

# ANNUAL REPORT

## FY 2016

(October 1, 2015 - September 30, 2016)

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AUBURN UNIVERSITY  
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

## **MEMBERSHIP LIST**

(November 2016)

### Full Members:

#### **The States of**

Arkansas  
Georgia  
North Carolina  
Oklahoma  
South Carolina  
Tennessee  
Virginia

#### **Forest Industry**

Rayonier  
Weyerhaeuser  
K & L Forest Nursery, LLC

#### **Non-Industrial – Private**

Westervelt  
ArborGen, LLC  
International Forest Company  
Campbell Global (Crown Pine Timber Nursery)

#### **US Government**

USDA Forest Service

### Associate Members:



AUBURN UNIVERSITY  
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

## EXECUTIVE COMMITTEE

Service Rotation  
(November 2016)

<b><u>FISCAL YEAR†</u></b>	<b><u>Member 1</u></b>	<b><u>Member 2</u></b>	<b><u>Member 3</u></b>
2012	Tennessee	North Carolina	Arkansas
2013	North Carolina	Arkansas	South Carolina
2014	Arkansas	South Carolina	Weyerhaeuser
2015	South Carolina*	Weyerhaeuser	Virginia
2016	Weyerhaeuser**	Virginia	ArborGen
<b>2017</b>	<b>Virginia***</b>	<b>ArborGen</b>	<b>Louisiana</b>
2018	ArborGen	Louisiana	Forest Service
2019	Louisiana	Forest Service	Plum Creek
2020	Forest Service	Plum Creek	Georgia
2021	Plum Creek	Georgia	Rayonier
2022	Georgia	Rayonier	Oklahoma
2023	Rayonier	Oklahoma	IFCo
2024	Oklahoma	IFCo	Campbell Timberland
2025	IFCo	Campbell Timberland	Native Forest Nursery
2026	Campbell Timberland	Native Forest Nursery	Tennessee
2027	Native Forest Nursery	Tennessee	North Carolina
2028	Tennessee	North Carolina	Arkansas
2029	North Carolina	Arkansas	South Carolina
2030	Arkansas	South Carolina	Weyerhaeuser
2031	South Carolina	Weyerhaeuser	Virginia
2032	Weyerhaeuser	Virginia	ArborGen

† Member 1 would conduct the Coop business meeting held in that fiscal year. For example, Tennessee conducted the business meeting for FY12, in November of 2011.

\* South Carolina could not attend the 2015 meeting. Weyerhaeuser substituted.

\*\* South Carolina filled in for Weyerhaeuser.

\*\*\*Virginia could not attend the 2016 (FY17) meeting. ArborGen substituted.



## **THE EIGHT FUNDAMENTAL RULES OF ANTI-TRUST COMPLIANCE**

1. Competitors may not agree on prices they charge for goods they sell.
2. Competitors may not agree on the prices they charge for services.
3. Competitors may not agree on terms of sale.
4. Companies may not use dominant market position to monopolize a market, control prices, or exclude competitors.
5. Competitors may not agree not to compete by allocating customers, territories, or markets.
6. Competitors may not agree not to compete on bids – i.e. bid-rigging.
7. Competitors may not agree on prices for products or services they buy.
8. Competitors may not join in a boycott of suppliers or customers to accomplish anti-competitive ends.





# Rules and Policies for the Auburn University Southern Forest Nursery Management Cooperative

Approved November 1997

## MEMBERSHIP

1. Full membership in the Cooperative is open to companies with domestic operations and state and federal agencies that operate a forest tree nursery. Associate membership in the Cooperative is open to domestic companies that do not operate forest tree nurseries but plant forest tree seedlings. Associate membership in the Cooperative is also open to manufacturers and distributors of commercial products used in the production of forest tree seedlings in container or bare-root nurseries.
2. Full members are required to pay annual dues. Associate members are required to pay one-half the dues set each year for full members.
3. Voting rights will be granted to full members only.
4. Membership is for one year. Membership may be terminated by either the member organization or by Auburn University by giving 60 days written notice before October 1.
5. Membership will be contingent on signing a memorandum of agreement with Auburn University.

## ORGANIZATION

6. The Dean, School of Forestry, Agricultural Experiment Station of Auburn University in consultation with the Coop Executive Committee, will appoint the Cooperative's Director. The Director will be responsible for:
  - A. Directing the activities of the Cooperative;
  - B. Employing a competent staff;
  - C. Developing the Cooperative's direction in conjunction with the Advisory Council;
  - D. Ensuring each member participates to a threshold level; and
  - E. Reporting research accomplishments to the Advisory Council
7. An Advisory Council consisting of one representative from each cooperating organization shall be established to:
  - A. Act as a liaison between the organization and the Director;
  - B. Develop Cooperative policies;
  - C. Advise the Director on the Cooperative's direction;
  - D. Approve the annual budget and membership fee.

- E. The Advisory Council will have an annual meeting in the first quarter of each fiscal year.
8. An Executive Committee consisting of three Advisory Council members and the Director shall have the authority to meet and conduct routine business in the name of the Advisory Council. One Executive Committee member will be appointed annually according to a rotating schedule and will serve for 3 years. The Advisory Council chairman will be the senior member of the Executive Committee and will preside at the Executive Committee and Advisory meetings. Associate members are not eligible to serve on the Executive Committee.
  9. Contact representatives will be designated by each cooperating organization. This individual may or may not be the same person serving on the Advisory Council. Contact Representatives will be directly involved in research established with each member organization. A meeting of contact representatives will be held in the 3rd quarter of each fiscal year.
  10. All data will be available to all members in the Cooperative.

## DUES and BUDGET

11. Membership fees will be set by the Advisory Council at its annual meeting. Recommended fees will be computed annually by the Executive Committee based on the consumer price index (CPI) for the previous year, and will become effective October 1 of the following year.
12. The Cooperative will operate on the fiscal year October 1 to September 30. Invoices for membership fees will be sent to all member organizations on October 1 of each year, or by special arrangement with the individual organization.
13. When a Cooperative member is acquired by another member organization, all, two-thirds, and one-third of the full membership fee will be paid for the lost member the first, second, and third years after acquisition, respectively, by the continuing member.

## RULES CHANGES

14. Changes in, deletions from, and additions to the membership rules may be adopted by a two-thirds vote of advisory members in attendance at regularly scheduled or special sessions of the Advisory Council.

DIVISION OF RESPONSIBILITIES BETWEEN AUBURN  
UNIVERSITY AND MEMBER ORGANIZATIONS  
IN THE AUBURN UNIVERSITY SOUTHERN FOREST  
NURSERY MANAGAMENT COOPERATIVE

1. Study plans will be developed by Auburn University in conjunction with the Cooperative's Technical Committee. Responsibilities will be delineated in individual study plans.
2. Auburn will do all data analysis and processing, as well as manuscript preparation, and will insure timely distribution of results to cooperators.
3. Auburn will be responsible for developing a procedure for uniform soil testing and analysis.
4. Auburn will act as a clearinghouse on current nursery management research and will disseminate appropriate information on these practices.
5. Auburn University graduate students will be utilized to work on specific problems.
6. All cooperators will be responsible for adhering to the study plans.



**Rules and Policies for the Auburn University Center for Advanced Forestry Systems (CAFS)  
funded by the Industry/University Cooperative Research Center Program of the National  
Science Foundation**

**Approved November 2013**

A. The CENTER (Auburn University) will be operated by faculty, staff and students at the UNIVERSITY. For the first five years, the CENTER will be supported jointly by industrial firms, Federal laboratories, the National Science Foundation (NSF), the State, and the UNIVERSITY. It is possible that the UNIVERSITY may receive support from NSF for an additional five years.

B. Any COMPANY, Federal Research and Development organization, or any Government-owned Contractor Operated laboratory may become a sponsor of the CENTER, consistent with applicable state and federal laws and statutes. Federal Research and Development organizations and Government-owned Contractor Operated laboratories may become sponsors of the CENTER on terms and conditions other than those in this agreement upon approval by UNIVERSITY and two-thirds of the Industrial Advisory Board.

C. Any COMPANY that contributes \$25,000 annually to University Sponsored Research Cooperatives to support any of the CENTER(s) will thereby become a full member or at least \$5,000 to become an associate member.

D. The organization and operation of CENTER will be specified by CENTER bylaws that will be adopted at the Industrial Advisory Board meeting. The bylaws, when adopted, will become part of this Agreement.

E. There will be an Industrial Advisory Board composed of one representative from each member. This board makes recommendations on (a) the research projects to be carried out by CENTER (b) the apportionment of resources to these research projects, and (c) changes in the bylaws. The operation of this board is specified in the bylaws.

F. All patents derived from inventions conceived or first actually reduced to practice in the course of research conducted by the CENTER shall belong to UNIVERSITY. UNIVERSITY, pursuant to chapter 18 of title 35 of the United States Code, commonly called the Bayh-Dole Act, will have ownership of all patents developed from this work, subject to "march-in" rights as set forth in this Act. COMPANIES that wish to exercise rights to a royalty-free license agree to pay for the costs of patent application. UNIVERSITY agrees that all such CENTER sponsors are entitled to a nonexclusive royalty-free license. COMPANY will have the right to sublicense its subsidiaries and affiliates. If only one COMPANY seeks a license, that COMPANY may obtain an exclusive fee-bearing license through one of its agents. COMPANY has the right to sublicense its subsidiaries and affiliates.

G. Copyright registration shall be obtained for software developed by CENTER. COMPANY shall be entitled to a nonexclusive, royalty-free license to all software developed by CENTER. COMPANY will have the right to enhance and to re-market enhanced or unenhanced software with royalties due to CENTER to be negotiated, based on the worth of the initial software.

H. Any royalties and fees received by UNIVERSITY under this Agreement, over and above expenses incurred, will be distributed in accordance with UNIVERSITY royalty-sharing schedule.

It is further stated that:

1.The UNIVERSITY reserves full right of publication, but the UNIVERSITY will give the COMPANY privilege of reviewing any manuscripts before they are published.

2.That this agreement may be terminated by either party by giving 60 days notice to the other in writing.

The UNIVERSITY, in accepting these funds, has for its purpose the promotion of improved forestry.

AUBURN UNIVERSITY  
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

## FY17 ADVISORY MEETING AGENDA

**Wednesday, November 9, 2016**

<b><u>TIME</u></b>	<b><u>EVENT</u></b>	<b><u>SPEAKER</u></b>
11:00 – 1:00	Registration	SFWS Conference Hall - 1101
1:00 – 1:05	Welcome to Auburn University	Janaki Alavalapati - Dean
1:05 – 2:00	FY16 Accomplishments	Scott Enebak – SFWS
2:00 – 2:30	Pesticide Update	Ryan Nadel – SFWS
2:30 – 3:00	Container Seedling Update	Ryan Nadel - SFWS
3:00 -3:30	Break	
3:30– 3:45	Update Rapid ID of Pitch Canker Screening	Ryan Nadel - SFWS
3:45 – 4:30	Seedling Quality Studies	Ryan Nadel - SFWS
4:30 – 5:00	Unmanned Aerial Vehicles Study	Christian Brodbeck - AU
5:00 – 5:30	Shortleaf Pine Initiative	Edward Loewenstein - SFWS
5:30 – 6:00	Study Plan Open Discussion	Nursery Cooperative
6:00 – 8:00	BBQ Dinner and Social	Enebak Estate

**Thursday, November 10, 2016**

<b><u>TIME</u></b>	<b><u>EVENT</u></b>	<b><u>SPEAKER</u></b>
7:00 – 8:00	Breakfast – Danish / Coffee / Juice	SFWS Conference Hall - 1101
8:00 – 8:30	Herbicide Trial Updates	Nina Payne - SFWS
8:30– 9:00	2015-16 Seedling Production Survey	Scott Enebak - SFWS
9:00 – 10:00	FY17 Work plan Discussion & Approval	Scott Enebak & Virginia
10:00-10:30	Break	
10:30 – 12:00	FY 17 Budget Discussion	Scott Enebak & Virginia
12:00 ish	Adjourn	Have a safe trip home





FY 2016 ADVISORY COMMITTEE MEETING  
November 9 & 10, 2016

## MINUTES

- 1) The FY 2017 Advisory Committee Meeting was opened at 1:00 p.m., Wednesday, November 9, 2016 by Scott Enebak, Director.
- 2) This is to serve as a reminder that all business is conducted according to the guidelines of anti-trust legislation (see page 7).
- 3) Those in attendance of the FY 2017 Advisory Committee Meeting were as follows:  
  
Mike Coyle, IFCO  
Elizabeth Bowersock, AU (Thursday only)  
Dave Bowling, Arkansas  
Barry Brooks, AU  
Ken McQuage, Weyerhaeuser  
John Conn, Tennessee  
Tommy Conwell, Westervelt  
Mark Davis, Rayonier  
Scott Enebak, AU  
Jeff Fields, Georgia Forestry Commission  
Larry Foster, ArborGen  
Tim Adams, South Carolina Forestry Commission  
Ryan Nadel, AU  
Doug Sharp, IFCO  
Ken Singleton, K & L Forest Nursery  
Nina Payne, AU  
Brandon Loomis, Westervelt
- 4) Please see page 16 for the FY 2017 Advisory Committee Meeting Agenda. The following presentations were made on Wednesday afternoon or Thursday morning as noted in the Agenda:
  - a. Pesticide Update – Ryan Nadel
  - b. Container Seedling Update – Ryan Nadel
  - c. Update Rapid ID of Pitch Canker Screening – Ryan Nadel
  - d. Seedling Quality Studies – Ryan Nadel
  - e. Unmanned Aerial Vehicles Study – Christian Brodbeck
  - f. Shortleaf Pine Initiative – Ed Loewenstein
  - g. Herbicide Trial Update – Nina Payne
  - h. 2015-2016 Seedling Production Survey – Scott Enebak
- 5) The FY 2017 Business Meeting of the Auburn University Southern Forest Nursery Management Cooperative was called to order at 8:50 a.m. on Thursday, November 10, 2016, by Larry Foster of ArborGen. Cooperative Members as listed above (page 15)

were present. All members present concurred unanimously to begin the meeting. Topics of the FY17 Work Plan were discussed and voted upon, with amendments, as follows:

Goal A.

Objective 1.

a. Methyl Bromide Substitution

*Motion to Approve: John Conn*

*2<sup>nd</sup>: Larry Foster*

*Unanimous Approval*

b. Herbicide Trials

*Motion to Approve: Mark Davis*

*2<sup>nd</sup>: Larry Foster*

*Unanimous Approval*

c. Fusiform Rust Control

*Motion to Approve: Dave Bowling*

*2<sup>nd</sup>: Doug Sharp*

*Unanimous Approval*

Objective 2.

a. Development of a Rapid Screening Test for the Presence of *Fusarium circinatum*

*Motion to Approve: Jeff Fields*

*2<sup>nd</sup>: John Conn*

*Unanimous Approval*

b. NIR

*Motion to Approve: John Conn*

*2<sup>nd</sup>: Ken McQuage*

*Unanimous Approval*

c. Controlled Release Fertilizer

*Motion to Approve: Doug Sharp*

*2<sup>nd</sup>: Mike Coyle*

*Unanimous Approval*

Objective 3.

a. Drone Studies

Discussion:

Have they flown container? Why fixed wing? Would rotary wing be a better option for nursery use? (Can go lower, stop, hover, etc. to possibly get container counts.) Quantification would be nice.

*Motion to Approve: Ken McQuage*

*2<sup>nd</sup>: Mike Coyle/Doug Sharp*

*Unanimous Approval*

- b. The Availability of Prills for PTM Use in Container Seedling Production

Discussion: Not possible due to EPA. Test generic to see effectiveness?

*Motion to Approve: Mike Coyle*

*2<sup>nd</sup>: Doug Sharp*

*Unanimous Approval*

#### Objective 4.

- a. Chilling Hours and Seedling Storability

Discussion: Prefer sachets; they work in bags and boxes. For bundles... may have to try the root sprays/gels next year. M. Davis: have we actually measured ethylene concentration? D. Sharp: Ken McNabb may have done this years ago.

*Unanimous Approval*

#### Goal B.

##### Objective 1.

- a. Methyl Bromide
- b. Update Nursery Label Book
- c. Revision of Ah Handbook 473, Hardwood Nursery Guide
- d. Re-registration of Nursery Pesticides
- e. Maintain and Update Nursery Cooperative Website
- f. Leveraging of Nursery Cooperative Data

##### Objective 2.

- a. Contact Meeting – July 10-12, 2016 – Myrtle Beach, SC
- b. Research Reports
- c. Newsletters

##### Objective 3.

- a. Individual and Organization Contacts
- b. Seedling Production Survey
- c. Nursery Customer Meeting Presentations
- d. Short Course – Survey will be sent out in January to assess the need

#### Goal C.

##### Objective 1.

- a. Advisory Committee Meeting – Nov. 8 and 9, 2017
- b. Nursery Cooperative Membership
- c. Update Coop Membership and Nursery Directories

Objective 2.

- a. Presentations at Meetings
- b. Publications
- c. Extramural Funding of Nursery Cooperative Projects
- d. Interaction with other Research Cooperatives

*Motion to Approve Goal B and Goal C: John Conn*

*2<sup>nd</sup>: Larry Foster*

*Unanimous Approval*

**BUDGET**

\$500 dues increase for FY18, reassess each year.

*Motion to Approve FY17 Budget Projections with \$500 dues increase: Ken Singleton*

*2<sup>nd</sup>: Larry Foster*

*Unanimous Approval*

- 6) The FY 2017 Business Meeting of the Auburn University Southern Forest Nursery Management Cooperative is adjourned.

AUBURN UNIVERSITY  
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

## FY 2016 BUDGET – PROJECTED VERSUS ACTUAL

(October 2016)

FISCAL YEAR  
(Oct. 1, 2015 - Sept. 30, 2016)

	<b><u>FY 16</u></b> <b>(Projected)</b>	<b><u>FY 16</u></b> <b>(Actual)</b>	<b><u>Difference</u></b>
<b>REVENUE</b>			
Carryover from Previous Year	166,069	166,069	(0)
FY 16 Year's Income	201,300	178,150	(23,150)
<b>Total Revenue</b>	<b>367,369</b>	<b>344,219</b>	<b>(23,150)</b>
<b>EXPENDITURES</b>			
<b>Personnel Costs</b>			
Professional/Non-Faculty - Tom Starkey	33,250	35,471	(2,221)
Professional/Non-Faculty - Elizabeth Bowersock	24,980	24,980	0
Research Assistant - Barry Brooks	43,350	43,350	0
Research Assistant - Nina Payne	45,020	45,020	0
Graduate Students - PhD/MS	8,500	0	8,500
Student Labor	3,770	0	3,770
Employee Benefits	45,446	47,808	(2,362)
<b>Total Personnel Costs</b>	<b>204,316</b>	<b>196,629</b>	<b>7,687</b>
<b>Operating Costs</b>			
Travel	10,000	14,146	(4,146)
Vehicle Mileage	8,000	10,094	(2,094)
Supplies	6,000	9,176	(3,176)
Equipment	2,000	0	2,000
<b>Total Operating Costs</b>	<b>26,000</b>	<b>33,416</b>	<b>(7,416)</b>
<b>Total Expenditures</b>	<b>230,316</b>	<b>230,046</b>	<b>270</b>
<b>CARRYOVER FOR NEXT YEAR</b>	<b>137,053</b>	<b>114,173</b>	<b>(22,880)</b>



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SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

**THREE YEAR FINANCIAL STATEMENT**  
(October 2016)

FISCAL YEAR  
October 1 - September 30

	<u><b>FY17</b></u> (Projected)	<u><b>FY18</b></u> (Projected)	<u><b>FY19</b></u> (Projected)
<b>REVENUE</b>			
Carryover from Previous Year	114,173	117,053	80,408
Fiscal Year's Income	199,750	195,067	191,633
<b>Total Revenue</b>	<b>313,923</b>	<b>312,120</b>	<b>272,041</b>
<b>EXPENDITURES</b>			
<b>Personnel Costs</b>			
Research Fellow - Ryan Nadel; 61.83%	10,162	29,889	29,889
Research Assistant - Barry Brooks; 100%	44,419	44,419	44,419
Clerical Staff - Elizabeth Bowersock; 50%	26,572	26,572	26,572
Research Assistant - Nina Payne; 100%	47,756	47,756	47,756
Graduate Students - PhD/MS	0	9,000	9,000
Student Labor	0	0	0
Employee Benefits (31%)	39,962	46,077	46,077
<b>Total Personnel Costs</b>	<b>168,870</b>	<b>203,712</b>	<b>203,712</b>
<b>Operating Costs</b>			
Travel	10,000	10,000	10,000
Vehicle Mileage	10,000	10,000	10,000
Supplies	6,000	6,000	6,000
Equipment	2,000	2,000	2,000
<b>Total Operating Costs</b>	<b>28,000</b>	<b>28,000</b>	<b>28,000</b>
<b>Total Expenditures</b>	<b>196,870</b>	<b>231,712</b>	<b>231,712</b>
<b>CARRYOVER FOR NEXT YEAR</b>	<b>117,053</b>	<b>80,408</b>	<b>40,329</b>





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SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

**NURSERY COOP**  
**EIGHT YEAR PROJECTED PLANNING BUDGET**  
(October 2016)

	\$10,300	\$10,800	\$10,800	\$10,800	\$11,300	\$11,300	\$11,800	\$11,800
	<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>FY22</b>	<b>FY23</b>	<b>FY24</b>
<b><u>Revenue (000s)</u></b>								
Carryover	114.2	117.1	80.4	40.3	5.8	(30.2)	(66.1)	(93.8)
Income	199.8	195.1	191.6	188.2	196.5	196.5	204.7	204.7
<b>Total</b>	<b>313.9</b>	<b>312.1</b>	<b>272.0</b>	<b>228.5</b>	<b>202.3</b>	<b>166.3</b>	<b>138.6</b>	<b>110.9</b>
<b><u>Expenditures</u></b>								
Personnel/Benefits	168.9	194.7	194.7	194.7	204.4	204.4	204.4	204.4
Student Labor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Graduate Student	0.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0
Travel	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Supplies	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Equipment	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
<b>Total</b>	<b>196.9</b>	<b>231.7</b>	<b>231.7</b>	<b>222.7</b>	<b>232.4</b>	<b>232.4</b>	<b>232.4</b>	<b>232.4</b>
<b><u>Carry Over Balance</u></b>	<b>117.1</b>	<b>80.4</b>	<b>40.3</b>	<b>5.8</b>	<b>(30.2)</b>	<b>(66.1)</b>	<b>(93.8)</b>	<b>(121.5)</b>

<u>Members</u>		
16	Full	\$500 Dues increase to be reassessed every year
1	Associate	½ full dues



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# **FY 2016 ACCOMPLISHMENTS**

**As presented to the Southern Forest Nursery Management  
Cooperative Advisory Committee  
November 9 - 10, 2016**

AUBURN UNIVERSITY  
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

## FY 2016 ACCOMPLISHMENTS

### GOAL A: RESEARCH

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

#### **Methyl Bromide Substitution**

No new studies have been recommended. A couple of watch trials were installed at member nurseries that used higher rates of MBr and propylene oxide as a soil fumigant. If needed, Nursery Cooperative staff can assist member nurseries in data analysis.

*✓ Accomplishment: No new chemistries were introduced into forest-tree nurseries for the 2016 growing season.*

#### **Herbicide Trials**

Herbicide trials will be developed and installed to examine the effects of herbicides on specific weeds and on seedling quality. Several of these are further developments of herbicide studies installed in 2015.

- In response to insufficient weed pressure in 2015 and to acquire additional seedling tolerance information, a container trial will be repeated to test the effectiveness of Pendulum<sup>®</sup> AquaCap<sup>™</sup> on black willow and other weed control, and to test pine tolerance to applications of PAC in container media. Applications will be made weekly during the sowing period to coincide with willow seed dispersal. (Payne/Enebak)

*✓ Accomplishment: Now in the second year of this container trial, PAC was applied at two rates to newly-sown trays of loblolly, longleaf, shortleaf and slash pine at the IFCO Nursery in Moultrie, GA. Timing of sprays was coordinated with estimated willow seed dispersal, so weekly applications were made on each species in order to accumulate as many willow seeds as possible in the studies. In October, counts of willow and other weeds, weed identification, seedling survival and seedling quality measurements were made. This data will be used to evaluate container seedling tolerance to PAC and its effectiveness in willow and weed control. In contrast to the 2015 installation of this*

***trial, adequate willow and weed populations were present in 2016 to evaluate control with PAC. Results of this trial will be included in a Research Report.***

- Two outplanting studies will be installed at Westervelt (AL) and the IFCO nursery/orchard (LA) using container loblolly seedlings: one study will include seedlings treated with Marengo® during the 2015 growing season and the second will include seedlings treated with Pendulum® AquaCap™ during the 2015 growing season. Both studies will be used to compare survivability to non-treated seedlings. The nursery /orchard outplanting site in Louisiana will be part of the Southern Forest Nursery Association meeting nursery tour. (Payne/Enebak)

***✓ Accomplishment: The Marengo® outplanting studies were established near the Westervelt (AL) Nursery and at the IFCO (LA) nursery in December 2015. The PAC outplanting studies were installed at the same times and locations. Field layouts and planting were done by nursery and SFNMC personnel. Maintenance of tests was performed by nursery personnel through the 2016 growing season. In late 2016, measurements of survival and growth will be made, with results included in the PAC and Marengo® Research Reports. The tests will continue to be grown for an additional year to augment first-year data.***

- A study testing multiple post-emergent herbicides for the control of broadleaf weeds, grasses and sedges will be installed at member nurseries of various soil types. These herbicides have been identified by AU Department of Crop, Soil and Environmental Sciences faculty as potential control agents for member nurseries' identified weed problems but have not yet been tested by the Nursery Cooperative. Possible herbicides include penoxsulam, florasulam and trifloxysulfuron. Pine seedling tolerance and herbicidal effectiveness will be measured. (Payne/Enebak)

***✓ Accomplishment: The 18 installations of this study were placed at K&L Forest Nursery (GA), Georgia Forestry Commission's Flint River Nursery, the Weyerhaeuser Nursery near Camden, AL and ArborGen's Nursery near Selma, AL. Low rate applications of three post-emergent herbicides, florasulam used as Defendor™, penoxsulam used as Grasp®, and trifloxysulfuron used as Envoke®, were made at sowing and in over-the-top single applications at 8, 13 and 16 weeks post-sowing in loblolly and slash pine. Visual inspections through the spring and summer revealed stunting of seedlings in applications made at sowing, particularly in the penoxsulam study. Installations were evaluated for weed control in September 2016, and seedling quality from each treatment plot will be evaluated in November as nurseries are in position for lifting. Results will be compiled into a Research Report. As results of seedling tolerance are evaluated, decisions to repeat trials with certain herbicides will be made.***

- Morning glory and other broadleaf weeds in hardwood nurseries continue to be a problem. Trials testing the ability of herbicides to control weeds with directed spray applications in hardwoods will be installed as equipment is available. (Payne/Enebak)

✓ *Accomplishment: No herbicide trials using directed spray applications were installed due to scheduling conflict with member nursery.*

➤ Additional studies not included in the FY 2016 Work Plan approved in November 2015:

✓ *Accomplishment: A third year installation of the original 2014 Marengo<sup>®</sup> trial for willow control in container production systems was completed at the IFCO Nursery in Moultrie, GA, in order to confirm results from previous studies of lower plug weights of treated seedlings. Three rates of Marengo<sup>®</sup> were sprayed over-the-top of longleaf, loblolly, slash and shortleaf seedlings at 6 weeks post-sowing of each species. Willow and weed counts, weed identification, and percent fill of trays were recorded prior to spray application in the spring and again in October. Seedling quality of samples from each installation was measured in October. Additional seedlings from each speciesXrate combination were placed in aerated tanks in October to quantify root growth potential. Results from these RGP tests will be available in November, with all results included in a Marengo<sup>®</sup> Research Report.*

✓ *Accomplishment: In response to requests for control options for goosegrass, a trial of the pre- and post-emergent herbicide sulfentrazone, used under the name Dismiss, was established at one bareroot nursery in loblolly and slash pine. Applications of a low rate of the herbicide were made at sowing and post-sowing at 8 weeks only, 13 weeks only, at 8 and 13 weeks, and at 16 weeks only. Plots were evaluated for weed control in September 2016, although few weeds were present with no goosegrass present in the entire study. Seedling quality from each treatment plot will be evaluated in November when the nursery is in position for lifting. Results will be compiled into a Research Report. As results of seedling tolerance are evaluated, a decision to repeat this trial will be made, as sulfentrazone is listed as controlling or suppressing many of the sedges, grasses and broadleaf weeds that appear mid-season in member nurseries.*

## **Fusiform Rust Control**

A seed treatment study on loblolly will be done using various rates of Proline<sup>®</sup> in conjunction with the US Forest Service Rust Testing Laboratory in Asheville, NC. Current label rates for Proline<sup>®</sup> as a seed treatment on conifer seed were based on the use of tridimefon activity. Label rates for others agronomic seeds are 10-100 x less ai per unit of treated seed. The ability to identify the lowest effective rate for Proline<sup>®</sup> use on conifer seed will decrease pesticide usage. Conifer seed (longleaf, loblolly and slash) will be treated in Auburn and then sown into USFS container systems until germination at which time the seedlings will be challenged with basidiospores of fusiform rust. (April - Nov 2016) (Starkey/ Enebak)

✓ *Loblolly and slash pine seedlings were treated 5 rates of Proline, standard Bayleton and water check to determine the lowest effective rate to control fusiform rust when used as a seed treatment prior to sowing. Bayleton and non-treated seed were included as a positive and negative control. Treated seed were sown at the USFS Rust Testing Laboratory and 6 weeks post sowing were challenged with 30,000 basidiospores of*

*Cronartium quercuum f.sp fusiforme. Seedlings were then cared for by USFS staff and the amount of infection determined by treatment recorded in October. Effects of reduced seed-treatment rates on infection will be compiled into a Research Report.*

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

### **Development of a rapid screening test for the presence of *Fusarium circinatum***

Pitch canker caused by *Fusarium circinatum* is an economically important disease occurring on 47 pine species worldwide. We continue testing this new method on conifer seed and seedlings for the presence of the pitch canker fungus and aim to have this new technology adopted and approved by the International Seed Testing Association (ISTA) as a seed screening method that can then be enforced as an alternative to the current blotter paper method used by seed certification companies, disease diagnostic laboratories and plant inspection agencies. SFWS staff will focus on equipment grants that would allow the purchase of a qPCR such that the system could be used to quantify seed infestation. (Nadel/Enebak)

- ✓ *Accomplishments: The molecular protocol developed to rapidly screen for the presence of Fusarium circinatum in pine seed and seedlings has been submitted to the ISTA for review and approval. Pitch canker screening of seedlot and seedling samples is now a service available to members. In collaboration with SFWS staff we have been able to recently acquire a real time PCR machine that will enable us to now work on quantifying the actual seed infestation using molecular method.*

### **Using Near Infrared (NIR) to Detect Freeze Injury in Loblolly Pine**

Near-infrared Spectroscopy (NIR) was originally developed for use in the pharmaceutical industry and is now used in agriculture, and chemical manufacturing. Recently this technique has found a use in identifying different species of Eucalyptus. Initial testing in both bareroot and container loblolly pine that represents a base line for freeze tolerance (e.g. 7-56, Atlantic Coast, Marion County) will be done with a laboratory NIR machine to develop a baseline for non-injured tissue. Two years of funding has been secured from SFWS to bring on a PhD student, who has been identified and is starting on the project in June 2016. Seedlings will then be subjected to various levels of exposure to freezing temperatures to determine if freeze injury can be detected. If successful, we will try to obtain a portable NIR instrument which has been successfully used in forestry. (June 16 – Dec 2017) (Starkey/Enebak/Via)

- ✓ *Accomplishments: With this initial data, we were able to secure \$44,000 from SFWS to support a PhD student for 2 yrs to examine this process in more detail. After the first student backed-out of the stipend and a delay in the application process for a second student, we will begin on this project January 2017.*

## **Controlled Release Fertilizers in Container Seedlings & Nutrient Status**

This study will be repeated for a second year using the same protocol as this last year. The use of long-term controlled release fertilizers (CRF) (> 14-18 months) will be examined in the production and nutrient status of container seedlings over time. Examples of CRF would be #2 Polyon 16-5-11 and Multicote coated urea. Container sets at IFCO will be seeded with different numbers of prills and seedling nutrient status analyzed at the end of the season. Other participating nurseries will be asked to incorporate a sample of both fertilizers in a small portion of their media by hand. Nutrient status will be measured on seedlings treated with various fertilizers and examined for foliar nutrients after outplanting. Nurseries interested in participating in the experiment include IFCO, River Bend, North Carolina Forestry Commission and Westervelt. (Starkey/Enebak).

- ✓ *Accomplishments: The initial trial results revealed that prior to outplanting the Polyon and Multicote treatment RCD were significantly greater than that of the nursery fertilization control. This trend has continued following outplanting. The two rates of each CRF incorporated with the same container set revealed that all rates of Polyon and Multicote were visually greener and larger than the standard nursery control. Results from these two trials will be repeated in 2016 in addition to being outplanted so as to observe growth differences during seedling establishment.*

## **Monitoring the hardening off of seedlings**

The hardening off of seedlings typically begins with the reduction of irrigation and fertilizer. However, occasionally seedlots that have not reached their target standards are “pushed” into the early fall. If these seedlings have not been properly hardened before shipping, they may suffer freeze injury in the nursery or field that can effect establishment and growth. Monitoring the dry weight fraction of the terminal leader is a method used in colder climates before seedlings are subjected to freezing temperatures. The results have been variable. To our knowledge, this method has not studied for southern species. The dry weight fraction of the terminal leader will be monitored every two weeks beginning in early October until January and correlated with temperatures and foliar analysis. (Starkey/Enebak)

- ✓ *Accomplishments: No progress was made with this proposal this year.*

## **The effect of a new formulation of Thiram on loblolly pine germination**

Last April, a nursery that treats their seed with Thiram reported a significant reduction in germination on their loblolly pine with a new Thiram formulation. This January we will do a seed treatment and germination study in the greenhouse comparing the two formulations of Thiram. (Starkey/Enebak)

- ✓ *Accomplishments: It appears that the SIGNET® 480FS (Thiram) from NUFARM is affecting geotropism of the seedling radical causing the inability of the seed to properly*



*send the radical down into the soil. However, the phototropism is still working causing emerging seedling to try to erect itself. Based on these results, this product should not be used as a seed treatment on loblolly pine seed until we have a more complete picture of what is occurring to the radical. Management Alert 16-01 contains more information.*

**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.**

**The use of drones: Unmanned Aerial Vehicles (UVAs) in seedling production**

Working with the Department of Bioscience in the College of Agriculture, 2 nurseries will be flown over the growing season and the data analyzed to examine the effects of nursery practices on seedling productivity. (McDonald/Starkey/Enebak)

- ✓ *Accomplishments. In April of 2016 some exploratory work using UAS to generate a time series of visible and near-infrared images, tracing the growth and establishment of seedlings at ArborGen's SuperTree nursery near Shellman, GA. The proposal was to conduct flights five times throughout the growing season with the first flight occurring immediately after sowing, but before full germination, and the final flight right before lifting. At each growth stage, two flights were conducted, the first utilizing a Trimble UX5 outfitted with a 24 mega-pixel camera allowing for the generation of high-resolution imagery as well as the creation of 3-dimensional point clouds. The second flight was with Sensefly's eBee Ag carrying a Sequoia multi-spectral camera taking images in the visible as well as the near-infrared part of the light spectrum. The high-resolution visual imagery that was created during each flight allowed for a quick visual analysis of the entire nursery. Since the imagery was high-resolution, it was possible to zoom in closely and look at problematic areas, identifying spots within the nursery that may require additional attention.*

**The availability of prills for PTM use in container seedling production.**

Nursery Cooperative staff will determine the feasibility of fiprinol in prills as a delivery method for insect control in container seedlings. (Brooks/Starkey/Enebak)

- ✓ *Accomplishments. No progress was made with this project this growing season.*

**Objective 4. Further define the “optimal seedling” so as to maximize the cost effectiveness of artificial regeneration forestry systems.**

**The effect of central terminal leader integrity on root growth following outplanting**

In a good year, seedlings that have been outplanted will begin new root growth within six weeks of outplanting. Last year a number of outplanted seedlings were examined from stands having poor seedling performance. There was a consistent correlation in a lack of root growth for those seedlings that had a visibly dead central terminal leader. This study will examine the root growth associated with outplanted seedlings with a central terminal leader and with a central terminal leader that has been killed. This study will be partially done in Plexiglas boxes in the greenhouse and also in the stress facility, in addition to seedlings planted in the Trophotron. (Starkey/Enebak)

- ✓ *Accomplishments: A three levels of planting stress study was undertaken. A low stress (exposed to moderate temperatures and were watered), moderate stress (amount of water was regulated but seedlings were exposed to ambient temperatures) and stressed (no supplemental water and exposed to ambient temperatures). For the study every second seedling had its growing tip burned. Study revealed water and temperature stress had an effect on root and shoot development. Burning the tip resulted in significantly less root weight, shoot weight, new root growth and fewer new white tips when compared to the unburned control. Tip dieback due to freeze injury / drought, significantly affects root growth infield and could also affect survival.*

**Comparison of loblolly root development in two types of Ellepot container trays.**

This is a manufacturer sponsored study. The design of these container trays/systems are very different than more traditional container sets requiring more intensively management irrigation. Seedling quality will be evaluated. These containers are being used in South America. The first phase of this study last year was to compare seedling quality and RGP. This next year we will place seedlings in out Plexiglas boxes and examine root morphology. (Starkey)

- ✓ *Accomplishments: This study began in April 2015, is still underway and will be complete in April 2016. Due to the difficulty in extraction, the Pioneer trays have been excluded from part of this study. Seedling quality will be completed at the end of the growing season with three treatments, two Ellepot® types and control. Final measurements will be taken and information released to the membership in early January 2017.*

## **Chilling Hours and Seedling Storability.**

A meta-data analysis (statistical analysis of data across multiple studies) will be attempted to determine if there is a link to the number of chilling hours seedlings are exposed to and their ability to survive storage after outplanting. (Enebak/Loewenstein).

✓ *Accomplishments. No progress was made with this project this growing season.*

## **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 spring 2013. (Starkey/Enebak)

✓ *Accomplishments: Nursery Cooperative staff participated in 2 conference calls with the MBIP and the CMTF on soil fumigation rules. Nursery Cooperative staff continue to survey members each fall and spring as to their soil fumigation operations. Soil fumigation use, rates, compounds and issues are being compiled for inclusion on the soil fumigation REDs including Telone, which appears to have a lower toxicity ranking than previously reported. These, and other changes, will be part of the new labels, scheduled to appear in 2020.*

✓ *Accomplishments: There was one contact made to Nursery Cooperative staff by USDA in FY 2016 with respect to MBr use under the QPS process of the Montreal Protocol. There was concern that QPS use was “increasing” in forest-tree nurseries. Data*

*supplied by member nurseries indicate that MBr rates have been constant with alternative ai's increasing.*

### **Update of Nursery Label Book**

The Nursery Pesticide Label Book on the Nursery Cooperative's website will be updated to include recent additions of herbicide, insecticide and fungicide labels. (Brooks/Enebak)

- *Accomplishments: The collection and listing of herbicides, insecticides and fungicide labels continues. Labels for herbicides, Insecticides and Fungicides were linked to an Excel Spreadsheet that is available on the Nursery Cooperative Web Page.*

### **Revision of Ag Handbook 473, Hardwood Nursery Guide (Hardwood Manual)**

In collaboration with the US Forest Service and with input from Nursery Cooperative membership, Dr. McNabb and Nursery Cooperative staff will make one last attempt to identify authors for the missing chapters of the Hardwood Manual. If they cannot be completed, we will post the completed chapters on the Nursery Cooperative Web Site for member access. (McNabb/Enebak/Bowersock)

- ✓ *Accomplishments: After a 5-yr hiatus, progress has been made with this project. This Hardwood Manual, revision, funded entirely by USDA Forest Service, edited by Dr. Ken McNabb is back on track. Newly hired Carolyn Pike, USFS – Area Regenerations Specialist out of Purdue University has picked up this process. New authors have been identified for the missing chapters and Ken McNabb has come out of retirement to serve as senior editor. This project's completion is slated for 2017.*

### **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, etc) when necessary. (Enebak/Starkey)

- *Accomplishments: There were no pesticides used in forest-tree nursery production systems that were up for EPA review in FY16.*

### **Maintain and Update Nursery Cooperative Web Site**

The Nursery Cooperative staff will continue to update the Nursery Cooperative website for use by Nursery Cooperative Members and increase the “searchable” status of the Cooperative's data and reports. (Bowersock)

- ✓ *Accomplishment: A compilation of herbicide Research Reports from 1979 to 2016 was developed and distributed to nursery members in paper format at the 2016 Contact Meeting, and also made available as a searchable Excel spreadsheet to interested nursery personnel. This list allows for searches by herbicide common and trade name, weed type, and species tested. (Payne)*

## **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 is in year last year of 5-yr agreement to share seedling production data under a Cite License. For an annual fee of \$10,000, seedling production data will be given to USFS Washington Office for them to use in their planning and reporting programs. Funds are used towards Elizabeth Bowersock's salary to compensate for her time.*
- ✓ *Accomplishments: A proposal that used Nursery Cooperative funds as a match/leverage for Center for Advanced Forestry Systems (CAFS) was approved in April 2016. The Nursery Cooperative will share \$60,000 annually with the Forest Health Cooperative in FY 17 that will go towards Dr. Ryan Nadel's salary.*

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

### **Contact Meeting**

The Nursery Cooperative Contact meeting will be conducted as a 1/2 day program will be held in conjunction with the Southern Forest Nurserymen's Association Meeting in Louisiana, with IFCO hosting the nursery tour in July 18-21, 2016. The agenda will cover presentations by Nursery Cooperative staff on current research activities and results. Details will be worked out with George Hernandez and Jim Tule (IFCO) with meeting information outlined in the Spring 2016 Newsletter. (Enebak/Bowersock)

- ✓ *The 2016 Nursery Cooperative Contact meeting was held on July 18 in conjunction with the Southern Forest Nursery Association biennial meeting in Lake George, LA with IFCO and Campbell Timberlands hosting the nursery tours. The meeting was attended by 43 Nursery Cooperative members and over 120 members of the Southern Forest Nursery Association. Nursery Cooperative staff presented information to the entire group on soil fumigant usage rates over time, weed control and a rapid pitch canker identification tool that is ready for members to participate on. The field trips at this meeting included a tour of the Campbell Global bareroot nursery in Jasper, TX*

*with a demonstration of the UAV capabilities conducted by the Biosystems Engineering Department at Auburn University. Dr. Christian Brodbeck and his team have been flying the Shellman Nursery all summer, gathering information on crop production over the growing season. In addition to the tour in Texas, we also had an opportunity to visit Evans Seed Orchard / Container Nursery operated by IFCO in DeRidder, LA. Special thanks to Tim Stewart and Wayne Bell for their efforts to host the group.*

## **Research Reports (Staff)**

We plan on producing Research Reports and Technical Notes in FY16.

- ✓ *Accomplishments: Nursery Cooperative staff produced 5 Research Reports and 1 Technical Note that covered the following topics.*
- *RR 2016-01 Herbicide tolerance of native plant seedlings in nursery production systems. Enebak and Barnwell.*
- *RR 2016-02 Weed control and herbicide tolerance of established seed production areas of native plant species. Enebak and Barnwell.*
- *RR2 016-03 Pendulum® Aquacap™ (pendimethalin) applications on weed and willow control and tolerance to bareroot and container-grown loblolly and slash pine and buttonbush. Payne, Brooks and Enebak.*
- *RR 2016-04 Effect of rate of over-the-top applications of Marengo® (indaziflam) on weed control and tolerance in bareroot and container-grown pine seedlings and of timing of directed spray Marengo® (indaziflam) applications on weed control and tolerance in pin oak. Payne, Brooks and Enebak.*
- *RR 2016-05 Effect of soil types and temperature of Pendulum® Aquacap™ applications on gall formation in container-grown loblolly pine seedlings. Payne and Enebak.*
- *RR 2016-06 Seedling quality and root architecture of loblolly and longleaf pine container seedlings. Starkey and Enebak.*
- *TN 15-01. Forest tree seedling production in the southern United States for the 2015-2016 planting season. Enebak.*
- *MA 16-01. Seed germination concerns when using Signet 480FS (Thiram) from Nufarm Chemicals. Enebak.*

## **Newsletters**

Newsletter distribution will be planned for March and September 2016. Members are encouraged to submit articles and organizational updates. (Staff)

**2016 Contact and Advisory Mtgs**  
**Nursery Production Survey**  
**Controlled Release Fertilizers**  
**Herbicide Trials**

**CAFS Update**  
**Pesticide & QPS Updates**  
**Drones – UAVs**  
**Seedling Quality Analysis**

**Leadership 101-Millennials**  
**Nursery 101 - Cytokines**  
**20 yrs ago (1996)**  
**Know Weeds – Goose Grass**

**Pitch Canker Screening**  
**Tom Starkey - Retires**  
**Chemical Corp. Mergers**  
**Know Weeds - Annual Sedge**

**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 organization within the Nursery Cooperative as cases arise during the growing and planting season. (Starkey/Enebak)

	<b>Starkey</b>	<b>Payne</b>	<b>Enebak</b>	<b>Nadel</b>
<b>Phone calls</b>	<b>28</b>	<b>40</b>	<b>21</b>	<b>6</b>
<b>Letters</b>	<b>17</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Emails</b>	<b>22</b>	<b>280</b>	<b>31</b>	<b>20</b>
<b>Site Visits</b>	<b>9</b>	<b>48</b>	<b>3</b>	<b>6</b>
<b>Diagnosis</b>	<b>7</b>	<b>1</b>	<b>8</b>	<b>12</b>

#### **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 2015 to 2016 planting season. The survey will be sent out in June 2016. (Enebak/Bowersock)

- ***Accomplishments: A mailing list that 54 nurseries was mailed in May 2016 throughout the southern US to gauge seedling production for the 2015-2016 planting season. Data was compiled and put into Technical Note 16-01 which will be mailed to all participating nurseries.***

#### **Nursery Customer Meeting Presentations**

Over the past several years as schedules and travel permits, Nursery Cooperative personnel have participated 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. 30-minute presentations such as “*Why Did My Seedlings Die?*” and “*The Ten Commandments of Seedling Survival*” are presentation the staff have made.

- ***Accomplishments: There were no requests for special one-on-one meetings or presentations with member organizations in FY16.***

## **Short Course**

With the Nursery Cooperative's short course in Auburn in September 2015, we will hold off for a year or two and revisit the course again in January 2017. The Short course would be offered in September 2017. (Staff)

# **GOAL C: COOP DEVELOPMENT**

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

## **Advisory Committee Meeting**

The FY16 Advisory Committee Meeting will be held on November 10-11, 2016. A 2, half-day meeting will be planned. If there are any meetings that conflict with this time frame, let us know and we can try and accommodate Advisory Members. (Enebak/Bowersock)

- ✓ *Accomplishments: Nursery Cooperative Advisory Meeting will be held in Auburn on November 9-10, 2016, Workplan, Accomplishments and Budget will be shared with membership.*

## **Nursery Cooperative Membership**

The Nursery Cooperative staff will make an effort to recruit new members among those nurseries that will benefit from activities of the Nursery Cooperative. (Staff)

- ✓ *Accomplishment: Provided membership information to one nonmember nursery exhibiting at the national Association of Consulting Foresters conference in June 2016, however, no new members joined for FY16.*

## **Update the Coop Membership and Nursery Directories**

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

- ✓ *Accomplishments: Nursery Cooperative Membership Directories were updated and sent to Cooperative Members in October 2016.*



**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)

*✓ Accomplishment: Nursery Cooperative staff at Auburn University presented 3 talks on nursery related topics to regional and local groups. Topics and Titles are listed below:*

- **Attended and represented SFNMC at the national Association of Consulting Foresters conference in June and at the Forest inSight conference in October. (Payne)**
- **Starkey, T.E. and Enebak, S.A. 2016. Root development and morphological comparisons of container-grown longleaf pine and subsequent productivity after establishment. Center for Advanced Forestry Systems. April 25-28, 2016. Pensacola, FL.**
- **L.G. Eckhardt, R.L. Nadel, E.A. Carter, M.A.S. Sayer and G. Matusick. 2016. Quantifying the impact of pine decline in the southeastern United States. April 25-28, 2016. Pensacola, FL.**

**Publications**

Nursery Cooperative staff is encouraged to publish research results in scientific journals. (Staff)

*✓ Accomplishments: Nursery Cooperative staff at Auburn University published 5 manuscripts on nursery related topics in national and international journals. Titles and journals are listed below:*

- **Harper, R.A., Hernández, G., Arseneault, J., Woodruff, K.J., Enebak, S.A., Overton, R.P and Haase. D.L. 2016. Forest Nursery Seedling Production in the United States; Fiscal Year 2015. Tree Planters' Notes 58:60-64.**
- **Levendis, W., Barlow, B., Kush, J. and Enebak, S.A. 2016. Site suitability for shortleaf pine restoration in the eastern Alabama fall line region, pgs 429-432. In: Proceedings of the 18th biennial southern silvicultural research conference. Eds: Schweitzer, C.J., Wanye, K., and Oswalt, C.M. Gen. Tech. Rep. SRS-212.**

- Matusick G., Nadel R.L., Walker D.M., Hossain M.J. and Eckhardt L.G. (2016) Comparative behavior of root pathogens in stems and roots of southeastern Pinus species. *Fungal Biology* 120, pg. 471 – 480. DOI 10.1016/j.funbio.2015.12.0007
- Poona N., van Niekerk A., Nadel R.L. and Ismail R. (2016) Random forest (RF) wrappers for waveband selection and classification of hyperspectral data. *Applied Spectroscopy* 70 (2), pg.322 – 333. DOI 10.1177/0003702815620545
- Roux J., Germishuizen I., Nadel R., Lee D.J., Wingfield M.J and Pegg G.S. (2015) Risk assessment for *Puccinia psidii* becoming established in South Africa. *Plant Pathology* 64, pg. 1326 – 10335. DOI 10.1111/ppa.12380

### **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: The Southern Forest Nursery Cooperative and the Forest Health Cooperative jointly was awarded a 3<sup>rd</sup> year of a 5-yr proposal period of which \$60,000/year that will be used to direct Nursery Cooperative and Forest Health Cooperative research.*

### **Interaction with other Research Cooperatives**

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

- ✓ *Accomplishments: Attended, served as meeting hosts and presented Nursery Cooperative information at the 2016 Annual CAFS meeting in Pensacola, FL April 25-28, 2016*

AUBURN UNIVERSITY  
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

# **FY 2017 WORK PLAN**

**As approved by the Southern Forest Nursery Management  
Cooperative Advisory Committee  
November 9-10, 2016**

AUBURN UNIVERSITY  
SOUTHERN FOREST NURSERY MANAGEMENT COOPERATIVE

## FY 2017 WORK PLAN

### GOAL A: RESEARCH

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

#### **Methyl Bromide Substitution**

We will establish a replicated Methyl Bromide substitution trial at Rayonier Elberta Nursery, AL. The data collected will include seedling quality, nematodes, weeds and Trichoderma levels prior to and post fumigation. Data will be collected for two growing seasons and treatment plots will be part of the 2018 Southern Forest Nursery Association's annual meeting to be hosted by Rayonier. Products to be tested include Etheylenedinitril, Dominus, Vapam, Ally 33 and propylene oxide. (Nadel/Enebak)

#### **Herbicide Trials**

Herbicide trials will be developed and installed to examine the effects of herbicides on seedling quality and on targeted weeds as reflected in our recent problem weed survey. Several of these are further developments of herbicide studies installed in in previous years.

- Pendulum® AquaCap™ on containerized pine: To gain additional seedling tolerance and targeted weed control information, a third-year container trial will be installed to test the tolerance of 4 pine species in container media to applications of PAC and the effectiveness of PAC on black willow and other weeds. Applications will be made weekly during the sowing period to coincide with willow seed dispersal. (Payne/Enebak)
- Pendulum® AquaCap™ and Marengo® outplanting studies: The four outplanting studies currently in place at Westervelt (AL) and IFCO (LA) nurseries will be continued for one additional growing season to gain additional data. Measurements from these studies will be used to compare survivability and growth of treated to non-treated container loblolly pine seedlings. Outplanting test maintenance is provided by cooperating nursery staff; measurements will be made by either nursery or SFNMC staff. (Payne/Enebak)
- Marengo® in bareroot eastern red cedar: A follow-up trial applying Marengo over-the-top

of eastern red cedar seedlings will be established at the Georgia Forestry Commission's Flint River Nursery. This trial will be used to confirm results of a 2015 study installed at this nursery in which cedar seedlings treated with Marengo® exhibited increased growth characteristics when compared to untreated seedlings. (Payne/Enebak)

- Pendulum® AquaCap™ second application timing trial: In response to concerns from multiple bareroot nurseries over reoccurrence of spurge in late summer (after PAC application was made at sowing), a timing trial of PAC will be installed at several nurseries of varying soil types. This study will be used to determine if PAC applications made at sowing and again at 8, 10, or 12 weeks post-sowing will result in herbicide gall formation or have other effects on seedling quality. A similar timing trial with PAC was made in 2013 without an at-sowing PAC application. (Payne/Enebak)
- 'New' herbicides screening study: A replicated screening study of multiple (up to 20) pre- and post-emergent herbicides for the control of sedges, grasses, and broadleaf weeds will be installed at member nurseries of various soil types to target specific weed problems. Using our recent problem weed survey, faculty of AU Department of Crop, Soil and Environmental Sciences will identify herbicides to include. These herbicides have not yet been tested by the SFNMC but are presently used in either turf or agricultural settings. Pine seedling tolerance and herbicidal effectiveness will be measured. In addition, second-year trials of any of the 4 herbicides tested in 2016 may be installed after seedling quality data are analyzed to quantify seedling tolerance. One of these 4 new herbicides (sulfentrazone) may be used in an additional trial targeting annual sedge. (Payne/Enebak)
- RonstarFlo® (oxadiazon) study targeting annual sedge (*Cyperus compressus*): As a result of increased incidence of annual sedge in both bareroot and container nurseries, a trial of pre- and post-emergent applications of RonstarFlo®, alone and in combination with other preemergent herbicides, will be made. In 2012 and 2013 trials using RonstarFlo®, bareroot pine seedlings exhibited tolerance to the herbicide with good sedge control. (Payne/Enebak) Try this on small set of container loblolly also?
- A survey of member nurseries will be made to document historical and current use of Goal® (oxyfluorfen) products in weed control regimens. This survey is relevant due to the presence of weeds that appear to be more resistant to Goal® in a limited number of our member nurseries.

## **Fusiform Rust Control**

A seed treatment study on loblolly will be done testing new chemistries in addition to using various rates of Proline® in conjunction with the US Forest Service Rust Testing Laboratory in Asheville, NC. Current label rates for Proline® as a seed treatment on conifer seed were based on the use of tridimefon activity. Label rates for others agronomic seeds are 10-100 x less ai per unit of treated seed. The ability to identify the lowest effective rate for Proline® use on conifer seed will decrease pesticide usage. Any potentially new fungicide seed treatment chemistries

will also be assessed in this study. Conifer seed (longleaf, loblolly and slash) will be treated in Auburn and then sown into USFS container systems until germination at which time the seedlings will be challenged with basidiospores of fusiform rust. (April - Nov 2017) (Nadel/Enebak)

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

### **Development of a rapid screening test for the presence of *Fusarium circinatum***

We continue testing this new method on conifer seed and seedlings for the presence of the pitch canker fungus and aim to have this new technology adopted and approved by the International Seed Testing Association (ISTA) as a seed screening method that can then be enforced as an alternative to the current blotter paper method used by seed certification companies, disease diagnostic laboratories and plant inspection agencies. SFWS staff will focus on equipment grants that would allow the purchase of a qPCR such that the system could be used to quantify seed infestation. (Nadel/Enebak)

### **Using Near Infrared (NIR) to Detect Freeze Injury in Loblolly Pine**

Near-infrared Spectroscopy (NIR) was originally developed for use in the pharmaceutical industry and is now used in agriculture, and chemical manufacturing. Recently this technique has found a use in identifying different species of Eucalyptus. Initial testing in both bareroot and container loblolly pine that represents a base line for freeze tolerance (e.g. 7-56, Atlantic Coast, Marion County) will be done with a laboratory NIR machine to develop a baseline for non-injured tissue. Two years of funding has been secured from SFWS to bring on a PhD student, who has been identified and is starting on the project in January 2017. Seedlings will then be subjected to various levels of exposure to freezing temperatures to determine if freeze injury can be detected. If successful, we will try to obtain a portable NIR instrument which has been successfully used in forestry. (Jan – Dec 2017) (Enebak/Via)

### **Controlled Release Fertilizers in Container Seedlings & Nutrient Status**

This study will be repeated for a third year using the same protocol as this last year, but focussed on application rates. The use of long-term controlled release fertilizers (CRF) (> 14-18 months) at different rates will be examined in the production and nutrient status of container seedlings over time. An example of a CRF would be #2 Polyon 16-5-11. Container sets of participating nurseries will be seeded with different numbers of prills by incorporating a sample of the fertilizer, at different rates, in a small portion of their media by hand. Nutrient status will be measured on seedlings treated with various fertilizer rates and examined for foliar nutrients after outplanting. Nurseries interested in participating in the experiment include IFCO, Bellville, River Bend, North Carolina Forestry Commission and Westervelt. (Nadel/Enebak)

### **Literature search on bareroot seedling nutrient loading**

A literature search will be undertaken to determine whether any research has been undertaken on nutrient loading of bareroot seedlings, without the resulting excess foliage flushing. (Nadel/Enebak)

**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.**

### **The use of drones: Unmanned Aerial Vehicles (UVAs) in seedling production**

Working with the Department of Bioscience in the College of Agriculture, UVAs will be flown over the growing season and the data analyzed to examine the effects of nursery practices on seedling productivity in a continuation and confirmation of the 2016 data collection. The ability to count the number of seedlings in a container nursery is imperative. This study will focus on determining the correct software to be used to count individual seedlings from the images obtained from UVAs (McDonald/Enebak/Nadel)

### **Test alternative fipronil chemistries for use in seedling production**

Nursery Cooperative staff will test alternative fipronil chemistries as an alternative to PTM. (Enebak)

**Objective 4.        Further define the “optimal seedling” so as to maximize the cost effectiveness of artificial regeneration forestry systems.**

### **Chilling Hours and Seedling Storability**

Determine the impact of ethylene management on increasing seedling storability and its impact on chilling hours through a one molecule inhibitor of ethylene (1-MCP). Several types of stresses (such as temperature, moisture and nutrient stress) induce ethylene production. Increased Ethylene production has been shown to reduce the growth and survival of several agricultural crops. The AgroFresh Inc. 1-MCP product inhibits the production of ethylene (due to the blocking nature of the molecule) and successfully used in fruit production and storage increasing yields and survivability of such crops. There are potential opportunities for the forestry industry to use such a product (during lifting and storage of seedlings) to increase survivability. This

study we aim to determine what impact the 1-MCP molecule will have of ethylene production of seedlings and whether such a product could aid in increasing seedling storability and out planting success. (Nadel/ Enebak)

A meta-data analysis (statistical analysis of data across multiple studies) will be attempted to determine if there is a link to the number of chilling hours seedlings are exposed to and their ability to survive storage after outplanting. (Enebak/Loewenstein)

## **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 spring 2013. (Nadel/Enebak)

### **Update of Nursery Label Book**

The Nursery Pesticide Label Book on the Nursery Cooperative's website will be updated to include recent additions of herbicide, insecticide and fungicide labels. (Brooks/Enebak)



### **Revision of Ag Handbook 473, Hardwood Nursery Guide (Hardwood Manual)**

In collaboration with the US Forest Service and with input from Nursery Cooperative membership, Dr. McNabb and Nursery Cooperative staff and Carolyn Pike, of the USFS, Purdue will complete the missing chapters of the Hardwood Manual. (McNabb/Starkey/Bowersock)

### **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, etc) when necessary. (Enebak/Nadel)

### **Maintain and Update Nursery Cooperative Web Site**

The Nursery Cooperative staff will continue to update the Nursery Cooperative website for use by Nursery Cooperative Members and increase the “searchable” status of the Cooperative’s data and reports. (Bowersock)

### **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)

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

### **Contact Meeting**

The Nursery Cooperative Contact meeting will be conducted as a 2-3 day program will be held in in South Carolina. ArborGen’s SuperTree Nursery in Blenheim, SC will serve as the host and conduct the nursery tour. Working with Gary Nelson, cooperative trials will be install as part of the outreach component of Nursery Cooperative research. The agenda will cover presentations by Nursery Cooperative staff on current research activities and results during the week of July 10, 2017. Details will be worked out with Gary Nelson with meeting information outlined in the Spring 2017 Newsletter. (Enebak/Bowersock)

## **Research Reports (Staff)**

We plan on producing Research Reports and Technical Notes in FY17.

## **Newsletters**

Newsletter distribution will be planned for March and September 2017. Members are encouraged to submit articles and organizational updates. (Staff)

## **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 organization within the Nursery Cooperative as cases arise during the growing and planting season. (Nadel/Enebak)

### **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 2016 to 2017 planting season. The survey will be sent out in June 2017. (Enebak/Bowersock)

### **Nursery Customer Meeting Presentations**

Over the past several years as schedules and travel permits, Nursery Cooperative personnel have participated 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. 30-minute presentations such as “*Why Did My Seedlings Die?*” and “*The Ten Commandments of Seedling Survival*” are presentation the staff have made.

### **Short Course**

With the Nursery Cooperative’s short course in Auburn in September 2015, we will hold off for a year or two and revisit the course again in January 2017. The Short course would be in September 2017. (Staff)

## **GOAL C: COOP DEVELOPMENT**

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

### **Advisory Committee Meeting**

The FY18 Advisory Committee Meeting will be held on November 9-10, 2017. A 2, half-day meeting will be planned. If there are any meetings that conflict with this time frame, let us know and we can try and accommodate Advisory Members. (Enebak/Bowersock)

### **Nursery Cooperative Membership**

The Nursery Cooperative staff will make an effort to recruit new members among those nurseries that will benefit from activities of the Nursery Cooperative. (Staff)

### **Update the Coop Membership and Nursery Directories**

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

**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)

### **Publications**

Nursery Cooperative staff is encouraged to publish research results in scientific journals. (Staff)

### **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)

### **Interaction with other Research Cooperatives**

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