Southern Forest Nursery Management Cooperative™

FY 2022 ACCOMPLISHMENTS

As presented to the Advisory Committee of the Southern Forest Nursery Management Cooperative

November 2-3, 2022

FY 2022 ACCOMPLISHMENTS

GOAL A: RESEARCH

Objective 1. Identify, test, evaluate, and promote the registration of cost-effective pesticides for use in forest tree nurseries.

Fusiform Rust Control

A seedling treatment study will be conducted on loblolly and slash, to test new chemistries in conjunction with the US Forest Service Rust Testing Laboratory in Asheville, NC. These are Revytek® (mefentrifluconazole/fluxapyroxad/pyraclostrobin), Ascernity® (benzovindiflupyr/difenoconazole) and Miravis Duo® (pydiflumetofen / difenoconazole) all of which the active ingredients have with preventative, systemic and curative properties that provide a number of different modes of disease control. Seed will be sown at Auburn into USFS container systems until germination at which time the seedlings will be treated prior to being challenged with basidiospores of fusiform rust (April – Nov 2022) (Newell/Stokes)

- ***Accomplishments:*** *Three new fungicides, Mural® (Azoxystrobin, Benzovindiflupyr), Postiva™ (Pydiflumetofen, Difenoconazole), and Miravis® Neo (Azoxystrobin, Propiconazole, Pydiflumetofen) are also being tested at the Resistance Screening Center for rust control on loblolly and slash pine. Final assessments will be made in mid-November 2022, 6 months after inoculation.*

Based on the results from basidiospore inoculation studies, fungicide treatment chemistries will be assessed for field season in a member nursery. Conifer seed (loblolly and slash) will be sown, with Proline and once germinated, seedlings will be treated every two weeks with compounds to determine rust control. At the end of the growing season, seedlings will be assessed for the incidence of fusiform rust (April - Nov 2022) (Newell/Enebak)

- ***Accomplishments:*** *A field trial was installed at the Arborgen Shellman Nursery in Georgia to operationally assess the effectiveness of Protect® DF in controlling fusiform rust on loblolly and slash pine. Protect® DF was shown to be effective in basidiospore inoculation studies. Seedlings will be collected from the field in mid-November for final assessments.*

Nanocellulose/Lignin Impregnated with Insecticides to Control Pine Tip Moth

Dependent on the results obtained from the 2021 sampling using imidacloprid and prothioconazole, we aim to determine whether this technique can be used with other chemicals and how long the ai remains within the plant tissue. (Stokes/Peresin/Newell)

- ***Accomplishments:*** *The concept was presented as a proposal to the USDA Specialty Crops Research Initiative (SCRI) program in January 2022. The project proposal was for $4.2 million. Tittle of the proposal: "Sustainable Nanoscale Biopolymer Carriers for Pesticides and Fertilizers in Pecan and Peach Crop Systems" in collaboration with LSU, UGA, Vireo Advisors, LLC, and CAES. Reviews were positive and encouraging, and the proposal was ranked as "High Priority" but not funded. A new provisional patent is being filed in collaboration with John Hopkins Univ and the Connecticut Agriculture Experiment Station and new field and green house data*

on pecan trees are undergoing in preparation for a resubmission to USDA for funding. It is anticipated that the technology is applicable to all trees and crops species.

Nursery Weed Control

At the recommendation of SFNMC member nurseries, trials will be designed and installed to investigate weed control methods, including use of herbicides in bareroot and container growing systems. Several trials proposed are continuations or expansions of trials currently in progress:

- **Large-scale Post-emergent Herbicide Trial Targeting Yellow Nutsedge in Bareroot Pine:** Replicated trials of Vexis® (pyrimisulfan) post-emergent herbicide will be conducted in multiple bareroot pine nurseries. This herbicide specifically targets nutsedge but is not currently labeled for conifer nurseries. Rates of ½X, 1X, 2X, and 4X (if required by manufacturer) will be applied in trials at several member nurseries in multiple pine species. The timing will be consistent on all installations (between 8 – 9 weeks post-sowing). Data collected from these trials may be used by the manufacturer to request Section 24(c) Special Local Needs labels in the states where SFNMC member nurseries are located. (Payne/Newell)

  - ***Accomplishments:*** *Vexis® trials were installed in 4 SFNMC member nurseries in loblolly and slash pine. Treatments were altered from the 2021 study to use an earlier first treatment (at 7 weeks post-sowing) and to add an additional treatment at 12 weeks post-sowing on half of the plots. These should allow us to quantify tolerance to the herbicide by younger seedlings, and to measure the effect of multiple applications (for possible use later in the growing season). Visual inspections show good seedling tolerance with excellent nutsedge control. Sample pine seedlings from each plot in each nursery will be collected between November 2022 and January 2023, with measurement data used to quantify seedling tolerance. Analysis of all field data, together with results of the outplanting study and 2 greenhouse studies, will be included in a Research Report.*

- **Vexis® Outplanting Trial:** Slash pine seedlings treated with Vexis® in 2021 trial will be lifted in January and outplanted in a replicated trial by rate on the campus of Auburn University, Southern Forest Nursery Management's Trophatron. Seedling survival and growth at the end of the 2022 growing season will be measured to determine if the herbicide has any deleterious effects on seedling growth. (Newell/Payne)

  - ***Accomplishments:*** *Outplanting trial was planted in February 2022 with loblolly and slash pine seedlings from each replication of each Vexis® treatment in the 2021 trial at the Georgia Forestry Commission Nursery. These seedlings will be lifted for measurements in November 2022, with results included in the Vexis® Research Report.*

- **Vexis® Nutsedge Survival:** Soil from the plots treated with Vexis® in 2021 will be screened for the presence of nutsedge nuts and collected by treatment. An equal number of nuts by treatment will be then sown into soil microcosms in the greenhouse at Auburn and monitored for nut germination over the growing season to determine if the herbicide is "static" or "toxic" to the nuts in the soil. (Newell/Payne)

  - ***Accomplishments:*** *Soil from the plots treated with Vexis® in 2021 will be screened for the presence of nutsedge nuts and collected by treatment. An equal number of nuts by treatment will be then sown into soil microcosms in the greenhouse at Auburn and monitored for nut germination over the growing season to determine if the herbicide is "static" or "toxic" to the nuts in the soil. (Newell/Payne)*

- **Vexis® Hot Spot Purple vs Yellow Nutsedge Trials:** An alternative trial would be to secure yellow and purple nutsedge from the internet and using microcosms in the greenhouse, treat the two species with differing rates of Vexis to determine the tolerance of each to the herbicide. (Newell/Payne)

- ***Accomplishments:*** *We were only able to acquire yellow nutsedge and are wrapping up that experiment in the greenhouse. Information on nutsedge control will be presented as part of the Vexis update to Advisory members in November.*

- **Ronstar®Flo Timing Trial in Container Pine**: A replicated timing (based on the appearance of weeds in container sets < 10 weeks sowing) trial using Ronstar®Flo in a post-emergent application will be conducted in member container pine nurseries. This herbicide has been successfully tested in pre-emergent applications in SFNMC member nurseries for 3 years. Certain weeds, such as oxalis, are presenting larger populations more efficiently controlled by herbicide than by hand-weeding if a safe, effective herbicide can be identified and applied as needed. (Payne)

  - ***Accomplishments:*** *This trial was installed in May 2022 on 7- and 8-week-old longleaf pine seedlings. Reports from the nursery indicate no visible damage of seedlings to date. Samples from each study will be collected in November 2022, with analysis of measurement data to be included in a Research Report.*

Nematicide Trials

This trial with Broadform™ (fluopyram + trifloxystrobin) will be continued in 2022 at the Bullard, Texas and Jesup, Georgia nurseries if nematode control and seedling tolerance is satisfactory as determined from results of the 2021 study. Adjustments to the 2021 spraying regime (rates, timings, number of sprays) may be made in order to focus applications on those shown to be most effective in 2021. (Payne/Newell)

- ***Accomplishments:*** *This trial was installed at the IFCO Jesup, Georgia Nursery in 2022 by nursery staff. Product applications were made at 14, 28, and 42 days post-sowing in both loblolly and slash pine beds. Nematode counts made from 5 soil sampling dates identified populations ranging from 5/100cc soil (May) to 1300/100cc soil (August). Analysis of this data is not complete, but initial assessments indicate no differences in control of nematodes in the treated plots. Seedling samples will be collected in November with measurement data used to quantify effects of Broadform™ on seedlings. Information on nematode control and seedling tolerance will be included in a Research Report.*

Broadform™ Hot Spot Trials: Nursery Cooperative personnel will reach out to member nurseries in April – May and remind them of the nematicide Broadform™ and to be on the lookout for hot spots of nematode activity. If present, the nematodes species will be identified via soil sample collections, and small-scale plots will be treated with the nematicide and the plots monitored for nematode control and seedling quality. (Newell/Payne)

- ***Accomplishments:*** *Nurseries did not reach out to Annakay or Nina about setting up a quick trial using Broadform to control nematodes.*

A second trial using Reklemel™ active (fluazaindolizine) which is a non-fumigant, chemical nematicide discovered and developed by Corteva Agriscience. Reklemel™ is the first sulfonamide nematicide, a chemical group different from other commercial nematicides. Its mode of action appears different from all other currently available nematicides, including the traditional fumigants, organophosphates and carbamates and the newer active ingredients, such as fluopyram, fluensulfone and tioxazafen. Reklemel™ has excellent activity on root-knot nematodes and many other important plant-parasitic nematode species. It has a favorable environmental profile and is biologically compatible with beneficial insects, including pollinators and a wide range of beneficial soil organisms. (Newell/Payne)

- ***Accomplishments:*** *This trial was delayed one year, to the 2023 growing season, due to the increase in research efforts on the herbicide Vexis®.*

Objective 2. Identify and develop economically feasible nursery cultural practices that enhance seedling quality.

Seedling Counting/Measuring

Researchers at AU's Biosystems Engineering Department will continue to examine and develop a system to count seedlings for inventory using new technologies. Nursery Cooperative funds will not be used on this project. (Bao/McDonald/Stokes)

- ***Accomplishments:*** *A system with three cameras was developed to collect video from different drills in the seedling bed. The videos were preprocessed to restrict the region of interest to the center portion of the image in each camera and separated each drill in individual videos. Two different modalities, i.e., video, and optical flow, were evaluated as inputs to a convolutional neural network followed by a long short-term recurrent network to model the sequence of frames and regress to the seedling count for each plot. The mean absolute percentage error (MAPE) of our best performing model was 7.53%, which is an improvement over the baseline manual sampling-based approach with a MAPE of 11.07%. The results showed that the proposed approach was able to count seedlings in a crowded scene under complex field conditions with higher accuracy than the standard manual practice. Therefore, the proposed system and results demonstrated the potential to replace manual counting and even provide further information such as a seedling density map over the field for precision forest nursery management and seedling harvesting.*

Seed Disinfectant Systems

Light at different wavelengths on the electromagnetic spectrum can be used as broad-spectrum antimicrobials. Specifically, Ultraviolet Light (UVC) and Near Infrared (NIR) have been used in sterilization, surgery, seed in transport, food systems, etc. If this technology can be transferred to seed treatment without any negative effects on germination, it could be beneficial for nurseries (Newell)

- ***Accomplishments:*** *We were not able to test NIR or UVC technologies due to the scale of the project. We did, however, test wet and dry heat as alternative disinfection methods. A research report of the study was produced.*

Objective 3. Develop methodologies to minimize the environmental impact of nursery cultural practices while maximizing their effectiveness including the development of integrated pest management programs.

Hardening-off Practice of Reducing Water Availability and Its Impact on Outplanting Success

Following our trial reported in Research Report 21-04 that suggest that loblolly pine does not have a mechanism to refill embolized xylem conduits, we propose to further investigate the impacts of nursery drought hardening practices on the physiology and outplanting success of loblolly pine. We intend to examine multiple drought hardening routines with quantitative measures to determine an optimal strategy to achieve proper drought condition seedlings (Stokes/Newell).

- ***Accomplishments:*** *Experiments on the effect of drought hardening practices on the physiology and outplanting success of loblolly pine were conducted. A research report will be produced after all final datasets have been analyzed.*

Objective 4. Further define the "optimal seedling" to maximize the cost effectiveness of artificial regeneration forestry systems.

Impact of Genetics on Cold Hardiness

In collaboration with the Tree Improvement Program at North Carolina State University, as well as the Forest Products Development Center at Auburn University, we want to assess the impact that genetics has on cold acclimation and freeze tolerance. Building on from the collaborative research project undertaken at the Nursery Cooperative in which we showed near infrared spectroscopy to monitor variations in soluble sugars after cold acclimation, we wish to assess whether this model be used for various genetic families of Loblolly pine. If successful, nursery managers could assess the freeze tolerance of seedlots before outplanting using NIR spectroscopy. (Stokes/Via/Heine - NCSU)

- ***Accomplishments:*** *There has been some progress on model to examine the plant sugars and were getting some good relationships. The modeling is not easy to understand and the Via Laboratory at the forest products division continues to work on it.*

Impacts of Genetics on Freeze Damage as Measured by Chlorophyll Fluorescence

In collaboration with the Tree Improvement Program at North Carolina State University, we want to assess the ability of using Chlorophyll fluorescence to ascertain the degree of immediate damage caused by sub-freezing temperatures and also the ability to predict future damage and survival. This will be accomplished by challenging 3 genotypes of known freeze tolerance with an experimental freeze mimicking natural freeze events that occur in the region and examining the changes in chlorophyll reflectance (Stokes/Newell/Heine - NCSU).

- ***Accomplishments:*** *NIR statistical models were developed for the tree seedlings encompassing several loblolly pine families, either frozen or not frozen. Total sugar extractions were undertaken, and models developed as with previous work undertaken. The models that were developed showed good relationships with sugars and need to be further refined to reduce the number PCA's in the model. We continue to make the models more robust and better predictors in the future freeze events using hand-held NIR detection systems.*

GOAL B: TECHNOLOGY TRANSFER

Objective 1. Serve as a clearinghouse of information related to nursery production and tree planting.

Methyl Bromide

In collaboration with MBr manufacturers, the Methyl Bromide Industry Panel (MBIP), the Chloropicrin Manufactures Task Force (CMTF) and applicators, the Nursery Cooperative staff will continue to keep abreast of EPA actions and/or possible legislative initiatives that may affect the future availability of soil fumigants. We will continue to inform the membership through the Advisory Committee to keep the membership knowledgeable of these activities.

The Nursery Cooperative staff will continue to keep abreast of activities related to the Quarantine pre-shipment (QPS) process. We will inform the membership of any EPA initiatives and continue to work with the AF&PA, the Crop Protection Council, USDA and APHIS to provide input and influence the QPS process if necessary.

The Nursery Cooperative staff will continue to work with the AF&PA, and USDA to inform and influence the EPA deliberations regarding pesticide regulation as it pertains to the soil fumigation re-registration decisions that were released in the 2013. (Enebak/Newell/Payne)

- ***Accomplishments:*** *There were three requests or questions to the Nursery Cooperative staff concerning the use of soil fumigants, MBr, Chloropicrin, etc. from federal or state agencies in FY 22. These pertained to the pests that were to be controlled that could not be transported across county or state lines. The Nursery Cooperative continues to monitor pesticide regulations as it pertains to soil fumigants and will keep track of soil fumigation trends in forest-tree nurseries.*

Re-registration of Nursery Pesticides

The Nursery Cooperative staff will continue to follow the re-registration process for pesticides currently under review under the Food Quality and Protection Act (FQPA) used in seedling production and will provide information to the necessary regulatory agencies (USDA, APHIS, EPA) when necessary. (Enebak/Newell/Payne/Stokes)

- ***Accomplishments:*** *Like last growing season, there were four specific requests for data on pesticide use from USDA-APHIS and EPA in seedling production systems. These included Ronstar Flo (oxadiazon), PTM (fipronil), Goal (oxyfluorfen) and Proline (prothioconazole). Working with members and cooperators, the Nursery Cooperative submitted letters to the agency indicating the use of these compounds in nurseries and the importance to the industry. Those that make decisions on pesticide use are now up to date with how seedling production would be affected without these important pesticides. Deadlines for the final RED update for these active ingredients is FY 23.*

Labeling of Nursery Pesticides

Using information gained from the herbicide, fungicide, insecticide and nematicides, Nursery Cooperative staff will work with registrants, EPA, USDA and State Plant Protection agencies to obtain labels, special use, (24-C) or full label status for member states (Payne/Newell/Enebak)

- ***Accomplishments:*** *Based on data obtained from field trials using Vexis® (pyrimisulfan) to control yellow and purple nutsedge in seedling beds, the Nursery Cooperative staff had a meeting with the registrant (PBI/Gordon) to determine the viability of adding nursery production sites to the label. The meeting was productive and encouraging, with a request for at least one more year's worth of pine trials in different soil types and possibly hardwood nurseries. Company's concern is in size of market and profitability from bareroot seedling nurseries.*

Maintain and Update Nursery Cooperative Website

The Nursery Cooperative staff will continue to update the Nursery Cooperative website for use by Nursery Cooperative members. (Bowersock)

- ***Accomplishments:*** *The Southern Forest Nursery Management Cooperative website was updated to include all outreach efforts (Research Reports, Contact Meetings, Short Course) to members of the Cooperative.*

Leveraging Nursery Cooperative Data

The Nursery Cooperative staff will continue to stress the importance of Cooperative membership and when possible, leverage Cooperative information for grant proposals and data cite license for the seedling production survey. (Staff)

- ***Accomplishments:*** *The Nursery Cooperative had a fifth year added to the 5-yr agreement to share seedling production data under a Site License. For an annual fee of $10,000, seedling production data was provided to the USFS Washington Office for them to use in their planning and reporting programs. Funds were used toward salaries to compensate for time. With the addition of Lindsay Colegrove, USFS State and Private Forestry, southern forest nurseries have added a new voice to address forest seedling production issues that can be used for leveraging Nursery Cooperative dues. USFS State and Private Forestry is looking into using their funds to*

leverage FL and KY to become members of the Nursery Cooperative.

Develop a Forest Nursery Management Minor

Working with Nursery Cooperative members and units on campus, SFWS will look into developing a minor focused on the production and outplanting of bareroot and container seedlings used in the reforestation of the southern US. This minor would be part of the Natural Resources Management degree that requires a student to declare a minor as part of the BS degree (Enebak/Cooperative Members)

- ***Accomplishments:*** *Ad Hoc members Lindsay Colegrove, USDA Forest Service; Doug Sharp, IFCO; David Bowling, Arkansas Forestry Commission; and Thomas Meeks, Meeks' Farms and Nursery collaborated during spring of 2022 to develop a 15-credit Forest Seedling Nursery Management Minor. This minor, now approved by the Auburn University Board of Trustees, consists of the courses copied below from the AU Bulletin that are taken in conjunction with the Natural Resources Management BS degree within the College of Forestry, Wildlife and Environment.*

Forest Seedling Nursery Management Minor: This minor will prepare students to work in state, private and federal forest seedling nurseries with the production of conifer and hardwood bareroot and container seedlings used in the reforestation programs throughout North America. Successful graduates of this minor will become knowledgeable in the process of seedling production from seed collection, sowing, cultivation, irrigation, pest management, lifting, packing, storing and outplanting. Along with seedling cultivation, students will also become familiar with the business aspect of running a forest-tree seedling nursery.

Core Courses for Minor

Course	Title	Credits
ACCT 2810	Fundamentals of Accounting	3
FORY 5140	Forest Regeneration and Seedling Production	3
HORT 2240	Plant Propagation	3
HORT 3000	Growth and Development of Horticultural Plants	3
	Total Credits	**12**

Restricted Courses: ONE OF THE THREE COURSES BELOW

Course	Title	Credits
HORT 5230	Nursery Management	4
HRMN 3420	Human Resources Management	3
SCMN 3710	Logistics: Management of Fulfillment Process	3
	Total Credits	**15-16**

Update Forest Seedling Crop Profile

Working with the Southern IPM Center, we will begin the process of transferring the Forest Seedling Nursery Practices in the Southern US – Bareroot and Container information into the Crop Profile database. Data will also come from the USDA Forest Service Handbook 680, 2012. Conduct a workshop with growers, stakeholders, and research scientists to develop a plan to locate any missing "data" or "pesticide usage" into the Crop Profile. (Newell)

- ***Accomplishments:*** *Working with the Southern IPM Center, USDA and EPA, an up-to-date Crop Profile was developed, written, and submitted to USDA that represents the current status*

of conifer seedling production in the southeastern United States. This 48-pg document includes cultural, chemical, and biological aspects of seedling production systems and the insects, fungi, weeds, and nematodes that interfere with seedling quality and production in a single Pest Management Strategic Plan.

Develop an SFNMC Certificate for Members

As part of the benefits to members staff at Auburn University's Nursery Cooperative will look into creating a Certificate of Nursery Cooperative Grown that can be used to market their seedlings as meeting a list of best-management practices that can be placed on their seedling boxes/bags (Newell/Enebak/Bowersock).

- ***Accomplishments:*** *Working with Advisory Members and the AU Technology Transfer Office, the Nursery Cooperative developed a 10 Best Management Practices that allows member nurseries to use the approved SFNMC Logo's in their marketing and packaging process. Member nurseries will be sent a letter annually in November each year signifying their continue use of the most current and up-to-date research on seedling quality.*

Objective 2. Efficiently and regularly transfer the results of cooperative research to the membership.

Contact Meeting

The 2022 Southern Forest Nursery Management Cooperative Contact meeting will be conducted as a 1/2-day program in July 2022 in conjunction with the Southern Forest Nursery Association is scheduled to be held in Charleston, South Carolina. As usual, the agenda will cover presentations by Nursery Cooperative staff on current research activities and results. Details will be worked out with nursery members with meeting information outlined in the Spring 2022 Newsletter. (Enebak/Bowersock/Colegrove)

- ***Accomplishments:*** *The 2022 Nursery Cooperative Contact meeting was held on July 19, 2021, during a half-day online program prior to the Southern Forest Nursery Association meeting in Charleston, SC. This meeting was 2+ yrs in the making as it was originally planned for July 2020. There were 32 members who participated in the Nursery Cooperative portion of the meeting and 74 attendees at the joint meeting. The IPM Workshop to finalize the Conifer Nursery Crop Profile was a success and I thank everyone for their input and sticking around for the entire day. This document has been finalized and is now in the national IPM Database as part of the Pest Management Strategic Plan for conifer nurseries.*

Information Sheets

"A Closer Look" is a new outreach document for the SFNMC. This information sheet on pests/diseases will be produced biannually and will become the centerpiece for each newsletter. (Enebak/Staff)

- ***Accomplishments:*** *A "Closer Look" document was prepared and distributed to Nursery Cooperative members in the Fall 2022 Newsletter. (It did not appear in the Spring 2022 Newsletter.)*

Research Reports

We plan on producing Research Reports and Technical Notes in FY22 that document all research conducted by the Nursery Cooperative, for distribution to member nurseries. (Enebak/Newell/Payne/Stokes)

- ***Accomplishments:*** *Nursery Cooperative staff produced 4 Research Reports, 1 Technical Note,*

and 2 Management Alerts that covered the following topics:

- ***Management Alert 2022-01:*** *Be alert of upcoming freeze injury conditions; Eastern US, Jan 28-30, 2022.*
- ***Management Alert 2022-02:*** *Be alert of upcoming freeze injury conditions; Central Plains, Feb 3-4, 2022.*
- ***Technical Note 21-01:*** *Forest-tree seedling production in the southern United States for the 2020-2021 planting season. Enebak and Newell. 18 pp.*
- ***Research Report 22-01:*** *The effect of modifications to sowing procedures on the growth and development of loblolly pine seedlings. Payne, Stokes, and Singleton. 3 pp.*
- ***Research Report 22-02:*** *A second trial to determine the effect of multiple applications of a non-fumigant nematicide (fluopyram) on nematode control and loblolly pine seedling characteristics. Payne, Stokes, and Bickerstaff. 4 pp.*
- ***Research Report 22-03:*** *The efficacy of pyrimisulfan on nutsedge control and the tolerance of loblolly and slash pine in bareroot seedling beds. Payne, Stokes, Newell, Fields, and Ayres. 6 pp.*
- ***Research Report 22-04:*** *Use of oxadiazon in over-the-top applications in containerized growing systems. Payne, Stokes, and Meeks. 4 pp.*

Newsletters

Newsletter distributions are planned for March and September 2022. Members are encouraged to submit articles and organizational updates. (Staff)

- ***Accomplishments:*** *Two newsletters were produced and distributed via electronic delivery to 90+ contacts within the Nursery Cooperative membership in April and October of 2022.*

Objective 3. Provide a limited consultancy function to the membership in the area of nursery seedling production and outplanting.

Individual and Organization Contacts

An on-going activity and is handled as individual situations within each member organization within the Nursery Cooperative as cases arise during the growing and planting season. (Enebak/ Newell/Payne)

- ***Accomplishments:*** *Staff participated in the following one-on-one contacts with members.*

	Payne	Enebak	Newell
Phone calls	10	13	7
Letters	5	6	0
Emails	98	37	28
Site Visits	19	0	11
Diagnosis	0	9	3

Seedling Production Survey

The Nursery Cooperative staff will continue the seedling production survey initiated in FY 03. The same questionnaire will be used to obtain production figures for the 2021 to 2022 planting season.

The survey will be sent out in June 2021. (Enebak/Bowersock/Newell)

- ***Accomplishments:*** *A survey was emailed to 53 nurseries throughout the southern US in June 2022 to gauge seedling production for the 2021-2022 planting season. Data was compiled and put into Technical Note 22-01 that will be distributed to all participating nurseries in late November 2022.*

Nursery Customer Meeting Presentations

Over the past several years, as schedules and travel permits, Nursery Cooperative personnel have participated in customer (internal and external) meetings at nurseries in an effort to encourage and improve customer relations and educate nursery customers on seedling planting and successful plantation establishment. Thirty-minute presentations such as "*Why Did My Seedlings Die*?" and "*The Ten Commandments of Seedling Survival*" are presentations the staff have made. (Staff)

- ***Accomplishments:*** *One invitation to speak at an SFNMC member stakeholder event was requested for FY22. On September 22, Nina Payne presented "The Ten Commandments for Better Bareroot and Container Seedling Survival", and Annakay Newell and Elizabeth Bowersock attended the IFCO Pine Hill Nursery Open House. Approximately 30 stakeholders were in attendance.*

Short Course

Restrictions on travel for participants and speakers continue to get in the way of successfully conducting this informative and important workshop for new nursery personnel. We will send out a request in January 2022 to gauge interest and availability. If enough interest, and travel is not restricted, we will offer another Short Course in September 2022. (Staff)

- ***Accomplishments:*** *The 2022 Nursery Management Short Course was offered to 19 attendees on September 13-15th, 2022. This 3-day course covered 23 different topics on seedling production in the southern US. Those in attendance earned 15 CUEs and 21 Pesticide Credits. We will send out a request in January 2023 to gauge interest and availability. If enough interest, and presenters can/will attend, we will offer another Short Course in September 2023.*

GOAL C: COOPERATIVE DEVELOPMENT

Objective 1. Provide for the continual relevancy and efficiency of the Cooperative research and technology transfer programs.

Advisory Committee Meeting

The FY23 Advisory Committee Meeting will be held on November 2-3, 2022. A two, half-day meeting will be planned. (Enebak/Bowersock)

- ***Accomplishments:*** *The Nursery Cooperative Advisory Meeting will be conducted on November 2-3, 2022 at Auburn University's College of Forestry, Wildlife and Environment.*

Nursery Cooperative Membership

The Nursery Cooperative staff will continue to recruit new members among those nurseries that will benefit from activities of the Nursery Cooperative. This would include the Florida Division of Forestry, PRT in Atmore, AL, and Kentucky State Nursery. There is also discussion with non-nursery production members to include an Associate status. (Staff)

- ***Accomplishments:*** *No new members joined the Nursery Cooperative. We continue to have conversations with PRT, that operates the container nursery in Atmore, AL, the Florida Division*

of Forestry, and Kentucky. Lindsay Colegrove, USDA Forest Service, is looking into funding from her office to support these State Nursery memberships into the Nursery Cooperative. While there have been some conversations with smaller nurseries and consulting forestry companies with respect to Associate Membership, none have joined the group.

Update the Cooperative Membership and Nursery Directories

An on-going activity with an updated directory distributed annually to each member. (Bowersock)

- ***Accomplishments:*** *The Nursery Cooperative Membership Directory was updated and sent to Cooperative members in November 2021.*

Objective 2. Increase the visibility and effectiveness of the Cooperative as a source of information on issues related to seedling production and plantation establishment.

Presentations at Meetings

Nursery Cooperative staff will continue to be encouraged to participate as a speaker or attendee in regional and national meetings related to artificial regeneration. (Staff)

- ***Accomplishments:***

  - *A poster entitled "In-field pine seedling counting using end-to-end deep learning for inventory management" was presented at the "Envisioning 2050 in the Southeast: AI-Driven Innovations in Agriculture" conference held at Auburn in March. It received first place in the poster presentation competition.*

  - *A conference paper received an award in the Information Technology, Sensors, and Control Systems (ITSC) technical community at the 2022 ASABE Annual International Meeting in July.*

  - *A provisional patent application for the bareroot seedling inventory technology was filed in February.*

Publications

Nursery Cooperative staff is encouraged to publish results outlined in annual Research Reports and Technical Notes in scientific journals after a period of 2-3 years have elapsed. (Staff)

- ***Accomplishments:*** *A peer-reviewed publication entitled "Alabama's trees for generations to come" was published in Tree Planter's Notes:*

  - *Alabama's trees for generations to come. Albritton, Barlow, Platt, Stone, and Payne. Tree Planter's Notes. Spring 2022. 65 (1): 16 pp.*

Extramural Funding of Nursery Cooperative Projects

Nursery Cooperative staff will continue to be encouraged to locate and generate extramural funding opportunities directly related to artificial regeneration. (Staff)

- ***Accomplishments:*** *Three extramural competitive grants were prepared and submitted for research funding on the following topics by Nursery Cooperative staff.*

  - *"An Ai-Powered Ground-Based Vision System for Automated Inventory and Quality Assessment of Bareroot Pine Seedlings for Forest Tree Nurseries." Bao, Y., Enebak, S.,*

McDonald, T. and Tang., L. USDA – AFRI ***FUNDED @ 3% Director's Salary.***

- "*Temperature Adaptations and Acclimation in Southern Pine Conifers". Aspinwall, M. Enebak, S., Payn, K., Raley, F. and T. Martin. USDA-AFRI* ***FUNDED @ $20,000 Travel***

- *"Engineering softwood and hardwood biochar for climate-smart nursery production". Peng, Y., Cristan, R., Via, B., Enebak, S., Newell, A., Zhang, Y., Sun, Y., Song, Y. USDA-NRCS.* ***Funding Pending***

Interaction with other Research Cooperatives

The Nursery Cooperative staff will make efforts to interact, attend, work with other regional and national forest research Cooperatives to broaden and strengthen research ties that can benefit seedling production. (Staff)

- ***Accomplishments:*** *Completed the study with the Tree Improvement Cooperative (NCSU) regarding looking at the impact of genetics on cold hardiness (Newell) and infrared imagining, as described above. Seedlings are currently being grown for studies that will be conducted in winter 2022-23.*

International Nursery Research Collaboration

Working with joint nursery research in other regions of the world, an 8-day trip that allows interaction of Nursery Cooperative members with other nursery production systems in South Africa will be identified and planned for Summer 2022. (Nadel)

- ***Accomplishments:*** *Dr. Ryan Nadel had put together a trip that involved a number of forest seedling nurseries, outplanting sites, and reforestation efforts in three different plantation forestry regions across South Africa that include the growth of pines and eucalypts. The tour included the opportunity for view African wildlife in two distinct landscapes and world heritage sites in South Africa. Since Ryan is no longer with the Nursery Cooperative, this nursery workshop prospect in South Africa dims with each passing year. In addition, Covid conditions in South Africa are not conducive to travel from the US.*