Winter 2020/2021

Spring is here. After a fairly chilly winter, we are looking forward to getting in the field. While Covid caused us to scale back some outreach efforts this winter, our research still went on as in any other year, albeit with some unique challenges. In this newsletter we hope to update you on a just a few of our efforts focused on sustainable agriculture, as well as some of the great people we have working in the field. Thank you for your support and here's to an exciting upcoming field season.

Timothy Coolong
Professor of Horticulture
State SARE Coordinator

It is hard to believe that another winter has come and gone. As Dr. Coolong said, researchers, graduate students, and Extension agents have been plowing ahead with their studies and continuing to produce some amazing work. Out of the field, universities, nonprofits, and some of our favorite event organizers are looking hopefully towards a return to in-person conferences and events by 2022. Keep an eye on future Sustainable Agriculture Newsletters for updates on those, and please enjoy these articles from our fantastic contributors.

Sarah Jackson Sarvis
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Extension

Examining Water Quality for Georgia Livestock

Livestock production relies on good water quality sources for health, performance, reproduction, and adequate consumption. To inspire producers to consider the drinking water quality they provide, a multi-county water sampling effort was conducted to examine parameters known to adversely effect livestock. Thanks to a grant provided through the Georgia Ag-ricultural Commodity Commission for Beef, a water sampling effort was conducted in northeast Georgia to test for parameters that can cause animal health issues and deter livestock from drinking.

The fifty-three sources of livestock drinking water analyzed included a variety of well-water troughs, as well as surface water sources of ponds and streams. Samples were tested for pH, levels of the major minerals and metals that can cause issues, as well as anions, soluble salts, total dissolved solids, turbidity, and coliform bacteria. A select number of sites were also tested for water temperature. Data loggers recorded water temperature every 15 minutes in 30 of the watering sources during August, September and October – months known to record high temperatures.

Collecting water samples from a trough.

Collecting water samples from a stream.

Over half (60%) of the samples tested were within scientifically recommended limits for chemical elements. The most common elemental contaminants above the limit were iron (22% of samples), manganese (18%), and pH (12%). High iron and manganese levels affect water palatability, possibly decreasing intake. Unusually high or low pH may dissolve materials from pipes, ditches, or soils, which can be toxic or impart an unpleasant taste to the water. Nonspecific effects related to digestive upset, diarrhea, poor feed conversion and reduced water and feed intake can also occur. Two samples had high nitrate-nitrogen levels, which could occur as a result of contact with natural minerals, agricultural runoff (fertilizer, manure) or industrial processes. High levels can contribute to nitrate poisoning. Copper and phosphorous were each higher than recommended in one sample. Copper can affect taste and odor. Short-term exposure causes gastro-intestinal distress; long-term exposure causes liver and/or kidney failure. Specific disorders caused by phosphorus toxicity include urinary calculi from excess phosphorus or inadequate calcium to phosphorus ratio. Turbidity levels were unacceptable in one stream and one pond.

Turbidity in water is a measurement of how cloudy or murky it is due to particles suspended or dissolved in the water. High turbidity water can deter livestock water intake and affect weight gain.

The EPA recommends that livestock water contain less than 5,000 coliform organisms per 100 milliliters and fecal coliform should be near zero (10 or less). Fecal coliform levels were higher than recommended in 86% of the samples. Some of the highest counts were from troughs in high density corrals. Fecal coliform bacteria presence indicates animal waste contamination and possible occurrence of other biological pathogens that may cause chronic or intermittent diarrhea and off feed problems.

Fecal coliform analysis for different watering methods. (All values MPN/100ml)

Median	Average	Minimum	Maximum	Water Source
30	118	10	500	Ponds
170	354	20	1700	Streams
110	436	10	5000	Pasture Troughs
5000	6333	5000	9000	Corral Troughs

Drinking is a vital part of the daily activities of livestock. Given a choice, cattle would prefer to drink water with moderate temperatures, rather than very cold or hot water. Water temperatures were above the 80° F recommended limit 0% of the time for streams, 16% for troughs, and 38% for ponds.

Fecal coliform contamination appears to be the greatest concern for livestock water quality in northeast Georgia, followed by iron and manganese palatability issues, and water temperature. Each water source can prove to be beneficial, but water quality can vary by location, delivery, and maintenance. Drinking water impacts livestock more than you might think; the importance of water to livestock—quality and quantity—shouldn't be overlooked. Producers can use water test results from a certified lab to determine the best management actions to provide the safest water possible for livestock on their farm.

Carole Knight
UGA Extension - Madison County
&
Martin Wunderly
UGA Extension Area Water Agent

Research

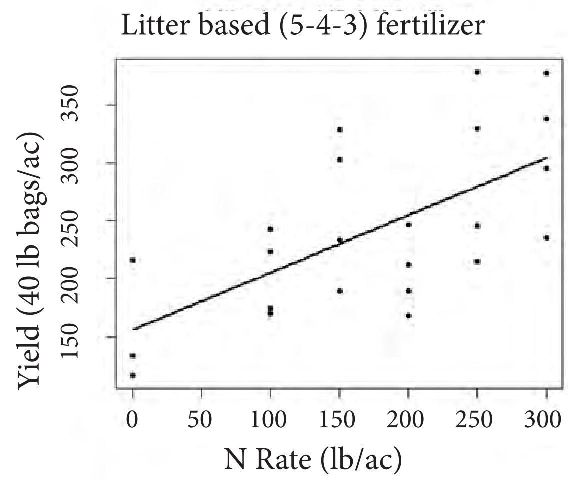
Organic Onion Fertilizer Evaluation

Vidalia onions are a critical part of Georgia's agricultural economy. In 2019 they were grown on more than 11,000 acres and had a farm gate value of more than $130 million. As with many fruits and vegetables, there is a significant demand for organically-grown Vidalia Onions. Dozens of trials have been conducted over the last few decades on the impact of different nitrogen rates and fertilizer programs on the yield, bulb quality, and disease resistance of Vidalia Onions, comparatively, less research has been done on organic onion production. Drs. George Boyhan and Juan Carlos Diaz-Perez from the University of Georgia's Department of Horticulture have previously conducted research to evaluate the role of poultry litter and pelletized poultry litter fertilizers on yield and bulb quality in Vidalia onion. Recently, we have looked to build on their earlier work to compare the performance of pelletized litter and feather meal-based organic fertilizers on yield, quality and disease levels of Vidalia onions. The first trial year was during the 2019-2020 growing season. We evaluated two organic fertilizers: a litter based 5-4-3 and a feather-bone-blood meal based 10-2-8 at several rates ranging from 0 to 300 pounds of nitrogen per acre (for example, 300 pounds of nitrogen from 10-2-8 would equal 3000 pounds of total product applied). Trials were conducted in Watkinsville (clay loam) and in Tifton (sandy loam) on certified organic land (Figures 1.1 & 1.2).

Figure 1.1 - Organic onions being grown at the Durham Horticulture Farm in Watkinsville, GA. March, 2021.

Figure 1.2- Organic onions being grown at the Hort Hill farm in Tifton, GA. January, 2021.

First year results were interesting. In both locations the 10-2-8 outperformed the 5-4-3 in terms of yield and vigor. Further, the 10-2-8 when provided at 170 pounds of nitrogen per acre, had an equivalent yield as the 5-4-3 provided at close to 300 pounds of nitrogen per acre (Figure 2). Differences in nitrogen accumulation and removal were also found between the two fertilizer programs. Disease rates were low across both locations so we were unable to note differences between the two programs for disease incidence in year 1. Results are preliminary but suggest that differences between mineralization and availability of organic pelleted fertilizers at equivalent rates of nitrogen can significantly influence yield and should impact how growers use these organic fertilizers in their crop. Research is being repeated in the 2020-2021 growing season to determine consistency of results.



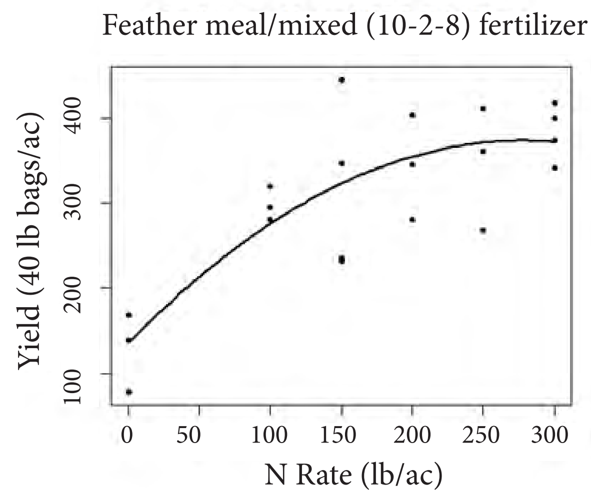


Figure 2. Yield for onions grown in Tifton, Ga using the litter based 5-4-3 fertilizer (upper) and feather meal based 10-2-8 fertilizer (lower). Data courtesy of Hanna De Jesus, PhD student, UGA Horticulture Dept.

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Meet the National Needs Fellows

The Sustainable Food Systems Initiative (SFSI) in UGA's Crop and Soils Sciences Department exists to provide a space for students, scientists, and practitioners to take an interdisciplinary approach to solving the grand challenges we face in developing sustainable food systems for a growing population. Through the SFSI's graduate certificate program and two USDA National Needs Fellowship grants, the SFSI supports graduate students in their interdisciplinary research and outreach, which cover a wide array of subjects. For more information on the Sustainable Food Systems Initiative and Graduate Certificate, visit https://site.extension.uga.edu/sfsi/. Please enjoy meeting the SFSI National Needs Fellows:

Kate Costello

I am a graduate student in the wild peanut lab working with Dr. Soraya Bertioli. As you might expect, the wild peanut lab focuses on peanuts. Specifically, we utilize the natural resistance that wild peanut species have to various pathogens and pests in order to give that resistance to cultivated peanuts (Arachis hypogaea).

Wild peanuts look very different from the kind of peanut you would find in the store. The pods are often very small and don't contain two large tasty seeds. But while these wild peanuts don't grow seeds that are very good to eat, they have an advantage over cultivated peanuts: they are resistant to many pathogens. Cultivated peanuts have very low genetic diversity and are unable to reproduce sexually with its wild relatives naturally. Due to this, it is susceptible to many pathogens that cause problems for peanut farmers.

Cultivated peanuts are tetraploid, meaning they have 4 sets of chromosomes. Most wild peanuts are diploid, meaning they only have 2 chromosomes. This is why they are sexually incompatible. However, it is possible to use a chemical called colchicine to force the wild peanut chromosomes to double, creating artificial tetraploids. This then allows the wild and cultivated peanuts to be bred together. My lab takes advantage of this to breed desired resistance genes into cultivated peanuts while still keeping the desired characteristics of the cultivated peanut such as large seeds. A previous Ph.D student in the lab—Dr. Carolina Ballén-Taborda—had created a population of peanuts with resistance to a common peanut pest root-knot nematode. She had bred 3 generations of peanuts using the wild peanuts A. stenosperma and A. batizocoi with cultivated peanut lines from researchers in Tifton, GA.

This is where my project comes in. Along with the resistance to root-knot nematode, the plants in this population had shown possible resistance to fungal foliar diseases while growing in the greenhouse. There are three important foliar diseases that affect peanut: early leaf spot (Passalora arachidicola), late leaf spot (Nothopassalora personata), and peanut rust (Puccinia arachidis).

My project focuses on discovering which genes from the wild peanut species could be causing resistance to these pathogens, and then continuing the breeding scheme in order to create lines of peanuts with resistance to these fungi along with the root-knot nematode resistance. The first step is to cut leaves off of the plants and then paint the fungal spores onto those leaves.

Painting fungal spores on peanut leaves

After a few weeks, the susceptible leaves will be infected with the fungus, but those that are resistance will not. This assay allows me to get a baseline of which of my plants have the resistance genes I am looking for and which do not. From there I can look at the genome and try to discover which genes are causing this resistance. My goal is to have some peanut lines with this resistance that might someday be available to peanut farmers!

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Natalie Perkins

I remember the first time that I heard about aquaponics, I was listening to my professor talk about how the fish fertilized the system and the plants cleaned the water before returning it to the fish. He explained it as an incredibly renewable system which offered a cleaner alternative to most methods of food production. I was interested, but the thing that really caught my attention was when he started talking about the teachers in Georgia who wanted to use aquaponics to engage their students, but were struggling with these innovative, sometimes challenging systems because of how hard it was to find reliable information. The opportunities were great. Aquaponics could not only up teachers' hands-on learning game, but also had the potential to create another link in their local food systems which connected students directly back to real-life food production. I want to help here, I remember thinking.

That driving thought led me to specialize in aquaponics throughout the rest of my undergraduate classwork, making connections with teachers and hosting informational workshops which fueled the fire to address this real-world problem. When a graduate position opened up which offered a chance to formally research how to begin developing an informational resource for using aquaponics in the classroom, I jumped at the chance.

My research with NNF has taken the form of an advanced needs assessment, as you can't hit a target well without knowing first where that target even is. With the goal of understanding in mind, we first assembled a team of Georgia teachers who had worked with aquaponics and asked them a simple question – "what do you need?" This one question generated a round-table discussion, from which we found more questions to conduct a survey investigating certain dimensions of need. From there, we've done another study which used focus groups to figure out how information could be delivered successfully to these teachers. Analyzing the qualitative data for themes, quotes, patterns, and characteristics will paint a picture of what an effective aquaponics resource would look like for these teachers. My work has been to understand; at the end of my project, I hope to have a clear blueprint for this future resource so I can hand it off to someone who can create. In this way, I hope to point the arrow to a clear target, so we can make sure we directly hit the mark in the future.

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Interested in contributing an event or article to the Sustainable Agriculture Newsletter? If so, contact sustainag@uga.edu for more information.