



Industry-wide Field Day Utilizing Soil and Tissue Testing for a Second Year to Determine Crop Nutrient Needs as Part of a Comprehensive Fertilizer Management Plan for Cut Foliage

KAREN STAUDERMAN*

University of Florida/IFAS, Volusia County Extension, 3100 E. New York Ave.,
Deland, FL 32724

ADDITIONAL INDEX WORDS. *Chamaedaphne calyculata*, unmanned aerial vehicle, HOB0 onset datalogger

Cut foliage growers recognize the importance of Florida Best Management Practices (BMPs). These practices are crucial in monitoring nutrient levels in leaves and soil. The goal of this effort was to assist growers with launching a nutrient soil and tissue baseline for the cut foliage industry, interpret second year test results, and to promote smart decisions with fertilizer use. In 2017, a grant was procured to provide free soil and tissue sample analysis, and promotional items in order to entice growers to participate in the study and to attend an on-farm field day. Twenty-three growers were provided free soil and tissue testing on leatherleaf fern and other cut foliage. An industry-wide field day held in May 2018 reinforced the importance of the BMP yearly monitoring. A total of 206 soil and tissue samples were submitted by industry growers participating within Volusia, Putnam, and Lake Counties. Test samples from 2016 were used to compare against the 2018 soil and nutrient tests. The long term outcome will be for growers to use the soil and tissue baseline analysis as a tool in order to make fertilizer management decisions resulting from their test results.

Soil and tissue nutrient analysis are significant factors for the commercial leatherleaf (*Chamaedaphne calyculata*) and the cut foliage green industry. They are so important that any unbalance in the plant or soil can lead to yellowing, stunting or deformity that causes the foliage to be unmarketable. The cut foliage industry is currently valued at \$80 million and growing. Demand for the product has climbed higher in 2018 since its lowest level in 2007 at \$55 million with 70.8% of the acreage grown in Volusia County and by 2012, the state acreage dropped 3.5%. With response like this, growers must have accurate guides to help with diagnostic efforts to keep the crop green and healthy.

The Volusia County commercial horticulture extension agent and an industry soil specialist understood the need to monitor baseline guides for leatherleaf fern and cut foliage greens from field soil and tissue analysis for micro- and macronutrients in commercial production for use by Florida growers. Without proper tools, new technology alternatives and laboratory test interpretations, the management of leatherleaf and cut foliage greens for nutrients in tissue and soil is based on benchmarks available from Agricultural and Environmental Services Laboratories (AESL) guidelines from 2018 University of Georgia College of Agricultural and Environmental Sciences. Unfortunately, Florida soil and tissue requirements differ considerably from those of Georgia.

Irrigation management is also a significant factor in the cut green industry. It impacts disease incidence and spread, fertilizer and pesticide effectiveness. To make matters worse, the variable weather patterns in Central Florida result in tenuous field decisions to avoid excessive irrigation applications. Advances in irrigation

technology lead growers to transition away from field rain gauges, television/radio weather reports and surface soil scratches to now relying on weather apps, weather service websites and newer precision sensors to stay relevant and cost effective.

Background

Pierson, FL, is home to a Florida Automated Weather Network (FAWN) weather station that allows growers to tap into current online weather conditions to help with farm management. While this helps in the larger scope, today's growers look to precision tools for their unique on-site conditions. Demonstration of unmanned ariel vehicles (UAVs), also known as drones, soil moisture sensors, and field data loggers assist growers in considering on how to best manage the data and information gathered through field days on our local soils. Growers that excel at irrigation will lead to better management decisions of fertilizer, pesticides and conservation of natural resources.

Materials and Methods

For five years, the Volusia County commercial horticulture extension program has been actively promoting the Florida Department of Agriculture and Consumer Services (FDACS) nursery Best Management Practices (BMP) compliance throughout the county and surrounding areas. Among the benefits of cost sharing opportunities, the program requires yearly soil and tissue testing to aid with the monitoring of nutrient and pH balance. This practice alone enables growers to make smart field decisions based on laboratory test results and prevents nutrient loading that negatively impacts Florida's natural resources.

*Corresponding author. Email: kstauderman@ufl.edu.

Starting in 2016, a limited amount of soil and tissue samples were collected in hopes of diagnosing immediate nutrient needs for the industry. An FDACS BMP grant was awarded to the Volusia County commercial horticulture extension program that provided the funding to conduct free soil and plant tissue tests to allow growers of leatherleaf and cut foliage greens with incentive to voluntarily supply soil and tissue samples from their production fields in order to contribute to a basic diagnostic overview of the soil and tissue nutrient needs throughout the area. It targeted soil and nutrient laboratory test results in the Central Florida area of Volusia, Lake, and Putnam Counties. Initially in 2016, 18 commercial cut foliage growers submitted 34 plant tissue samples and 79 soil samples to the extension agent who sent them to the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Soil Testing Laboratory in Gainesville, FL. for nutrient and soil analysis. This early work laid the foundation for the need to form a baseline standard for Central Florida as the soils in northwest Volusia County differed greatly from soils in Georgia. The information gained from these tests helped to form an industry wide recommendation for the 2016 field season and demonstrate the similarity of soils and nutrient readings of cut foliage in the area. This assisted the nursery industry while providing anonymity to growers that directly participated in the study.

By 2018, the extension agent once again procured funding from an FDACS grant targeted to fern growers, foliage growers, and crop advisors. The goal was to follow up with a second year study to see if the leatherleaf and cut foliage industry was within ideal range of soil and tissue nutrient levels. It also served to encourage the industry to participate with the horticulture extension programming and provide them with useful education and crop assessment to reinforce strong partnerships and potential future funding.

The grant was advertised to Putnam, Volusia, and Lake County commercial growers by way of listserv, email, field visits, and telephone calls. This time, 23 growers submitted 103 plant tissue and 106 soil samples to participate in the study. Terrance Fullerton, soil specialist, and owner of Agro Services International, LLC, Orange City, FL, volunteered (as in 2016) to assist the extension agent in organizing the data and establish baseline nutrient requirements, then, present the laboratory test results to attendees at the 2018 BMP Leatherleaf and Cut Foliage Field Day, held on 10 May 2018. The educational portion of the field day also provided two pesticide Continuing Educational Units.

This four-hour field day was held at Hagstrom Fernery packing shed, 208 East 2nd Ave., Pierson, FL. The first hour of the field day was a demonstration of deep-well maintenance and protection of irrigation outputs by Lars Hagstrom, a grower, and owner of the host site, followed by the calibration of a boom sprayer. Karen Stauderman, the Volusia County extension agent, spoke on the importance of BMP record keeping and the HOBO data logger (Onset Computer Corp., Bourne, MA) that monitors onsite air temperature, soil moisture, solar radiation, leaf wetness, and rainfall (Fig. 1). That was followed by a lesson and field exhibition with the new technology tool using Unmanned Aerial Vehicles (UAVs) with telemetry. The water resource regional state extension specialist, James Fletcher, showed how the UAV gathers and analyzes data output in multiple field locations to monitor potential disease outbreak, nutrient deficiencies, and drought conditions—(Fig. 2). Justin Jones, of BMP Logic, Inc., Trenton, FL, introduced the TRIScan™ soil moisture sensor (Sentek Technologies, Adelaide, Australia). He explained the resource benefits and cost savings of monitoring



Fig. 1. Karen Stauderman describes the HOBO data logging system as an option for monitoring onsite field conditions at the Volusia County Extension field day held at Hagstrom Fernery, in Pierson, FL.



Fig. 2. Jim Fletcher demonstrates an Unmanned Aerial Vehicle for use as BMP leatherleaf and cut foliage field monitoring at the Volusia County Extension field day at Hagstrom Fernery in Pierson, FL.

soil moisture and as a valuable tool in the refinement of their irrigation management.

Kelly Morgan, of the UF/IFAS Soils and Water Science Department, explained the diverse variety of field tools available and onsite weather apps to help with onsite water, nutrient and pest monitoring for use in field decisions. The conclusion of the field day was a one-hour presentation by Terrance Fullerton of Agro Services International, LLC, Orange City, FL, about the 2018 grant funded soil and tissue test results from leather leaf

and cut foliage greens. He interpreted all of the laboratory soil and tissue tests, diagnosed nutrient needs, and referenced them to the BMP guide of nutrient management.

Remarkably, Fullerton compared Year 1 (2016) soil and tissue test results against that of Year 2 (2018) and found two significant issues that the growers needed to address immediately.

Many soil samples analyzed in 2018 showed adequate to high levels of phosphorus but tissue levels were low, suggesting an uptake problem. Factors such as soil pH extremes and poor field sampling were examined and eliminated as possible causes. Tissue boron levels were also low. Inadequate soil boron is known to reduce phosphorus uptake but there were no soil boron tests to confirm this. However, boron is normally low in our sandy Florida soil, similarly to that of some South American and Caribbean island soils.

Another possible reason for the low phosphorous uptake was over-irrigation. Phosphorous does not leach out of mineral soils readily but can be leached out of the organic soil layer where most leatherleaf roots grow. Unfortunately, the soil and tissue samples from the growers were taken during a cold spell after a period of freezing weather in which irrigation water ran continually during the freezing temperatures. Fullerton surmised that this played a role in lower phosphorous levels in the soil.

Fullerton prescribed growers to first test their soil for boron deficiency prior to applying boron to their field soil. Boron is toxic in small quantities and if it is applied in excess, it will result in crop loss. If the soil results come back deficient, the addition of boron will greatly enhance the health and yield of their crop.

Results & Discussion

Thirty-one attendees were present at the field day, and 26 of them were commercial foliage growers. Of the 26 grower attendees surveyed, 14 of them plan to make changes to their spring/summer 2018 fertilization practices as a result of the soil and tissue test results as presented at the field day. The remaining attendees were government workers, industry representative and employees of growers. Survey results were analyzed and the data denoted that:

- 47% of growers were BMP certified, 13% were not, and 40% didn't know their status.

- Of the 53% that were not certified or uncertain of their certification status, 88% wanted to BMP certified.
- 80% of growers were making fertilizer, nutrient, and pH changes to their fields as a result of their free tissue and soil analyses that the extension agent procured from the grant.
- 100% of the growers preform yearly soil testing and 60% yearly tissue testing.
- Responses from the growers ranging between 60 to 90% agreed to commit to:
 1. updating water saving practices,
 2. introducing new technology,
 3. maintaining BMP records, and
 4. applying for cost sharing.

All attendees admitted to "considerable" (61 to 80%) perceived knowledge gain averaging 67.2% on new irrigation field technology. Whereas, their post survey results indicated a higher percentage of 79% correctly answering four questions about UAVs.

Impact

We met the goal of the FDACS grant to analyze soil and plant tissue nutrient test results of leather leaf and cut foliage greens industry-wide so that growers will routinely implement yearly tests and make sound field decisions. Continual yearly testing will result in accurate monitoring of resource management for nutrients within cut foliage, and avoiding excess fertilizer usage resulting in a lower negative impact on the environment. Secondly, the mission was to provide alternative field tools, demonstrations and updates in new technology to offer options in water conservation and irrigation management. As a result of the field day, three new growers signed up for the FDACS BMP program to become compliant including two that expanded their operation to include an additional 89.3 acres in Volusia County. One grower signed up with St. Johns River Water Management District to obtain cost share funding for wireless soil moisture sensors and four growers made requests for purchases of TRIScan™ soil moisture sensors directly from the company representative. The FDACS grant was selected to be presented at a state professional meeting to share the successful outcome results of this program's effort.