

# SMALL FARM RESEARCH AGRI-NEWS

## Agricultural Research Service

### Dale Bumpers Small Farms Research Center Newsletter



#### Greetings from the Research Leader, Dr. Phillip Owens

The year 2020 has been a challenge! We recently completed the government's Fiscal Year as of September 30, 2020 and kicked off Fiscal Year 2021 on October 1. The end of the fiscal year reminds us to reflect on what we have accomplished over the last 12 months.

The productivity of the Dale Bumpers Small Farms Research Center has been outstanding. Our group of 4 scientists (Drs. Phillip Owens, Joan Burke, Jose Franco and Christine Nieman) were authors and co-authors on 29 scientific publications submitted to peer reviewed research journals. That average of 7.4 publications per scientist per year is exceptional and competes with top performing ARS programs in the US. The 4 scientists (Dr. Christine Nieman hired June 2020) were successful in securing additional grant funding that supports research for improving the viability of small farms. Additionally, the infrastructure and grounds improvement have been significant. Our center added a new barn, feed storage silo, new fencing and renovated animal facilities on the East End of the farm. As described in previous updates, the Easter wind storm destroyed the renovation on the East End; however, we received support from the USDA, ARS to repair all damages. The improvements started in October and will continue over the next 6 months. Our Center added new heavy equipment such as a bulldozer and dump truck, which are critical for improving our grounds. We were approved to change our phone system to VOIP which will modernize communication as well as update the HVAC system in two of our main buildings. As the Research Leader, I see improvements with all aspects of our Center. Working with the USDA, ARS Grassland Soil and Water Research Laboratory in Temple, TX, we have added an Unmanned Aerial Vehicle (drone) to our research program which will utilize a high performance camera able to detect a wide spectrum of light to assess plant health, disease and nutrient deficiencies. Our contribution to helping small farmers focuses on improving parasite resistance through genetics and management, cattle management through improvement of nutrition, diversification of farms with new innovative crops like *Silphium* and Kernza wheatgrass, utilizing bialage by demonstrating nutritional benefits and incorporating new technology with GPS auto-steer tractors. I am excited about our new year and all the work the Dale Bumpers Small Farms Research Center team will do to help the small farm agricultural community.



Picture of drone  
Source: XFold Company



#### ARS Featured Photo



Spring at the ARS Dale Bumpers Small Farms Research Center

A photo taken by Erin Wood, Agricultural Science Research Technician, was selected as the ARS Featured Photo in September 2020. The photo showed Biological Science Aides, Joie Bogart and Jessie Tanner. They were moving the breeding ram flock to a new pasture. The link featured more photos and information from critical animal work conducted at our location throughout the pandemic.

#### Damage from April 2020 high winds



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### Agroecology and Sustainable Farming Systems Research Spotlight



**Dr. Jose Franco**

Major highlights from Dr. Franco's research group include the establishment of a Kernza intermediate wheatgrass field trial in open pastures and pine alleys and the start of an organic systems trial to evaluate different okra cover crop termination methods and fertilizer application strategies for organic small grain production in this region.

Kernza is a variety of intermediate wheatgrass, a cool-season forage species, that is being developed and researched for its potential to provide a perennial grain for use in baking, health foods, cereals, beer making, and other products, while also providing numerous environmental benefits. As a perennial grass, it can diversify economic opportunities for growers by providing quality late-season and winter forage and, in addition, provide income potential from grain production.

Roughly 3.6 million southeastern acres (over 11,000 producers in Arkansas alone) grow a combination of grain and oilseed crops, hay, and livestock. Thus, Kernza may be a promising crop for growers in the mid-South and Southeast due to its versatile, dual-use, and perennial nature. Little is known, however, how well this crop will perform in the hot, humid climate of the region since it has primarily been grown in more arid climates of the West and in colder climates of the Upper Midwest. We are in the early stages of a trial that will establish baseline grain and forage yields, evaluate different grazing management strategies, and identify management obstacles associated with growing Kernza in Arkansas. Kernza, tall fescue, Rush intermediate wheatgrass (a forage only type of wheatgrass), and an annual crop of winter wheat were planted at the center from late September to early October. It has been over two weeks since planting and we are seeing the emergence of Kernza and other test crops. We are working with county extension agents and a non-profit organization to extend our findings to the grower community, as well as beginning on-farm trials with cooperating growers in Fall 2021. We are excited about the potential of this crop and look forward to sharing our progress in the coming months.



**Kernza seedlings emerging**

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**Planting in pine alleys**



**Winter wheat emergence is strong**



**Okra plots pre-termination**

Similarly, organic crop production can provide economic opportunities for mid- to small-scale growers in Arkansas and the mid-South/Southeast. As part of regional efforts to expand organic production, we are investigating okra as a viable cover crop in small-grain cropping systems, effective okra termination strategies that minimize soil disturbance and conserve soil resources, and poultry litter application strategies that reduce losses to the environment at DBSFRC's organic-certified Rodeo Unit. To date, we have shown the success of growing an okra cover crop. We recently imposed various termination strategies that included two no-till methods, a hay mower commonly used by producers in the region and a roller-crimper which can be effective at creating a mulch layer to suppress weeds, and a disc implement that incorporates cover crop residue but also creates disturbance to the soil. We applied poultry litter either by top-dressing (surface applied) or using the sub-surfer (sub-surface banded) developed at the DBSFRC, this was followed by the planting of two small grain crops (winter barley, winter wheat). The practices being evaluated cover a range of management practices that we would expect growers in the region to use should organic small grain production expand in acreage, from maximum disturbance strategies that are less conservation-minded (disc, surface litter application) to little- to no-disturbance strategies that are conservation focused (no-till, sub-surface/banded litter application). We will evaluate these systems based on various parameters including grain yield response, weed suppression, and soil microbiological, physical, and chemical properties. We anticipate sharing our preliminary results within a year.



**Termination using a disc with more intense soil disturbance**

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**Roller-crimped okra in progress**



**Termination of okra using no-till options: a roller-crimper (left) and hay mower (right)**



## Small Ruminant Research Spotlight



**Dr. Joan Burke**



### Sheep Update

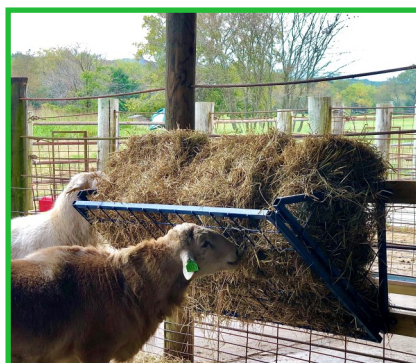


Checking newborn lamb

Fall lambing is underway and as of the end of October we have had 169 lambs including 6 sets of triplets. We have put to good use our automatic lamb milk machine with nine orphan (pulled from ewe) lambs. The machine produces “on demand” warm milk to orphans which cuts down on human interaction and allows the lambs to stay with the flock using a walk through panel. This walk through panel enables the orphan lambs access inside the barn as needed.

We began transitioning our flock to an electronic ID system in 2019. Chad Lee, Animal Caretaker, is placing a RFID (electronic) ear tag in a newborn lamb’s ear for identification. These tags have a microchip that provides instant identification using an RFID reader and transfers data collected to a spreadsheet.

The sheep crew have utilized telework opportunities to research and review literature on topics including soil health, forage improvement, animal handling, and new equipment. This research has led to the implementation of a new feed with mineral included to reduce labor and ensure animals ingest the proper amount of minerals, a new hay feeding system for animals that reduces hay waste and cleanup time, and added input in the fall planting of sheep pastures.



New hay feeder



Research cool season plots growing.

The crew put on their agronomy hats recently to help get high priority small ruminant fields brush hogged and planted in time for an upcoming parasite research study. These plots are key to successful research projects that produce meaningful results for our stakeholders.

### Sheep Production and Management Online Class

The American Sheep Industry (ASI) in cooperation with Pennsylvania Extension Service and through Penn State University offered a course for sheep producers and researchers. Sheep Production and Management was an online course put together by top experts in the field. ASI saw it as a tool to improve production in the sheep industry. Dr. Joan Burke, Research Animal Scientist at DBSFRC offered it to her employees as an educational opportunity to benefit the sheep program she oversees. The course consisted of 25 credit hours with eight different sections of production. Five of Dr. Burke’s team enrolled in the course including Chad Lee, Cullen Pfeifer, Sarah Hayward, Joie Bogart and Jessie Tanner. When asked, Cullen Pfeifer said this about the course, “I loved this course. It was super informative. My favorite part was the marketing section. I love learning more of the business end of things. Overall I enjoyed the whole course. Love learning new things that can help me in my future as a farmer and in my career”.

## Cattle Spotlight



**Dr. Christine Nieman**

### Pine silvopasture study – the first year summary

Fall marks the end of the first year of data collection for a silvopasture research project supported by a Southern SARE grant received by Dr. Christine Nieman and University of Arkansas collaborator Dr. Dirk Philipp.

One of the main goals of the project is to determine the best forage species for cultivation in mature loblolly pine silvopasture. In Fall 2019, 24 plots with 8 different species and 3 replicates each, were established in 32 foot alleys in the mature pine plantations at the Dale Bumper Small Farms Research Center. The species chosen for the study were 4 perennial species, or-

chardgrass, tall fescue, white clover, and alfalfa; and 4 annual species, annual ryegrass, Italian ryegrass, crimson clover, and arrowleaf clover. These species were chosen to create comparisons of multiple species with different function traits, including perennials and annuals and grasses and legumes. Although information about these species in open pasture is widely available, this study aims to test these species in shaded environments, where performance may differ because of less available light for photosynthesis and greater competition from weed species that prefer shade. Heavy and frequent rains caused flooding in alleys in early spring and summer of 2020, mostly killing alfalfa plants, which are intolerant of flooding. Other species were able to recover from the heavy rains and were productive over the season. Perennial plots were heavily contaminated with annual ryegrass, which made up most of the forage yield in these plots in early spring.

However, after April and May harvests, perennial species took hold and by July were contributing a greater amount of forage mass. All annual species were productive in spring and early summer and were terminated after the July harvest. The annual species were then replanted in October

2020, to repeat the study in 2021.



Forage plots in October 2020, the last harvest of the season.



Forages are planted into a prepared seedbed with an 8 foot billion seeder. Annuals are replanted each fall.

Preliminary results indicate that tall fescue, at 2.5 tons per acre, was the most productive species, followed closely by orchardgrass, which produced 2 tons per acre. The next highest yielding were annual ryegrass and Italian ryegrass, which both produced 1.9 tons per acre. It was hypothesized that annual species may be more productive because of the availability of water in early spring compared to summer and fall, when water is generally limited because of

less rainfall and competition with trees. In 2020, water availability was not an issue, giving perennial species an edge with additional production in summer and fall. This project will be repeated in 2021 and 2022 in order to accumulate more years of data and strengthen the species comparison. After three years of data collection, we plan to compare yield, quality, and persistence of the chosen forage species; and finally, make an economic comparison to better advise producers on forage species selection for loblolly pine silvopasture.

## Cattle update

The cattle crew at DBSFRC has had an eventful summer/fall. The crew has been working with cooperator's cattle, planning fertilization of pastures, starting fall vaccinations and preparing for weaning. The cooperators' cattle came to the farm in April at around 500lbs each and were returned in October weighing around 750lbs each. The cattle crew oversaw the dispersion of poultry litter to 220 acres of grazing land in early October. In late September the veterinarian, Dr. Leon Mitchell, met with the crew to give an overview of vaccines and tour the cattle at the location. The crew is currently in the middle of giving 1st round fall vaccinations to the cow/calf herd and intends on starting the 2nd round of vaccines in the upcoming weeks. Along with the 2nd round of vaccines, the calves will be separated from the cows to begin fence-line weaning.





**Articles**

**Controlling coccidiosis in lambs and doe kids**

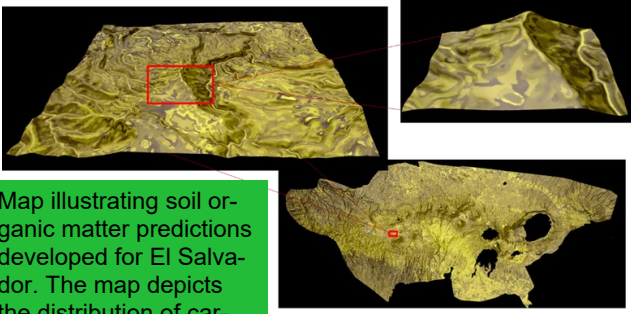
Coccidiosis is an economically devastating parasitic disease commonly seen in recently weaned lamb and kids. The causative organism is a single-cell protozoa called coccidia that can result in diarrhea, dehydration, weight loss, and death. In recent years, plants rich in condensed tannins have been studied for their role in the reduction in coccidia and associated clinical signs. Three studies were conducted at the Dale Bumpers Small Farms Research Center in Booneville, AR to find the effect of feeding condensed tannins extracts from quebracho to lambs and doe kids for the control of coccidiosis and gastrointestinal nematodes. In the first experiment, supplementary quebracho tannins were fed to naturally infected lambs after weaning. Although fecal oocysts (infectious form of the parasites) were decreased, clinical signs of coccidiosis (soiling around rear of lamb, slurry feces) and gastrointestinal nematodes (estimated by fecal nematode egg count) did not differ between lambs fed quebracho or a control diet. In a second experiment, lambs were fed quebracho tannin weeks before weaning. Here, fecal oocyst count remained low while the beneficial effects such as a reduction of clinical signs of coccidiosis and decrease in the gastrointestinal nematodes was not observed. In the third experiment, quebracho tannins were fed to weaned doe kids. Fecal oocyst counts were lower in quebracho fed lambs and other effects such as a reduction in clinical signs of coccidiosis and reduction in the number of gastrointestinal nematodes was not found. Quebracho-fed lambs were lighter in body weight than the lambs fed the control diet, whereas in doe kids weights were similar between treatment and control group. In conclusion, quebracho was effective in reducing fecal oocyst count but not the clinical signs of coccidiosis in both lambs and kids, and may not be highly digestible as it caused loose stool.



**Digital Soil Mapping in Central America – From space-based satellites to fertilizer recommendations on small farms.**

Small farms are the foundation of rural communities. Of some 570 million farms in the world, more than 475 million are smaller than 5 acres. And, the USDA National Agricultural Statistics Service claims small farms make up 88% of the farms in the USA based on farm revenue sales. With small farms being of global importance, scientists at the USDA ARS Dale Bumpers Small Farms Research Center have focused on helping small farmers in Central America. The goal of the project titled “Water Smart Agriculture” was focused on implementing management practices intended to increase infiltration and storage of water following rainfall events. The benefits of storing water in soils includes less runoff which decreases erosion, minimizes flooding and provides long-term storage for drought mitigation. Water is intricately

linked with crop production because water is needed to uptake nutrients for grain and fruit development. How can we affect water storage in the soil? We must know the type of soil and how that soil behaves to tailor management techniques. The



Map illustrating soil organic matter predictions developed for El Salvador. The map depicts the distribution of carbon with increasing detail where the lighter areas show less organic matter and the darker areas with higher organic matter.

team led by Dr. Phillip Owens utilized a digital soil mapping techniques they patented to predict the soil properties at each 90 foot interval for agricultural areas in the countries of El Salvador, Honduras, Guatemala and Nicaragua. The process is based on utilization of data from satellites which provide a 3 dimensional assessment of the earth’s surface. The team takes this data and uses some mathematical equations to identify patterns which relate to soil properties and related soil behavior. As these data and maps were being developed, the team training the scientists in each country on how to develop the digital soil maps to improve over time as more data becomes available. The maps were utilized by extension personnel who report an increase of 30% in bean production in the dry corridor. The governments have utilized the maps to determine the best soil amendments to focus on for coffee production such as amending soils with lime for higher quality and greater output. This was a 5 year project funded by the Howard G. Buffett Foundation and the Catholic Relief Services that ended in September 2020. The work at Booneville has had global impact which helps small farmers support local communities for a viable rural economy.

## Recent publications and presentations

**Long-term effects of pasture management and fenced riparian buffers on soil organic carbon content and aggregation** Sutie Xua , Sindhu Jagadamma, Amanda J. Ashworth, Surendra Singh, Phillip R. Owens, Philip A. Moore Jr.

Soil organic carbon (SOC) plays a key role in sustaining pasture agroecosystem function and its rate of accumulation can be influenced by management practices including manure deposition and grazing intensity. This study was conducted to determine the impacts of 13-years of different pasture management practices on SOC content and aggregation. The field experiment was conducted in a watershed consisted of five pasture management practices: (i) hayed (H), (ii) continuously grazed (CG), (iii) rotationally grazed (R), (iv) rotationally grazed with a grass buffer strip (RB), and (v) rotationally grazed with a fenced riparian buffer (RBR). Since 2004, all treatments received 5.6 Mg ha<sup>-1</sup> of poultry litter annually except the buffer area located at the base of RB and RBR. Starting from the top of hillslope, each plot was divided into three landscape positions. In addition, the ungrazed, unfertilized riparian buffer strip (RBS) in RBR was also studied. In general, upper landscape positions showed greater SOC than lower positions for most of the treatments, and in particular, soils in the landscape top position had greater SOC than RBS. However, permanganate oxidizable Carbon (POXC) was higher in all poultry litter amended pasture systems compared to the RBS. Rotational grazing practice promoted the formation of large macroaggregates compared to other pasture management practices and RBS. All five pasture management treatments improved large macroaggregate-associated SOC content as compared to RBS, and it was higher in grazed plots than the hayed plots. Overall, this study showed that organic manure addition improved total SOC, POXC and SOC associated with large macroaggregates, while differences in SOC among different pasture management strategies were subtle even after 13 years of continuous management.

<https://doi.org/10.1016/j.geoderma.2020.114666> Received 17 May 2020; Received in revised form 2 August 2020; Accepted 5 August 2020 Abbreviations: SOC, soil organic carbon; H, hayed; CG, continuously grazed; R, rotationally grazed; RB, rotationally grazed with a grass buffer strip; RBR, rotationally grazed with a fenced riparian buffer; RBS, fenced riparian buffer strip; MBC, microbial biomass carbon; POXC, permanganate oxidizable C; CRD, completely randomized design □ Corresponding author. E-mail address: [sjagada1@utk.edu](mailto:sjagada1@utk.edu) (S. Jagadamma). Geoderma 382 (2021) 114666 0016-7061/ Published by Elsevier B.V.

Appropriate Technology Transfer for Rural Areas (ATTRA) has two videos featuring Dr. Joan Burke discussing animal health. They are excellent! There are 2 videos discussing diagnosis of parasites and preventing parasites. Click on links below:

[-Managing Your Flock, Part 1: Diagnosing and Treating Sick Sheep](#)

[-Managing Your Flock, Part 2: Preventing Internal Parasites](#)

There are several videos on the site for many areas of agriculture. Here is the link to all the educational videos: <https://attra.ncat.org/category/videos/>

### Wilma Black Remembered...



On Monday, July 27, 2020, Wilma Black, passed away in Fort Smith at the age of 74. Wilma was a highly respected colleague for more than 30 years in her roles at Fort Chaffee and at our very own Dale Bumpers Small Farms Research Center. She was a consummate professional and approached her work with extremely high standards. She was analytical, highly organized, and had tremendous drive to complete the job at hand. She was a friend of all and always welcomed us with her warm smile and engaging personality. She will be deeply missed.

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