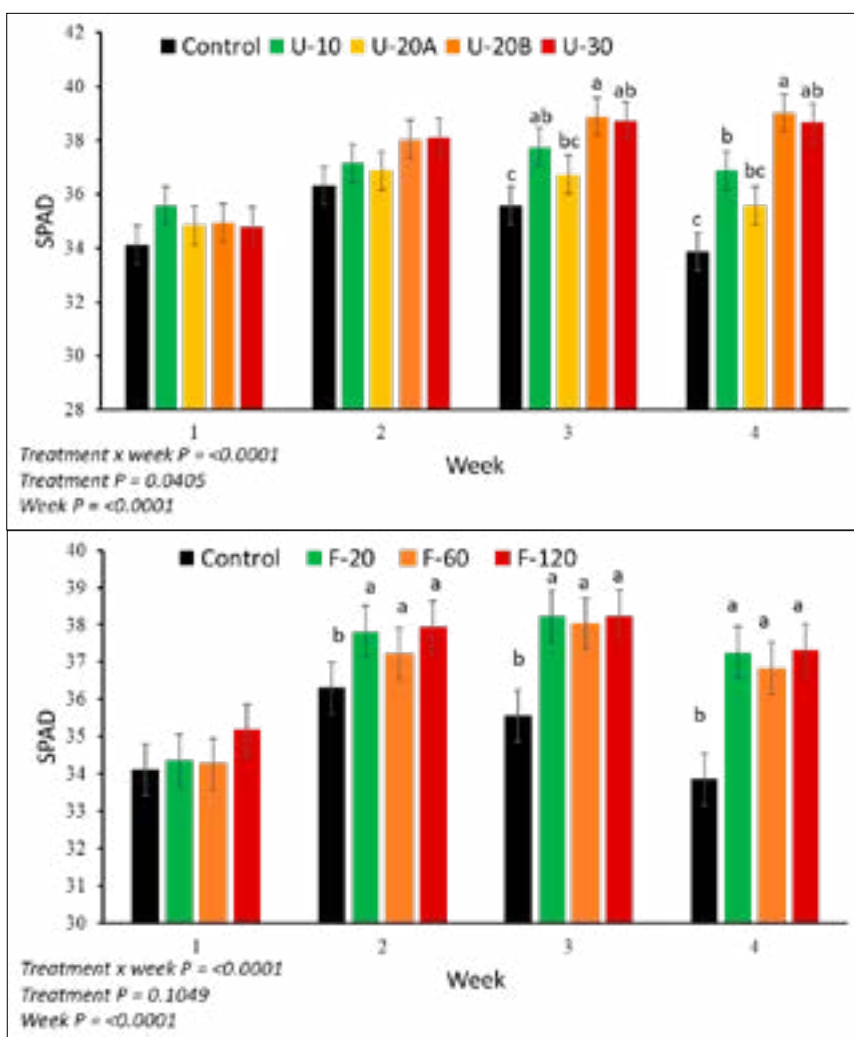


Figure 1. Chlorophyll content or SPAD readings measured in Beauregard slips weekly over four weeks treated with paclobutrazol and uniconazole and compared to the control (water treatment).

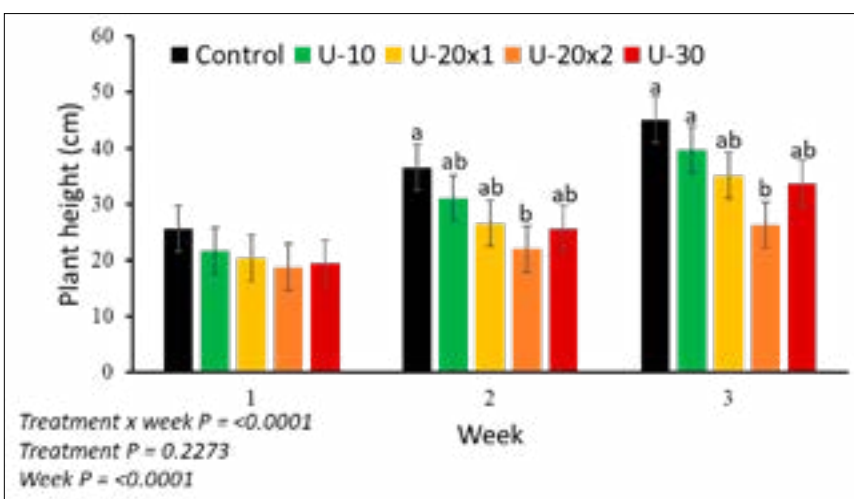


Figure 2. Plant height of sweetpotato slips treated with uniconazole. The application of uniconazole at a concentration of 20 mg·L⁻¹ administered twice resulted in a notable reduction in plant height among the treated slips.



FORESTRY



A SURVEY OF THE MISSISSIPPI LOG TRUCKING INDUSTRY

BY JAMES T. SHANNON, T. ERIC MCCONNELL, JOHN B. AUDEL, SHAUN M. TANGER, DONALD L. GREBNER, AND ROBERT K. GRALA

RECENT STUDIES involving the southeastern United States log trucking industry have documented aging ownership, difficulties recruiting truck drivers, operation of older equipment compared to other trucking industries, disproportionate increases in insurance rates, and constrained profits. This research assessed these challenges in the Mississippi log trucking industry through a statewide survey. Business owners responded through either in-person Mississippi Loggers Association district meetings, an e-mail survey, or an online QR code survey during late 2022 and early 2023.

On average, Mississippi firms had a fleet size of four trucks, three employees, production of 57 loads per week, and a 57-mile loaded haul distance. The typical log trucking business owner's age was 52 years, and 27% of the respondents were over 60. Eighty-one percent of truck drivers employed by participating firms were over 40 years old. The average log truck age was approximately eight years compared to slightly less than six years across all United States trucking business types in 2021. Safety practices employed by most of the respondents included regular safety meetings (75%), distracted driving prevention (68%), pre-trip truck inspections (67%), truck scales (64%), and road-facing cameras (61%). Twenty-three percent reported utilizing technology to train drivers. More than 50 percent stated that driver education was not regularly implemented.

Statistical analysis revealed 11 differences related to region of operation, operational structure, and business organization. Findings centered around the adoption of safety practices and technologies, offering educational outreach strategies that could improve safety and efficiency.

A safe, productive, efficient log trucking industry positively impacts Mississippi's

forest economy. Continuing education programs relating to road-facing cameras would benefit the Northern and North-Central Mississippi regions. Truck scale use could be strategically promoted in the North Mississippi region. Meetings about speed governor use and integrating driver training with camera technology would be constructive in the South-Central and South regions, respectively. Sole proprietorships and partnerships would benefit from programs emphasizing the importance of internal safety meetings. Contract trucking firms operated older trucks and trailers, indicating a need for programs that address the benefits of safety equipment and preventative maintenance programs.

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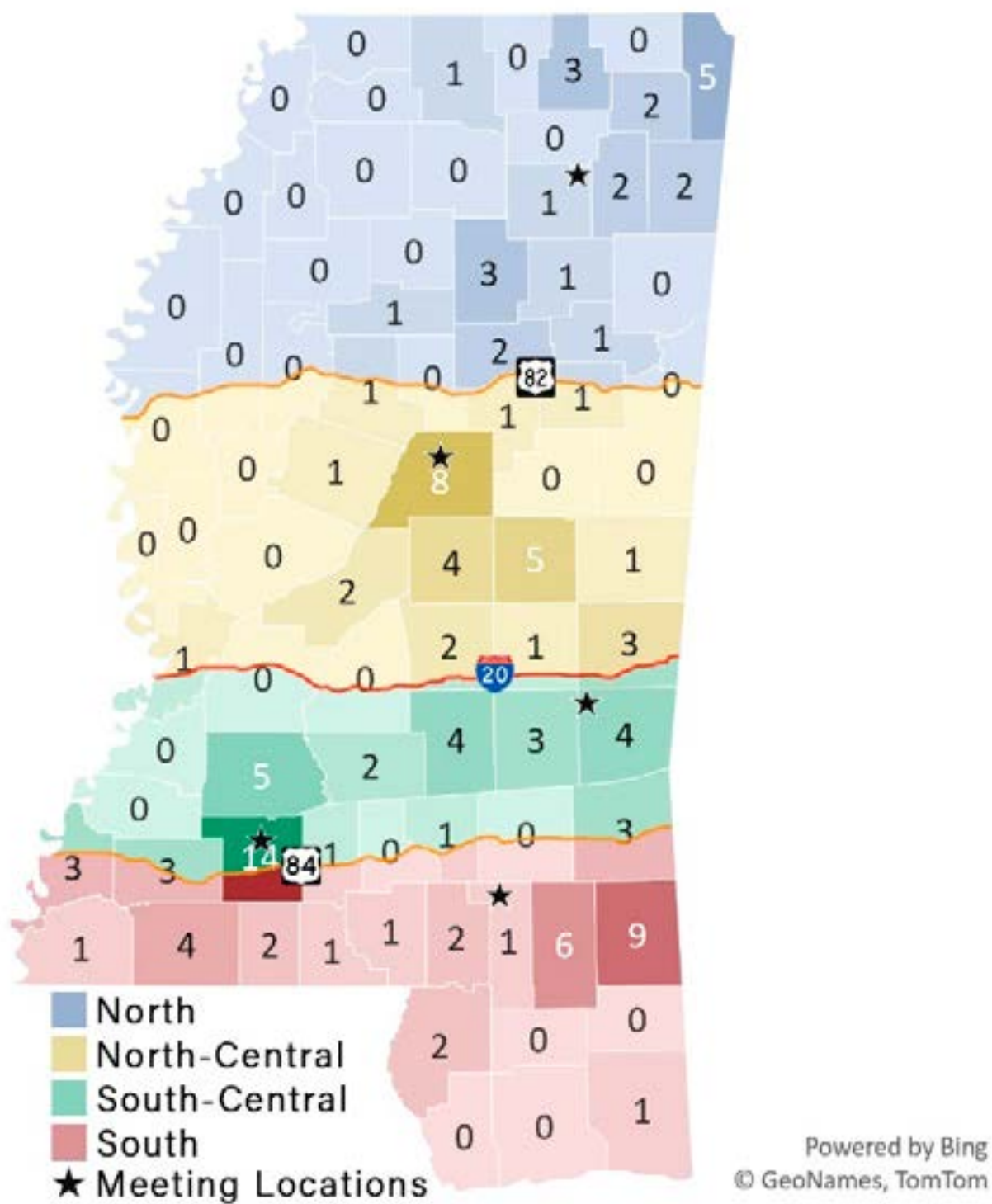


Figure 1. Mississippi log trucking mixed-mode survey analysis regions, meeting locations, and county-level participation. Data collected during 2022-2023 (n=128). Two respondents were not listed due to zip code data entry error that prevented county determination. Assistance with figure creation courtesy of Ms. Lara Taylor

THE INFLUENCE OF MISSISSIPPI LOG TRUCKING BUSINESS ATTRIBUTES ON LIABILITY INSURANCE PREMIUMS

BY JAMES T. SHANNON AND T. ERIC MCCONNELL

RIISING LIABILITY insurance premiums have negatively impacted log trucking businesses in Mississippi and across the southeastern United States. Average insurance premium increases above 50% were documented from 2018 through 2021 for log trucking firms in Alabama, Arkansas, Florida, Georgia, Louisiana, and Mississippi. A statewide mixed-mode log trucking business owner survey was used to study factors impacting liability insurance in Mississippi during 2019, 2020, and 2021. The three-year inflation-adjusted average insurance premium for Mississippi companies was \$12,466 per truck per year, with a minimum value of \$4,000 per truck per year and a maximum of \$24,404 per truck per year. A hedonic regression model was developed to identify log trucking business features that significantly influenced insurance premium variation. Marginal implicit prices were calculated to estimate an average liability insurance premium dollar value contribution by each significant business attribute. This based insurance costs on a firm's characteristics, allowing owners to make informed business decisions and investments.

Managing risk is crucial for business owners to avoid crashes that lead to liability insurance rate increases. Each additional

1,000 miles traveled per truck contributed \$50 to the average insurance premium, which reflected unavoidable risk. This was partially offset by each additional year of owner experience, providing a \$72.42 discount to the mean insurance premium. Safety and overweight citations had the highest impact on insurance premiums, adding \$3,322 and \$1,311, respectively, for each occurrence. These violations can be used as predictors for the likelihood of crashes and claims when insurance companies determine premiums.

Approximately one-third of Mississippi log trucking firms reported that distracted driving prevention, pre-trip truck inspections, truck scales, and road-facing cameras were not used regularly indicating opportunities for improvement. The cost of safety and overweight tickets, along with increased liability insurance premiums, make crash avoidance and implementation of accident prevention measures important business attributes. Participation in the Mississippi Department of Public Safety Commercial Vehicle Safety Program is another strategy that potentially reduces citations and improves safety through voluntary truck inspections.

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BEEF CATTLE





IMPACT OF POSTWEANING STAIR-STEP NUTRITIONAL REGIMEN IN BEEF HEIFERS ON REPRODUCTIVE DEVELOPMENT AND PRODUCTIVITY AS PRIMIPAROUS COWS

BY BROOKLYN SAWYER, MASON DREWERY, ANNA BETH SULLIVAN MCGEHEE, AND BRANDI KARISCH

REPLACEMENT BEEF HEIFERS represent a substantial investment in beef cattle operations, and they should be managed to achieve puberty, conceive, and calve in a timely fashion. Heifers that fail to reach puberty by 12 months of age and conceive during the breeding season incur excessive development costs, resulting in economic losses to the producer. Nutritional management is paramount to longevity and success in the cow herd, as heifers must achieve appropriate body weight (BW) and composition to be reproductively successful. Research demonstrates that heifers fed to an accelerated BW gain during juvenile development exhibit advancement of puberty onset. However, research conducted with nursing beef heifers fed to increase average daily gain (ADG) prior to weaning reported these females had decreased milk production as primiparous cows. Cardoso reported positive outcomes on puberty attainment when heifers were reared on a stair-step regimen of ADG, whereas no milk production parameters were investigated. Based on this gap in knowledge, the objectives of the present experiment were to investigate the impacts of 3 post-weaning nutritional regimens of beef heifers weaned at seven months of age on their puberty attainment, mammary gland development, and milk production as primiparous cows. Sixty weaned heifers seven months of age were ranked by age and BW, and randomly assigned to receive 1 of 3 supplementation strategies during the growing phase:

1. **LOW CONTROL (LC):** heifers were fed a forage-based diet to promote an ADG of 0.5 kg/d;

2. **HIGH CONTROL (HC):** heifers were fed a high-concentrate diet to promote an ADG of 1.0 kg/d; or

3. **STAIR-STEP (SS):** heifers were fed a high-concentrate diet for two months, followed by restricted dry matter access of a high-forage diet to promote ADG of 0.35 kg/d for two months, followed by a high-concentrate diet for the final two months of the growing phase.

Average daily gain from days -3 to 168 was greater ($P < 0.05$) in HC vs. LC and SS (0.76, 0.48, and 0.68 kg/d, respectively; SEM = 0.02) and greater ($P < 0.05$) in SS vs. LC heifers. A treatment \times day interaction was detected ($P < 0.01$) for puberty attainment as HC heifers reached puberty earlier compared to SS and LC heifers, whereas no difference was detected ($P = 0.78$) for final puberty attainment on day 168. Accordingly, LC heifers were older at puberty compared to HC and SS heifers ($P < 0.05$). Heifers were assigned to a fixed time AI protocol combined with natural service, and no treatment differences were detected ($P = 0.85$) for final pregnancy rate. Upon calving, data collection will continue to include calf birth BW, heifer BW, and heifer BCS. Milk production will be assessed via weigh-suckle-weigh when heifers are approximately 45 days postpartum, and offspring BW will be collected at weaning. This research, combined with previous research efforts, will provide foundational knowledge regarding the relationship between replacement heifer development and productivity as primiparous cows, thereby supporting future research to identify specific management strategies to optimize production efficiency of beef cattle systems nationally.

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Table 1. Growth parameters of replacement beef heifers assigned to either 1) Low control (LC): heifers were fed a forage-based diet to promote an ADG of 0.5 kg/d; 2) High control (HC): heifers were fed a high-concentrate diet to promote an ADG of 1.0 kg/d; or 3) Stair-step (SS): heifers were fed a high-concentrate diet for two months, followed by restricted dry matter access of a high-forage diet to promote ADG of 0.35 kg/d for two months, followed by a high-concentrate diet for the final two months of the growing phase).

Item	LC	SS	HC	SEM	P =
Age (d 0) d	241	241	238	6	0.91
Growth Parameters					
Initial (d -3), kg	226	227	226	5	0.99
End of Period 1 BW (d 56), kg	256	270	269	6	0.24
Period 1 ADG, kg/d	0.52 ^b	0.75 ^a	0.72 ^a	0.04	< 0.01
End of Period 2 BW (d 112), kg	294 ^b	311 ^{ab}	327 ^a	6	< 0.01
Period 2 ADG, kg/d	0.73 ^b	0.68 ^b	1.04 ^a	0.03	< 0.01
End of Period 3 BW (d 168), kg	307 ^b	341 ^a	355 ^a	6	< 0.01
Period 3 ADG, kg/d	0.22 ^b	0.51 ^a	0.54 ^a	0.04	< 0.01
Overall ADG (d -3 to 168), kg	0.48 ^c	0.68 ^b	0.76 ^a	0.02	< 0.01

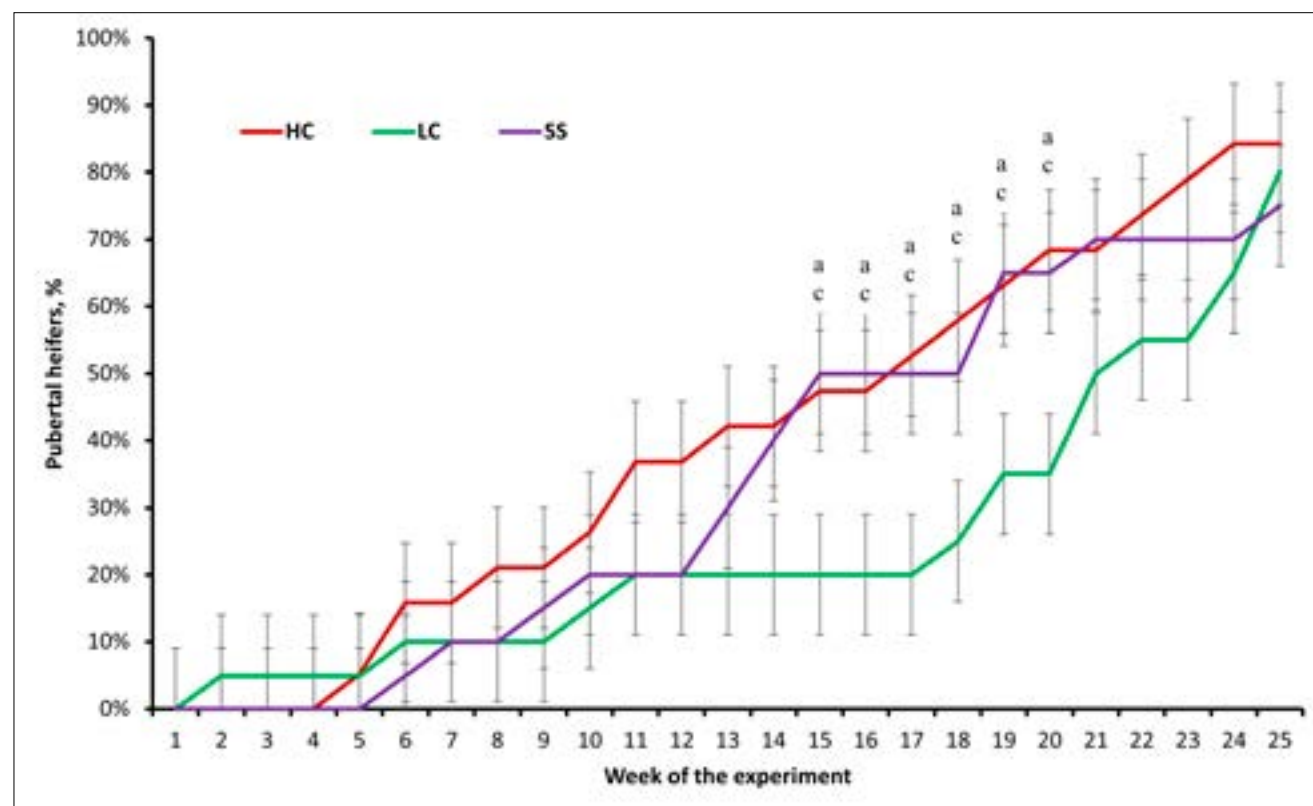


Figure 1. Weekly body weight of replacement beef heifers assigned to either 1) Low control (LC): heifers were fed a forage-based diet to promote an ADG of 0.5 kg/d; 2) High control (HC): heifers were fed a high-concentrate diet to promote an ADG of 1.0 kg/d; or 3) Stair-step (SS): heifers were fed a high-concentrate diet for two months, followed by restricted dry matter access of a high-forage diet to promote ADG of 0.35 kg/d for two months, followed by a high-concentrate diet for the final two months of the growing phase. Treatment \times week $P < 0.01$, Within days, letters indicate ($P \leq 0.05$); a = HC vs. LC, b = HC vs. SS, c = SS vs. LC.

ASSESSING THE CONSUMPTION PATTERNS OF A GRANULAR MINERAL SUPPLEMENT CONTAINING CHLORTETRACYCLINE WHEN OFFERED FREE-CHOICE TO BEEF COWS ON PASTURE

BY W. ISAAC JUMPER, KELSEY M. HARVEY, MADELINE G. MCKNIGHT, MASON E. DREWERY, JASON R. RUSSELL, AND DAVID R. SMITH

MINERALS, both macro and micro, are an essential nutritional component of the diet of beef cattle. In the southeast, most beef cow-calf systems depend on forage for the primary source of nutrition for many months out of the year. In pasture-based production systems, cattle are often in need of supplemental micro and macro minerals to make up for deficiencies in forage mineral content. Unlike other commercial livestock production industries (i.e., swine and poultry production), beef cattle are often hand fed a complete diet containing their exact mineral requirements when pasture forage is plentiful. Cattle on pasture may be provided protein or energy supplementation at strategic points in the year when forage quality decreases, however, beef cattle on pasture are rarely hand fed a complete, total mixed ration. Because forage is the primary dietary component for many cow-calf operations, hand-feeding cattle a supplement daily is often not practical nor economically feasible. Thus, mineral supplements

are often delivered to cattle on pasture in a free choice manner, such that cattle are able to consume the quantity they desire at a frequency of their choosing. These mineral supplements often contain a salt (i.e., NaCl) limiter, and may often be used as a vehicle to deliver various medications. Chlortetracycline (CTC) is an example of one medication that may be included in mineral supplements for the purpose of controlling illness and death associated with bovine anaplasmosis. Several formulations of CTC exist for inclusion in minerals, with products available that are labelled to be fed free choice as well as hand fed. Regardless of label, producers routinely feed mineral supplements in a free choice manner. This may lead to cattle consuming inappropriate doses of CTC. The objective of our work was to describe the consumption patterns of a granular mineral supplement containing CTC across seasons when offered free choice to beef cows on pasture, as well as

assess associations between mineral consumption and productive outcomes (i.e., calf weaning weight, etc.)

Ninety-four cows in three approximately equal pasture groups were used in this study. Mineral intake was monitored using SmartFeed (C-Lock, Inc.) units from 5/18/23 to 10/26/23. During this time, all cows consumed some amount of CTC-medicated mineral. On average, 47% of cattle consumed any amount of mineral on any given day of the 162-day study period. Figure 1 displays a histogram of proportion of the herd to consume any amount of mineral on any given day of the study. Figure 2 displays a histogram of the mean average daily dose of CTC consumed by cows when offered CTC-medicated mineral free choice. The label indicates that cattle should have consumed approximately 1.1 mg CTC/kg of body weight/day. Sixty-four cows (68%) consumed less than 1.1 mg CTC/kg of body weight/day on average throughout the 162-day study.

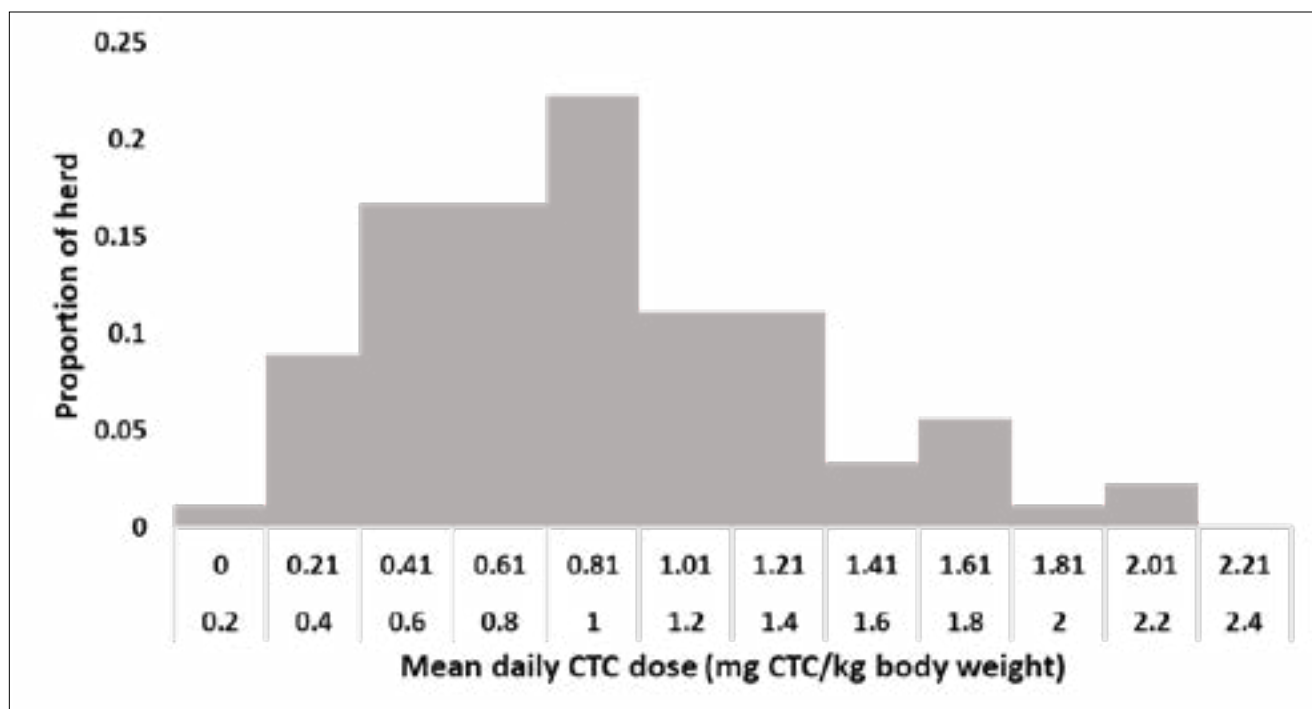


Figure 1. Histogram of mean daily dose of CTC (mg CTC/kg body weight) consumed.

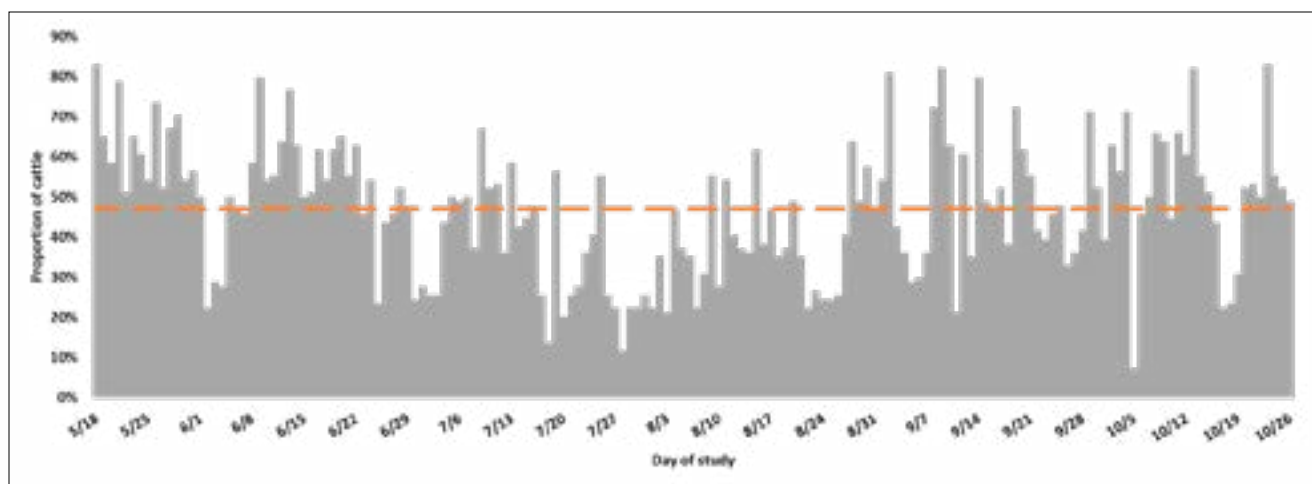


Figure 2. Proportion of cows that consumed any amount of mineral per day of the study. The dotted line represents the mean proportion of 47%.

A close-up photograph of a green tomato plant. The image shows a thick, hairy stem in the foreground, with several green leaves and a small, developing flower or fruit cluster in the upper right. The background is a soft, out-of-focus green. The word "HORTICULTURE" is written in large, bold, white capital letters across the center of the image.

HORTICULTURE



TOMATO PRODUCTIVITY AS AFFECTED BY NITROGEN APPLICATION RATES

BY TIMOTHY AYANKOJO, THOMAS HORGAN, AND FATIMA LAZO ROMERO

NITROGEN IS AN ESSENTIAL crop nutrient. It is a major production requirement for vegetable crops and critical for optimum yield and fruit quality. An adequate nitrogen supply improves plant growth and health and can reduce plant susceptibility to diseases. Although nitrogen is needed by plants in relatively large quantities, excessive application may reduce crop productivity and increase the risk of groundwater and/or surface water pollution. Presented in this report is a follow-up study conducted to determine the amount of nitrogen needed for optimum field tomato productivity.

Tomato variety “Red Deuce” was transplanted on April 30, 2024, six weeks after seeds were planted in the greenhouse. Seedlings were transplanted in raised beds made with a pressed-pan-type bed shaper that lays white plastic mulch and drip tape in one pass. Seedlings were

planted in a single row spacing two feet apart. In this study, a total of 6 nitrogen application rates were evaluated. For each treatment, the total required amount of nitrogen application was applied at a split rate of 50% preplant and fertigation using ammonium nitrate (33-0-0). The remaining nitrogen was applied weekly as fertigation using calcium nitrate (15.5-0-0) starting at six weeks after transplanting. Both potassium and phosphorus were applied 100% pre-plant using 0-46-0 and 0-0-60 fertilizers, respectively.

Insecticides Mustang Maxx (Zetacypermethrin), Entrust (Spinosad) and Pyganic (Permethrin) were mixed with fungicides Quadris Plus (Aoxystrobin), Bravo WS (Chlorothalonil) or Kocide (Copper Hydroxide) every seven to 10 days. Harvest started July 2 and ended July 25 for a total of 4 harvest events. All harvested fruits were graded according to the USDA

standards of extra-large, large, and medium.

Tomato yield was highest (18 lb/plant) at 240 lb per acre nitrogen rate. This is approximately a 38% increase in yield compared to the nitrogen application rate at 120 lb/acre. Similarly, the increase in nitrogen application rate reduced soil-borne disease incidence rate. Disease incidence increased from 0 to 90 lb/acre nitrogen application rates, however, disease incidence rate declined steadily as rate increased above 90 lb/acre. Disease incidence was lowest at 240 lb/acre application rate and highest at 90 lb/acre application rate. Therefore, other than the impacts of nitrogen application rates on tomato productivity, this study suggests that increasing nitrogen application up to 120 lb/acre could enhance tomato resilience to disease pressure during the production season.

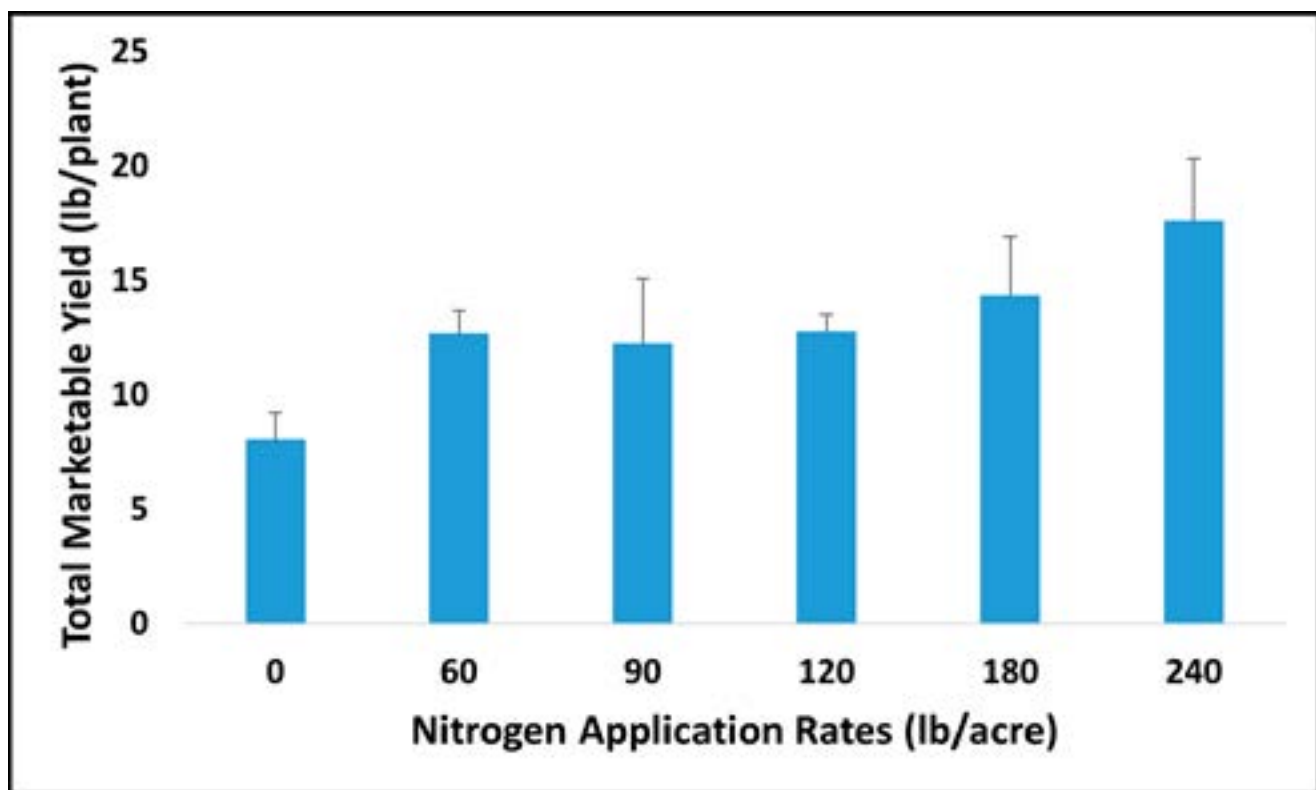


Figure 1. Effects of nitrogen application rate on tomato marketable yield (lb/plant).

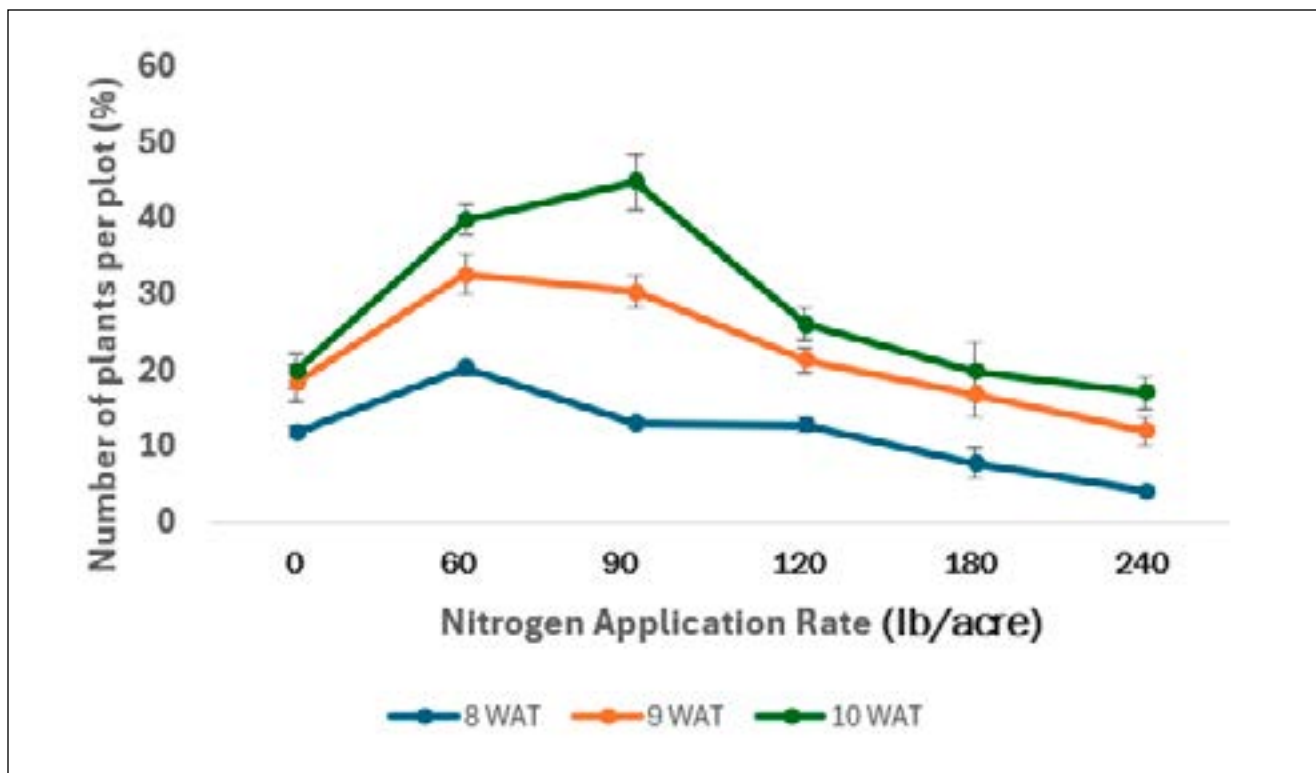


Figure 2. Effects of nitrogen application rates on soil-borne disease incidence. WAT = Weeks After Transplanting.

EFFECTS OF SUPPLEMENTAL LIGHTS ON GREENHOUSE LETTUCE DURING SHORTER DAYLENGTH IN NORTH MISSISSIPPI

BY TIMOTHY AYANKOJO, THOMAS HORGAN, AND FATIMA LAZO ROMERO

IN MISSISSIPPI, where daylength can be especially short during the winter months, greenhouse growers face challenges in maintaining optimal growth conditions for crops like lettuce. Lettuce, a cool-season crop, requires specific light conditions to thrive. As natural sunlight diminishes in the colder months, supplemental lighting becomes crucial for maintaining healthy, high-quality lettuce production.

Lettuce is sensitive to both light intensity and photoperiod, which is the length of the day. During the winter, when daylight hours are shorter, insufficient natural light can lead to slow growth, poor leaf development, and increased susceptibility to diseases. This is particularly problematic in greenhouses, where plants may not receive enough light to photosynthesize efficiently. Supplemental lighting, typically provided by high-efficiency LED lights, can help to fill this gap by extending the photoperiod and improving light intensity during short days. By artificially increasing the period of light exposure, growers can observe faster growth, higher yields, and more uniform crops.

Therefore, this study was conducted to determine the optimum duration for light supplement on growth and yield of greenhouse lettuce during the winter season (shorter day length) in north Mississippi. Two lettuce varieties (Green Forest and Ruby) were transplanted in a deep water culture system on 1/10/2024. A total of three treatments (normal daylight or zero light supplement, 4-hour, and 8-hour light supplement) were evaluated for both varieties. The daily light supplement was programmed

to start at sunset beginning at transplant. Data collection includes plant height, leaf number, and fresh weight.

Results suggest that the average number of leaves produced per plant was similar across all treatments and varieties, however, light supplement increases plant height compared to treatment with no light supplement. The results demonstrated that fresh lettuce weight increased with an increase in supplemental light duration regardless of variety. For Green Forest, the percentage difference in fresh lettuce weight increased by 43% and 55% for 4-hour and 8-hour light supplements respectively compared

to treatment with no light supplements. Similarly, the percentage differences in fresh lettuce weight also increased for the Ruby variety by 51% and 62% for 4-hour and 8-hour light supplements respectively compared to the treatment with no light supplements. Therefore, the results suggest that increasing light supplements up to eight hours after sunset could be an important production strategy for increasing greenhouse lettuce productivity during the winter months and periods with shorter day lengths in north Mississippi. However, the additional cost due to light supplements needs to be considered for a true economic impact.



Figure 1. Data collection during the study.

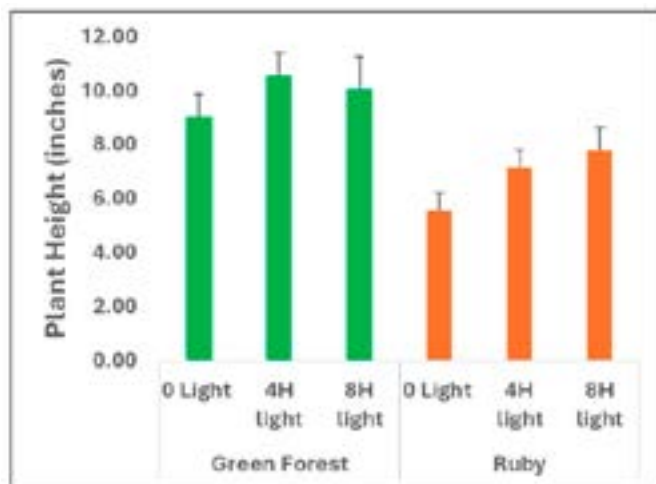


Figure 2. Effect of light supplement on lettuce height.

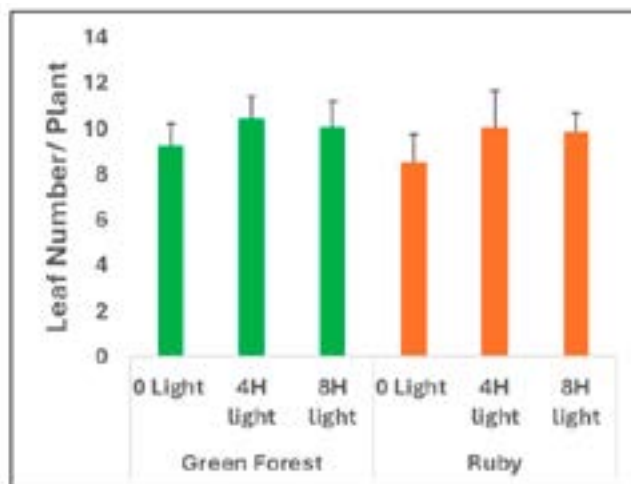


Figure 3. Effect of light supplement on lettuce leaf number.

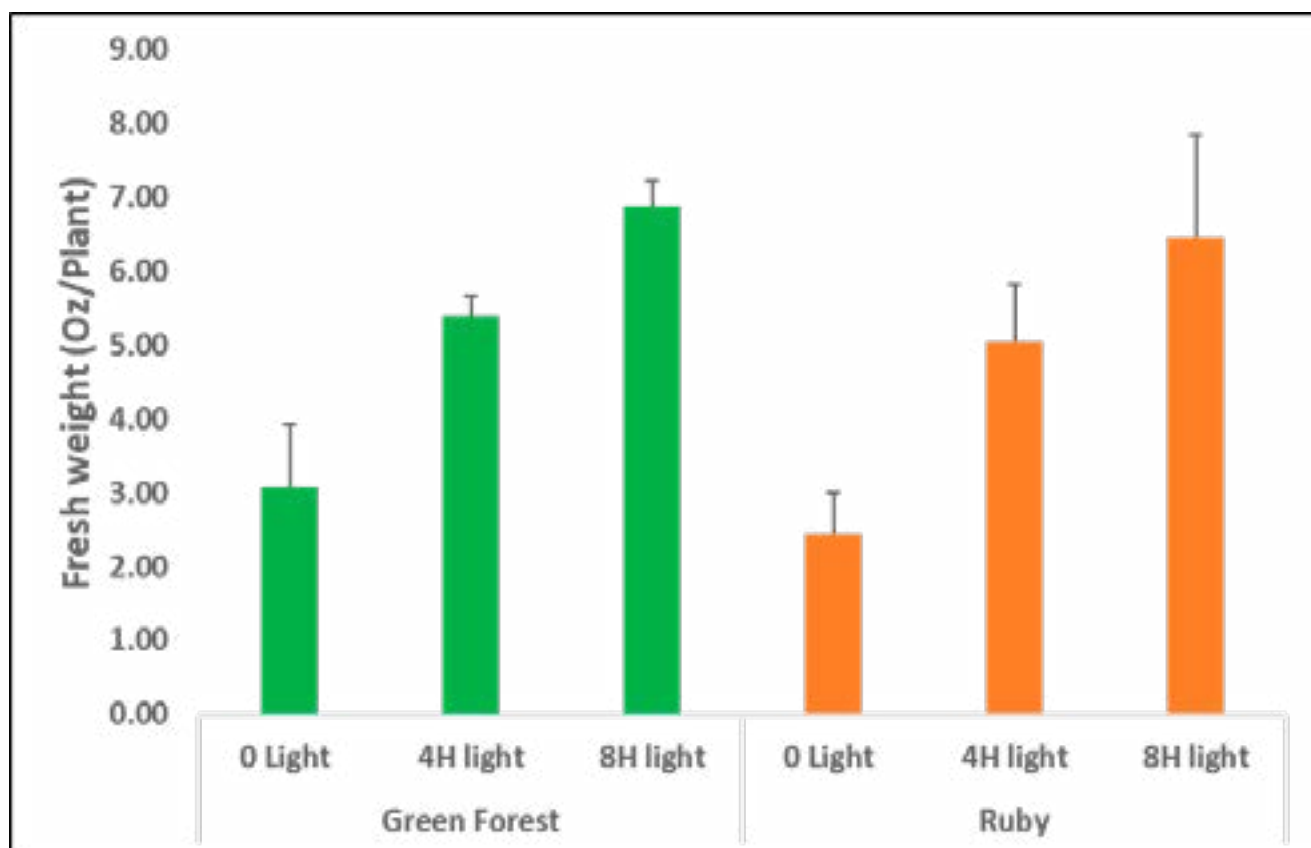


Figure 4. Effects of light supplement on average lettuce fresh weight at harvest.

MISSISSIPPI MASTER GARDENER VOLUNTEER PROGRAM 2024

BY JEFF WILSON AND SUSAN MCGUKIN

THE MISSISSIPPI MASTER GARDENER (MG) Volunteer program began in 1992. Now in its 33rd year, there are over 1600 active MGs assisting in 62 counties. It is a major factor in helping MSU Extension meet its' consumer horticulture clientele needs. MGs assist Extension agents and specialists statewide to provide research-based educational programs and information to improve the economic, social, and cultural well-being of all Mississippians.

MG Trainees (Interns) receive 40 hours of online instruction in botany, soils, weeds,

honeybees, propagation, urban trees, ornamentals, lawns, entomology, diseases, fruits & nuts, vegetables, and volunteerism. Interns take a final exam to complete the training and then volunteer for 40 hours to become certified volunteers. To maintain an active status, they provide a minimum of 20 service and 12 education hours annually.

In 2024, 228 gardeners participated in the online MG training with 185 completing, an 81% completion rate! Overall, 874 MGs entered 74,207 volunteer hours into the reporting system. MGs volunteered

enough time to be equivalent to 36 full-time employees and their service provided \$1.89 million dollar value to Mississippi.

Master Gardeners make a difference in the lives of Mississippians in local communities. They provide horticulture education to demonstrate efficient, safe gardening and they support the state's green industry. MGs also use horticulture to encourage gardeners to be more active and develop healthier lifestyles. Our Mississippi Master Gardeners are making a difference in Mississippi!

BOTTOM: (L) Mississippi Master Gardener Volunteers educating their local community. (R) Master Gardeners receiving continuing education hours. (Photos submitted)



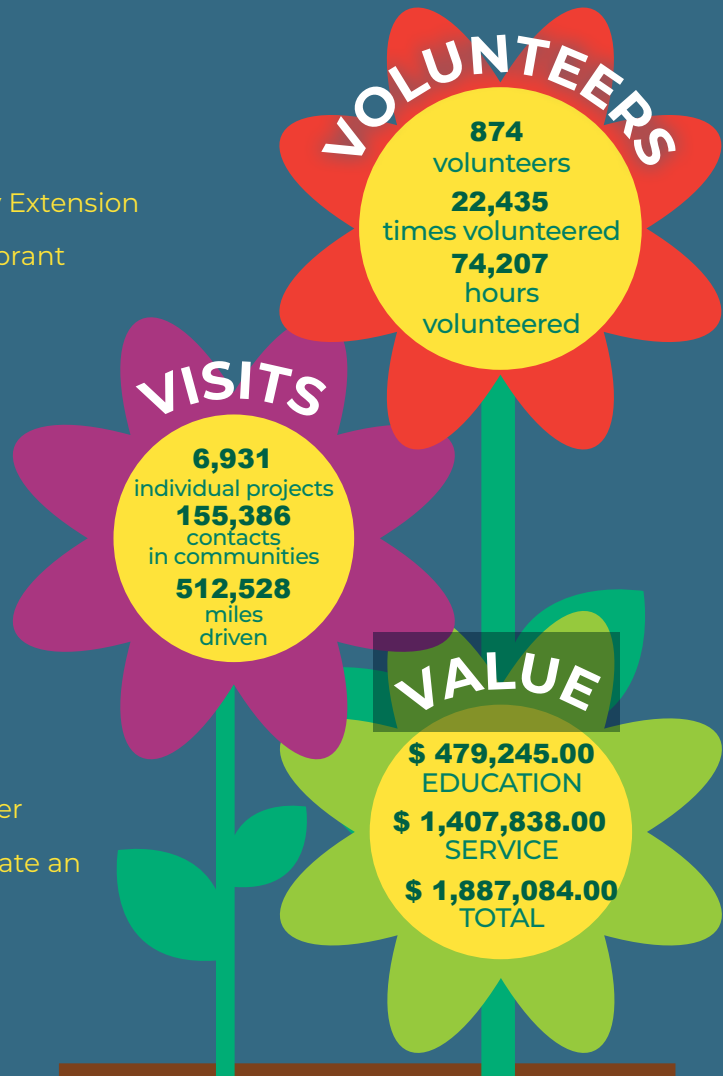


2024 SEEDS SOWN*

Mississippi Statewide

The Mississippi State University Extension Service oversees the state's vibrant volunteer-driven Master Gardener program, allowing participants to gain gardening expertise, complete gardening projects, and make communities more beautiful.

From answering residents' gardening questions to completing projects that beautify communities, the Mississippi Master Gardeners are making our great state an even more beautiful place to live.



* Based on Mississippi Master Gardeners' self-reported annual datasets.

Produced by Agricultural Communications.

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MAGNOLIA BOTANICAL GARDENS

JEFF WILSON AND SUSAN WORTHEY

THE MAGNOLIA BOTANICAL GARDEN serves north Mississippi as a demonstration and educational garden for consumers, professionals, and horticulture educators. It is a green space for people to enjoy and a resource for plant evaluations and educational programs (Figures 1 & 2). The main 2024 educational program was Fall Garden Day in October. Over 150 people attended to hear dynamic speakers, shop with local garden vendors, and enjoy the beautiful gardens.

Evaluating Native Christmas Tree Species Production in North Mississippi

JEFF WILSON, SUSAN WORTHEY, AND AMEE BUMGARDNER

Three native tree species were grown for three years, ending in 2024. Varying nitrogen fertilizer rates were applied in both spring and summer from 2022–2024. Initial, annual, and final growth data was collected to determine the treatment effect on the different tree species (Figure 3). Results here only discuss data from the Leyland Cypress ‘Ovensii’. Third year (final) stem height data showed treatment L3 (1x rate) to be significantly greater than all other treatments ($p < .0001$). Final year caliper data showed treatment L3 (1x rate) to be significantly greater than treatments L1 (.25x rate) and L4 (2.0x rate) ($p < .0001$) (Table 1). Data showed stem height and caliper to be lowest with treatment L4 (2.0x rate).

American Rose Trial for Sustainability (A.R.T.S.)

JEFF WILSON, SUSAN WORTHEY, AND SUSAN MCGUKIN

Two separate trials conducted between 2022 and 2023 studied the growth of unknown cultivars with no inputs other than adequate irrigation. Plants were installed in beds amended with ammoniated pine bark and then top-dressed with shredded pine bark mulch. A completely randomized block design with 3 blocks and 1 replication per block was used. A pre-designed rating system based on 45% flowering, 45% foliage health, and 10% plant form was used to evaluate plants twice monthly for eight months by two Master Gardener teams (Figure 4). Evaluations were submitted electronically in real-time directly to the trial manager. The regional and national winning selections are released each May.

Regional winners for 2022-2023 were Arctic Blue, Easy to Please, Pretty Polly Lavendar, Sunset Horizon, and True Bloom Ture Friendship (Figure 5). The trial process will continue in 2025.

Proven Winners Herbaceous Annual and Perennial Trial

JEFF WILSON AND SUSAN WORTHEY

An industry partner provided annual and perennial ornamental varieties for a 6-month trial. Plant material included Angelonia, Begonia, Coleus, Cuphea, Dahlia, Helianthus, Impatiens, Petunia, Portulaca, Salvia, and Scaevola. (Figures 6 and 7). Plant data including plant health, bloom stage, insect rating, and landscape value was recorded by the MSU trial manager. This trial not only provided research, but also enhanced the MBG’s annual area and provided consumers with a firsthand view of new plant materials. The results from this trial will be published in a future MAFES publication.

Comparing Container Grown to In-Ground Grown Lettuce

JEFF WILSON, SUSAN WORTHEY, AND AMEE BUMGARDNER

Trials were conducted in spring and fall of 2023 and 2024. ‘Green Forest’ and ‘Vulcan’ Lettuce varieties were grown in containers using Pro-Mix Soil and Sta-Green Flower & Vegetable Garden Soil, respectively (Figure 8). The rest were grown in a raised bed composed of red sand, pine bark fines, and top-soil mix. All plots were treated at planting with a slow-release Osmocote Vegetable fertilizer at a rate of one tablespoon per four square feet. Plots were treated and maintained equally, with the only difference being the soil type or having a container.

Results indicated lettuce grown in containers having Pro-Mix had a head weight that was significantly greater ($P < 0.0001$) than lettuce grown in raised beds in all four trials. Lettuce head weight was significantly greater ($P < 0.0001$) in three of four trials when grown in Pro-mix soil or Sta-Green soil when compared to lettuce grown in raised beds (Table 2).



Figure 1. Master Gardener's fruit pruning program.



Figure 2. Magnolia Botanical Garden.



Figure 3. Native Christmas trees year three.



Figure 4. Master Gardeners performing monthly evaluation.



Figure 5. Regional winner 'Sunset Horizon.'



Figure 6. Proven Winners trial – Portulaca species.



Figure 7. Proven winners trial – Petunia Supertunia 'Vista Bubblegum.'



Figure 8. Lettuces grown in patio-picker containers.

Treatment	Height (cm)		Caliper (mm)	
L1 - .25x	100.09	B	40.83	B
L2 - .5x	95.44	B,C	41.01	A,B
L3 - 1.0x	138.89	A	46.03	A
L4 - 2.0x	71.63	C	28.88	C

Table 1. Leyland cypress 'Ovensii' Christmas tree stem height & caliper, year three.

Soil Type	Mean Head Weight	
P – Pro-Mix	9.885	A
S – Sta-Green	7.828	B
G – Raised Bed Mix	2.958	C

Table 2. Fall 2024 lettuce head weight data by soil type.



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