February 2021

SMALL FARM RESEARCH AGRI-NEWS

Agricultural Research Service

Dale Bumpers Small Farms Research Center Newsletter

Greetings from the Research Leader, Dr. Phillip Owens

It goes without saying that 2020 was a challenging and unprecedented year for everyone, although at the Dale Bumpers Small Farms Research Center, we have risen to meet the challenges of the pandemic. Research and farm maintenance has continued even with increased obstacles. However, while continuing our mission, safety and health remain our top priority. On any given day at the Center you will see our employees arriving before sunrise to begin working cattle and sheep. As we break daylight, the farm crew begins operations to keep our Center's operations moving forward. Research that has been conducted during the pandemic requires approval at higher USDA levels where health and safety protocols are reviewed and approved. DBSFRC leads the USDA- ARS Southeast Area in number of projects approved and research project numbers conducted. While the world is already moving to depend more on technology, the pandemic has increased the rate of adoption for working remotely. Due to social distancing, we all work at least part-time on our computers away from the office. It was challenging initially, however, the "can do" attitude of our employees made the transition swift. We have continued to complete research projects, initiate research and acquire additional grant funding. Our publication numbers for the year were one of the highest we have seen in the last 10 years. All these challenges show the dedication and solutions oriented nature of our team. We are gearing up for our research this spring and you will see more research focused on practical and applied uses of technology in forage, livestock, and crop production. We are making the best use of time now; however, we are looking forward to the days when we are back at the Center hosting field days and visits from you. Stay safe and looking forward to seeing you soon!

Dr. Owens Soils Research Spotlight

Sensing the soil – getting a better look below ground.

Soil provides forages and crops the nutrients and water they need to grow and produce food for humans and animals. Soils are not created equal with respect to their ability to provide nutrients and water for plants. As producers, we see the evidence of variable production in the field when we harvest; however, we do not always know whether differences we see are due to available water, nutrients, or a combination of both limitations. (continued page 2)

Ground penetrating radar being pulled over soil to determine soil properties.

In this issue:

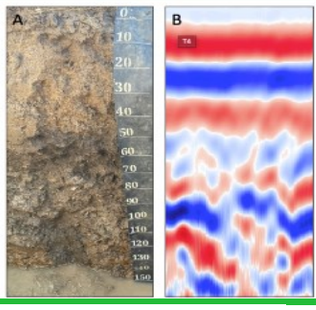
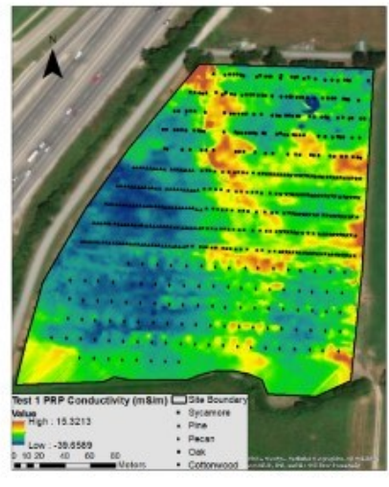


Photo of soil profile with associated ground penetrating radar signal on the right. Below 50 centimeters, the soil increases rock content and increases clay content as illustrated by the radar reflection pattern in blue and red.

Dr. Owens is leading an effort to use proximal sensing techniques, or the use of radiation (light) to sense objects remotely, to better quantify below ground features related to water holding capacity without ever even sampling or digging a hole. Two research projects were initiated with Dr. Amanda Ashworth (USDA-ARS Poultry Production and Product Safety Unit in Fayetteville) and Dr. Kris Brye (Professor at the University of Arkansas) and the preliminary results are promising for understanding water differences using proximal sensing. Proximal sensing is a group of technologies that are used to measure or identify properties that is in indirect contact with the soil.

The first project is using a ground penetrating radar instrument owned by the USDA-NRCS. The ground penetrating radar was used to sense below ground limiting layers such as depth to bedrock or layers with very high clay content. When rocks are present, the soil has less volume to store water. Harrison Smith (native Arkansan with a background in sensing technology applications) was hired to apply this ground penetrating radar to a silvopasture site in Fayetteville, AR. The technology uses radar pulses and reflections to detect dense features. When the pulse hits a rock, it reflects back a strong signal, whereas soil without rocks reflects a weaker signal. The instrument is pulled across a field to see the dense features below- ground to quantify the water available to forages and trees. With the help of Michael Schmidt (DBSFRC) we excavated the soil at 6 locations and related the soil properties to the radar signal.



Map of electrical conductivity of the soil at 20 inches depth in a 10 acre silvopasture research site.

The second project conducted on the same research site uses an instrument to detect the electrical conductance of the soil. Shane Ylagan, a graduate student at the University of Arkansas, is studying how soil electrical conductance can be used to understand water variability and ultimately tree and forage growth. This technology works by directing a pulse into the soil on one side of the instrument and receiving the pulse on the other side of the instrument. The strength of the received, specific pulse relates to the electrical conductance of the soil (related to water content), thus measuring the electrical conductance without touching the soil (proximal sensing). Field scans are made to estimate salt levels in the soil, which is important for inferring water status. For example, soils with the same salt content, but greater water content, will have greater salt dilution (decreasing the conductance and received signal), whereas less water will result in increased salt content and thus increased conductance and received signal. (continued on page 3)

Our instrument is pulled across the field behind a UTV and makes a measurement every second to create a map of the field. We are detecting areas with higher or lower plant available water. We will use both electrical conductance and ground penetrating radar to understand how soil properties related to nutrient-use efficiency for targeting fertilizer applications. Our goal is to meet the needs of the crops spatially while minimizing over application which will aid to manage risk.

UTV pulling the electrical conductivity sensor in a sled to detect changes for evaluating soil moisture at a silvopasture research site near Fayetteville, AR.

Dr. Christine Neiman Research Spotlight

Dr. Christine Neiman

Forage in thinned hardwood forests.

Although somewhat unconventional, many farmers across the state and southeast are interested in utilizing some of their unmanaged forests as pasture. Often, these forests are cleared for pastures. However, many farmers across the southeast are interested in maintaining some trees to provide shade for grazing cattle. In these cases, farmers are removing a select number of trees from the area, opening the canopy, and allowing light in for forage growth. For those interested in this approach, a common question is how much canopy they should remove. This project aims to answer this question by taking an unmanaged, mostly oak forest of 80-90 basal area and removing trees to achieve 30, 50, or 70 basal area. Basal area is defined as the cross-sectional area of trees at chest height (4.5 ft above ground). Essentially, if one were to cut all the trees in an acre at 4.5 ft, the basal area would be the area occupied by those stumps. It is a common metric for describing stand density and the units are square feet per acre. The first step in reducing basal area is marking the appropriate trees for removal. Figure 1 shows trees with orange paint on the trunks, these trees were chosen to stay in the plot, all other trees will be removed. A forester can determine the basal area and the trees for removal with a tool called a wedge prism. A wedge prism is essentially a wedge-shaped piece of glass which refracts light, thereby creating critical angle. When viewing a tree through the prism, the tree is displaced through an angle depending on the “basal area factor” of the prism. For this technique, the forester stands at one point and complete a 360-degree sweep counting all trees that are “in” the prism. (continued on page 4)

Figure 1 Hardwood Plot Area

The forester then takes the total number of “in” trees and multiplies them by the basal area factor. With this method, the forester can measure basal area and can determine which trees to keep and which to remove when reducing the basal area. For this project, we chose to kill trees with an herbicide injection, commonly called the “hack n’ squirt” method. After the spring flush, a hatchet can be used to “hack” through the tree’s cambium (growing tissue of the tree, just under the bark) and herbicide is “squirted” into the wound, entering the tree’s tissue, and eventually killing the tree. This management is also referred to as Timber Stand Improvement (TSI) and is common for improving habitats for wildlife. Trees eventually die and fall over, creating great habitat for wildlife. After herbicide injection, we chose to mulch the brush and small diameter trees (< 6 inches) to create room for driving the tractor and planter, and to create even seedbeds for forage establishment. Figure 2 shows the mulcher attachment on the skid steer.

Figure 2 Mulcher Attachment

Trees that are too big to be mulched, will eventually die, and fall on their own. Figure 3 shows progress made with the mulcher, with brush and small trees removed, and Figure 4 shows an example of the residue left by the mulcher. In mid-November, 36 plots measuring 30 ft by 8 ft were planted with an 8-foot Brillion seeder, 18 plots were planted to novel endophyte tall fescue and 18 plots were planted to orchardgrass. Plots were lightly “tilled” with the mulcher prior to planting, this helped removed leaves and remove any large mulcher debris. These two species were chosen because of their known tolerance for shaded environments. Orchardgrass is more tolerant to shade, but previous research at the station shows that tall fescue also has some tolerance to shaded environments. Over the next three years, we will monitor the growth and persistence of these plots under the various basal area treatments. In the first year, we expect some differences in canopy cover among the treatments, with more light allowed through the canopy in the 30 and 50 basal area treatments. However, likely by year two and three, these differences will be less obvious, as tree branches grow to fill the gaps left by dead trees and canopy cover will increase in all treatments. We will also be monitoring the brush regrowth and general weed pressure and forage yields from both species. With this project, we hope to determine if this method or a similar method may be an option for farmers in Arkansas and the southeast. Look for updates in the newsletter for developing information on this project in the coming years.

Figure 3 Plot Area

Figure 4 Plot Area residue

Small Ruminant Research Spotlight

Dr. Joan Burke

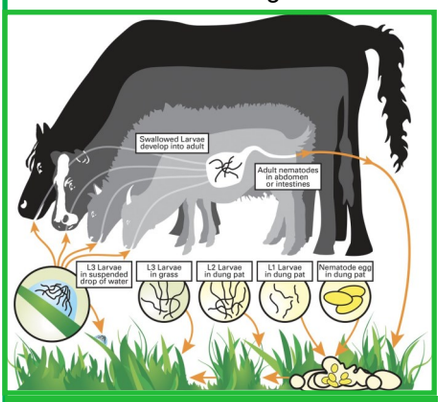
Sheep Update

Sheep crew lambing activities has begun…..again!! We began the winter lambing season with 65 bred ewes and at 2 weeks to go we are down to 11 ewes and have 80 lambs. Which brings our total number of lambs from fall and winter lambing to 270 and the entire flock number just below 500 head. Within our flock there are 2 lambing seasons, Fall (Oct/Nov) and Winter (Jan/Feb). We prefer ewes to lamb in the fall since late gestation and weaning dates coincide with fall and spring forage growth. In addition, weather conditions are more favorable for pasture lambing in the fall, and lambs are exposed to far fewer parasites leading to markedly reduced deworming. Conception rates have been a challenge in the past due to breeding "out-of-season" during shorter days (ewes are seasonal breeders, breeding in the shorter days of fall) and in the heat of the summer. However, since introducing multiple sires, the conception rates have increased greatly. The greater competition among rams and even ewes increases cycling of ewes (allowing them to reproduce). Ewe lambs (first time lambers) are difficult to breed out-of-season since their reproductive hormone cycle has not fully matured; therefore, winter lambing normally consists of this group and the odd high-value mature ewe that did not breed for fall. Because these younger ewes and their lambs will be more susceptible to parasites, they are ideal for parasite studies.

2021 Lambing

Current Research

Along with our ongoing long-term small ruminant studies, we currently have two studies using the commercial product BioWorma®. BioWorma® is a nematode-trapping fungus fed as a feed additive that helps control the spread of parasitic larvae on pasture. The spores of the fungus in BioWorma® is fed to grazing animals, passes through the digestive system with no effect to the animal. When passed on to the pasture through the manure, the fungus sporulates, grows and forms sticky traps and loops around the parasitic larvae that matures from eggs in the feces and feeds on them. The lifecycle of the parasite is broken. Over time, fewer and fewer infective larvae are available to lambs (or cattle, goats, horses, llamas) and less deworming required. We are examining effective and economic strategies of including BioWorma® to sheep or goats, and determining whether it can be added to mineral rather than feed. Grass-fed operations can only use the product in a trace mineral mix. The Australian company is pursuing sale of a certified organic product which will offer more options for parasite control in this group of animals that cannot receive anthelmintic and maintain organic certification.



BioWorma® Lifecycle

Agroecology and Sustainable Farming Systems Research Spotlight

Dr. Jose Franco

Winter highlights from Dr. Franco's research group include the initiation of treatments in a greenhouse study evaluating rosinweed (Silphium integrifolium) response to defoliation and fertilization. Rosinweed is a plant native to the Midwest and mid-South region of the U.S. and has gained interest by the scientific community for use as a perennial oilseed crop. In addition to providing a perennial crop, rosinweed may provide quality forage and silage for livestock. Belonging to the same genus as rosinweed, cup plant (Silphium perfoliatum) has been more thoroughly researched and has been shown to provide quality livestock feed. Preliminary trials on rosinweed in South America indicate it can also provide quality forage, comparable to alfalfa. If this plant is to be used as a dual-use perennial oilseed crop and forage, we must learn more about how it responds to defoliation intensity and frequency, as well as fertilization management; data which this project will provide. Our ultimate goal is to evaluate rosinweed as an alternative forage that may provide supplemental feed in Bermuda grass/tall fescue-dominated pastures of western Arkansas.

Conservative cutting height on rosinweed

Conservative cutting height on cup plant

Standard cutting height on cup plant

Dr. Jose Franco departs for new ARS position

I would like to thank everyone involved with DBSFRC, including scientists, staff, and collaborators, as I transition to a new position with the ARS Dairy Forage Research Center in Madison, Wisconsin. The progress I've made in my career over the last two years, as a scientist and as a supervisor, has only been possible with support I've received during my time here. Rest assured that ongoing projects, including trials evaluating alternative and dual-use crops and forages for production in the mid-South such as Kernza® intermediate wheatgrass and Silphium (rosinweed) and an okra cover crop/organic small grain production trial, will be completed as planned. I look forward to continued collaborations with the scientists and technical staff at DBSFRC. I have enjoyed my time in Arkansas and now it's on to more adventures. The past year-and-a-half has been truly challenging in many ways and in different ways for all of us. I'm truly grateful to have the opportunity to continue my journey.

Staff Spotlight

Michelle Armstrong
Research Technician

Michelle Armstrong grew up in Bethel Acres, OK. Following high school, she attended Oklahoma State University where she obtained a B.S. degree in Agronomy- Crop Science in 1996 and a M. S. Degree in Agronomy-Weed Science in 1998. While attending college she was mentored by a small grains weed scientist and focused on herbicide experiments for all major chemical companies on weeds in hard red winter wheat. Upon graduation, Michelle went to work at Texas A&M University at Vernon, TX as a research technician for the beef nutritionist focusing on feed quality of cool season grasses. Following that experience, she accepted a position as a research assistant to the legume breeder at the Samuel Roberts Noble Foundation in Ardmore, OK. Noble Foundation research focused on grazing studies with alfalfa and other legumes. After 5 years at Ardmore, she returned to her husband's hometown of Poteau, OK and began a new career as a high school biology, physical science, and zoology teacher. After 7 years of teaching, Michelle returned to agriculture and began working for a large animal veterinarian. She assisted in all aspects of animal care for cattle and horses. She joined the Dale Bumpers Small Farms Research Center in May of 2019 working with the farm crew, assisting in field preparation, planting, and harvesting field plots as well as hay baling. In November of 2020, she accepted the research technician position under Dr. Christine Nieman and will focus on beef nutrition. Michelle's hobbies include breakaway roping and day working for area ranchers.

Organic Inspection

In December, Liz Nelson, an inspector for Nature's International Certification Services, announced she would conduct an organic inspection for our location. Due to the current state of the pandemic, the normal inspection process was not possible. In the inspection report the inspector said that, "although not the usual inspection, with the quality and extent of record keeping, as well as Bumpers (the center) allowing inspections of field and flocks, made it a complete inspection". Thanks to a team effort, our organic research program passed with flying colors and will continue to conduct quality organic research for our stakeholders.