BEEF & FORAGE CENTER

UTIA INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

University of Tennessee Institute of Agriculture

Beef and Forage Center Annual Research Report

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Photo Credit: Dr. Phillip Myer

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Welcome

Welcome to the fifth volume of the UT Beef and Forage Center Annual Research Report. The mission of the Center is to facilitate research and communication of science-based information to advance the Tennessee beef and forage industry. The Center functions as an "information hub" serving all in the Tennessee beef and forage industries. The Center also serves as a focal point and catalyst for research, Extension, and teaching efforts related to issues facing beef and forage systems in Tennessee. The report aims to build on this vision by providing an opportunity to highlight the current work related to the Center to producers and stakeholders across the state. Although abbreviated this year, future volumes of the report will provide comprehensive material to convey new knowledge and technology to improve the management, efficiency and production of high-quality beef cattle.

The Beef and Forage Center would like to thank the contributors to the report and to the staff and students who help with the research, teaching and Extension activities on beef cattle and forages. Finally, thanks to the funders of the grants that help fund the research projects and students/staff working on the projects. We truly appreciate your contributions to our research programs because without this support, the research would not be possible.

Should have any questions about the work reported in this report, please do not hesitate to contact the UT Beef and Forage Center or any of the authors of the individual reports. Thank you for your encouragement and support of beef and forage research in Tennessee.

We extend our appreciation to Dr. Kyle McLean and Dr. Phil Myer for the efforts and dedication in compiling this report. Also, to all those who participated in the annual meeting with contributions and great discussions.

Sincerely,

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Dr. Bruno Pedreira- Director
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Malerie Fancher- Research Specialist

2024 Beef and Forage Center Summary:

Dr. Bruno Pedreira,
Forage Specialist & Director of the UT Beef and Forage Center,
Department of Plant Sciences

It has been an honor to lead the UT Beef and Forage Center (UTBFC) for over a year with the invaluable support of David McIntosh as coordinator. During this time, I've had the opportunity to learn more about Tennessee's forage and livestock industries, connect with agents and farmers, and continuously improve the Center's activities. Our mission remains focused on advancing Tennessee's beef and forage industries by facilitating research and communicating science-based information.

Over the past year, we launched the *Live.Stock* Podcast and Companion, which can be accessed at https://utbeef.tennessee.edu/live-stock/. Our Beef and Forage Center YouTube channel saw an increase in views, reaching 22.9K views and 1,000 hours of watch time. The channel also grew in subscribers, from 322 to 581. The UTBEEF.COM website garnered 171K views from 139K unique users. Our social media presence on Facebook, Instagram, and "X" has been used actively to inform producers about timely topics. In August 2024, a single post about armyworms in pastures reached over 70,000 people and was shared more than 296 times. Additionally, our faculty maintained a strong presence in the *Tennessee Cattle Business Magazine*, which reaches over 7,000 producers across the state.

At the Forage Laboratory, we analyzed more than 1,500 samples from producers, as well as over 9,000 samples from research projects and the NIRS Consortium. Using NIRS methodology, we generated nearly $400,000 in cost savings when compared to wet chemistry costs for the research project samples.

We've also made significant progress with our forage variety trials. We published new reports for Tall Fescue, Orchardgrass, and Annual Ryegrass, available at https://utbeef.tennessee.edu/forages-tennessee-variety-trials/. Our warm-season variety trials expanded to include new species such as Brachiaria, and we're planning to establish alfalfa, mixed pasture, and winter/early spring annual variety trials.

Several Extension publications were updated, and new ones were developed, including the *Forage and Field Seeding Guide*, *Strategic Resource Management for Forage-Livestock Systems in Drought*, *Longhorned Tick and Bovine Theileriosis: Tennessee 2024 Update*, *Weed Control Strategies to Maximize Cool-Season Pasture Productivity*, and *Buying Hay vs. Raising Hay for Beef Producers*.

Our team also welcomed Malerie Fancher as our new research assistant, along with several undergraduate students and visiting scholars.

We look forward to seeing you at next year's Annual Meeting!

Beef and Forage Center Meeting Proceedings

Keynote Speaker: Carlos Saviani,
Beef Sustainability Director, Cargill

Topics:

- Industry Perspective of Beef Sustainability from Cargill for Research and Extension at Land-Grant Universities
- Opportunities for collaboration between UTIA and Cargill

Beef sustainability

- At Cargill, our ambition is to have the most sustainable food supply chains in the world.
    - Every day, our employees work alongside farmers, ranchers and customers to discover and implement new sustainable practices to reduce our impact on the planet and protect people.
- As our global population rapidly increases, the demand for protein is expected to rise by more than 70% over the next 30 years.
- We know the only way we'll meet the growing need for this critical nutrient is by working collaboratively with our cross-sector partners to find ways to increase protein production through sustainable practices that also help address climate change. Beef is front and center in those efforts.
- Cargill offers farmers and food producers incentives, training and support to help them adopt more sustainable practices.

Value of research / extension

- Cargill is committed to working with researchers, farmers, and ranchers to advance and accelerate best-in-class sustainability practices within the industry.
- Cargill's ongoing investment in research continues to explore new solutions and technologies to discover sustainable opportunities in the beef supply chain, creating efficiencies for farmers and ranchers to do more with less.
- Across Cargill, we promote extension of this research by investing in training that empowers farmers to maximize productivity and profitability while protecting ecosystems.
    - Our goal is to help farmers grow their businesses and strengthen their resilience to shocks and stresses while ensuring a supply of safe, quality products through a more diverse, resilient, and sustainable value chain that offers value to our customers.
- As part of our overall sustainability strategy and core focus on People, Cargill is committed to providing training on sustainable agricultural practices and improving access to markets for 10 million farmers by 2030.

University research in collaboration with Cargill examples

- Colorado State University AgNext
    - Cargill has invested $1 million in a grant to Colorado State University's AgNext research program to advance the study of feeding practices that can help reduce greenhouse gases.
    - This investment supports cutting-edge research aimed at promoting sustainable animal agriculture practices and reducing the environmental impact of the beef industry.
    - The research focuses on developing robust baseline greenhouse gas emissions data from cattle, addressing a critical agricultural challenge: enteric methane emissions from feedlot cattle, which are naturally produced during the digestive process.
    - Current USDA guidelines rely on assumptions about the effects of different feeding strategies on methane emissions. AgNext aims to bridge the gap by providing empirical data through groundbreaking experiments at Colorado State University's Climate Smart Research Facility over the next two years.
    - The research will determine the impact of different ingredients and additives in cattle diets on enteric methane emissions in beef steers fed typical finishing rations and explore the additive effect of these ingredients and additives to determine if additional methane reduction is possible.
- Cornell Respiration Chambers
    - Cargill is a lead funder of Cornell's Department of Animal Sciences' new state-of-the-art animal respiration chambers, which are designed to study the environmental impacts of livestock, with a focus on greenhouse gas emissions – especially methane.
    - The goal is to optimize livestock feed and water intake, improve animal health, and reduce climate-warming emissions from livestock, particularly in milk and meat production.
    - Researchers will conduct controlled experiments in the chambers to test how various dietary changes and management techniques affect greenhouse gas emissions and animal welfare.
    - Results from these studies will be shared with the agricultural community to help farmers adopt practices that reduce methane emissions while maintaining efficient and nutritious food production.

BeefUp - addressing climate change in the beef supply chain. An example from the industry

- One of the greatest challenges of our time is addressing the urgency of climate change. To feed a growing population while protecting the planet, we believe we can unlock the potential within our beef supply chain to build a better, more resilient world.
- At Cargill, we have committed to achieving a 30% greenhouse gas (GHG) intensity reduction across our North American beef supply chain by 2030.

- Through BeefUp Sustainability, we are collaborating with farmers, ranchers, NGO partners and like-minded companies to make this ambitious goal a reality, combining traditional practices with the latest agricultural technology to cultivate healthier soils, protect nature and reduce our carbon footprint.
    - We're listening to our customers about what is important to them and using that insight to drive action. We help them differentiate and grow their businesses with sustainable solutions, including holistic programs that advance cattle welfare, protect wildlife, preserve nature and safeguard agricultural livelihoods.
    - This work with customers and NGO partners spans multiple geographies, biomes and sustainability projects.
    - Our existing BeefUp projects are expected to reduce the intensity of our North American beef supply chain by an estimated 2.5 million metrics tons of CO2e in the year 2030, impacting roughly 5.2 million acres across 13 U.S. states and 3 Canadian provinces.
- We believe beef can be a force for good, and the work we do through our BeefUp program and the partners we're highlighting today is how we harness this force.

Other Cargill sustainability efforts across beef production

- In our processing operations, we're motivated to be good stewards of the environment by enabling innovation in sustainability, such as wastewater reuse and conservation efforts.
- Cargill's byproducts business is driven by an opportunity for recycling and a commitment to reduce food waste within our supply chain.
    - For Cargill, supplying hides for leather is part of its philosophy that, in animal agriculture, no part of the animal should go to waste. Our hides and byproduct businesses ensure that all parts of the cattle are put to good use.
        - As an example, Cargill's plant in Wyalusing, Pennsylvania, produces cowhides for Tennessee Tanning Co., a Rawlings company, and the exclusive manufacturer of Major League Baseball leather. Tennessee Tanning uses about 36,000 hides each year, which is about 10% of Cargill's hide sales.
- Cargill is also a signatory of WRI's 10x20x30 initiative which has a goal of reducing operational food waste by 50% by 2030 in our Protein facilities.

Semen Factors Influencing Pregnancy Rates

Saulo M. Zoca, Adella B. Lonas, Samantha R. Roberts, Emma A. Hessock, Troy Rowan, Lew Strickland, J. Lannett Edwards, Sarah E. Moorey

The bull plays a pivotal role in pregnancy success. In the beef industry, more than 90% of females are bred exclusively through natural service. However, only 31% of herd bulls are tested for semen quality (USDA, 2020). Currently, the only method to estimate a bull's field fertility is through a breeding soundness exam (BSE). Although a BSE accurately detects infertile and subfertile bulls, some bulls classified as satisfactory potential breeders (i.e., those who pass a BSE) still exhibit lower than expected pregnancy rates. A bull with an expected pregnancy rate is one that falls within 3% of the average. Thus, developing methods to better estimate bull fertility is essential for the profitability and sustainability of the beef industry.

For a bull to pass a BSE, it must be in good physical soundness without signs of lameness, blindness, or other injuries that could impair its ability to breed cows. Size of the testes within scrotum matters for sperm production. The bull must meet or exceed the minimum scrotal circumference for its age. For example, scrotal circumference should measure at least 30 cm if younger than 15 months or more than 34 cm if older than 24 months. Semen quality is independent of age, and all bulls must have at least 30% of motile sperm moving in a progressive manner and have at least 70% exhibiting normal morphology (Koziol and Armstrong, 2018). Bulls that do not meet these criteria can be classified as either unsatisfactory potential breeders or deferred. A classification of deferred means that the issues preventing the bull from passing all three components of the BSE may be reversible; its classification could change with treatment or rest, though a new test is required to assess improvement.

The percentage of bulls that fail a BSE is 20% and can range from 18 to 38%. Reasons for failure include poor semen quality, physical problems, or a combination of both (Carson and Wenzel, 1997; Chenoweth, 2002; Kennedy et al., 2002; Overton et al., 2003; Roberts et al., 2018; Zoca et al., unpublished). Most bulls that fail a BSE are not infertile; rather, they are subfertile. Consequently, when these bulls are turned out with cows, it is very likely that some cows will still get pregnant; however, these bulls are not efficient at getting cows pregnant. As a result, subfertile bulls can have a significant economic impact, leading to lower pregnancy rates, delays in when cows conceive, and ultimately lower weaning weights (Wiltbank and Parish, 1986; Menegassi et al., 2011; Chenoweth and McPherson, 2016). Furthermore, a bull that passes a BSE one year does not guarantee that it will pass in the following year; thus, it is recommended to test every bull before it is introduced to a breeding group.

Bull fertility is multifactorial and depends on various events that must occur in an orderly fashion for a viable pregnancy to be established (Amann and Hammerstedt, 1993). Whether a bull is used for natural service or artificial insemination (AI), it is crucial that the semen is of high quality. The term "high quality" is subjective and depends on the factors being examined. The preliminary results of our lab's studies presented explored two aspects: 1) the relationship between currently reported Angus EPDs and bull fertility (passing a BSE and pregnancy rates in a fixed-time AI protocol); and 2) the relationship between sperm molecular-cellular mechanisms (multiple omics) and the fertility of bulls used for AI.

In summary, bull fertility is complex and influenced by several factors. Some of these factors are known, such as scrotal circumference, sperm motility and morphology, and bull physical soundness, all of which are included in a BSE. Other factors remain unknown or are not easy or affordable to measure, such as DNA integrity, miRNAs, metabolites, proteins, and others. Therefore, to advance the beef industry's efficiency, profitability, and sustainability, it is essential to enhance our knowledge and ability to detect bulls with higher fertility. Meanwhile, the adoption of BSE for all bulls before each breeding season remains the best management practice to reduce the chances of subfertile bulls breeding cows.

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What's in your bale?

Dr. Bruno Pedreira
Forage Specialist & Director of the UT Beef and Forage Center, Department of Plant Sciences

Most of the time, hay bales aren't weighed after they're baled. We may have a rough idea or estimate, but weighing bales isn't common practice. Similarly, hay isn't routinely tested for key nutritional values like crude protein, total digestible nutrients, fiber, energy, and ash content. Often, it takes a situation like a fire to highlight the importance of properly measuring and qualifying our hay.

What if your hay barn burns down? Could you accurately value the hay inside and prove its worth? I know this is an extreme example, but every year, hay is bought and sold without knowing important details like weight and nutritional value. In general, we tend to overestimate the weight of hay bales. That's why it would be beneficial to weigh a few bales from each harvest every year. Additionally, although a forage test costs around $17, most of the hay in Tennessee isn't tested. By incorporating these simple practices, we can make more accurate valuations and improve the reliability of hay transactions.

If you're producing your own hay, knowing its nutritional value can help you improve management practices and fine-tune animal supplementation, ultimately leading to better weight gain. Without knowing hay quality, it's not uncommon for cattle to underperform.

On the flip side, if you're buying hay that hasn't been tested, there might be a reason behind it. If you're producing high-quality hay and investing in your production, why not test it to prove your hay is the best? In my experience, most of the non-tested hay I've dealt with has been poorly made. So, if you've already bought hay, why not test it to know its quality and make the best supplementation decisions for your cattle? This can also help you identify reliable sellers in your area, ensuring you return to the good ones next year and avoid the ones who fall short.

If you decide to test your hay, take samples from about 10 bales in each batch (from the same harvest and field). The best way to get the samples is by using a forage sampling probe and taking the samples from the side toward the center of the bale. Check with your local Extension office for information on how to access these samplers.

If you've put a lot of time and effort into your hay production, why not send a sample to the Tennessee State Fair Competition (State Hay Contest) or the Southeastern Hay Contest? Proving your hay is the best can help you sell it more effectively. Your local Extension Agent can assist with the process. Let's show everyone that Tennessee produces the best hay!

Current Research Reports

IN PROGRESS: Assessing the potential of plant growth-promoting bacteria replacing nitrogen fertilization to enhance crabgrass production and nutritive value.

C. E. Lima[1], D. W. McIntosh[2], R. A. Reis[3], and B. C. Pedreira[4]

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Take Home Message: *While nitrogen is essential for plant growth, the combination of nitrogen with plant growth-promoting rhizobacteria (PGPRs) did not enhance yield, crude protein, or digestibility in this trial. Instead, applying nitrogen (N) alone at 45 or 60 units through mineral fertilizer was just as effective in maintaining both production and quality.*

Summary: The technologies association of nitrogen fertilizer and plant growth-promoting bacteria (PGPRs) is singular by reducing the costs but maintaining or increasing forage production, farmers will increase their production and financial efficiencies. Nitrogen (N) is the limiting nutrient for plant growth worldwide and the use of technologies in the forage-livestock systems can improve the results and productivity (Silva et al., 2020). However, in this trial, when N was associated and PGPRs no response was observed in yield, Crude Protein (CP), and digestibility represented as *in-vitro* True Dry Matter Digestibility (IVTDMD48h). On the other hand, the application of 45 and 60 units of N via mineral fertilizer resulted in the same production and quality. This suggests that the additional use of PGPRs may not provide a significant benefit under the conditions tested, and that optimizing nitrogen application alone could be sufficient for achieving desired outcomes in forage-livestock systems.

Introduction

Forages are a major feeding source for livestock production in Tennessee and fertility management practices play a major role in pastures directly affecting forage quality (Lima et al., 2022; Leite et al. 2021). However, mineral fertilizer is very expensive and contributes to greenhouse gas emissions by these systems (Bourscheidt et al., 2019).

The use of PGPRs can lead to qualitative and quantitative improvements in forage production and, consequently, increase productivity and reduce the use of chemical inputs, generating less environmental impact (Fukami et al., 2018). Furthermore, with the demand for N-dependent intensification, PGPRs have become a promising technology to increase the productivity and sustainability of millions of hectares of pastures. Utilization of this technology in combination with PGPRs has a promising future and therefore research into the benefits of this is promising.

Materials and Methods

The experiment is being carried out at the Middle Tennessee AgResearch and Education Center in Spring Hill, TN, USA (April to September 2024). The experimental design was a randomized completed block with four replicates. Plots were seeded on

May 13, 2024, at a seeding rate of 6 lbs/acre of crabgrass (*Digitaria* spp. cv Mojo, Barenbrug USA). The treatments were *A. brasilense* Ab-V5 and Ab-V6 associated or not with 45 or 60 lb of nitrogen per acre (Table 1).

Table 1. Treatment descriptions

Treatment	Description
Control	(No inoculation and no N)
Inoculated	inoculated and no N
45N	non-inoculated with 75% of the recommended N rate (45 Lb Acre^{-1} of N);
60N	non-inoculated with 100% of the recommended N rate (60 Lb Acre^{-1} of N);
45Ni	inoculated with 75% N (45 Lb Acre^{-1} of N);
60Ni	inoculated with 100% N (60 Lb Acre^{-1} of N).

The PGPRs inoculant (MicroAZ-ST Dry, TerraMax, Eagan, MN, USA) was mixed with seed on treatments (Inoculated, 45Ni, and 60Ni) at a rate of 8 oz to 100 lbs. After the first harvest, the inoculant was foliar sprayed at a rate of 20 oz per acre (solution of 21.3 gallons per acre) with *A. brasilense* Ab-V5 and Ab-V6 (MicroAZ-ST Liquid).

Plots were harvested on July 3 and August 4, 2024, using a forage flail-type harvester (RCI Engineering, Mayville, WI) with a 36" swath at 3.5" stubble height. After weight in the field, a subsample was taken to the lab to determine yield by drying to a constant weight. To determine CP and IVTDMD48h, samples were then ground using a Wiley Mill (Thomas-Wiley Laboratory Mill Model 4, Arthur H. Thomas Co., Philadelphia, PA) passing through a 2-mm screen; followed by a cyclone sample mill (Foss Cyclotec, Foss North America, Eden Prairie, MN) grind to pass through a 1-mm screen (McIntosh et al., 2022). Additional drying of the prepared sample in a forced air oven at 55^{o}C was completed to ensure consistent moisture for scanning on a near infrared spectrometer (NIRS) for less variability in predicted results across all samples (McIntosh et al., 2022). The samples were scanned on a FOSS DS2500F NIR spectrometer using ISIScan Nova v. 8.0.6.2 (Foss North America, Eden Prairie, MN). Spectra were then applied to the 2024 Grass Hay calibration provided and licensed by the NIRS Forage and Feed Consortium (NIRSC, Berea, KY). The global and neighborhood statistical tests were monitored and analyzed for accuracy across all predictions with the entire data set fitting the calibrations within the (H <3.0) limit of fit and reported accordingly (Murray and Cowe, 2004). Units of measurement for nutritive analyses are presented at 100% dry matter (DM) for the CP and IVTDMD48h parameters. Data analysis was conducted with a mixed models method with parametric structure in the covariance matrix (5% significance level), through the MIXED procedures of the statistical software SAS (SAS Studio, v. 9.4) (Littell et al., 2006) using the maximum-likelihood restricted method (REML).

Results and Discussion

Yields were affected by an over-all treatment x harvest interaction (P=0.0014). In the first harvest, lower values were observed in the control and inoculated than in the other treatments (Table 2). On the second harvest, there were no differences among treatments (Table 2). Overall, the inoculant did not improve the yield, and fertilization with 45 or 60 lbs of N/acre resulted in similar values (Table 2).

Crude protein was affected by harvest (P<0.001) and treatment (P<0.001; Figure 2). In the first harvest, CP was 13.5% while in the second harvest was 11.3% (Figure 2). Both CP values were above 7%, which is the

minimum recommended for proper dietary maintenance of a rumen (NRC, 2001). All treatments that received mineral N fertilization had greater CP when compared to control and inoculation (Figure 2).

Table 2. Mean crabgrass yield for the first two harvests in Spring Hill, TN.

	Treatment					
Harvest	Control	Inoculated	45N	60N	45Ni	60Ni
First	0.34 Bb*	0.18 Bb	1.33 Aa	1.59 Aa	1.24 Aa	1.27 Aa
Second	1.02 Aa	1.12 Aa	1.29 Aa	1.12 Aa	1.25 Aa	1.25 Aa

*Means followed by different uppercase letters in the column and lowercase letters in the row are significantly different by the probability of (P< .05).

Although IVTDMD48h was greater in the first harvest (76.9%) than in the second (72.9%) (P<0.001), there was no treatment effect (P=0.4780). Nitrogen is the limiting nutrient for plant growth worldwide, and the use of new fertilizer technologies in the forage-livestock systems can enhance productivity (Silva et al., 2020). However, in this trial, the combination of N and PGPRs did not affect yield, CP, and digestibility. On the other hand, the application of 45 and 60 units of N via mineral fertilizer produced similar yields and quality.

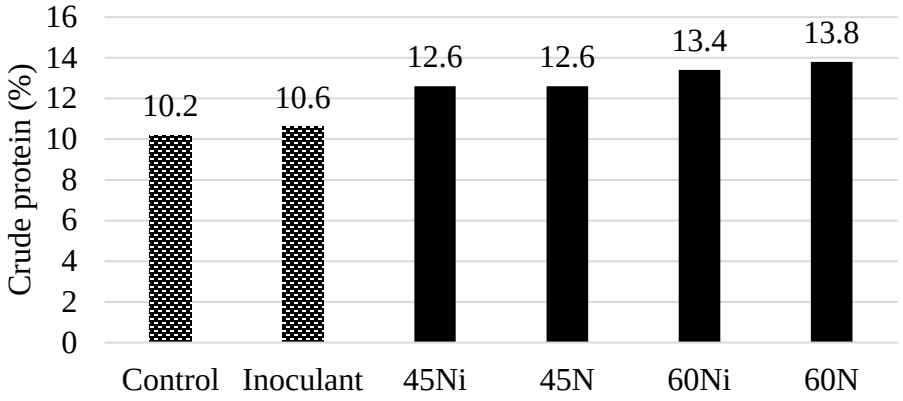

Figure 2. Average crabgrass crude protein (CP) for the first two harvests in Spring Hill, TN.

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The impact of divergent nutritional planes on reproductive efficiency in mature bulls

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Take Home Message: *One of the many factors influencing the reproductive efficiency of bulls is nutrition. Our main objective was to connect changes in body weight, body condition score, systemic immune score, and anatomical measurements to different nutritional plane provided and begin to connect these changes to alterations in conception that would occur between bulls.*

Summary: Bull fertility is a major component of reproductive efficiency. One factor that influences reproductive efficiency in bulls is nutrition. Improper nutrition can influence physiological features such as body weight and body condition score. Nutrient restriction can also lead to increased stress levels which can negatively impact reproduction as it can alter the molecular composition of ejaculate. Nutrient intake also influences the measurements of certain reproductive features in the male.

Introduction

Current literature focuses largely on the maternal impacts on reproductive success whereas the paternal side has been mostly ignored. Evaluating a bull's body weight (BW) and body condition score (BCS) can serve as an indicator for nutritional status and subsequent reproductive potential. Extremes on either side of the ranges can be detrimental to successful of reproduction. Nutrient restriction has been shown to influence both seminal plasmic (Harrison et al., 2022) but how that influences the bulls' systemic immunity or the uterine response to that bull remains to be elucidated. The immune system plays a large role in pregnancy outcomes. Certain key factors such as cytokines help signal for various biological processes to occur. Cytokines are small cell signaling proteins which can regulate inflammation and immunity (Gulati et al., 2016). The cytokine's role within the male is crucial to stimulating the correct female response in mice (Robertson, 2005). The cytokines present in the male reproductive tract could influence the female reproductive tract immune response following mating which could be important for early embryonic development (Nongbua, 2020 and Harrison, 2022).

Materials and Methods

Following a breeding soundness exam and a 21-day dietary adjustment period, mature Angus bulls (n = 6) were randomly assigned to one of two nutritional planes for a 119-day period: 1) restriction (RES; targeted a 3 lb per day decrease in BW) or 2) maintenance (MNT; targeted to maintain BW). Body weight and BCS were evaluated every 14 days and feed amounts were adjusted to meet BW targets. On days 72 and 93, scrotal circumference and blood samples were collected for analysis. Serum samples were evaluated for an immunity score using the Nano Discovery D2Dx Immunity Test™, that assesses samples for the presence of IgG, IgM, cytokines, and complement. Statistical analyses were conducted using R Studio to determine the effects of day, nutritional plane, and the interaction of day × nutritional plane on BW, BCS, scrotal circumference, and systemic immunity score.

After the final collection, bulls were euthanized at a local abattoir for IHC sample collection. Following exsanguination, the reproductive tracts from each bull were collected and the accessory sex glands and testicles were fixed in 10% neutral buffered formalin for histological analyses. Tissue samples were collected from the testes, epididymis, glans penis, urethral gland, bulbourethral gland, prostate gland, and the ampulla. The gross measurements of certain anatomical features of the male reproductive tract were recorded. Testicle weights with and without the epididymis cord were collected as well as their volume, length, and width. Statistical analyses were conducted to determine the effect of nutritional plane on the gross measurements recorded in SAS 9.4 (SAS Inst.; Cary, NC).

Results and Discussion

At the onset of treatments, all bulls had a greater (P = 0.008) BW (1706 ± 36.8 lbs.) and BCS (6.3 ± 0.15) than on d 72 (BW = 1665.8 ± 36.8 lbs; BCS = 5.5 ± 0.15, respectively) or 93 (BW = 1649.2 ± 36.8 lbs; BCS = 5.3 ± 0.15, respectively). According to the experimental model design, the MNT bulls had a greater (P = 0.001) BCS (6.1 ± 0.12) compared with the RES bulls (5.3 ± 0.12) throughout treatment. Body weights were also influenced by treatment with MNT bulls (1828.10 ± 19.7 lbs) having a greater BW (P > 0.001) compared with RES bulls (1583.91 ± 19.7). There was no effect of day × treatment on body weight (P > 0.18). Immunity scores were greater in the RES bulls (0.03 ± 0.003) compared to MNT bulls (0.003 ± 0.003). However, there was no effect of day or the interaction effect (P > 0.05) on the systemic immunity score. There was also no effect of day, nutritional plane, or interaction on scrotal circumference (P > 0.23).

Our results showed that nutritional planes were influential on body weight, body condition score, and systemic immune score. Immunity scores may lead to different seminal plasma compositions and reproductive outcomes. Further analyses are needed to elucidate the effects of paternal nutritional stress on the female uterine response after mating and reproductive efficiency. The future direction of this research is to observe the subsequent uterine response. We anticipate that the data will reveal varying female uterine immune responses to the different components of the ejaculate. The results will provide valuable insight into the area of paternal impacts on the female reproductive tract which could have a great influence on the establishment of pregnancy and overall reproductive efficiency in beef cattle.

Bulls that are utilized for breeding in the fall may require supplementation to ensure they do not lose too much body condition or weight. These bulls may as a result be susceptible to over conditioning which can impact negatively on the bulls' reproductive performance. Over conditioning can also cause the reproductive tract to experience excess fat deposition, inhibiting efficient heat exchange within the scrotum and testes (Skinner, 1981). As a result, this negative aspect of over conditioning can diminish sperm production. By either implementing a maintenance or restricted diet in practice, the bulls' body condition and weight may be optimal for a desired breeding season. Producers must also be aware of the potential effects of a restricted diet. Implemented too drastically and carelessly, bulls can suffer from nutrient restriction and physiological stress on the opposite spectrum. When nutrient intake does not meet energy or protein requirements, the animal experiences negative energy balance due to the loss of body weight and body condition score. Certain physiological functions such as reproduction and others may suffer (Dunn and Moss, 1992). To achieve an ideal body weight and condition,

a particular balance in nutrients must be established prior to the breeding season.

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IN PROGRESS: Evaluating alfalfa establishment when controlling glyphosate-resistant Palmer Amaranth with soil fertility and herbicide application

R. Furlan Jr.[1], T. C. Mueller[2], L. Steckel[3], R. N. Oakes[4], and B. C. Pedreira[3,4]

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[2]Professor;
[3]Associate Professor
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Corresponding author:

Take Home Message: *Combining strategies such as fertility management, herbicide application, and optimal seeding date is essential for achieving high forage accumulation, improved nutritive value, effective weed control, and stand longevity.*

Summary: Alfalfa, the third most valuable field crop in the U.S. just behind soy and corn, with high nutrient value, and has great potential to be grown in Tennessee. Boron deficiency has been recognized for many years, as well as the presence of glyphosate-resistant Palmer amaranth in the state. To face these challenges integrating management strategies is necessary to ensure forage growth and profitability.

Introduction

Alfalfa (*Medicago sativa* L.) is the most valuable forage crop grown in the world and is the third most valuable field crop produced in the U.S., currently valued at almost US$ 10 billion (NASS, 2021). One of the most important characteristics of alfalfa is its high nutritive value as an animal feed, with CP (crude protein) ranging from 18 to 25% (Quinby et al., 2021).

An alfalfa field's yield, quality, regrowth, and stand persistence are driven by essential elements, such as macronutrients and boron. Alfalfa has a higher demand for boron than most other crops, and farmers do not always consider it. Boron deficiency in alfalfa has been recognized for many years, where symptoms will occur typically after the first cutting. Boron deficiency can cause shortened internode spacing and bunching of the top leaves, opening space on the canopy for weed development, and is common on operations that export a lot of nutrients and do not often replenish them at the same levels, such as hay (Marschner, 2012).

The concept of investigating weed control through the integration of soil fertility and herbicide treatments aims to ensure comprehensive fulfillment of the crop's nutritional requirements, facilitating robust regrowth. This strategy involves accelerating ground coverage faster than weeds, enhancing resilience to adversities like droughts, and promoting forage accumulation (Storkey, 2021).

Objectives

1. Define which management strategy ensures greater forage accumulation and lesser weed mass through the first year after establishing
2. Answer if there is a synergistic or additive relationship between the boron fertilized and the herbicide-treated plots

Materials and Methods

The project has been carried out at the East Tennessee AgResearch and Education Center Holston Unit in Knoxville, Tennessee. The Roundup Ready® alfalfa field from the WL 372HQ.RR variety was established on September 6, 2023. The legume was seeded using a Great Plains no-till drill in a tilled see

dbed at a rate of 20 lbs/A

The experimental design is a randomized complete block in a 3 × 3 factorial arrangement with four replicates, totalizing 36 plots (10 by 30 ft, each). The treatments are three boron rates (0, 2, and 4 lbs/A) and three herbicide management (no herbicide, 26 oz/A of glyphosate, and 26 oz/A of glyphosate + 11.2 oz/A of paraquat dichloride). The boron was mixed with the 200 lbs/A of N, P_2O_5, and K_2O (12-24-24) during planting (September 6, 2023) and the same boron rates were applied in the spring, after the first alfalfa harvest. The glyphosate was applied 1 time in the fall in the treatments associated with paraquat dichloride, and 3 times per year during the growing season in both treatments, paraquat dichloride was applied after the first harvest that presents Palmer amaranth before alfalfa regrowth and will always be associated with 0.25% v/v non-ionic surfactant.

Forage was harvested for the first time on May 1. After this, plots were harvested for 4 times every 35 days until three weeks before the first forecasted frost. Two forage samples per plot were clipped inside a 20 x 20 in quadrat leaving 4 in of stubble height. After each harvest, the plots were mowed down to 4 inches. Forage samples were dried at 130 ºF until they achieved a constant weight. After drying, each forage sample will be ground through a 1/32-inch sieve with a Wiley Mill Grinder in preparation for near-infrared spectroscopy (NIRS). Samples will be analyzed for multiple quality factors on a dry matter basis, with crude protein, acid detergent fiber, neutral detergent fiber, and neutral detergent fiber digestibility, using a FOSS 5000 NIRS instrument.

Two different methods analyzed the weed control at the hayfield: 1. Forage samples from two 20 x 20 in quadrats per plot (mentioned above) were separated on alfalfa, palmer amaranth, and other weeds, and then dried at 130 ºF until constant weight; 2. Each plot was also evaluated by visual rating, where the evaluator compared the control plots with the treated ones right before each harvesting. Control plots will be considered 100% infested and the treated ones will receive ratings based on that.

Data will be analyzed using a mixed model method with parametric structure in the covariance matrix, through the MIXED procedure of SAS (Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006) Treatment means will be estimated as least square means (LSMEANS) and compared using the Tukey test ($P \leq .05$). Data from weed control and crop injury will be analyzed in Microsoft Excel.

Results and Discussion

When establishing the alfalfa stand in 2023, the treatments with a fall glyphosate application reduced the Palmer amaranth growth that was later interrupted by the first frost in the fall,

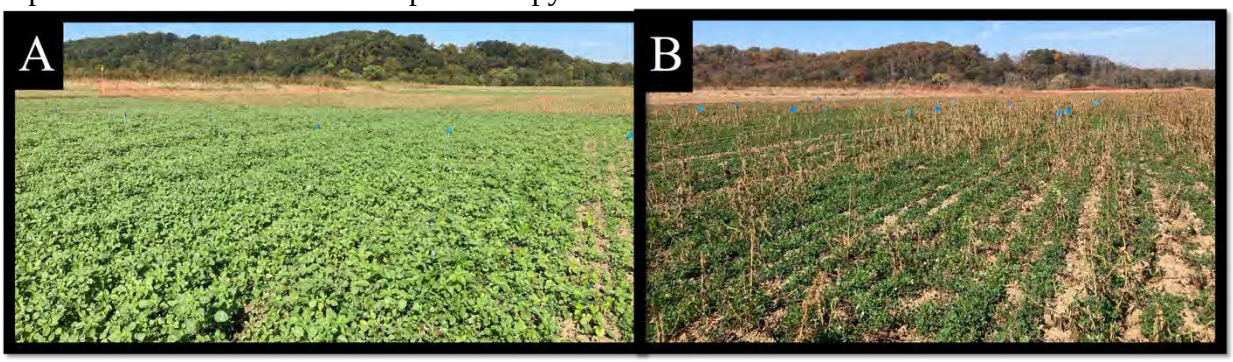

Fig 1. A: Alfalfa field 30d after seeding, 1 week after glyphosate application. **B:** Alfalfa field 50d after seeding, after a 28 ºF frost.

which combination allowed the alfalfa seedlings to cover the bare ground, survive during the winter, and have a fully established stand during the upcoming spring (Fig. 1)

Preliminary data indicate that treatments with boron fertilization and with the fall glyphosate application had greater forage accumulation. This supports that although glyphosate is applied to resistant weeds, such as palmer amaranth, they are not fully controlled but stunted, allowing the crop to outcompete the weeds and close the canopy.

After the germination of glyphosate-resistant Palmer amaranth in July, paraquat was applied right after the 3rd alfalfa harvest, followed by glyphosate 14 days later and its weed control and alfalfa injury were rated (Fig. 3). The glyphosate application improved the weed control from the paraquat dichloride treatment, resulting in cleaner stands. The treatment with only glyphosate provided great weed control, although some resistant weeds were observed, leading to slightly reduced weed control, and potentially less marketable forage.

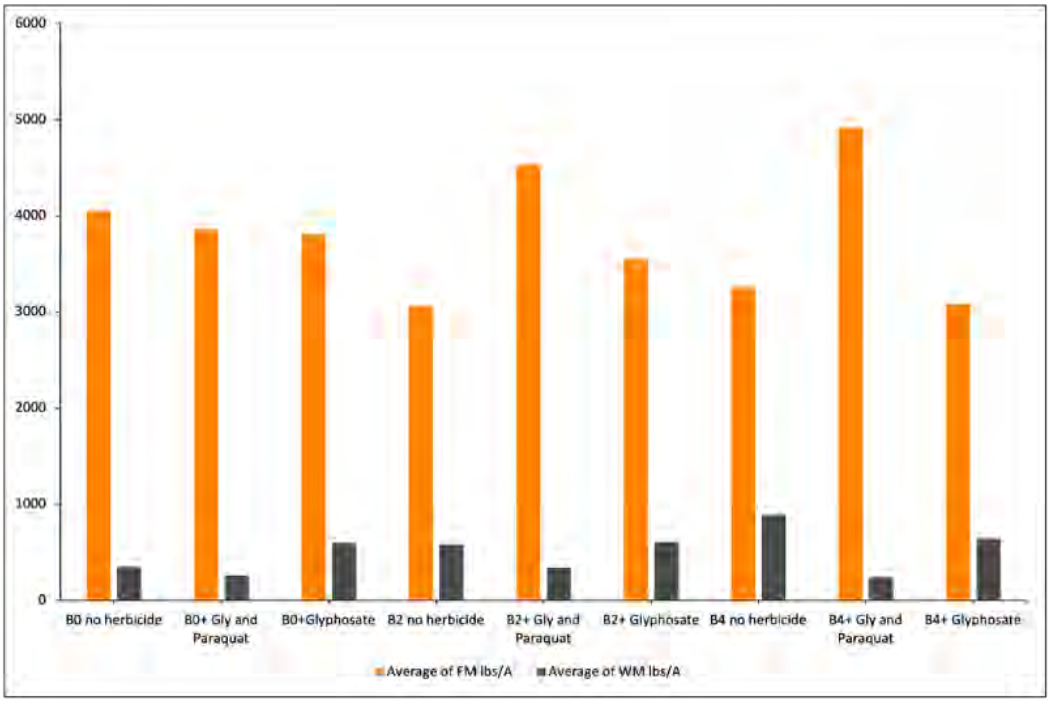

Fig 2. Forage and weed mass in the first alfalfa harvest after the stand was established (May 11th, 2024)

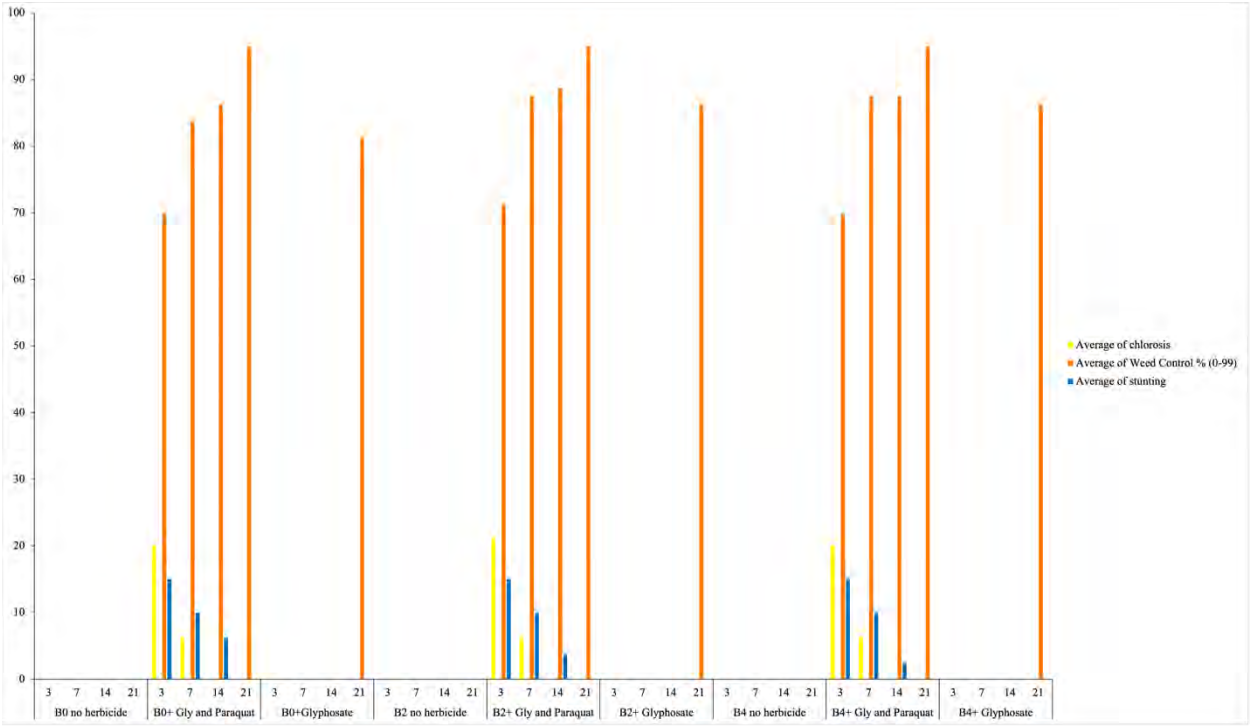

Fig. 3. Weed control and alfalfa injury symptoms (chlorosis and necrosis) 3, 7, 14, and 21 days after harvest.

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IN PROGRESS: Modeling tall fescue to simulate forage production and evaluate the effect of the El Niño Southern Oscillation phenomenon

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[2]Phd student
[3]Coordinator
[4]Professor
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[1,2,4] University of São Paulo, Department of Biosystem Engineering, Piracicaba, Brazil
[3,5] University of Tennessee, Department of Plant Sciences, Knoxville, TN.

Corresponding author:

Take Home Message: *Our goal is to calibrate the CROPGRO-Perennial Forage model to simulate the growth of tall fescue and assess the impact of the El Niño Southern Oscillation (ENSO), we aim to predict forage accumulation in Tennessee. This will help create more accurate scenarios that can potentially support programs like the USDA's Noninsured Crop Disaster Assistance Program (NAP) in refining their decision-making process.*

Summary:
Tall fescue, a key cool-season forage, is grown extensively in the southeastern U.S. The CROPGRO-Perennial Forage model, integrated within the DSSAT platform, simulates forage growth by using data on plant responses, soil, and weather. Current efforts involve calibrating the model with tall fescue data to improve accuracy and assess the impact of ENSO events. Initial simulations showed discrepancies, and future work will focus on refining model parameters. Accurate simulations will enhance predictions of forage accumulation and support decision-making for insurance programs.

Introduction

Tall fescue (*Lolium arundinaceum* (Schreb.) Darbysh.) is a perennial cool-season forage that grows well throughout the southeastern United States, covering 30 to 40 million acres in the United States.

The CROPGRO-Perennial Forage model is a process-based tool within the DSSAT platform that integrates physiological processes using input data (Jones et al., 2003). It simulates forage growth by considering plant responses, soil conditions, weather patterns, and management practices.

The model uses weather, soil, plant genetic, and experimental data to predict forage accumulation. Calibrating the CROPGRO-Perennial Forage model with tall fescue data enables the simulation of forage accumulation across different regions and allows for the evaluation of the impact of the El Niño Southern Oscillation (ENSO) phenomenon.

Objectives

1. Calibrate the CROPGRO-PF model to simulate tall fescue growth.
2. Assess the impact of the El Niño Southern Oscillation (ENSO) phenomenon.

Procedures

The project is being carried out using the CROPGRO- Perennial Forage model on version 4.8.2 of the DSSAT platform. The model will be parameterized with

experimental data in Greeneville-TN and Parsons-KS, validated with data in Columbus-KS and Mound Valley-KS, and simulated with data in different counties across the Fescue belt.

The parameterization process consists of using data from experiments and literature to change the genetics parameters of tall fescue, making the model more accurate (Fig. 1). The perennial CROPGRO Forage Model adapted and calibrated for alfalfa, including specific changes to simulate pasture growth, was used as the starting point to this study (Malik et al., 2018).

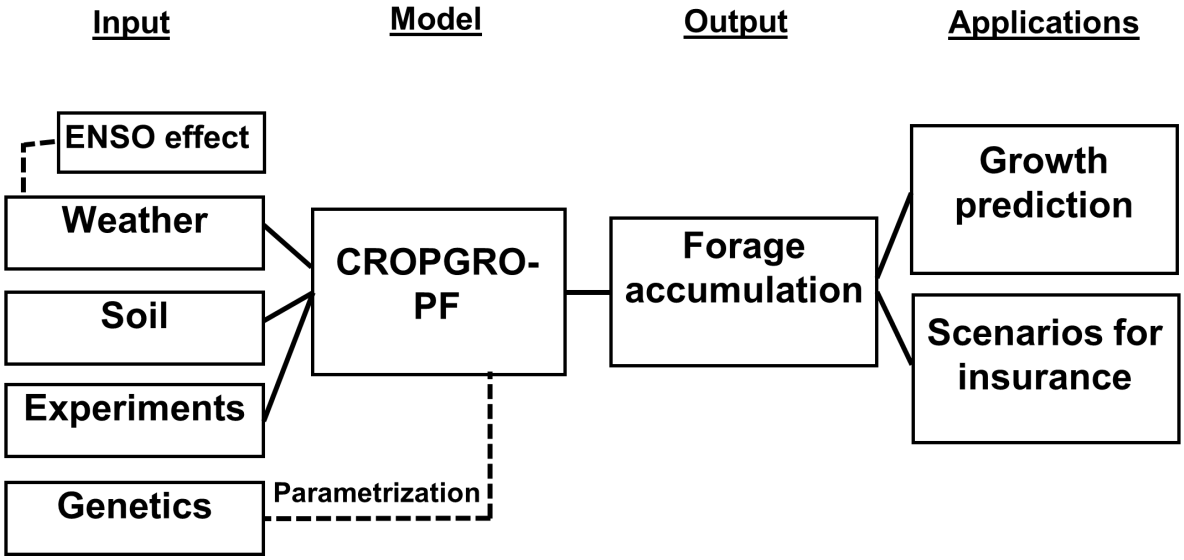

Figure 1: Representation of the CROPGRO-PF model and applications for forage systems.

Evaluating the ENSO effect shows that during El Niño, the northern U.S. experiences higher temperatures and drought, while the Gulf Coast and Southeast see more rain, often leading to floods. In contrast, La Niña brings drought to the southern U.S. and heavy rain with flooding in the Pacific Northwest, with winter temperatures warmer in the south and cooler in the north. This variability in weather patterns is why it's essential to assess the impact of ENSO on tall fescue production, as these changes can significantly affect its growth and forage availability across different regions.

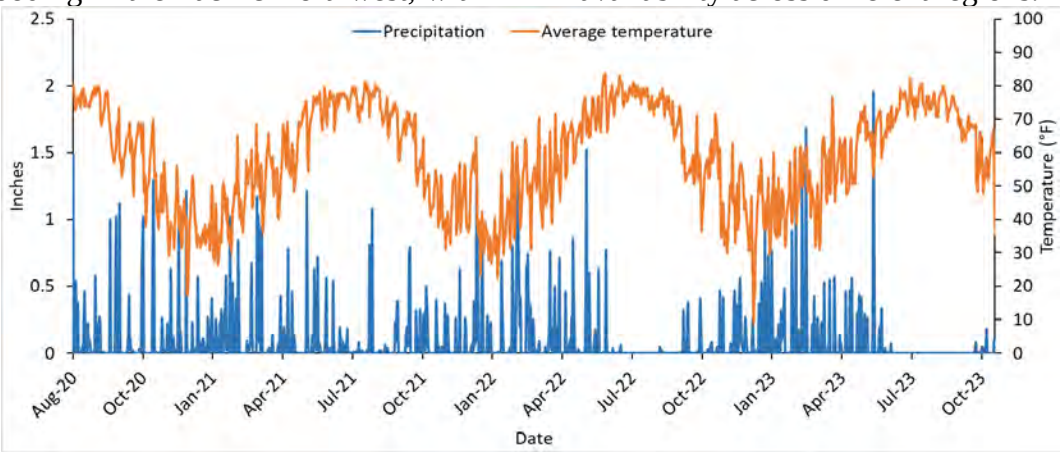

Figure 2: Daily precipitation (in) and average temperature (°F) from Aug/2020 to Oct/2023 in Greeneville-TN, USA.

Results and Discussion

Tall fescue is currently being calibrated in the model to enhance the accuracy of forage mass simulations. At this stage, weather, soil, and experimental data files have been created (Fig. 2), but the initial simulations were not precise (Fig. 3), with the predictions (solid line) falling below the observed data (round dots). The next step involves adjusting the model parameters to refine the simulation, based on the known physiological responses of tall fescue as supported by the literature.

Once the calibration is finished, the model should allow for accurate simulation of forage accumulation across various regions in the U.S., enabling a detailed evaluation of soil and weather impacts, including the effects of ENSO events.

Simulating tall fescue growth can predict forage accumulation across various regions and create more accurate scenarios, potentially aiding programs like the USDA's Noninsured Crop Disaster Assistance Program (NAP) in making more informed decisions.

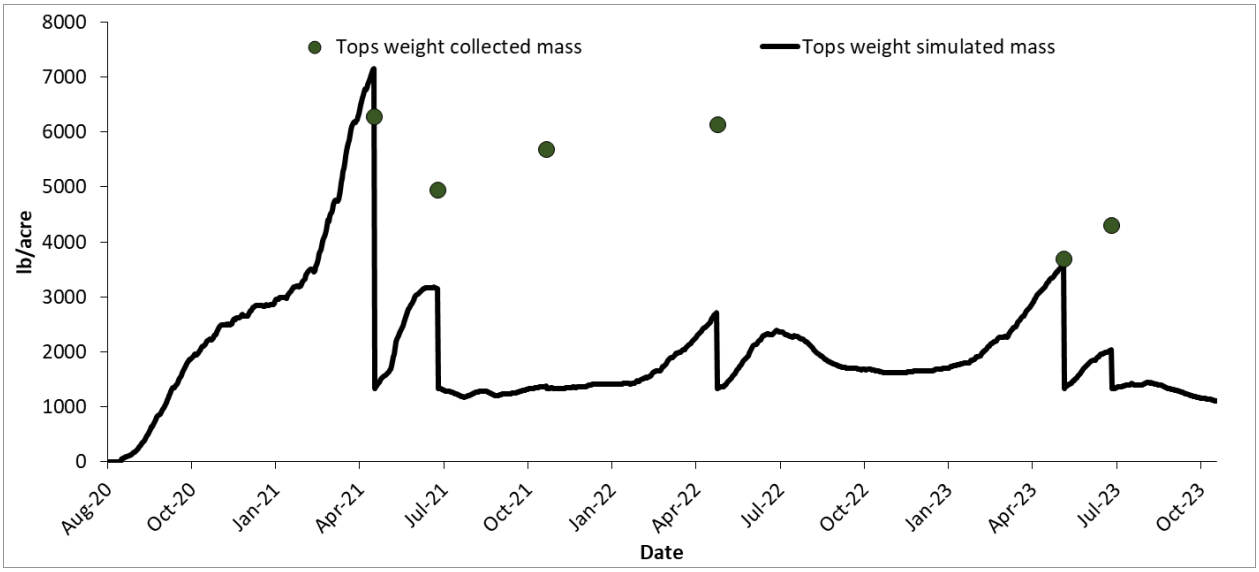

Fig. 3: Tall fescue tops weight (forage mass; lb/acre) simulated and observed from Aug/2020 to Oct/2023 in Greeneville-TN, USA.

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IN PROGRESS: Effect of Ensiling and Inoculation on Nitrate Levels in 'Greengrazer' Sorghum-Sudangrass

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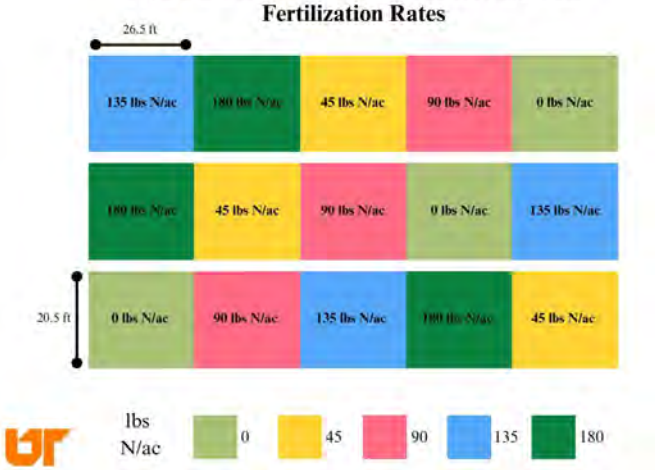
Nitrate Accumulation and Nitrate Poisoning

Sorghum-sudangrass, *Sorghum x drummondii*, provides nutritious forage for livestock during hot summer months when cool season grasses lay dormant. Despite its reputation for high nutrient quality, rapid growth, and dense herbage, sorghum-sudangrass has the potential to accumulate nitrates during stressful periods, such as hail, frost, and, most commonly, drought or heavily applied fertilizers (Bates, 1995). Nitrates are absorbed through the root system of the plant, and once consumed, metabolize first to nitrite and then ammonia to be used in the creation of protein in the rumen. Following a stressful period, however, the plant lacks the ability to convert nitrates to self-sustaining nutrients. Nitrates accumulate and cannot be fully broken down in the rumen but absorb into the bloodstream to prevent blood from efficiently transporting oxygen. The ruminant will become ill with what is known as nitrate poisoning, which may result in abortions, weak calves, and death from lack of oxygen (Bates, 1995).

With this potential for accumulated nitrates in certain grazing forage species, it is imperative to test grazing material, particularly following a stressful event. If nitrate levels are above the safe threshold (>2500 ppm) (Ball et al., 2015), what are potential uses for this forage besides cutting for hay?

In this study, our team is working to understand the effect nitrogen application has on nitrate levels and nutrient quality in sorghum-sudangrass as well as the potential for change in nitrate levels due to ensiling as baleage with and without bacterial inoculation.

Figure 1: Sorghum-Sudangrass Plot Map with Fertilization Rates



Part 1—Nitrogen Application

'Greengrazer' sorghum-sudangrass was planted on May 21, 2024 in 20.5 ft x 26.5 ft plots at the Northeast Tennessee AgResearch and Education Center in Greenville, TN. On June 26 there was a clean off harvest, and on July 1, fertilizer treatments were applied at treatment rates of 0, 45, 90, 135, and 180 lbs N/ac, shown in Figure 1. On August 6 representative samples from each plot were harvested in the half-bloom stage (~ 22-27% DM) and subsamples collected.

Three subsamples from each plot (a total of 45 subsamples) were bagged and wet weights and dry weights recorded. The 45 subsamples will be analyzed using NIR spectroscopy and wet chemistry. At the current research stage, results include only the forage mass in lbs/ac above 6 inches for each plot, depicted in Figure 2.

Part 2 — Ensiling and Inoculation

Five samples of 'Greengrazer' sorghum-sudangrass with varying nitrate levels were collected in August of 2024. Samples were ground and prepared for NIR spectroscopy and wet chemistry analysis to determine average nitrate levels of each sample group – anticipating a range of nitrate levels for comparison. Six subsamples from each sample group were dried to approximately 55% moisture and vacuum sealed to replicate the ensiling process for baleage. Three of these subsamples included application of a Promote® Forage-Mate® EBL Inoculant at a rate of 0.035 oz/2,000 lbs of forage. The subsamples are being stored in ambient outdoor temperatures for 6 weeks to encourage fermentation. Following the trial period, samples will be dried and prepared for NIR spectroscopy and wet chemistry analysis.

Current Conclusions

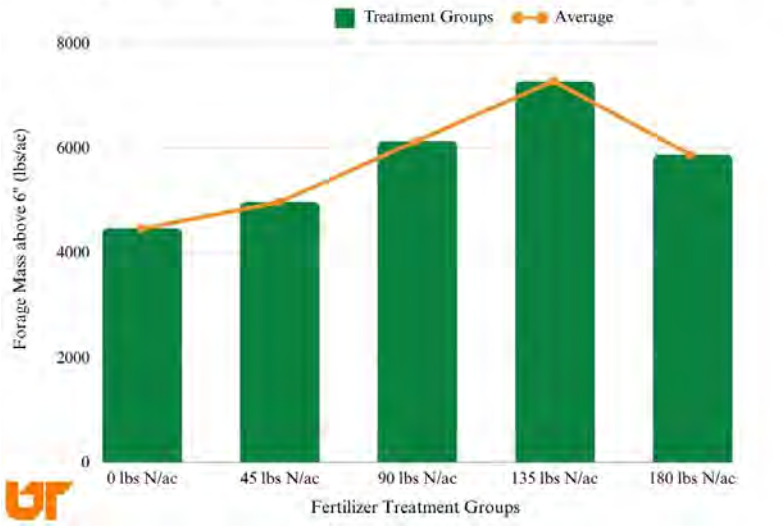
Plots with increased nitrogen fertilization rates resulted in increased forage mass of sorghum-sudangrass. However, this positive relationship between forage mass and nitrogen may have a threshold that when surpassed becomes a negative relationship, decreasing forage mass with increased nitrogen. More samples and treatments are necessary for further understanding.

Looking to the Future

By the end of 2024, we hope to have data illustrating nutritional differences between fertilization rates. This data will represent the potential for desirable or undesirable forage quality along a gradient of applied nitrogen.

Additionally, our team will have an understanding of nitrate concentration changes due to the ensiling process with and without inoculation at varying starting nitrate levels.

Figure 2: Forage Masses of Different Fertilizer Treatment Groups



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Extension Update

LIVE.STOCK Podcast:

- **Dr. Keith Carver: Live.Stock**
  https://www.youtube.com/watch?v=pQ4h6ohpC8I
- **Dr. Gary Bates, Dr. Bill Johnson, and Dr. Neal Schrick: Behind the Beef and Forage Center**
  https://www.youtube.com/watch?v=xVkHWZngTdM
- **Dr. Charley Martinez: Let's Talk Land Loss in Tennessee**
  https://www.youtube.com/watch?v=yLCErXn55IQ
- **Dr. Gary Bates: Then and Now - Forage Advancements in Tennessee**
  https://www.youtube.com/watch?v=53F4Fwpqmdw
- **Dr. David Lalman: Improving our Beef Herds through Genetic Selection**
  https://www.youtube.com/watch?v=eHqEOm85yGA
- **Dr. Rebecca Trout-Fryxell: Talkin' Ticks!**
  https://www.youtube.com/watch?v=Yr_nBCBNo44
- **Dr. Neal Schrick: Ag Fact or Fiction?**
  https://www.youtube.com/watch?v=l0MZj4hIhFs
- **Dr. Troy Rowan: Genetic Selection and Benefits**
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- **Dr. Saulo Zoca: Ramblin' about Reproduction**
  https://www.youtube.com/watch?v=ZhMd4UriQ_k
- **Dr. Carlos Saviani: Beef Sustainability: How can we do our Part?**
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LIVE.STOCK Companion: https://utbeef.tennessee.edu/live-stock/

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- **Volume 2 – January 2024**
- **Volume 3 – February 2024**
- **Volume 4 – March 2024**
- **Volume 5 – April 2024**
- **Volume 6 – May 2024**
- **Volume 7 – June 2024**
- **Volume 8 – July 2024**
- **Volume 9 – August 2024**
- **Volume 10 – September 2024**
- **Volume 11 – October 2024**
- **Volume 12 – November 2024**
- **Volume 13 – December 2024**

LIVE.STOCK companion

Volume 1: December 2023

MONTHLY TIP

Precipitation in early December has been very helpful to the winter annual forages, such as annual ryegrass. Although, the rain was late for stockpiled fescue. Keep allocating hay based on the animal's needs and checking your hay inventory. It is also important to check hay quality, especially for bales left outside, as they are losing nutrients. Small differences in protein and energy will require more animal supplementation. The best way to store hay is in a barn, where the losses should be from 2 to 6% and hay quality will last longer.

What's in your bale? soillab.tennessee.edu

"They didn't have internet when I started 30 years ago as a forage specialist-
Dr. Gary Bates."

FORAGE MANAGEMENT

Dr. Bruno Pedreira, UT Extension Forage Specialist

December is the last month of the year, which means that we made it through 2023. As forage growers, we could have improved soil fertility, added warm-season grasses to our forage program, stockpiled tall fescue, and used winter annuals to extend the grazing season to reduce the hay needs. We all know how much it costs to feed our cattle with hay and supplements, so a longer grazing season will help to reduce our variable costs. However, at this time of the year, there is not much to be done regarding forage production, but there are still alternatives to increase forage use efficiency and reduce hay losses.

CATTLE NUTRITION

Dr. Katie Mason, UT Extension Beef Cattle Nutrition Specialist

Minerals are a small, but mighty, nutrient requirement for cattle. These elements cannot be made by the body, and they are essential for proper function of the skeletal, immune, and muscular systems. Imagine that the major nutrients, such as carbohydrates and protein, are the bricks in a wall. Minerals can be viewed as the mortar that holds the wall together, playing a supportive role in using those major nutrients. Minerals matter, but it can sometimes be complicated to put your finger on exactly what you need in a mineral program. Mineral availability in pasture and hay forage fluctuates according to the season, fertilizer application, weather conditions, forage species, and other factors. Cattle mineral requirements also fluctuate with growth and stage of production. While cattle get minerals from the diet, we often recommend providing a complete mineral program year-round, just to be sure that minerals are being provided at the appropriate level in the diet.

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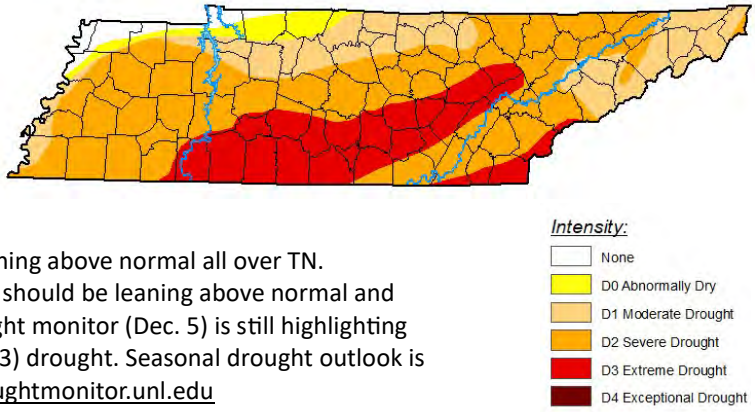
Knoxville, TN 37996
P: 865-974-7324
utbeef@tennessee.edu

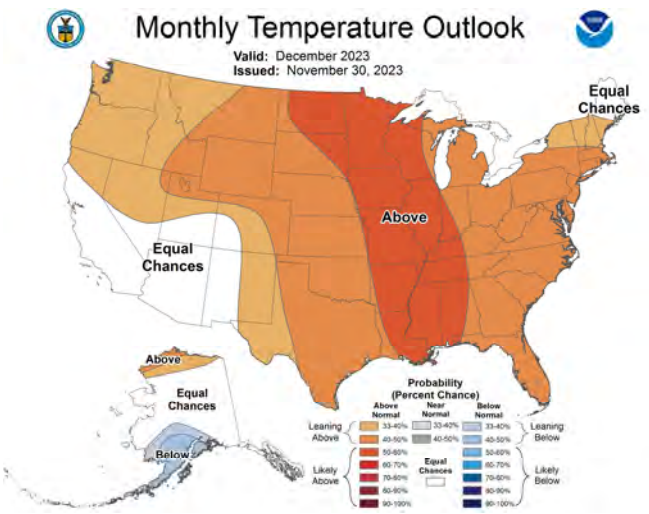
WEATHER

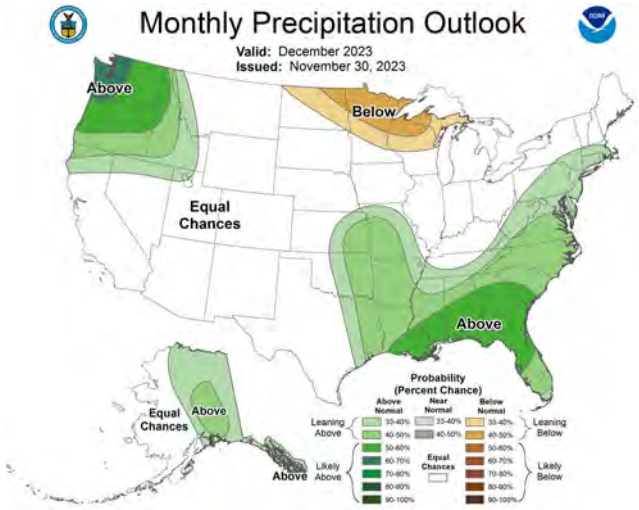
Dr. Bruno Pedreira, UT Extension Forage Specialist

In November, the average temperature and precipitation for the state of Tennessee were 2.7°F and -2.18" departing from the normal, which is 47.4°F and 4.05", respectively. ncei.noaa.gov



For December, temperatures are expected to be leaning above normal all over TN. Precipitation in the east and the whole southern TN should be leaning above normal and towards average in middle and southwest TN. Drought monitor (Dec. 5) is still highlighting most of the state from severe (D2) to exceptional (D3) drought. Seasonal drought outlook is still highlighting drought remains but improves. droughtmonitor.unl.edu





UPCOMING EVENTS

- **Live.Stock-** Join us for our inaugural live stream February 14, 2024 at 2 pm ET. utbeef.com/live.stock

Photo of the Month- taken by B. Pedreira UTIA Lone Oaks Farm, Hardeman, County

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion

Volume 2: January 2024

MONTHLY TIP

To minimize the need to graze drought-affected perennial cool-season pastures early in the year, consider overseeding clovers (2 lbs/acre of with clover + 4 lbs/acre of red clover) around the second week of February. It will help to improve forage production and, as clover is a great source of nitrogen, it will contribute to fescue fertilization. Spring oats are another option to increase forage yield (seeding rate is 100-150 lbs/acre and planting window is from Feb 20 to April 1). If you decide to spring oats, plan to drill seeds in late Februarv if moisture allows.

What's in your bale?
soillab.tennessee.edu

"If you have been putting off doing something until hell freezes over, don't miss your chance this week!"

Joe Elliott - Adams, Tennessee

FORAGE MANAGEMENT

Dr. Bruno Pedreira, UT Extension Forage Specialist

Most fescue pastures did not get precipitation enough to ensure great forage yield, compromising our ability to stockpile fescue. As it is hard to rely on weather forecasts, selling animals is not the first choice to reduce stocking rates, so over-grazing is usually a secondary effect in a drought year. Thus, besides the lack of forage produced in the fall, some grasses may not have had a chance to store carbohydrate reserves, as the pastures were over-grazed while we were waiting for a few drops of rain. Therefore, after being dormant through the winter, spring regrowth may be slower than usual, and some pastures will end up having fewer tillers. So, be prepared to reduce grazing pressure, fertilize, and control weeds.

CATTLE NUTRITION

Dr. Katie Mason, UT Extension Beef Cattle Nutrition Specialist

1. Understand hay demand. A mature cow will eat 2-2.5% of her body weight in dry matter per day. Account for total head of cattle, hay moisture content, and hay waste when determining total hay needs.
2. Test your hay. A forage analysis will reveal the exact nutrient composition of hay, allowing you to match the quality to an animal's stage of production.
3. Reduce hay waste. Hay should be stored under cover or at least on a well-drained surface with plenty of air flow. Using a hay ring can result in less waste than setting a bale directly on the ground.
4. Consider economical forage alternatives. Popular options for forage alternatives are range cubes, straw, or cottonseed hulls, but understand some options only provide 'bulk" and should be carefully supplemented.
5. Observe body condition. Keep herd body condition between 5 and 6, meaning no more than 1 or 2 ribs are visible, hip and pin bones are visible, but smooth, and the spine outline is not visible.

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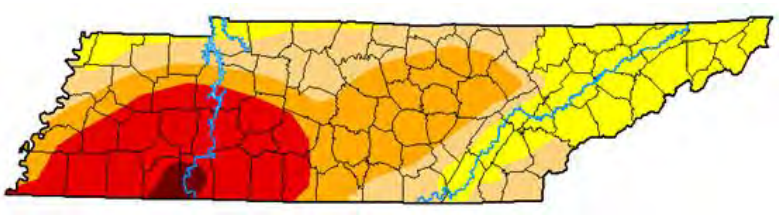
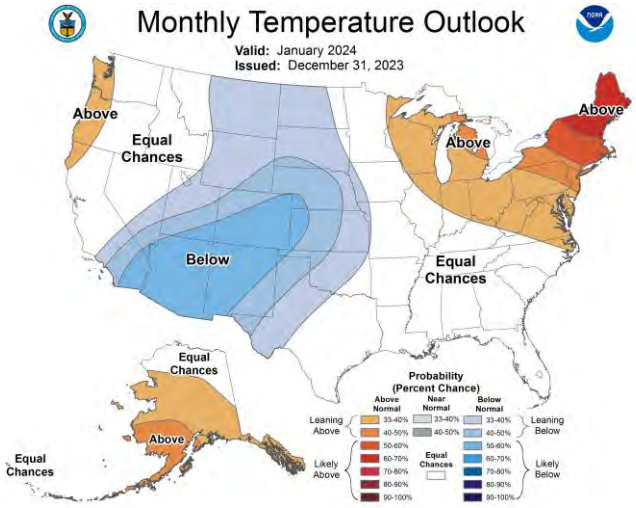
WEATHER

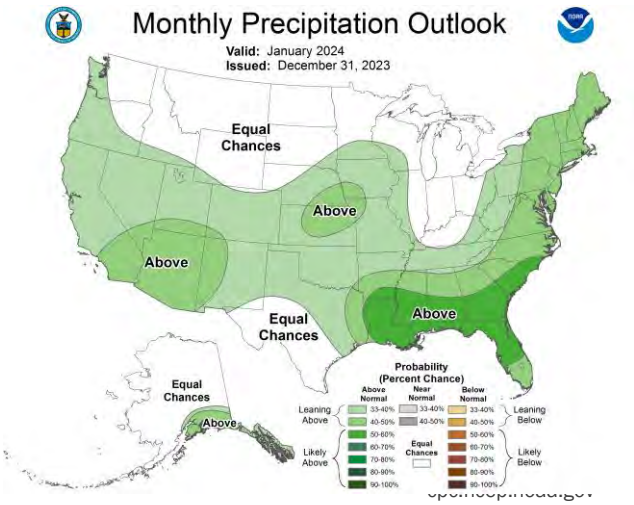
Dr. Bruno Pedreira, UT Extension Forage Specialist

In December, the average temperature and precipitation for the state of Tennessee were +5.3°F and -1.49" departing from the last 10-y average, which is 43.7°F and 5.61", respectively. ncei.noaa.gov



In January, normal temperatures are anticipated throughout Tennessee. However, precipitation is forecasted to be above the usual levels. As of the Drought Monitor report on January 16th, dry conditions persist throughout the entire state. Optimistically, the occurrence of snow events may bring relief and improve the current drought situation. Middle and West TN are still from D1 to D3 drought, while East TN is getting a little better moving to D0 and D1. McNairy and Hardin are the only two counties that are still in D4. droughtmonitor.unl.edu





UPCOMING EVENTS

- Live.Stock- Join us for our inaugural live stream February 14, 2024 at 2 pm ET.
- Silvopasture Systems of the Southeast United States March 7, 2024 – 1 to 3 pm ET.

Photo of the Month - taken by B. Pedreira, Vivien Allen's Farm, Franklin County, TN.

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion

Volume 3: February 2024

MONTHLY TIP

Stay vigilant for cool-season weeds. When the forecast indicates three or more consecutive days with temperatures exceeding 60°F, cool-season weeds will be still actively growing, and herbicides can be applied. This window provides an opportune time to apply herbicides effectively.

For detailed information on appropriate herbicides and rates check the UT Extension publication: Weed Control Manual for Tennessee

What's in your bale?
soillab.tennessee.edu

"Anytime you put a machine between the mouth of a cow and her feed source, it's costing you money!"

Forage Quotes & Concepts, Volume 3

FORAGE MANAGEMENT

Dr. Bruno Pedreira, UT Extension Forage Specialist

After the last drought fall, some pastures may need to be renovated, but a suitable fertility program for the upcoming growing season is needed. Thus, I strongly advise conducting a soil analysis to quantify the lack of nutrients. Three points to be considered: 1) Identify sources of variability in the area to be sampled. If you have fertilized half of the pasture/hayfields in the past, take two samples (fertilized and unfertilized). If there is a slope, split it into a hilltop, side slope, and bottom; 2) Take around 15 soil cores from a homogenous area, put them all in a clean bucket, mix them, and send the equivalent of a cup to the lab. I would request pH, P, and K analyses, at least; and 3) Make sure of the depth. All samples need to be taken 6 inches deep. Shallow sampling will lead to higher soil nutrient levels resulting in recommendations lower than truly needed. Guaranteeing that pastures or hay fields receive the essential nutrients to increase the probability of achieving optimal growth, stand persistence, and economic benefits.

CATTLE NUTRITION

Dr. Katie Mason, UT Extension Beef Cattle Nutrition Specialist

The occurrence of grass tetany, or low Mg levels in the blood, is most prominent in late winter and early in the spring as forage starts to green up and grow rapidly. The disorder is most often seen in animals grazing cool-season grasses and especially affects animals in early lactation. Common symptoms of grass tetany include nervousness, muscle twitching, and staggering. Older animals with suckling calves are particularly susceptible. The most dependable form of control is supplying a mineral supplement with a relatively high concentration of magnesium. Across the Southeast, the most common time to see grass tetany is mid-February through mid-April, so this coincides with the time that high-magnesium mineral should be fed to cattle. Magnesium is not stored in the body, so it is pertinent for cattle to meet their intake requirements daily. General guidelines for supplementing magnesium can be found below:

-Provide at least 1 oz. per day of magnesium oxide to yield at least 0.6 oz. of magnesium. "Hi-mag" minerals typically have around 12 to 14% Mg.
-The supplement should contain either magnesium oxide or magnesium sulfate (not magnesite or dolomitic limestone).
-Loose mineral mixtures are preferred.
-Keep hay available until cattle completely stop consuming it.
-After starting cattle on high-magnesium supplements, continue until "danger" is past in the late spring.

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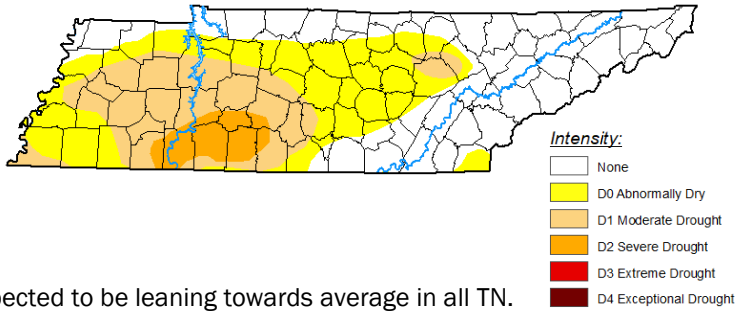
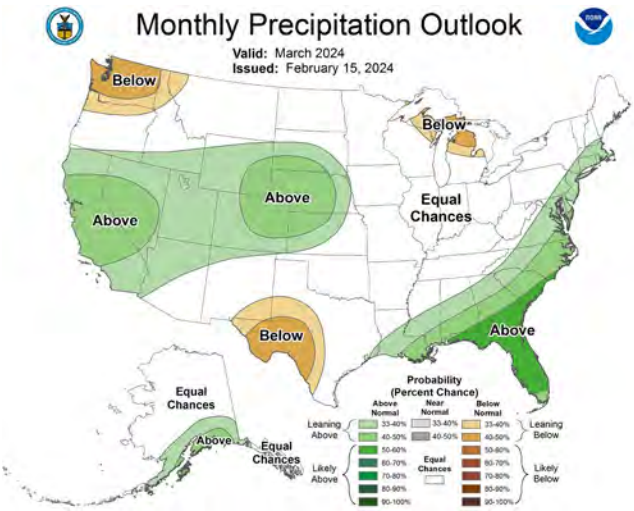
WEATHER

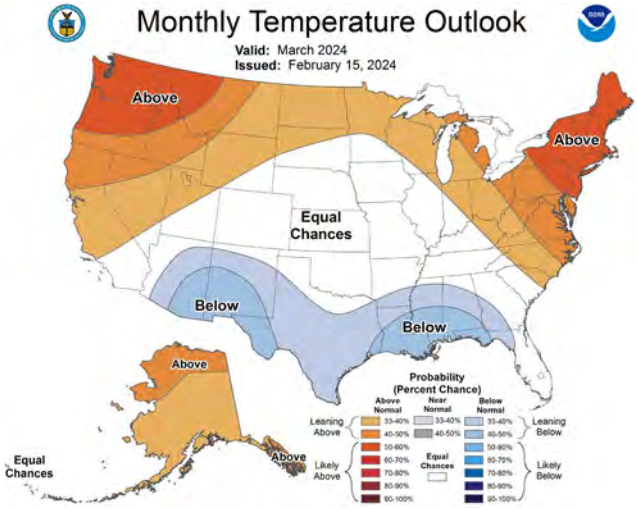
Dr. Bruno Pedreira, UT Extension Forage Specialist

In January, the average temperature and precipitation for the state of Tennessee were +3ºF and +1.89” departing from the last 10-y average, which is 37.8ºF and 4.52”, respectively ncei.noaa.gov



For February, temperatures and precipitation are expected to be leaning towards average in all TN. Northwest counties may have above temperatures and below-average precipitation. Drought monitor (Feb. 15) is showing some improvement, although is still highlighting most of the state from abnormally (D0) to severe (D2) drought. The fact that drought signals are still present shows how dry it was during earlier months. droughtmonitor.unl.edu





UPCOMING EVENTS

- Live.Stock- Join us for our live stream March 13, 2024 at 2 pm ET.
- Silvopasture Systems of the Southeast United States March 7, 2024 – 1 to 3 pm ET.

Photo of the Month - taken by B. Pedreira, Annual Ryegrass Variety Trial, UT Plateau Research and Education Center, Cumberland County, TN.

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion
Volume 4: March 2024

MONTHLY TIP

Anywhere there is moist, wet abrasive environmental conditions; there is a problem with foot rot. The incidence of foot rot varies according to the weather, season of the year, grazing periods. Close detail to environmental conditions and feeding a well-balanced dietary program nutrition are key in prevention. Consult with your veterinarian or Extension agent on a prevention program for your farm.

Dr. Lew Strickland
UT Extension Livestock Veterinarian

Check out the publication:
Livestock Health: Foot Rot-Prevention and Treatment

"Grazing animals are forage harvesting experts."

Forage Quotes & Concepts

FORAGE MANAGEMENT

Dr. Bruno Pedreira, UT Extension Forage Specialist

After taking soil samples, as discussed in last month's Live.Stock Companion, a fertilization program can be built. The first parameter to be assessed is soil pH, to understand more about the soil's chemical environment, followed by evaluating soil P and K. To increase soil pH, lime should be applied as soon as possible as it takes months to a year to react in the soil. P and K fertilizers, particularly with cool-season forages, can be applied once a year in the spring or fall. Although, P and K fertilizers prices tend to be lower in the fall. Nitrogen, on the other hand, must be applied strategically, precisely timed just before forage plants enter their growth phase. Usually, nitrogen will be applied preceding forage growth in late February-March for spring and September for fall harvests or stockpiling. Strategic fertilization, tailored to timing and rates, significantly enhances forage yield and quality, ensuring a profitable outcome.

CATTLE NUTRITION

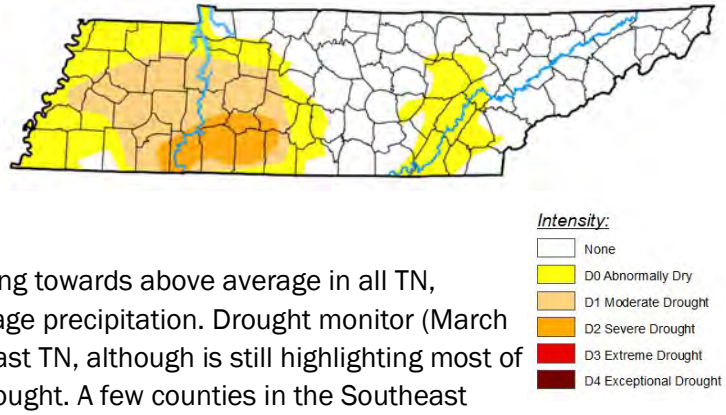
Dr. Katie Mason, UT Extension Beef Cattle Nutrition Specialist

What is the body condition of your herd?

In the winter, low or moderate quality hay without proper supplementation may have caused cows to drop body condition, especially given the cold snap and week of snow and ice. For cows that are close to calving or have just calved, we want to see a BCS of about 5 or 6. This allows them to have plenty of energy stored in the form of fat to pull from while lactating. If cattle have been "roughed" through the winter, you may want to provide supplemental energy to meet their needs. Body condition score at calving has an impact on the post-partum interval, meaning if BCS is too low, post-partum interval is longer, and it takes cattle longer to breed back. This results in extended calving seasons the following year. First-calf heifers especially need extra nutritional support during this time because they are still growing while lactating.

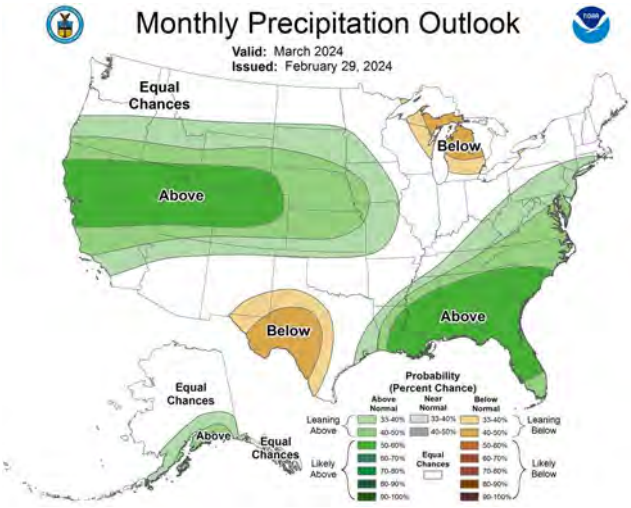
WEATHER

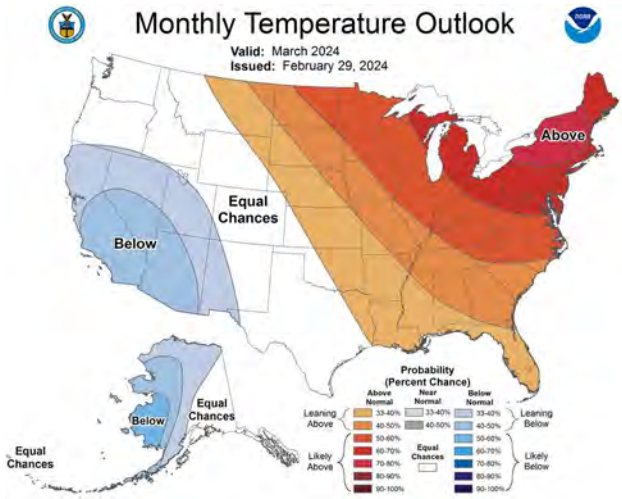
Dr. Bruno Pedreira, UT Extension Forage Specialist



In February, the average temperature and precipitation for the state of Tennessee were +4.5ºF and -2.41" departing from the last 10-y average, which is 43.2ºF and 6.55", respectively. ncei.noaa.gov

For March, temperatures and precipitation are leaning towards above average in all TN, although the northwest counties are expecting average precipitation. Drought monitor (March 14) is showing some improvement for Middle and East TN, although is still highlighting most of the West TN from abnormally (D0) to severe (D2) drought. A few counties in the Southeast region are also still in D0. The monthly drought outlook is still predicting that "drought remains, but improves" to "drought removal likely" for March in West TN. droughtmonitor.unl.edu





UPCOMING EVENTS

- Live.Stock- Join us for our live stream April 10th, 2024 at 2 pm ET
- Southeast Tennessee Beef Summit- April 26th, 2024 at 8 am ET

Photo of the Month - taken by Derrick Corbin spraying 2-4D for broadleaf weed control on the Annual Ryegrass Variety Trial, UTIA Plateau AgResearch and Education Center, Crossville, TN.

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion
Volume 5: April 2024

MONTHLY TIP

April is when cool-season forage stands should be assessed to define the right strategy for each pasture.

- If more than 70% of the ground is covered with fescue, keep the fertilizer and herbicide program, and consider adding clover next February.
- When the fescue stand covers from 40% to 70% of the ground it is recommended to reseed in mid-September.
- If the fescue stand covers less than 40% of the ground, it is time to start it over. The optimal planting window remains mid-September, however, burn it down 10 to 14 days before drilling in at the full seeding rate.

Dr. Bruno Pedreira
UT Extension Forage Specialist

UTBEEF.COM

"You can see present, future, and past with rotation. That's neither too slow nor too fast."

Jennifer J. Tucker - Forage Quotes & Concepts

FORAGE MANAGEMENT: LIME! WHY?

Dr. Bruno Pedreira, UT Extension Forage Specialist

If the soil pH is low, the nutrient availability to the plants will be limited. Some of the nutrients will be strongly held by the soil particles that plants will not be able to uptake them. Thus, by applying lime, soil pH will be increased, and nutrients will be more plant available. Before spending a few hundred dollars on a ton of P_2O_5 or Potashl, soil pH needs to be in the range of 6 to 7 for most of the cool- and warm-season grasses. If a legume pasture (such as alfalfa), or a clover-grass mixture is the target, soil pH should be elevated to above 6.5. Legumes are more sensitive to soil pH and will benefit from a higher soil pH. In last month's Live.Stock Companion, I already mentioned, "to increase soil pH, lime should be applied as soon as possible as it takes months to a year to react in the soil." It is also important to mention that in the UT soil test report, the lime recommendation is made assuming a Relative Neutralization Value (RNV) of 65%. For instance, if the recommendation is 2 tons/acre with a 65% RNV, but you are buying a 50% RNV, you will need to apply 2.6 tons/acre.

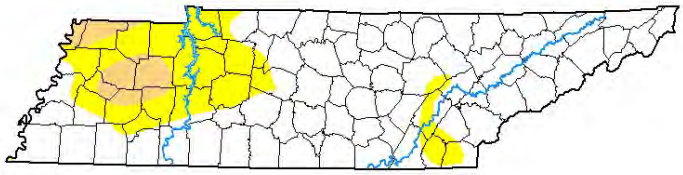
CATTLE NUTRITION: FIRST-CALF HEIFERS

Dr. Katie Mason, UT Extension Beef Cattle Nutrition Specialist

The first-calf heifer is different. She is different from mature cows and from replacement heifers, earning a spot in a category all her own. The reason for this is that the first-calf heifer is not at her mature body weight quite yet. Heifers are typically developed to reach about 60% of their mature body weight at breeding. By the time she calves, she is only about 85–90% of her mature body weight. Once the calf hits the ground, the first-calf heifer's energy is devoted, first, to meeting requirements for survival, and second, lactation. If those needs are met and there is excess energy is available in the diet, she will devote that energy to growth and finally, reproduction. If the first calf-heifer is receiving a diet that meets the needs of the mature cow herd, she is likely coming up short on energy. If that's the case, it will take her longer to begin to cycle and be ready for rebreeding. Design a feeding strategy that favors the nutrient requirements of the first-calf heifer to ensure that all of her needs are met and to set her up for a successful second pregnancy.

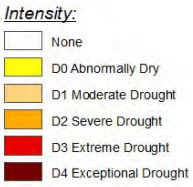
WEATHER

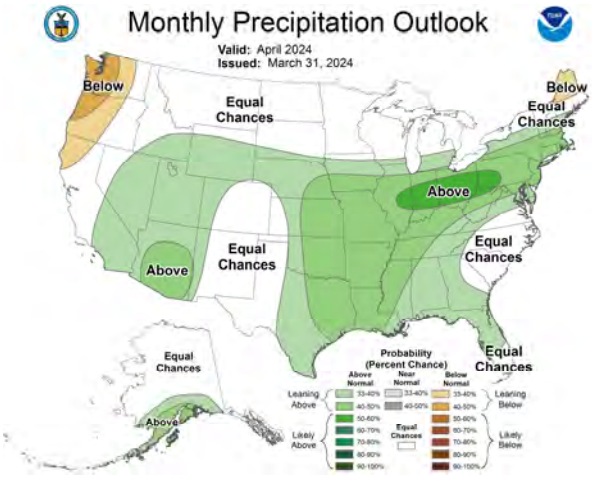
Dr. Bruno Pedreira, UT Extension Forage Specialist

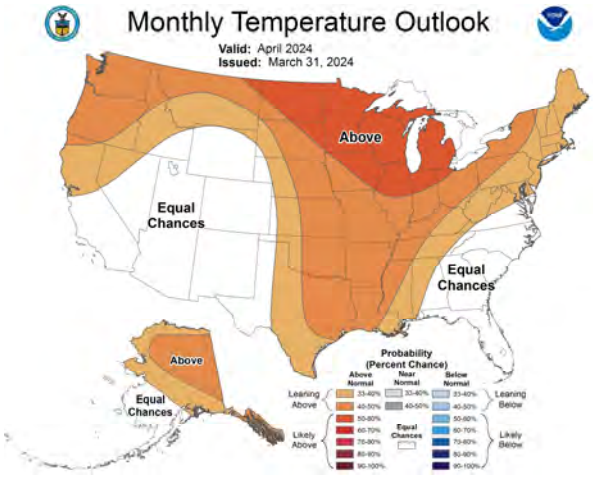


In March, the average temperature and precipitation for the state of Tennessee were +4.6°F and -1.15" departing from the last 10-y average, which is 50.7°F and 5.73", respectively. ncei.noaa.gov

For April, temperatures and precipitation are leaning towards above average in Middle and East TN, although West TN is predicted to be "likely above". Drought monitor (April 9) is showing fewer counties in need of moisture than in March. The West TN is still struggling but none of the counties are under severe drought (D2) anymore. Row-crop planting season is here and some rain would be very welcome. The monthly drought outlook is predicting a better scenario for April, although Humphreys, Benton, Carroll, Gibson, and Crockett area is still classified as "drought removal likely" in West TN. droughtmonitor.unl.edu







UPCOMING EVENTS- UTBEEF.COM

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- Southeast Tennessee Beef Summit April 26th, 2024 at 8 am ET

Photo of the Month by Derrick Corbin - Nitrogen effect on Annual Ryegrass Trial, UTIA Plateau AgResearch and Education Center, Crossville, TN.

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LIVE.STOCK companion
Volume 6: May 2024

MONTHLY TIP

In the heart of the tall fescue belt, bringing in a few acres of warm-season grasses can be a game changer for forage-based livestock producers. May is the month to seed our warm-season forages, such as:

- Crabgrass- May 1 to July 1, 3-5 lbs/acre
- Sudangrass and hybrids- April 20 to June 15, 30 lbs/acre drilled or 45 lbs/acre broadcast
- Bermudagrass- May 1 to July 1, 5-8 lbs/acre
- •Teff- May 1 to June 15, 6-8 lbs/acre

To ensure a successful establishment, check the drill calibration for seeding rates and seed depth.

Dr. Bruno Pedreira
UT Extension Forage Specialist

UTBEEF.COM

"When nature speaks, it pays to listen!"

Forage-Livestock Quotes & Concepts

MILK AND MEAT SUPPLY REMAINS SAFE

Dr. Lew Strickland, UT Extension Livestock Veterinarian

During the last weeks of April, USDA's Animal and Plant Health Inspection Service (APHIS) confirmed the detection of highly pathogenic avian influenza (HPAI) in dairy herds in multiple states. The situation continues to evolve and the USDA, along with state and federal partners, are sharing information as it becomes available. There are concerns that food products are infected with HPAI; however, the milk supply remains safe. The Food and Drug Administration (FDA) does not currently have concerns about the safety and availability of pasteurized milk products nationwide. Because milk products are pasteurized before entering the market, there are no concerns about the safety of the commercial milk supply. Pasteurization has continuously been proven to inactivate bacteria and viruses, like influenza, in milk. The USDA is confident in the safety of the meat supply. As always, consumers are encouraged to properly handle raw meats and to cook to a safe internal temperature.

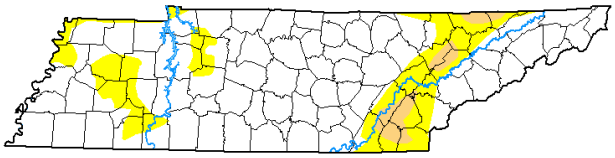
THE BIF ANNUAL SYMPOSIUM

Dr. Troy Rowan, UT Extension Beef Cattle Genetic Specialist

Tennessee is hosting the Beef Improvement Federation's (BIF) Annual Symposium in Knoxville from June 10-13. BIF is an organization made up of producers, breed associations, researchers, and extension personnel that focuses on using genetics to improve the beef industry. This year, our symposium's theme is, "Breeding a More Efficient and Adapted Cow." As the industry has focused much effort on improving feedlot and end product traits, we know that maternal quality and efficiency remain the major driver of profitability in cow-calf operations, especially in the Southeast and Fescue Belt. Our speakers will provide perspectives on the genetics of cow efficiency, adaptability, longevity, and productivity. The event kicks off with a "Young Producer Symposium" on Monday June 10th that will explore the less genetics-focused parts of seedstock production. Tuesday and Wednesday feature morning general sessions, and afternoon breakouts that allow attendees to choose more applied or technical sessions based on their interests. In addition to the scientific program, the symposium provides numerous opportunities to engage with other producers and members of industry. Finally, Thursday concludes the event with an optional tour of East Tennessee beef operations. You can find more information including the full schedule, hotel blocks, and registration at: 2024 Beef Improvement Federation Symposium.

WEATHER

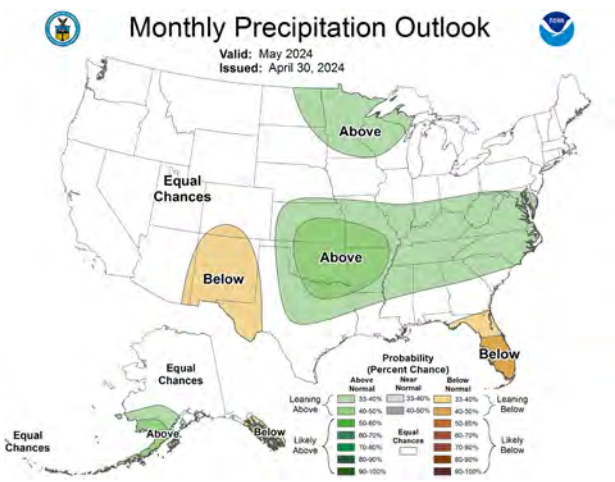
Dr. Bruno Pedreira, UT Extension Forage Specialist

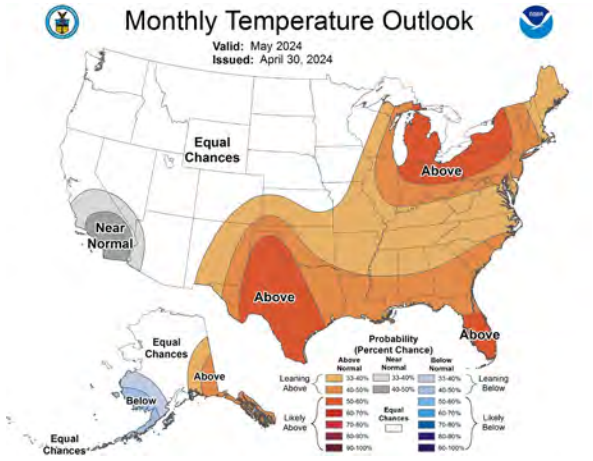


Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

In April, the average temperature and precipitation for the state of Tennessee were +2.48ºF and -1.00" departing from the last 10-y average, which is 58.2ºF and 5.05", respectively. ncei.noaa.gov

For May, temperatures and precipitation are leaning towards above average in the entire state of TN. Drought monitor (May 7) is highlighting a few counties in abnormally dry (D0) and moderate drought (D1). However, the second week of May has been registering above-average rainfall in most of the state. Luckily, May will keep going with good moisture, as our pastures and hayfields are reaching the spring production peak. That is the first time since last summer that the monthly drought outlook is predicting no drought for the state of TN. droughtmonitor.unl.edu





UPCOMING EVENTS

- Live.Stock - Join us for our live stream June 12th, 2024 at 2 pm ET
- 2024 Beef Improvement Federation Symposium June 10-13, 2024 in Knoxville, TN

Photo of the Month by Bruno Pedreira at the Southeast TN Beef Summit in McMinn Co., Athens, TN.

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion
Volume 7: June 2024

MONTHLY TIP

The past few weeks have made it challenging to find a 3–4-day window to harvest, tedder, rake, and bale high-quality hay. As a result, some hay was harvested later than planned, leading to more stems than leaves, higher fiber and lower protein contents. Therefore, it is crucial to determine the quality of the hay produced.

To assess the quality, take samples from 8 to 10 bales in each hayfield using an auger or a hay probe. Place the forage samples in a Ziplock bag and bring them to your local extension office. They will assist you in filling out the necessary forms and will send the samples for analysis.

Knowing what's in your bales allows you to fine-tune the amount of supplement needed to meet your animals' nutritional requirements or accurately price your hay.

Dr. Bruno Pedreira
UT Extension Forage Specialist

"Join us in celebrating the 10th Annual National Forage Week- June 16-22, 2024!"

UT BELL DEVELOPMENT AND EVALUATION PROGRAM: CLASS OF 2024

Dr. Saulo Zoca, UT Extension Beef Cattle Reproductive Specialist

The UT Bull Development and Evaluation Program has been going through some changes that I would like to highlight in this issue. To start out, we have moved our page to the UTBEEF.COM website. With that, test dates have also been moved, so bull nominations are due on June 28th, with animals being delivered at MTREC – Spring Hill on July 9th, 2024. This will allow younger bulls to participate in hopes of creating a more uniform group of animals for performance comparison. Another big change occurring in this year's Bull Test is that our sale will be on December 12th, 2024, instead of January. Lastly, in 2025, the Bull Test will move from MTREC – Spring Hill to MTREC – Lewisburg, where bulls will be developed in 5 pastures, each with 15 acres. The success of this program is dependent on its consignors and the quality of animals that have been brought in for several years. If you are interested in participating in this year's Bull Test or if you have any questions, feel free to contact Dr. Saulo Zoca. We look forward to the start of this year's Bull Test and to seeing the quality of participating animals!

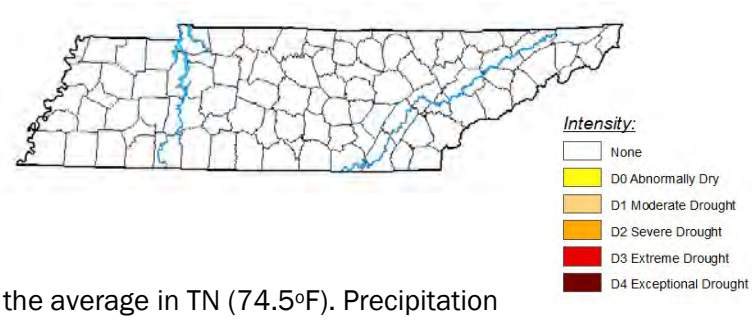
THE 17 DAY LONGHORNED TICK BLITZ – JUNE 10-27

Dr. Rebecca Trout-Fryxell, Associate Professor of Entomology and Plant Pathology

In collaboration with USDA APHIS, we are co-leading a national longhorned tick blitz. Our goal is to determine where these ticks are currently reported (fewer than 5 specimens) and established (6 or more specimens or two+ life stages) to better understand its dispersal across the country. To meet this goal, we are asking for help with sample collection and preparation. Knowing that YOU encounter many ticks through work-related responsibilities, we are asking you to collect and send us your ticks. For each collection, we request that each collector provide the following information: date, state, county, and method of collection (from a cow, yourself, your dog, the environment). Thanks to a grant from the UTIA Genomics Center of Agriculture, we will be screening Tennessee collected longhorned ticks for *Theileria orientalis* Ikeda. Please sign up for more information: https://forms.gle/2VkxmQ7k3jBPRkj1A

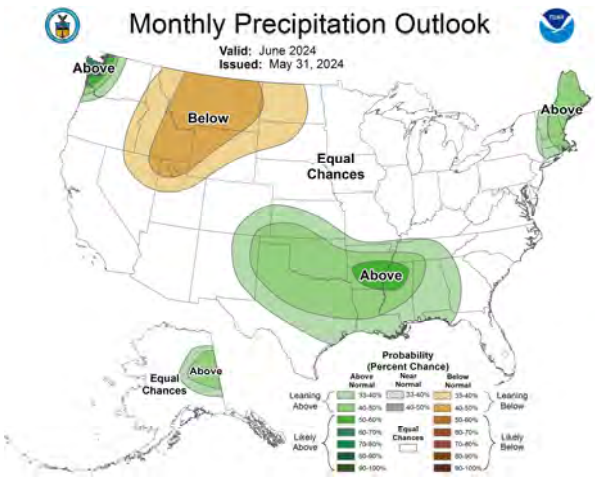
WEATHER

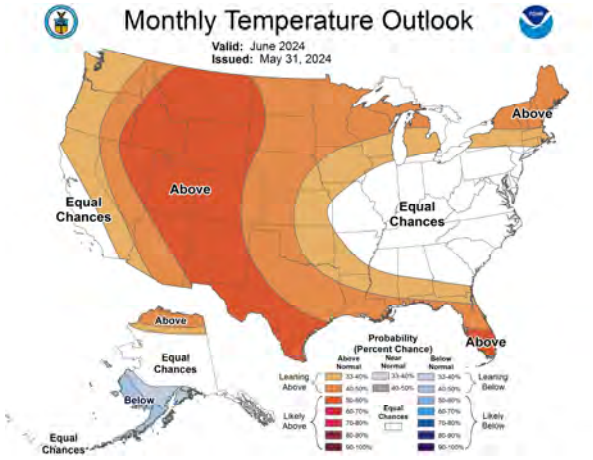
Dr. Bruno Pedreira, UT Extension Forage Specialist



May was a month with higher average temperature and precipitation for the state of Tennessee. On average, +1.92ºF and +3.44" departing from the last 10-y average, which is 67.5ºF and 4.57", respectively. ncei.noaa.gov

For June, temperatures are expected to be towards the average in TN (74.5ºF). Precipitation should be leaning toward above average in Middle and West TN, but farmers in the East should be expecting average rainfall. Since we started this column in December 2023, this is the first time no drought has been reported in the state (June 4), as a result of the above-average rainfall in May. This was good for the pastures, but a challenge for hay producers that may have harvested lower-quality hay due to the more mature forage. As June goes on, we expect to keep up with good moisture. droughtmonitor.unl.edu





UPCOMING EVENTS

- Live.Stock - Join us for our live stream
  July 10, 2024 at 2 pm ET
- Pasture Renovation 101
  June 20, 2024 online – 6 PM CT/7 PM ET
- Tobacco, Beef, and More Field Day
  June 27, 2024 in Springfield, TN – 8 AM CT

These events can be found on UTBEEF.COM

Photo of the Month by Malerie Fancher – 2024 4-H Academic Conference Beef Group learning more about the importance of forages for beef cattle.

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion
Volume 8: July 2024

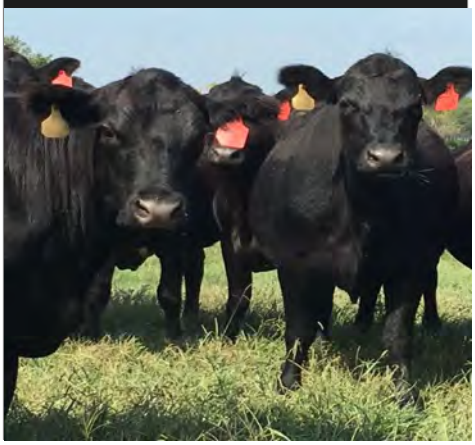
MONTHLY TIP

Tennessee State Fair Competition (State Hay Contest) is receiving hay samples up to August 11. This year 16 different hay categories are available, including square and round bales from grasses, legumes, and grass-legumes mixes.

For the Southeastern Hay Contest (https://site.caes.uga.edu/sehaycontest/) entries must be postmarked by August 30th, 2024. This contest is open to any hay or baleage producers from Tennessee and States located east of I-35. In this case, 9 different categories are accepted.

Proving your hay is the best can help you sell it more effectively. Your local Extension Agent can assist you with the process. Let's showcase that Tennessee has the best hay ever!

Dr. Bruno Pedreira
UT Extension Forage Specialist



UTBEEF.COM

"Anything worth doing is worth doing well."

Forage-Livestock Quotes & Concepts

NITRATES TOXICITY IN FORAGES

Dr. Bruno Pedreira, UT Extension Forage Specialist

In recent weeks, I have received several calls about nitrates in forages. Nitrate accumulation is especially likely during the summer when soil moisture is low, as has been the case recently in Tennessee. This buildup happens because plants continue to absorb nitrogen, but insufficient water limits their growth. Consequently, nitrates stay stored in the plants, waiting to be used for protein synthesis when water becomes more available. To determine the presence of nitrates in forages, county extension offices now offer a nitrate screening solution. To conduct the test, collect 10 to 15 stalks from various parts of the field or from the forage intended for feeding. Cut the stalks open lengthwise and apply 2-3 drops of the solution to the nodes. If the solution turns dark blue, nitrates are present, and it is recommended to perform a lab nitrate test to determine the exact concentration. Since the nitrate level in hay will not decrease during storage, it is important to have the hay analyzed prior to feeding.

NEW EQUINE NUTRITION SHORT COURSE BEGINS IN SEPTEMBER

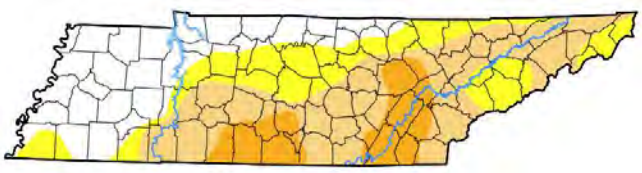
Dr. Jennie Ivey, Associate Professor and Equine Extension Specialist

The University of Tennessee Equine Program is excited to announce a new educational program – the Equine Nutrition Short Course (ENSC)! The ENSC will be 9 weeks long, running from September 3 – October 29, 2024. Each week, live webinars will be hosted on Tuesday evenings from 7:00-8:30 PM ET covering a variety of equine nutrition topics. Participants will also be added to an online classroom that will contain webinar information and recordings, a question/answer platform, topic-specific resources, and interactive case studies. "The ENSC brings science based, unbiased nutrition information to the equine owners, industry professionals, and enthusiasts. The contest is accessible and is applicable to any breed, age, experience level, or riding discipline," says Dr. Jennie Ivey. "We are excited to launch this long-anticipated program nationally recognized speakers, content, and interactive components to empower participants to make informed equine nutrition decisions," adds Dr. Ivey. Cost for participants is $165 until August 13, 2024, and will increase to $200 from August 14-September 10, 2024. Registration cost includes access to 9 webinars and the online classroom, a forage test, incentives, and a certificate. The ENSC is open to individuals ages 15 and over. Group pricing is available and can be arranged through direct email to Dr .Ivey at jzivey@utk.edu. For more information and to register, visit tiny.utk.edu/EquineNutritionShortCourse.

WEATHER

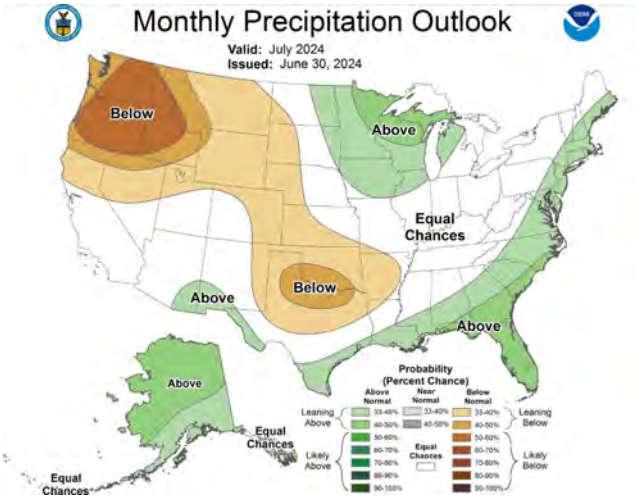
Dr. Bruno Pedreira, UT Extension Forage Specialist

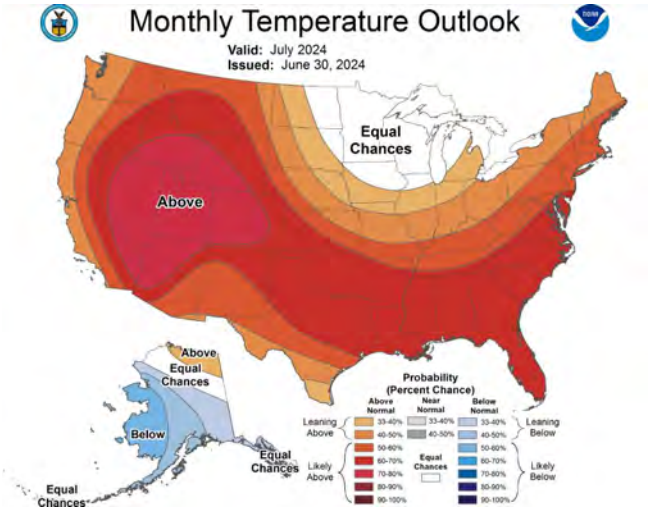
June was a month with lower average temperature and precipitation for the state of Tennessee. On average, -0.96ºF and -2.01" departing from the last 10-y average, which is 74.6ºF and 4.5", respectively. ncei.noaa.gov



Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

For July, temperatures are expected to be hot and above the average in TN. Precipitation should on average, with equal chances of precipitation. The drought monitor is showing low soil moisture in TN except for the West region. Several counties in East and Middle TN are already in Severe Drought (D2). droughtmonitor.unl.edu





UPCOMING EVENTS- Visit UTBEEF.COM for more information

- Live.Stock - Join us for our live stream August 14, 2024 at 2 pm ET
- Tri-State Beef Conference- August 1, 2024 in Blountville, TN
- Steak and Potatoes Field Day- August 22, 2024 in Crossville, TN

Photo of the Month by Malerie Fancher – Jonah Hillard, The UT Beef and Forage Center Summer Intern, assisting with a variety trial harvest.

This and other useful information can be found at your local UT Extension office, or on our website.

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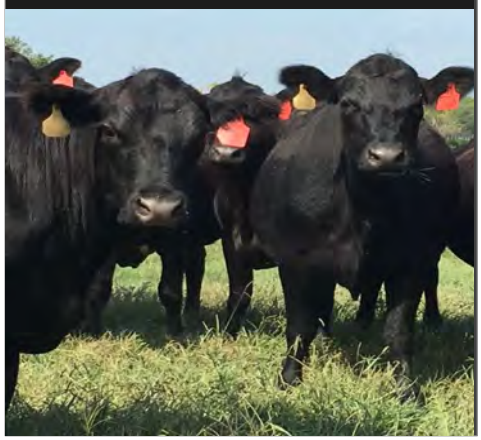
LIVE.STOCK companion
Volume 9: August 2024

MONTHLY TIP

To save money on hay, stockpiling forage is a smart way to stretch your grazing season and cut down on how much hay you'll need in the colder months. Start by picking the pasture you want to stockpile and apply up to 150 pounds of urea per acre after a good rain. Keep the animals off that pasture until after the first frost. If there's old growth or weeds, mow the pasture before fertilizing. This will help cool-season grasses grow faster in the fall, giving you more forage. In Tennessee, commonly used cool-season forages like tall fescue and orchardgrass are great choices for stockpiling because they produce forage in the fall and maintain their nutritional value. If your pasture has legumes mixed in, that's even better—legumes add nitrogen to the soil and produce high-quality forage with plenty of protein.

Dr. Bruno Pedreira
UT Extension Forage Specialist



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"Success is dependent on effort."

Forage-Livestock Quotes and Concepts

ARMYWORM ALERT: TIME TO SCOUT YOUR FIELDS!

Dr. Bruno Pedreira, UT Extension Forage Specialist

Armyworms have been reported in several counties this week and may be on the move. Have you spotted any? Armyworms are voracious eaters, and once you spot the first one, it is crucial to monitor closely. Up to 80 percent of this damage occurs during the last three to five days of larval feeding. Deciding whether to treat for armyworms depends on their development stage and the intended use of the forage. Generally, a population of 3 armyworms per square foot indicates a need for treatment. A list of insecticides is available on pages 60 and 61 of the 2024 Pasture Insect Control Recommendations (PB1768). Let's work together to protect our forages! Check the map as of August 13.

STOCKPILING TALL FESCUE CONSIDERATIONS

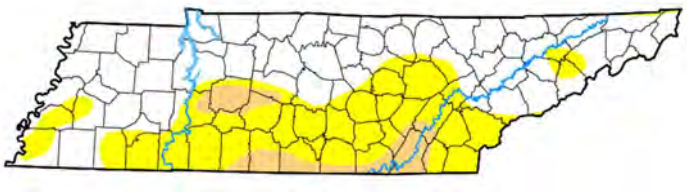
Dr. Katie Mason, UT Extension Beef Cattle Nutrition Specialist

One way to reduce feed costs in a cattle operation is to decrease hay feeding days. A method called stockpiling creates a standing hay crop to offset the number of days that hay must be fed during the winter. Tall fescue is especially suited for stockpiling, because you can capitalize on its fall growth and maintain forage quality well into the winter. To stockpile tall fescue, identify a hayfield or pasture that can be closed off from cattle access during late August to early October. After the stockpiling period is over, begin to use the stockpiled forage to feed the herd. It is beneficial to employ a strip grazing technique when utilizing stockpiled tall fescue to improve forage use and reduce waste. Forage yield and quality will vary based on soil fertility and other factors. A recent study in Tennessee and Alabama evaluated yield and quality of stockpiled tall fescue across various farms in the region. Average stockpiled fescue yield was about 3,300 lb dry matter per acre. Stockpiled tall fescue ranged from 15 to 17% crude protein and 68 to 70% total digestible nutrients when sampled from October through February. For dry, pregnant cows being carried through the winter, no energy or protein supplementation would be required given these quality parameters. An economic evaluation of the data illustrated that reducing hay feeding days by providing stockpiled fescue to cattle reduced total winter feed cost per cow.

WEATHER

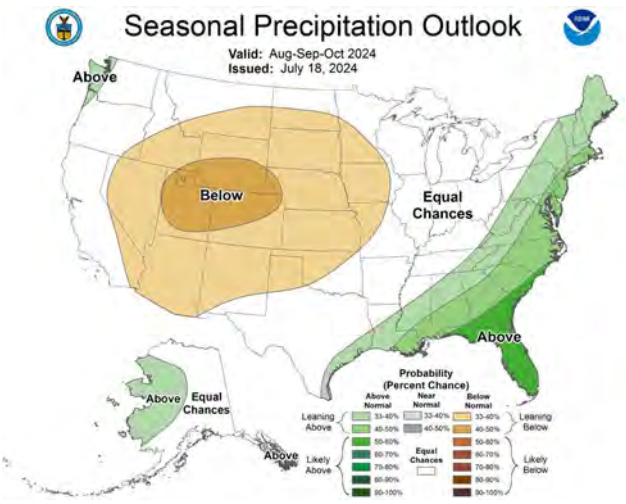
Dr. Bruno Pedreira, UT Extension Forage Specialist

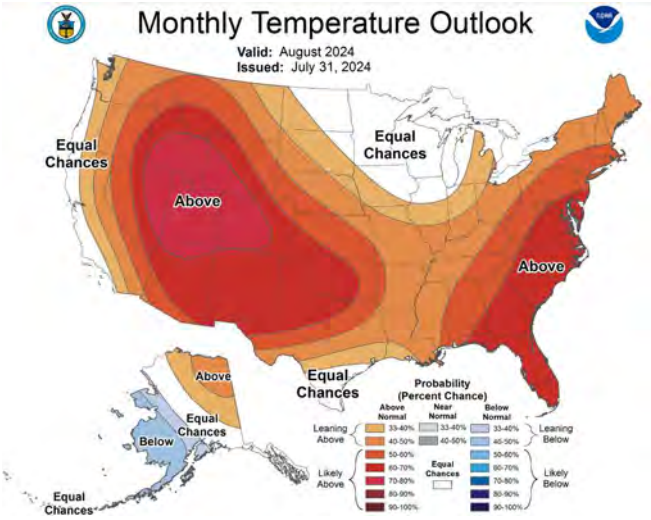
July was on average, +1.2ºF and -0.46” departing from the last 10-y average, which is 77.9ºF and 5.12”, respectively. ncei.noaa.gov



Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

For August, TN is looking at higher-than-normal temperatures. Rainfall is expected to be about average in East and Middle TN, but West TN might see less than usual. After a drought-free July, Southern TN is already seeing some dry conditions, with areas rated from D0 (abnormally dry) to D1 (moderate drought). The Climate Prediction Center (CPC) is predicting a 70% chance of La Niña forming between August and October, with a 79% chance of it sticking around through the winter of 2024-25. What does this mean for us? La Niña typically brings less rain to the southern U.S., which could slow down fall forage growth. We’ll need to count on getting enough rain in September and October to support good fall forage production. droughtmonitor.unl.edu





UPCOMING EVENTS

- **Steak and Potatoes Field Day**
  August 22nd, 2024
- **Live.Stock** - Join us for our live stream
  September 11, 2024 at 2 pm ET

Upcoming events can be found on UTBEEF.COM

Photo of the Month by Malerie Fancher – Jonah Hillard presenting his Summer Intern experience. Jonah also took home most creative display.

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion
Volume 10: September 2024

MONTHLY TIP

Planting season is here! Be sure to get the seeding rate, depth, and dates right. Tiny seeds planted too deep will use up all their energy trying to break through the soil, leaving little for growth. Planting at the wrong depth can reduce how many plants successfully germinate in your pasture. Seeding dates are just as important. They give you the best chance to establish a pasture stand that will last for decades. Seeding at the right rate, depth, and during the recommended window will boost your chances of success. But remember, if Mother Nature doesn't bring the rain or the right temperatures, even the best practices won't guarantee results. With favorable weather, though, proper seeding practices can make all the difference in growing a healthy, productive pasture.

Dr. Bruno Pedreira
UT Extension Forage Specialist

"Forages, particularly grasses, are the most important plants on the face of the Earth."

- Glenn W. Burton

WHAT'S IN YOUR BALE?

Dr. Bruno Pedreira, UT Extension Forage Specialist & Director of UT Beef and Forage Center

Most of the time, hay bales aren't tested after baling. We might have a rough idea, but testing for key nutritional factors isn't common practice. So, what's the value in testing your hay? Even though a forage test costs only $17, most hay in Tennessee isn't tested. By testing, you can ensure accurate valuations and improve your hay transactions. If you're growing your hay, knowing its nutritional content helps you make better management decisions. You can fine-tune your animal's feed plan, leading to better weight gain and reducing supplementation costs. Many times, cattle underperform because we don't know the quality of the hay we're feeding. If you're buying hay that hasn't been tested, there could be a reason for that. If you're producing high-quality hay and investing in your fields, why not test it to prove it's the best? In my experience, the worst hay I've dealt with is usually the kind that hasn't been tested. If you've already purchased hay, get it tested so you can make informed decisions about supplementation for your cattle. This also helps you identify trustworthy sellers, ensuring you return to the reliable ones and avoid those who cut corners. If you decide to test your hay, take samples from around 10 bales in each batch (same harvest, same field). The best way is to use a forage probe, taking samples from the side of the bale, deep into the center. Check with your local Extension office for help with sampling equipment.

REALISTIC EXPECTATIONS FOR COMMERCIAL GENOMIC TESTS

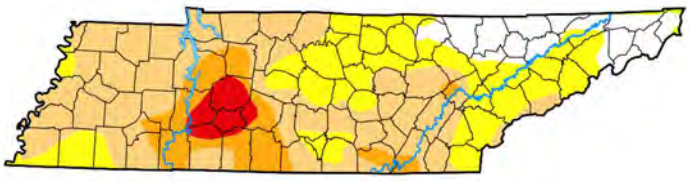
Dr. Troy Rowan, UT Extension Beef Cattle Genetic Specialist

As we make our way into weaning season, the next major milestone in a cow-calf operation is to figure out which females are selected as replacements. Commercial genomic testing has become a popular tool for helping inform that decision. These tests offer the ability for non-seedstock animals to receive estimates of genetic merit like an EPD. There are a few key differences that should inform the way that we view the result of these tests.

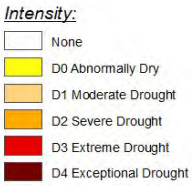
1. We have to test more heifers than we plan to keep for commercial genomic tests to be useful. Just testing heifers that we already know we are keeping does no good. Results have to be used to inform decisions.
2. Commercial tests only predict the genetic component of a trait. For lowly heritable traits, this means the test may only account for 5-10% of the phenotype's variation assuming it is perfectly accurate.
3. Commercial tests are less accurate than genomic EPD's. Without animal phenotypes to back up calculations, these tests rely heavily on data from the "training" population.
4. Commercial tests can help make more targeted breeding decisions. Understanding a herd's genetic weak spots can aid in bull selection decisions.
5. Commercial genomic testing may open up added value marketing opportunities. Genomics identify animals predisposed to perform in the feedlot and on the rail.

WEATHER

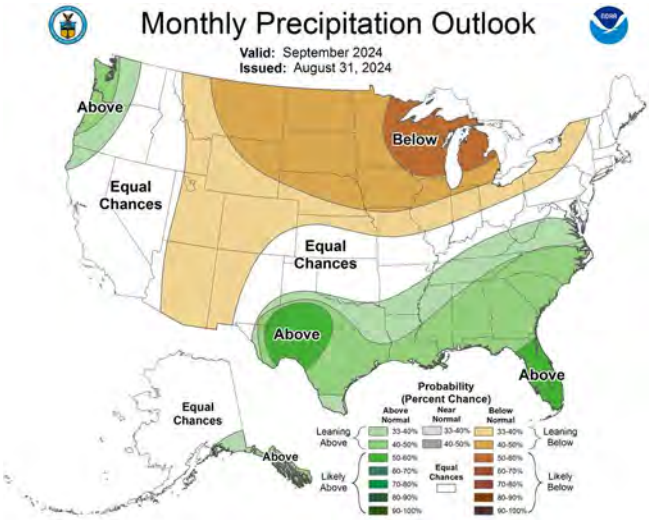
Dr. Bruno Pedreira, UT Extension Forage Specialist

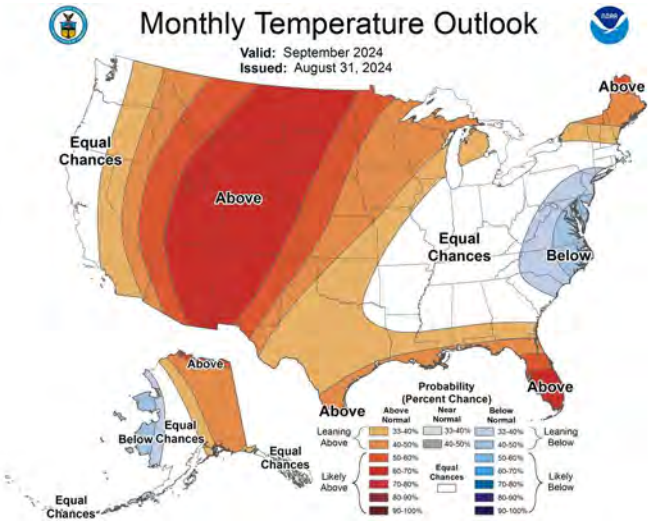


August temperatures averaged 0.3°F higher, and rainfall was 3.5 inches below the 10-year average of 76.4°F and 4.8 inches. ncei.noaa.gov



As August rainfall was only about a quarter of the usual amount, making the dry conditions from July even worse. Now, only a few counties in northeast Tennessee aren't in drought. Lewis, Hickman, Wayne, Perry, and Maury counties are already in D3, or extreme drought, which will definitely impact stockpiling forage and planting. Looking ahead to October, temperatures are expected to be around the average of 60.8°F, with above-average rainfall across the state. droughtmonitor.unl.edu





UPCOMING EVENTS

- Live.Stock - Join us for our live stream September 11th, 2024 at 2 PM ET
- Precision Livestock Technologies: Beef and Forage Systems Field Day – September 24th, 2024 at 8 AM CT

These events can be found on UTBEEF.COM

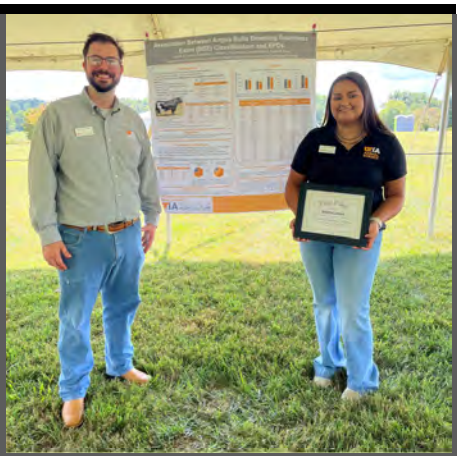


Photo of the Month by Malerie Fancher – Adella Lonas and Dr. Saulo Zoca, Beef Cattle Reproductive Specialist, at the 2024 Steak and Potatoes Field Day in Crossville, TN.

This and other useful information can be found at your local UT Extension office, or on our website.

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LIVE.STOCK companion

Volume 11: October 2024

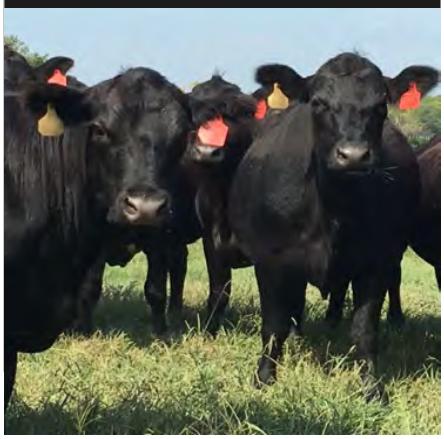
MONTHLY TIP

As cooler temperatures settle in Tennessee, be aware of the risk of prussic acid (cyanide) poisoning when grazing Sorghum, Sudangrass, and Johnsongrass after a frost. Prussic acid forms a few hours after frost but usually breaks down within a few days.

To be safe, if a frost hits, keep cattle off pastures with these forages for 14 days. Unlike nitrate toxicity, prussic acid levels decrease over time.

For Sudangrass, avoid grazing until it reaches at least 18 inches, and for Sorghum-Sudangrass, wait until it's 30 inches or taller.

Dr. Bruno Pedreira
UT Extension Forage Specialist



UTBEEF.COM

"The grass is always greener on the other side."

- Unknown

HAY FEED

Dr. Bruno Pedreira, UT Extension Forage Specialist & Director of UT Beef and Forage Center

After Hurricane Helene, checking your pastures and hay to ensure they're safe for livestock is important. Start by walking through the fields to look for any wind damage or debris. Foreign objects in the pasture can hurt the animals, so be sure to clear them out before turning livestock out to graze. Once the pasture dries, it's a good idea to do a soil test to check for nutrient loss. Heavy rain and flooding can wash away nutrients, so you may need to adjust the fertilization plan. Next, take a good look at your hay, especially if it was exposed to floodwaters. Stored hay, whether in barns or covered stacks, can be damaged by flooding. Flooded hay tends to mold quickly, and feeding moldy hay can cause livestock health issues. If your hay got wet, unstack it and let it dry out. But remember, hay that's been underwater probably isn't worth feeding, especially to pregnant or lactating animals, and definitely not to horses. If the hay is too far gone, with visible mold or rot, it's best to dispose of it.

SNAPSHOT OF RETAIL BEEF PRICES

Dr. Charley Martinez, UT Extension Director of UT Center for Farm Management

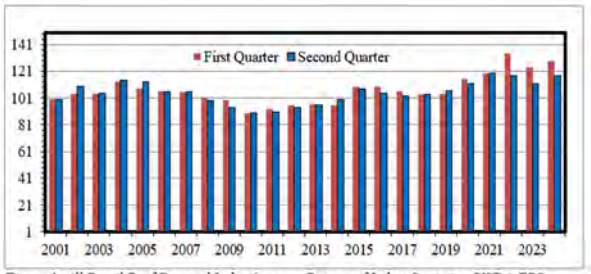


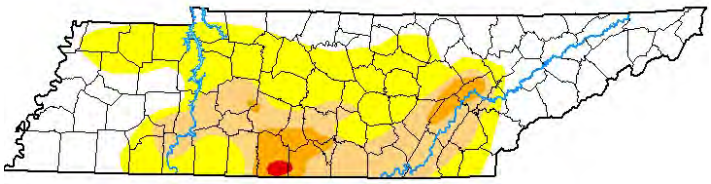
Figure 1. All Retail Beef Demand Index (source: Bureau of Labor Statistics, USDA-ERS, Compiled & Analysis by LMIC) ALL FRESH BEEF RETAIL DEMAND INDEX First and Second Quarter, Using CPI 2000=100.

In September, the latest quarterly consumer demand information was released. Figure 1 displays all fresh beef retail demand for the first (red) and second (blue) quarters of a year, for years 2001-2024. Over the last 23 years, the first quarter of 2021 had the highest demand. The first quarter of this year is the second highest in the last 23 years. Similarly, the second quarter of this year tied for the second highest indexed demand for the last 23 years. Monthly retail prices for the big three proteins in August saw retail beef prices average $8.15/lb, which is $5.71/lb higher than retail chicken, and $3.25/lb higher than retail pork. Thus, while beef prices are higher than the alternative proteins, beef demand is still remaining strong. Historically, the thought was that if beef prices rise, then consumers shift their demand to other protein alternatives. But, during this run, it seems that consumers are switching their demand within beef alternatives. That is, instead of ribeyes, consumers are switching to ground beef, or other cheaper beef alternatives. If beef demand starts to trend downwards, that will cause lower beef prices in the subsequent months (remember supply is expected to stay steady to lower given the national beef herd size), which will alter demand from retail through wholesale.

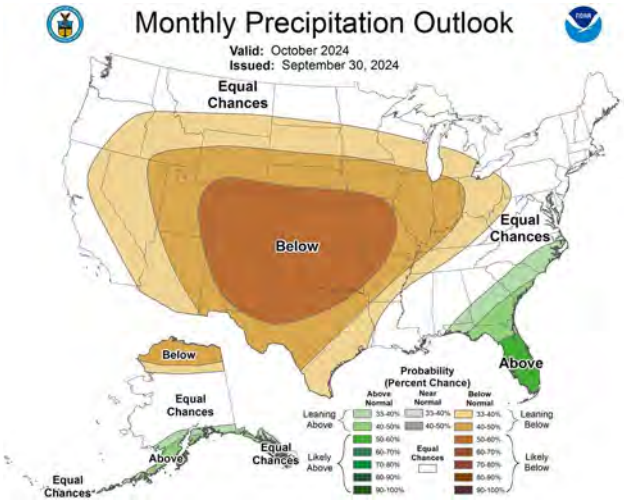
WEATHER

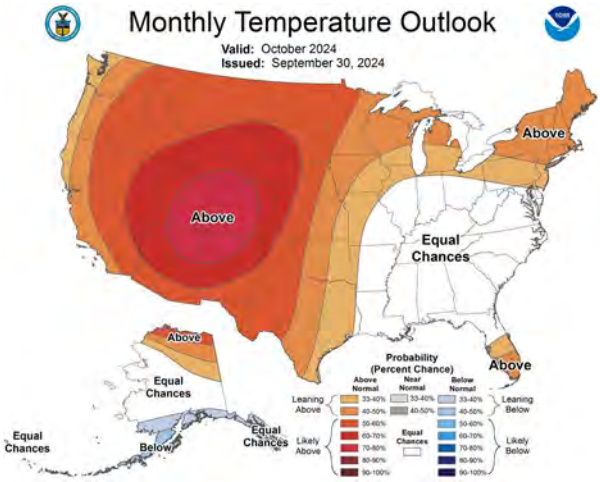
Dr. Bruno Pedreira, UT Extension Forage Specialist

As the "NCEI in Asheville has been significantly impacted by Hurricane Helene", we were not able to provide weather data for September. ncei.noaa.gov



For October, temperatures are cooling down and are expected to stay near the average. Rainfall in East Tennessee is already well above normal due to Hurricane Helene. Middle and West Tennessee saw some rain, but overall precipitation is expected to be below average. This has already impacted the drought monitor released on October 8. Northeast and Southwest Tennessee are now drought-free, but drought conditions persist in parts of Middle-South Tennessee. Several counties are experiencing dry conditions, ranging from D0 (abnormally dry) to D2 (severe drought). Giles and Lincoln counties remain the hardest hit, with some areas still in D3 (extreme drought). droughtmonitor.unl.edu





UPCOMING EVENTS

- Live.Stock - Join us for our live stream November 13, 2024 at 2 PM ET
- Northeast Tennessee Beef Expo October 17, 2024 at 8:30 AM ET
- Beef Heifer Development School October, 18, 2024 at 8 AM ET

These events can be found on UTBEEF.COM

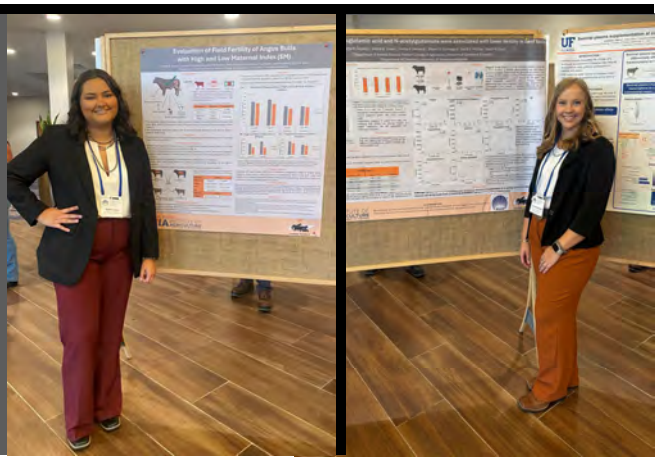


Photo of the Month by Dr. Saulo Zoca – Adella Lonas and Samantha Roberts, graduate students under Dr. Saulo Zoca, presenting their research at the biannual NAAB-CSS Conference. Both students received fellowship awards to present at this conference.

This and other useful information can be found at your local UT Extension office, or on our website.

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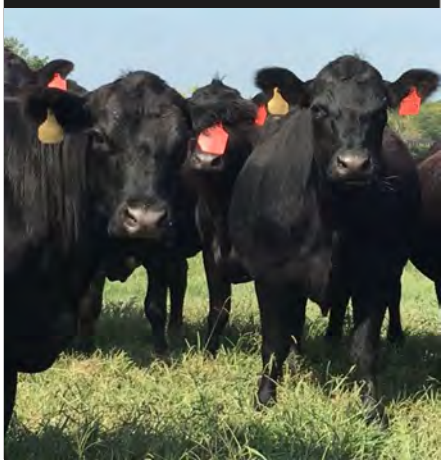
LIVE.STOCK companion
Volume 12: November 2024

MONTHLY TIP

Feeding hay is always a labor-intensive task. However, it's important to remember that not all hay in the bales will be consumed, and some will inevitably be lost. In a dry year like the one we're experiencing in Tennessee, every bale counts to help us get through the winter. Take stock of your hay inventory now to ensure you won't need to buy more in February when hay availability will be very limited, and prices will be high.

If you're unrolling hay, try to unroll only what is needed for the day to minimize waste. Unrolling too much at once often leads to greater losses. Whenever possible, use hay-feeding devices such as cone feeders, rings, or cradles, as these can significantly reduce hay waste.

Dr. Bruno Pedreira
UT Extension Forage Specialist



UTBEEF.COM

"There is not a sprig of grass that shoots uninteresting to me."

- Thomas Jefferson

COOL-SEASON WEED CONTROL

Roger Furlan - Graduate Student and Dr. Bruno Pedreira- UT Extension Forage Specialist

Weeds can significantly reduce the yield and quality of forage in cool-season pastures, thereby compromising animal performance. This issue is often caused by factors such as poor pasture establishment, overgrazing, neglecting soil fertility, fire, and unpredictable climate conditions, all of which create an environment conducive to weed growth. Effective weed management is crucial for optimizing forage production and ensuring animal health. Addressing weed problems in pastures requires a combination of immediate and long-term strategies. While herbicide use offers a quick solution, adopting practices, such as proper grazing management and maintaining soil fertility, acts as a preventive measure that strengthens the pasture's resistance to weeds over time. These practices reduce the reliance on herbicides and create a more resilient pasture system. In addition, successful weed management begins with accurate identification, which is essential for selecting the appropriate control methods. For chemical control, applying herbicides such as dicamba or 2,4-D at the right time, before weeds reach the bloom stage, maximizes effectiveness. Scouting fields early and understanding weed growth cycles are crucial for timely interventions. Combining these strategies with avoiding overgrazing and ensuring proper nutrient levels can help control weed populations while maintaining healthy forage stands.

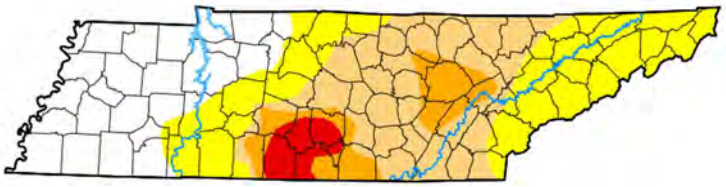
TFGC ANNUAL MEETING RECAP

Malerie Fancher- Research Specialist

On November 8th, the Tennessee Forage and Grassland Council hosted their annual meeting in Murfreesboro, TN. The annual meeting welcomed over 75 producers and industry representatives alongside USDA-NRCS and UT Extension faculty and staff. Members joined together to hear from forage specialists and producers on a variety of topics centered around "Forages Practices that Pay." Dr. Dennis Hancock, Center Director of the US Dairy Forage Research Center, joined the meeting as the keynote speaker, presenting on "Identifying Forage Practices that Make an Economic Impact." Another highlight of the meeting included producers representing each region of Tennessee coming together to form a panel and discussing different forage practices and techniques that increase efficiency and time management from a personal perspective. A forage plot tour, procured by Rutherford County UT Extension agent, Rebekah Norman, concluded the meeting's events. In all, attendees were eager to learn more about forage production and how we can implement "practices that pay". For more information about the TFGC please visit: https://utbeef.tennessee.edu/tennessee-forage-grassland-council/

WEATHER

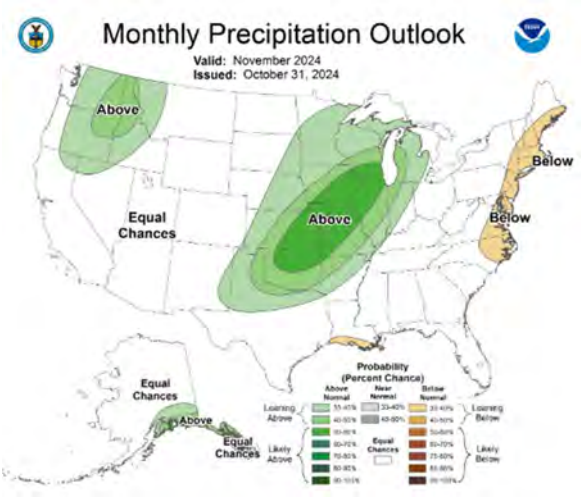
Dr. Bruno Pedreira, UT Extension Forage Specialist

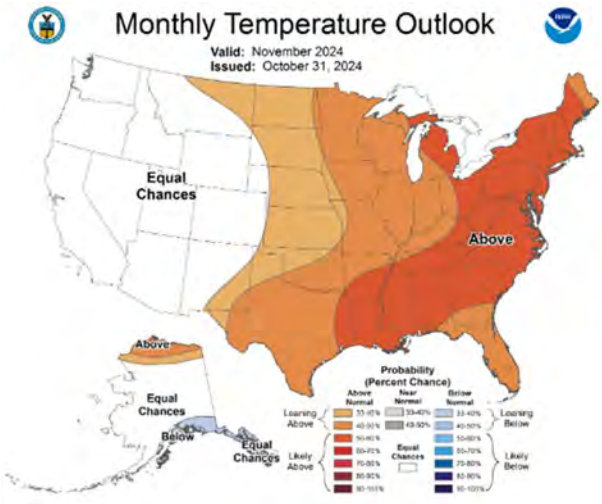


October temperatures averaged 0.8°F higher, and rainfall was 3.3 inches below the 10-year average of 60.9°F and 3.7 inches. ncei.noaa.gov

November's average temperature is 48.3°F. Although colder than October, this month is expected to bring above-average temperatures. Precipitation is forecasted to be near the average of 3.48 inches. Despite Hurricane Helene bringing significant rainfall a few weeks ago, East Tennessee remains classified as D0 (abnormally dry). Middle Tennessee continues to be the most affected region in the state since July, with dry conditions ranging from D0 (abnormally dry) to D2 (severe drought). Giles and Lincoln counties have remained in D3 (extreme drought) since last month, and now Moore, Bedford, Marshall, and Maury counties have also been classified as D3. droughtmonitor.unl.edu

Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought





UPCOMING EVENTS

- Live.Stock - Join us for our live stream December 11, 2024 at 2 PM ET
- UT Performance Tested Bull Sale December 12, 2024 at 12 PM CT

These events can be found on UTBEEF.COM

Photo of the Month by Malerie Fancher: The UT Forage Bowl team preparing in the field for the forage identification portion of the AFGC Forage Bowl Competition with David McIntosh, UT Beef and Forage Center Coordinator.

This and other useful information can be found at your local UT Extension office, or on our website.

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Volume 13: December 2024

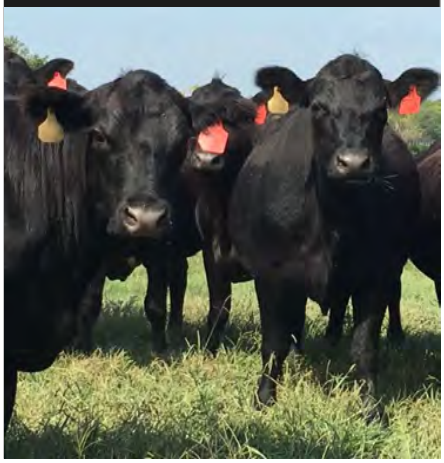
MONTHLY TIP

The ongoing drought has created challenges for us, especially when it comes to winter feed. Many producers have started feeding hay earlier than usual, and stockpiled fescue may not have accumulated enough growth to meet the winter needs. Take time now to check your hay inventory and compare it to what your herd will need in the months ahead.

If your inventory falls short, begin sourcing additional hay or alternative feed options as soon as possible. Prices may rise as supplies shrink, so acting early is key. You might also consider rationing strategies, such as mixing hay with supplements or utilizing crop residues, to stretch your feed supply.

Planning ahead will save you headaches later and keep your livestock in good shape this winter. Don't wait—look at your hay supply today!

Dr. Bruno Pedreira
UT Extension Forage Specialist



"Go the extra mile, it's never crowded"

\- Unknown

MONETIZING CARBON

Dr. Aaron Smith – Professor, UT Extension Agriculture Economist

There has been a lot of discussion regarding how, and if, producers can get paid for carbon or practices that are considered carbon friendly. A lot of the conversation has targeted row crop producers and practices like no-till and cover crops. However, livestock and forage producers could potentially play an important role in carbon markets. There are three general pathways to monetizing carbon or carbon friendly practices. 1) Carbon offsets – carbon is quantified, verified, and registered, then credits equal to one metric ton of CO2 equivalent are sold or used to "offset" carbon emissions for large companies or carbon emitters. 2) Carbon insets are a strategy where a company actively reduces the carbon footprint within its supply chain by implementing carbon friendly initiatives. These still require measuring and validating carbon sequestration or beneficial carbon practices; however, this may also include payments to producers based on a beneficial practice rather than CO2 equivalents. 3) Market based incentives– differentiating a product or commodity to extract a price premium relative to other production methods that produce the product or commodity. The three pathways contain variations and may overlap in some capacity, and there is tremendous variation in details, terms, and conditions based on the program provider.

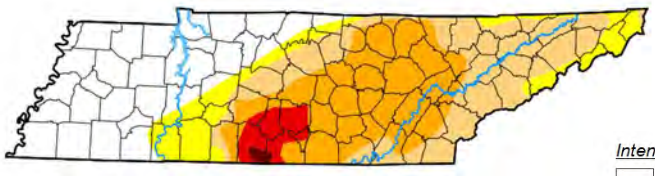
TENNESSEE MASTER FORAGE PRODUCER PROGRAM LAUNCH

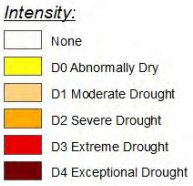
Dr. Bruno Pedreira – UT Extension Forage Specialist, Director of the Beef and Forage Center

I'm happy to announce the "Master Forage Program", an in-depth exploration of forage-livestock systems, focusing on soil-plant-animal interactions and practices to enhance productivity, sustainability, and profitability. Participants will learn foundational principles and advanced techniques, guided by guest lectures from leading experts who share insights into innovative practices from Tennessee and beyond. Topics include soil health, ecosystem services, forage quality, grazing management, weed control, nitrogen alternatives, and silvopasture systems, among others. Participants can choose between two options. The 100% Online Option includes 12 hours of asynchronous modules, completed within one year, with access to Q&A features and monthly virtual meetings. The hybrid option includes 9 hours of online modules plus an in-person farm visit led by Dr. Bruno Pedreira during the spring or fall Forage Tour, featuring hands-on activities like pasture walks and demonstrations across the state. The program fee is $100 (non-refundable), and certification is valid for three years, qualifying participants for the Tennessee Agriculture Enhancement Program (TAEP) cost-share. Program information and registration will be available in January 2025.

WEATHER

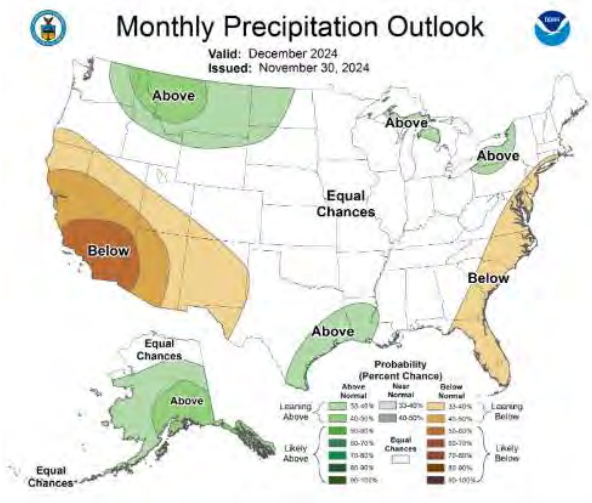
Dr. Bruno Pedreira, UT Extension Forage Specialist

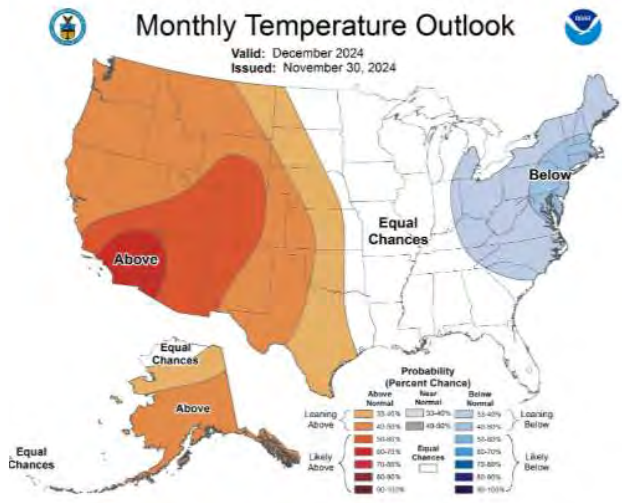




November temperatures averaged 6°F higher, and rainfall was 0.12 inches above the 10-year average of 48.9°F and 3.5 inches. ncei.noaa.gov

December's average rainfall over the last 10 years was 5.6 inches, and the current forecast shows equal chances of precipitation. The temperature outlook for December suggests West and Middle Tennessee will have average temperatures, while East Tennessee is expected to see below-average temperatures. What concerns me most right now is the drought monitor. Currently, 65% of Tennessee is experiencing some level of drought (D0-D4), with 29% in severe (D2) to exceptional drought (D4). Giles and Lincoln counties, which have been in extreme drought (D3) since October, now have areas classified as exceptional drought (D4). Additionally, Moore, Bedford, Marshall, and Maury counties have remained in extreme drought (D3) since October droughtmonitor.unl.edu





UPCOMING EVENTS

- UT Performance Tested Bull Sale
  December 12, 2024 at 12 PM CT
- Live.Stock - Join us for our broadcast on
  January 8, 2025 at 2 PM ET

These events can be found on UTBEEF.COM

Photo of the Month by Malerie Fancher: The Beef and Forage Center's most recent farm visit led us to Holston River Bison. During our visit, we met George, the American Bison.

This and other useful information can be found at your local UT Extension office, or on our website.

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Infographics

Association Between Angus Bulls' Breeding Soundness Exam (BSE) Classification and EPDs

Subfertile Bull → Economic Loss → Find new identifiers for subfertile bulls

BSE is the only method to estimate a bull's fertility (Fig. 1)

1. Physical soundness
2. Scrotal circumference (Table 1.)
3. Semen quality
   a. Motility: ≥30% Progressive Motile
   b. Morphology: ≥ 70% Normal Cells

Table 1. Minimum SC Required to Pass a BSE per Age

Age	SC
< 15 mo	30 cm
15-18 mo	31 cm
18-21 mo	32 cm
21-24 mo	33 cm
> 24 mo	34 cm

There are no EPD's for semen quality, or probability to pass a BSE as yearling bull

Table 2. American Angus Association EPDs by Classification

Production	Management	Maternal	Carcass	Indexes
CED	DOC	HP	CW	$EN
BW	CLAW	CEM	MARB	$M
WW	ANGLE	MILK	RE	$W
YW	PAP	MW	FAT	$F
RADG	HS	MH		$G
DMI				$B
YH				$C
SC				

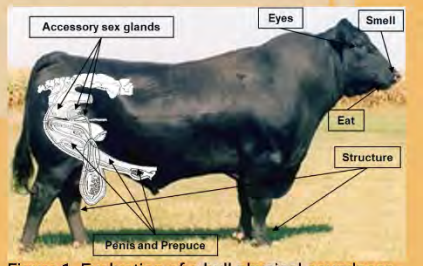

Figure 1. Evaluation of a bull physical soundness during a BSE

Experimental Design

Table 3. Bulls (5 breeds) and Angus Bulls that had a BSE Performed by Year

Year	Bulls, n	Angus, n
2019	59	42
2020	80	38
2021	66	30
2022	86	36
2023	59	21
Total	350	167

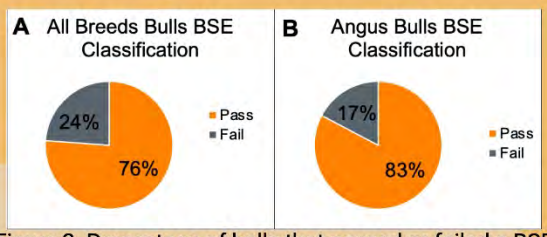

Figure 2. Percentage of bulls that passed or failed a BSE during the years 2019 to 2023 from the UT bull test.

Results

Average EPD & Indexes for Angus Bulls that Passed or Failed a BSE

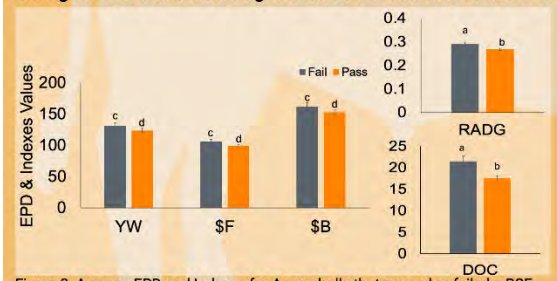

Figure 3. Average EPD and Indexes for Angus bulls that passed or failed a BSE at 430.4 ± 24.8 days old.
[ab]Bars not sharing the same superscript differ P≤0.01. [cd]Bars not sharing the same superscript differ P ≤ 0.10.

Table 4. Correlation between EPD & Indexes and Angus Bulls' BSE Components

EPDs	SC Actual	Normal Morphology	Sperm Head Defect	Sperm Tail and Midpiece Defect
WW	**0.244****	**-0.160****	**0.133***	0.099
YW	**0.238*****	**-0.184****	**0.167****	0.102
RADG	**0.152****	**-0.170****	**0.158****	0.091
DMI	**0.165****	-0.075	0.107	0.010
YH	**0.145***	0.027	0.006	-0.040
SC	**0.442*****	-0.120	**0.181****	0.007
DOC	0.047	**0.290*****	**0.176****	**0.232*****
CLAW	**-0.151****	0.042	-0.057	-0.008
HS	0.023	0.024	-0.017	-0.017
MW	**0.198*****	-0.125	**0.131***	0.054
MH	**0.173****	-0.037	0.054	0.003
$EN	**0.198*****	**0.138***	**-0.150***	-0.056
CW	**0.235*****	-0.117	0.124	0.050
$W	**0.186****	**-0.149***	**0.142***	0.077
$F	**0.161****	-0.095	0.102	0.040
$C	0.063	-0.115	0.056	0.103

* P ≤ 0.1
** P ≤ 0.05
*** P ≤ 0.01

Conclusion

Correlations were identified between BSE components and Angus bulls' EPDs. A larger data set, including actual phenotype for non-BSE traits, is necessary to validate these findings.

Authors: Adella B. Lonas, Samantha R. Roberts, Troy Rowan, Lew Strickland, Saulo M. Zoca

NITRATE POISONING: WHAT DO I DO?

how to be aware of high nitrates levels and options to mitigate this problem

WHAT ARE NITRATES?

Nitrates are chemical compounds that make up nitrogen. These compounds are absorbed through the roots of the plant and used to make protein in the rumen of cattle following grazing.

NITRATE POISONING

During stressful periods, plants are unable to break down nitrates. Forage accumulates nitrates which in excess in the rumen prevent proper oxygen transport within the blood, leading to abortions, low viability calves, and death.

Excess Accumulation

NITRATE NITRITE AMMONIA PROTEIN

FORAGES AT HIGHEST RISK

- Sorghum
- Sorghum X sudangrass
- Pearl Millet
- Crabgrass
- Johnsongrass

STRESSFUL WEATHER EVENTS

- Drought
- Frost
- Hail
- Cloudy Weather
- Low Temperatures

HOW DO STRESSFUL PERIODS AFFECT FORAGE?

Following stressful periods, forages do not have the ingredients necessary to convert nitrates into nutrients for the plant. Droughts lead to insufficient water, cloudy weather limits sunlight, frost and low temperatures reduce action of summer forages, and hail can damage leaf area needed to absorb sunlight. When these stressful events occur, nitrates will accumulate in the stem material of the plant. These nitrates increase as fertilizer is applied, especially soon before or after a stressful event.

WHAT ARE MY OPTIONS?

No fool proof options are available for lowering nitrate levels or grazing high nitrate forage. There is some evidence that suggests these options can help.

- Incorporate low nitrate forages
- Feed cattle before grazing
- Graze cattle acclimated to moderate nitrate levels
- Cut forage for hay or silage

NITRATES ARE DANGEROUS >2500 PPM

ALWAYS test your forage!

Recommendations are to avoid feeding high nitrate forages in any form. Be patient, nitrates can decrease following periods of heavy rainfall, sunlight, high temperatures, etc.

ANIMAL SCIENCE
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Evaluation of sperm metabolites and their correlation to a field fertility index

Rationale & Experimental Design

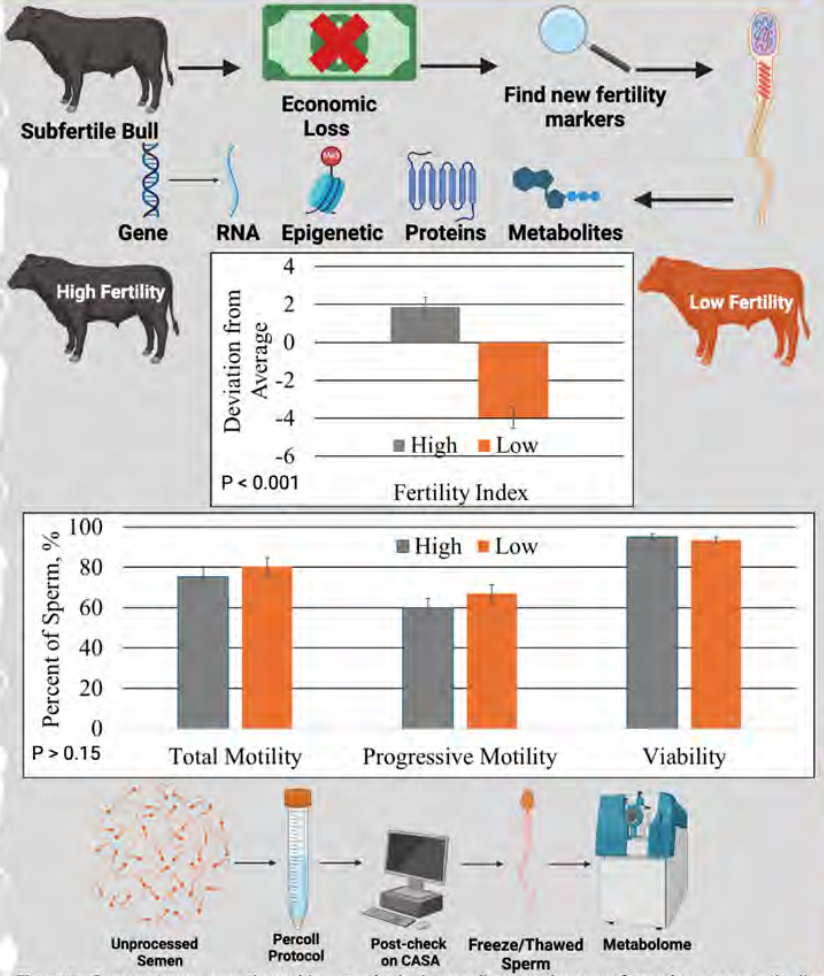

Figure 1: Semen straws were thawed in water bath. A percoll protocol was performed to separate the live sperm. Sperm quality was assessed on a computer assisted sperm analyses (CASA). Samples underwent five rounds of freezing and thawing in liquid nitrogen for cell lyses. Processed semen went through metabolomic analysis at the University of Tennessee Biological and Small Molecule Mass Spectrometry Core.

Objective

To perform metabolomic analyses of sperm from bulls with differing field fertility and evaluate the difference of metabolome profiles between high and low fertility bulls.

- 75 metabolites present in samples
- There was no correlation ($P \geq 0.10$) between metabolites and field fertility index
- Metabolites were correlated within fertility groups ($P \leq 0.05$; $r^2 \geq 0.109$)
- Significant metabolites were detected within individual fertility groups:
  - **High**- Orotate, N-Acetyl-D-glucosamine 6-phosphate, Phosphoenolpyruvate, and Inosine monophosphate (IMP).
  - **Low**- Hypoxanthine, Xanthine, and Tricarballylic Acid.
- Pyroglutamic Acid and N-Acetylglutamate had greater abundance in the four lowest fertility bulls compared to the four highest fertility (Fig. 2).

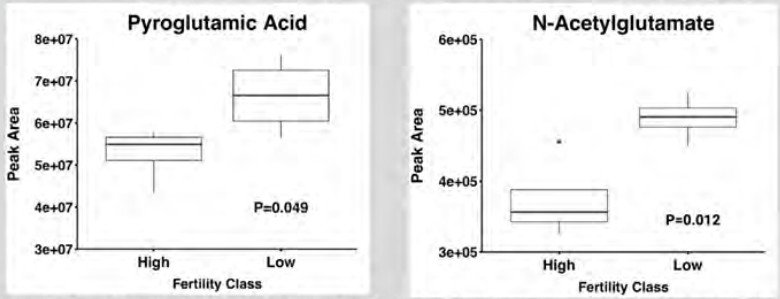

Figure 2. Boxplots depicting the relationship between significant metabolites and the four highest and four lowest fertile bulls

CONCLUSION

Removing sub-fertile bulls from a breeding population is economically important, and the use of metabolomic has promising future to do so.

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Abstracts

Quantifying phenotypic and genetic variation for cow fertility phenotypes in American Simmental cattle using total herd reporting data

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Reproduction plays a major role in the production efficiency of livestock species. However, cow- centric reproductive traits tend to be lowly heritable and are not expressed until later in an animal's lifetime, making phenotypic selection alone inefficient at generating genetic gain. Genetic progress can be accelerated by focusing selection on the predicted genetic component of reproductive traits using Expected Progeny Differences. We used the American Simmental Association's performance and Total Herd Enrollment data, made up of 533,155 calving records from 303,158 females (132,403 cows and 170,755 heifers), 33,732 of which are genotyped, to explore three continuous and two discrete phenotypes focused on quantifying early and sustained fertility in beef cows. We analyzed calving date (cow's calving date relative to the start of the calving season), calving interval (days between calves), first calving interval (calving interval observation between the first and second calving record for a female), heifer pregnancy (did the animal calve as a 2-year-old), and discrete early calving (did animal calve in the first 30 days of the calving season) as distinct, but correlated measures of fertility. This dataset provides insight into population-wide trends related to cow attrition, calving season lengths, and phenotypic variation in fertility. We used pedigree and genomic restricted maximum likelihood (REML) to estimate these five phenotypes' genetic, permanent environment, and temporary environment variance components. Pedigree estimated heritabilities were 0.06 ±0.010079 for calving date, 0.04 ±0.003699 for calving interval,
0.07 ±0.014758 for discrete early calving, 0.05 ±0.013841 for first calving interval, and 0.22 ±0.039218 for heifer pregnancy, consistent with other fertility traits across beef and dairy cattle. The incorporation of genomics increased the heritability estimate for heifer pregnancy (0.24 ±0.037215) and decreased the estimate for first calving interval (0.04 ±0.009604). Positive phenotypic and genetic correlations were found among these phenotypes (r_G = 0.01-0.96). These results call for further work in optimizing genetic predictions and exploration of the genetic architecture of early and sustained cow fertility through genome-wide studies.

A Novel alternative to antibiotic approach: Genetically engineered probiotic *Ligilactobacillus animalis* NP51

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Antimicrobial compounds have been widely used in the beef industry to improve cattle growth efficiency and reduce morbidities. Prophylactic usage of these compounds in livestock production has drawn consumer concerns over antimicrobial resistance resulting in the exploration of replacement strategies referred to as "alternatives to antibiotics" (ATA). An ATA approach that has been commonly accepted by the beef industry is the use of probiotics or direct fed microbials (DFM). Direct fed microbials have demonstrated the ability to inhibit pathogens, immunomodulate the gastrointestinal tract (GIT), and alter fermentation end-products in the live animal.

The expansion of gene editing technologies and development of precise genome editing tools has allowed for the organized exploration and regulation of genome function, including that of probiotic species. The application of these technologies to lactic acid bacteria (LAB) probiotics has been intended to enhance therapeutic effects in the treatment of human inflammatory and autoimmune diseases. However, there is limited research on the effect of bioengineered DFM on animal health in disease models.

We plan to investigate a novel ATA approach by genetically engineering a DFM to determine its impact on animal health and disease frameworks as well as evaluate factors connected to its implementation as a model for future bioengineered DFMs in bovine health. The DFM *Ligilactobacillus animalis* (LA) NP51 strain has demonstrated *Escherichia coli* O157:H7 (*E. coli* O157:H7) fecal shedding reduction and its systemic use in the beef industry makes it an ideal target candidate for enhancing existing efficacy. The genetically engineered LA (GELA) NP51 strain will be edited to deliver an anti-inflammatory cytokine, bovine interleukin 10 (IL-10). We propose that GELA NP51 will improve *E. coli* O157:H7 fecal shedding reduction, alter gut and fecal microbiomes, and impact GIT inflammation with limited risk to the animal, housing system, and agricultural environment.

CRISPR editing of bovine IGF2 and MSTN to enhance productivity

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The CRISPR/Cas9 system has been shown to improve specificity and efficacy of genome modification in livestock. There are two genes where molecular variation in different species has shown significant effects on increased lean growth and reduced adiposity: insulin-like growth factor 2 (*IGF2*) and myostatin (*MSTN*). In pigs, a G-to-A substitution in intron 3 of *IGF2* (g.3072G>A) disrupts a binding site of the transcriptional repressor ZBED6 increasing postnatal *IGF2* expression resulting in increased lean muscle yield and intramuscular fat deposition while decreasing backfat. In other livestock species, numerous *MSTN* loss-of-function (LOF) mutations have been reported. *MSTN* is a known early regulator of myoblast differentiation, resulting in muscle hyperplasia and the "double-muscled" phenotype. Animals of this phenotype have significantly increased skeletal muscle mass, improved feed conversion, and decreased fat deposition. These mutations may act synergistically as demonstrated by a mouse line possessing both mutations. Within this line, wild-type (WT) mice have an average body weight of 19.64 ± 1.89 grams at 11 weeks of age. In comparison, mice with the *IGF2* overexpression, *MSTN* LOF, and combination of both mutations have average body weights of 23.54 ± 2.31 grams, 26.14 ± 2.35 grams, and 31.43 ± 2.39 grams, respectively ($p<0.0001$). Based on these results in mice we have initiated editing of both genes in cattle. Two male fetal fibroblast cell lines were generated from day 75 fetuses from high genetic merit Angus matings. Four CRISPR guide RNAs (gRNA) have been designed for both genes, and ribonuclear protein complexes were electroporated into each cell line. Numerous individual targeted modifications were confirmed through sequencing, and a combination of gRNAs are being used to target both genes simultaneously. Successfully modified cell lines will undergo somatic cell nuclear transfer to produce live animals.

Bringing alfalfa back to Tennessee: Importance of fall weed control on spring forage accumulation

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Alfalfa (*Medicago sativa* L.) is the world's most valuable forage crop, has a high demand for boron, and its deficiency has been recognized for many years. Additionally, weeds like Palmer amaranth (*Amaranthus palmeri* S. Watson), are no longer controlled by glyphosate. This study aimed to quantify the effects of boron fertilization and herbicide management on total forage accumulation (TFA) and weed mass (WM) at first harvest in a Roundup Ready® alfalfa hayfield with glyphosate-resistant Palmer amaranth. The experiment was conducted at ETREC/Holston Unit, Knoxville, TN, where Roundup Ready® alfalfa was established in September 2023. Forage was harvested in each plot inside two 0.25 m^2 quadrats with 10 cm of stubble height, on May 11th, after achieving 10% bloom, and on June 17th, 2024. The experimental design was a randomized complete block design with four replicates (3-by-9 ft each) of a 3 × 3 factorial arrangement, including three boron rates (0, 2.25, and 4.5 kg/ha/year) and three herbicide management levels: control (no herbicide), 1283 g ai ha^{-1} of glyphosate applied after the first harvest, and 1283 g ai ha^{-1} applied after establishment and post-first harvest. The WM was calculated using data from the first harvest and TFA by summing the first two harvests, Data were analyzed using the MIXED procedure in SAS, with blocks considered random and boron, herbicide, and harvest effects considered fixed. Treatment means were compared using Tukey's test ($P \leq 0.05$). Herbicide application significantly affected TFA ($P = 0.009$) and WM ($P = 0.03$). Establishment-sprayed treatment had 11,410 kg/ha of FA and 315 kg/ha of WM, compared to 9,545 kg/ha of TFA and 685 kg/ha of WM in other treatments. Although glyphosate does not control resistant Palmer amaranth, it limits its growth, allowing alfalfa to better compete and establish, resulting in greater spring forage accumulation and cleaner stands.

Sustainable forage solutions: Native warm season grass establishment methods and soil health in the southeast U.S.

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Organic meat and dairy are leading industries in the U.S., with organic livestock production requiring ruminants to obtain at least 30% of their dry matter intake from grazing. As demand for organic meat and dairy increases, the need for high-quality organic forages becomes more pressing. In the southeastern U.S., tall fescue, a cool-season grass, dominates forage production. However, its association with an endophytic fungus causes toxicity in livestock, and as a cool- season grass, it underperforms during the hot summer months, limiting its effectiveness as a year- round forage. Native Warm-Season Grasses (NWSGs) offer a climate-adapted alternative, providing a viable forage option during summer. However, establishment of organic NWSGs presents challenges, particularly with weed control. Intensive tillage is often used for weed control but can degrade soil health, thus acting against the sustainability principles. An alternative is the use of smother crops which compete with weeds through rapid growth and dense canopy formation. This study evaluates the short-term soil health impacts of three NWSG establishment methods: (1) intensive tillage, (2) reduced tillage and grow pearl millet and cereal rye as smother crops followed by their biomass removal, and (3) reduced tillage and grow the same smother crops followed by residue retention. Soil samples were collected from 0–10 cm and 10–30 cm depths and analyzed for various soil health metrics. Microbial activity, estimated from a 48-hour incubation, showed significantly higher carbon mineralization in smother crop plots (0.115 g CO_2 kg^{-1} soil) than in intensively tilled plots (0.055 g CO_2 kg^{-1} soil). Mineral nitrogen levels were significantly higher in the intensively tilled plots compared to the smother crop treatments in both soil depths. The findings will help inform sustainable forage production practices that support both livestock and soil health in organic systems.

Investigating the role of Galectin-3 during early embryonic development in cattle

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Early embryonic mortality, defined as the loss of the embryo within the first 42 days of gestation, poses a significant economic burden to the U.S. beef industry, resulting in the loss of billions of dollars annually. Notably, evidence suggests that the early bovine embryo produces galectin-3 (*LGALS3*), a protein that plays a critical role in mammalian reproduction by influencing placental development, implantation, and immune modulation. Recent studies suggest galectins could be used as on-farm technology to reduce embryonic mortality in cattle. To investigate potential strategies for rescuing pregnancies vulnerable to embryonic mortality, we aim to use CRISPR- Cas9 technology to disrupt or "knock-out" galectin-3 in in vitro produced (IVP) embryos, monitoring their development before and after transfer to the surrogate. An in vitro DNA cleavage experiment was conducted to evaluate the cleavage efficiency of single guide RNAs (sgRNAs) targeting *LGALS3*'s functional region. Wild-type bovine DNA spanning the target region was amplified by PCR, purified, then incubated with Cas9 enzyme and sgRNA, and analyzed on an Agilent TapeStation 4200 using a D1000 ScreenTape to confirm sgRNA targeting efficiency. A second experiment was performed to confirm Cas9 delivery into embryos to target the *LGALS3* gene. Approximately 14 h after in vitro fertilization, single celled embryos, underwent electroporation using a green-fluorescently labelled Cas9 enzyme. Fluorescent images of the embryos were captured using a Nikon microscope and camera, immediately after electroporation and again on day 7. Notably, the images confirm the successful introduction of the Cas9 enzyme into the embryos, which survived until day 7, the time at which IVP embryos are typically transferred to surrogates. Preliminary results from this study will serve as a foundation for elucidating the function of *LGALS3* during pregnancy and developing on farm galectin-based technologies that reduce embryonic mortality. This research is funded by a 2023 AgResearch Seed Grant award.

Can plant growth-promoting bacteria replace nitrogen fertilization to improve crabgrass yield and nutritive value?

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Forages are a major feeding source for livestock production in Tennessee and fertility management practices play a major role in pastures. The use of plant growth-promoting bacteria (PGPR) could lead to qualitative and quantitative improvements in forage production. This project aims to evaluate *Azospirillum brasilense* Ab-V5 e Ab-V6 inoculation in crabgrass (*Digitaria* spp.) forage yield, and nutritive value. The experiment was carried out in Spring Hill, TN, USA (April to September 2024) as a randomized completed block with four replicates. Plots were seeded with crabgrass (*Digitaria* spp. cv Mojo, Barenbrug USA) with treatments *A. brasilense* Ab-V5 and Ab- V6 associated or not with 50 or 67 Kg of nitrogen per hectare. Plots were harvested in July and August 2024 to determine forage yield. Subsamples were taken to analyze crude protein (CP) and *in-vitro* true dry matter digestibility over a 48-hour period (IVTDMD48h) using NIRS (Near- infrared spectroscopy). Data analysis used the statistical software SAS (SAS Studio, v. 9.4) with 5% significance level. Yields were affected by a treatment x harvest interaction (P=0.0014). In the first harvest, the lower values were observed in the control and inoculated than in the other treatments. On the second harvest, there were no difference among treatments. The CP was affected by harvest (P<0.001) with the first harvest CP at 13.5% while the second harvest was 11.3%. All treatments that received N fertilization had greater CP when compared to control and inoculation (P<0.001). Although IVTDMD48h was greater in the first harvest (76.9%) than in the second (72.9%) (P<0.001), there was no treatment effect (P=0.4780). Therefore, the combination of N and PGPRs did not affect yield, CP, and IVTDMD48h. On the other hand, the application of 45 and 60 units of N via mineral fertilizer produced similar yield and quality.

Evaluation of field fertility of Angus bulls with high and low maternal index

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Bull selection is guided by phenotype and Expected Progeny Differences (EPD). Although several EPDs and Indexes are available, there is no EPD that can predict the fertility potential of a beef bull. The American Angus Association has developed Economic Selection Indexes that combine multiple traits to provide a closer look at specific breeding objectives. One of these indexes is Maternal Weaned Calf Value ($M) that is comprised of the following EPDs: CED, CEM, WW, milk, HP, docility, MW, claw, and foot angle. These traits are aimed to produce good replacement heifers; thus, we hypothesized that bulls with a high $M would have improved field fertility in comparison to bulls with low $M. Angus bulls were classified as high $M (n=10; $M≥77; mean=92.9±11.8; breedings n=893) or low $M (n=5; $M≤67; mean=59.4±6.7; breedings n=756) and used to breed cows (n=1019) and heifers (n=441) in a fixed-time AI protocol. Cows were randomly assigned to bulls based on age (4.8±2.7-years-old) and days post-partum (75.4±17.8 days). Heifers were randomly assigned to bulls based on weight (810.7±110.8). Estrus was assessed with the aid of an Estrotect patch. Statistical analysis was performed using the GLIMMIX procedure in SAS with the fixed effect of treatment, estrus, and year, and the interaction treatment by estrus. Bull was used as a random effect. Cow and heifer data were analyzed separately. There was no impact of $M classification or interaction estrus by $M classification for cows or heifers' pregnancy rates (P≥0.25). There was, however, an effect of estrus on pregnancy rates where both cows and heifers that exhibited behavioral estrus (69.2±2.2 and 60.9±3.1, respectively) had greater (P<0.01) pregnancy rates than cows and heifers that did not exhibit behavioral estrus (52.2±2.2 and 47.5±3.6, respectively). In conclusion, selection for high or low $M did not influence pregnancy rates of Angus bulls.

Relationship between sperm morphology during a Breeding Soundness Exam (BSE) on yearling Angus bulls and their Expected Progeny Difference (EPDs)

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The objective of this study was to investigate whether current EPDs reported by the American Angus Association (AAA) were associated with BSE components and results (pass or fail). The same theriogenologist performed all BSEs at The UT Bull Test from 2019 to 2023 on yearling Angus bulls (n=167; 430.3±24.8-days-old). Bull's BSEs were performed according to the Society for Theriogenology Guidelines and data for physical soundness, scrotal circumference, and semen quality were assessed. Bulls were classified as a satisfactory potential breeder or unsatisfactory potential breeder (deferred bulls were considered as unsatisfactory for the purposes of this research). EPDs and Indexes (recognized by a $) were retrieved from AAA. The appropriate statistical procedure was used to compare EPDs and Indexes of bulls that pass and fail BSE as well as correlations between BSE components and EPDs. Overall, 17% of Angus bulls (n=28) failed a BSE. On average, bulls that passed a BSE had lower ($P \leq 0.01$) Residual Average Daily Gain (RADG), and Docility (DOC), and tended ($P \leq 0.109$) to have lower Yearling Weight (YW), $Feedlot ($F), and $Beef ($B) than bulls that failed; other EPDS were non-significant ($P \geq 0.14$). Scrotal circumference at BSE was positively correlated ($P \leq 0.05$) with Weaning Weight (WW), YW, RADG, Dry Matter Intake, Scrotal Circumference (SCepd), Mature Weight, Mature Height, Carcass Weight, $Weaned ($W), and $F, and negatively correlated ($P \leq 0.05$) with Claw Set and $Energy. Percent of normal sperm was negatively correlated ($P \leq 0.05$) with WW, YW, RADG, and DOC. Percent of sperm head defect was positively correlated ($P \leq 0.05$) with YW, RADG, SCepd, and DOC. Also, the percentage of sperm tail and midpiece defects was positively correlated ($P = 0.004$) with DOC. In summary, we were able to identify correlations between BSE components and Angus bull's EPDs; however, a larger data set, including actual bull phenotypes for non-BSE traits, is necessary to validate these findings.

Elucidating the role of galectin-1 during early embryonic development in cattle

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Reproductive failure resulting from embryonic mortality, defined as the loss or death of the conceptus within the first 42 days of gestation, poses a significant challenge to US beef industry. Estimates suggest that embryonic mortality accounts for $2.8 billion in annual revenue losses, and thus, represents the single greatest economic burden experienced by American beef producers. Recent studies propose that galectin-1 (*LGALS1*), an immunomodulatory protein produced by the early embryo, could be used as an on-farm technology to minimize bovine pregnancy loss. To better understand the role of LGALS1 during early pregnancy, we aim to use gene editing technology (CRISPR-Cas9) to disrupt the *LGALS1* gene in *in vitro* produced (IVP) bovine embryos and subsequently monitor their development before and after recipient transfer. An *in vitro* DNA cleavage experiment was first performed to evaluate the cleavage efficiency of single guide RNAs (sgRNAs) targeting a functional region of *LGALS1*. To achieve this, wild-type bovine DNA spanning the target region of *LGALS1* was amplified by polymerase chain reaction (PCR). Purified PCR product was then incubated with Cas9 enzyme and sgRNA before analyzed on an Agilent D1000 ScreenTape to confirm sgRNA targeting efficiency. A second experiment was designed to validate the method of transferring Cas9 enzyme into embryos. During this experiment, single-celled embryos, underwent electroporation in the presence of green- fluorescently labelled Cas9 enzyme 14h after fertilization. Fluorescent images were captured immediately after electroporation and on Day 7 of embryonic development. Importantly, the images indicate successful transfer of the Cas9 enzyme into and survival of embryos through Day
7. By ultimately disrupting *LGALS1* in the bovine embryo, we hope to gain insight into the protein's function during establishment of pregnancy and develop technologies that mitigate early embryonic mortality in cattle. This research is funded through a 2023 AgResearch Seed Grant award and 2020 USDA-NIFA-AFRI award (2020-67015-31617).

Producer and consumer preferences for hay as a feedstuff

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Hay is an important input to livestock production and a large cost input for livestock producers. Additionally, hay serves as a significant source of income for producers and is a large driver of the US agricultural economy. Despite this, hay is relatively understudied compared to other agricultural commodities. Existing literature shows certain characteristics or attributes, like quality, increase the value placed on hay products. However, previous studies have only been conducted in auction settings where purchasing information is aggregated. Therefore, we created an experiment that elicited willingness-to-pay (WTP) for bales outside of an auction setting (spot market and private-treaty transactions). The experiment was conducted at multiple University of Tennessee field days, where four bales were analyzed by participants who were randomly placed in control or treatment groups. Participants in both groups were given the forage species and provided access to the bales (i.e. viewing, feeling, smelling) then asked to enter their WTP for each bale. The treatment group was shown forage analysis information and bale weight, but respondents in the control group were not. The forage analysis included measures of dry matter (DM), crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), relative feed quality (RFQ), and total digestible nutrients (TDN). We want to know if access to quality measures and forage analysis have a significant impact on WTP. On average, the control group reported a WTP of $39.06/bale, while the treatment group reported a WTP of $41.85/bale. This shows that forage analysis and bale weight have no significant impact on WTP as both values were not significantly different. Results were analyzed alongside a survey, revealing farm and producer demographics, which help determine what factors of operations increase WTP. Ensuing regression analysis provided further information on variables associated with an increased WTP for bales.

Parametrization of tall fescue growth using the CROPGRO model to assess the El Niño southern oscillation impacts

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Tall fescue (*Lolium arundinaceum* (Schreb.) Darbysh.) is a perennial, cool-season forage that thrives across the southeastern United States, covering an estimated 30 to 40 million acres nationwide. The CROPGRO-Perennial Forage (CROPGRO-PF) model, built on the DSSAT platform, simulates physiological processes using input data such as weather, soil, plant genetics, and experimental observations. This model allows us to simulate genetic improvements by assessing plant responses to environmental and management factors. Our objective is to parameterize the CROPGRO-PF model for Tall Fescue (Kentucky 31) and assess the influence of the El Niño Southern Oscillation (ENSO) phenomenon. The project uses version 4.8.2 of the DSSAT platform, with model parameterization based on datasets from two locations: Greeneville, TN, and Parsons, KS. Initial parameters from *Brachiaria brizantha* and Annual Ryegrass were adjusted to enhance simulation accuracy. Key modifications include adjustments to parameters like SLAVAR, SLAREF, SLAMAX, and SLAMIN to reduce leaf area. Carbohydrate partitioning to leaves and stems was calibrated using the YLFEST and YSTEST parameters, while SLWREF was adjusted to decrease productivity. The observed and simulated yields are 5190 and 4294 kg/ha in Greeneville, TN (with RMSE of 3567 and a D-Wilmott index of 0.307), and 5738 and 7619 kg/ha in Parsons, KS (with RMSE of 5807 and a D-Wilmott index of 0.281). While the results are promising, further refinements are required to improve the model's accuracy. Once fully calibrated, the model will allow us to simulate forage accumulation across various US regions and evaluate the effects of soil, weather, and ENSO on production. Simulation of tall fescue growth can help predict forage accumulation in different regions and create more precise scenarios to help producers get compensated by insurance, such as the NAP - Noninsured Crop Disaster Assistance Program (USDA).

Exploring differential metabolic responses in immune cells from naturally parasite-resistant sheep

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Reduced worm burden in parasite-resistant St. Croix sheep (STC) during infection with gastrointestinal nematode *Haemonchus contortus*, is predicated on the early signaling of immune responses. STC generates strong T helper type-2 (TH2) responses that result in a rapid clearance of *H. contortus*, while parasite-susceptible Suffolk sheep (SUF) have delayed responses. Immune metabolism impacts the ability of cells to differentiate and become activated. Therefore, the metabolic environment can influence the ability of its host to respond to pathogens. Currently, the relationship between metabolism and immune cell populations in SUF and STC is not known, nor how this relationship can impact overall host responses and its contribution to susceptibility or resistance towards helminth infections. To address this, peripheral blood mononuclear cells (PMBCs) were isolated from parasite naive SUF and STC for mitochondrial respiration analysis. Oxygen consumption (OCR) and extracellular acidification (ECAR) rates were determined via a Seahorse XFe96 analyzer and analyzed using Wave Desktop software (Aligent). Thus, the purpose of this study were to characterize the influence of mitochondrial respiration in the context of helminth infection and host protective immunity, utilizing a model of parasite susceptibility and resistance in sheep. Preliminary data expressed an increase of extracellular acidification rate (ECAR) in STC, proportional to baseline glycolysis, which suggested higher basal immune activation in STC. Interestingly, SUF consumed oxygen (OCR) at a higher rate when compared to STC, however both breeds produced the same amount of ATP, which may indicate that STC have lower immune metabolic requirements. While preliminary data did not express statistical differences of baseline mitochondrial respiration between naive SUF and STC, we hypothesize that actively parasitized sheep will express differences in their immune metabolism. Future studies will focus on the mitochondrial respiration of naive and *H. contortus* challenged SUF and STC, with emphasis on antigenic activation of PBMC cellular populations.

Identification and characterization of a novel polled allele in Wagyu cattle

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Polledness is a desired phenotype for both animal management and welfare practices. Scurs are rudimentary horns that are not attached to the skull and have a different genetic etiology. The Scurs phenotype can only be observed when an animal is polled, allowing for the expression of scurs. Wagyu are a Japanese cattle breed that are highly sought after for carcass quality. All fullblood Wagyu express horns. Recently, fullblood animals within two herds were discovered with only scurs instead of horns. We hypothesize that there is a novel polled mutation in these cattle that allows the animals to present with scurs. We will use whole genome shotgun sequencing to determine if the mutation is one of the other polled mutations. Then a GWAS will be conducted to identify regions of the genome that are associated with impeding horn bud development. The mechanisms responsible for creating the polled phenotype are unknown. There are four previously identified mutations at the *POLLED* locus. This region is not protein coding, but does code for a long intergenic non-coding RNA (lincRNA), known as *lincRNA#1*. We aim to characterize function of *lincRNA#1* and to understand what genes are involved in expressing the polled phenotype. These RNAs are thought to be important for genetic regulation, but their functions are not well understood. Previous studies have shown *lincRNA#1* to be upregulated in the horn bud region of polled animals compared to horned animals, but knockdown of the RNA does not return the animals to wild type.

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