Southern Forest
Nursery Management Cooperative
Spring 2015

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Director's Report

Another winter and lifting season has gone by since our last newsletter. If you have had anything like we've had in Alabama, things are wet, cold, and perhaps frozen, which can only be slowing things down for everyone involved in tree planting and lifting. Some of the chatter we've heard is that coolers are full of seedlings as everyone tries to get the seedlings out of the ground in anticipation of the planters coming to get them. Prior to the wintery weather, all of the nursery studies were taken down and data collected this past and are being put into Research Reports that will be published this year. A special thanks to Barry Brooks and Nina Payne for their efforts this past winter to measure and process all the studies that were installed. New studies have been worked out and those are getting ready to be installed this spring as outlined in the Work Plan approved last November. Watch your e-mail for specific announcements concerning the Contact meeting that is planned for July 27-30, 2015 and the Nursery Management Short Course in early September 2015. A lot of nursery related research was finished last fall and there are a few pesticide issues looming on the horizon. We continue to work on the soil fumigant issue with respect to the re-registration of those pesticides. Many of these topics are discussed in more detail below which I encourage everyone to read and digest carefully.

2015 Contact Meeting

The 2015 Nursery Cooperative Contact meeting is scheduled for Monday July 27-30, 2015 in St. Simons Island, Georgia. The meeting begins with a social Monday evening with the 2.5 day meeting will be in conjunction with the Auburn University Forest Health Cooperative. As is the normal practice we will have an indoor session of Nursery Cooperative and Forest Health Cooperative Staff presenting their most recent research findings and are working with Kyle Owens, Doug Sharp, Angela Hall of Plum Creek for the nursery and forest tour. Put that week on your calendar so that you can plan to attend.

2016 Advisory Meeting

The FY 2016 Advisory meeting is scheduled for Wednesday and Thursday, November 11 & 12, 2015 at the School of Forestry and Wildlife Building at 602 Duncan Drive. Place those days on your calendar and more information will be available in the Fall Newsletter.

Nursery Management Short Course

The Nursery Cooperative staff is once again offering the Nursery Management Short Course to Nursery Cooperative Members in Auburn at the School of Forestry and Wildlife Sciences Building on campus. We are scheduled to begin at 1:00 PM on Tuesday, September 8 and finish around noon on Friday, September 11, 2015. The short course is designed to provide training in the basic and applied aspects of forest tree nursery management as practiced in the southeastern U.S. The target audience is newly hired nursery managers as well as technicians and crew supervisors that might benefit from an understanding of the biological and administrative principles behind management decisions. The registration fee is $285 per person, and can be paid at the door, by check, cash or credit card. We are working with the various states to determine Continuing Education Credits and Pesticide points for the Short Course. We'll pass them onto you as soon as we get them approved and will have the necessary forms for attendees to fill out at the meeting in September. Please pass this information onto others in your organization that may be interested in attending.

QPS

Back in October 2014, there was a

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concerted effort to get the QPS regulations under the control of the USDA – APHIS and out of EPA jurisdiction. Some of you wrote letters in support of this legislative action, unfortunately, this legislation was stalled in congress and nothing was changed either way. Thus, there is nothing to report as EPA and the State Department continue to support QPS use in the United States and all seedling producers should continue to have access to MBr under the QPS rules.

Nursery Production Survey

Now into our 12th year, the Nursery Cooperative will survey regional seedling production for 2014 and will survey as many nurseries as possible to obtain a complete and accurate picture of production levels. This mail-out survey will be sent in early June and I ask that you help us out and return the survey back to us. Last year's results (2013) are published as Technical Note 14-03. This can be accessed on the Nursery Cooperative Web site or drop Elizabeth Bowersock a note (334.844.1012 or bowerep@auburn.edu) and she'll see that you get a copy. This year's report highlights that collectively, the forest-tree nurseries surveyed in the southern United States produced 792,579,000 bareroot conifers, 191,119,000 container conifers, 28,703,000 bareroot hardwoods and 1,562,000 container hardwoods during the 2013-2014 growing season. The total forest-tree seedlings produced in 2013-2014 was 1,013,964,000 seedlings and ends the four straight years that the southern region of the United States produced fewer than 1 billion seedlings annually for reforestation. The increase of 3.4% in seedling production this past planting season continues to increase, ending a downward trend of seedling production that started in 1998. The overall trend of seedling production for all species and stock type is shown in Figure 1. Seedling production by state for the previous two years is outlined in Table 1.

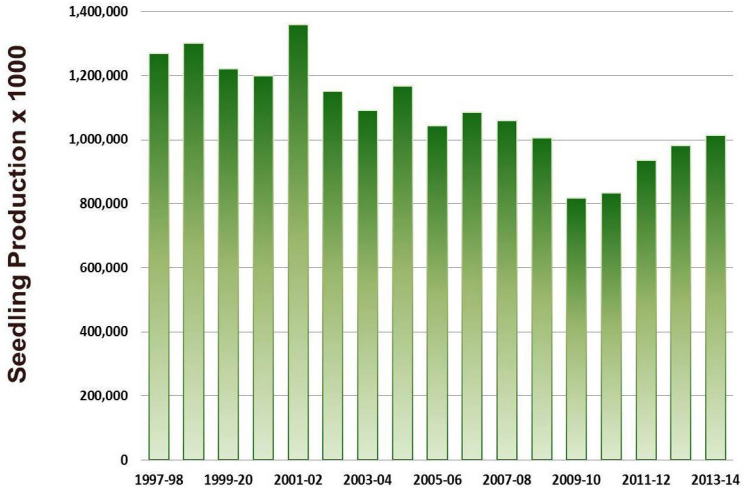

Figure 1. Seedling production (x 1000) for all species and stock types in the southern United States; 1997-2014.

Table 1. Seedling production by state for all species and change from previous year's production.

	2013-2014 Production (x 1000)	Rank	% Change Previous Year	2012-2013 Production (x 1000)	Rank	% Change Previous Year
Alabama	118,015	3	17	101,279	4	15
Arkansas	111,419	4	6	104,877	3	5
Florida	42,456	8	24	34,024	8	-5
Georgia	324,944	1	3	316,125	1	4
Louisiana	14,503	10	-31	20,880	10	-33
Mississippi	83,145	6	-8	90,082	5	2
N. Carolina	72,800	7	11	65,869	7	4
Oklahoma	2,818	12	-29	3,974	12	-6
S. Carolina	123,132	2	0	122,752	2	12
Tennessee	7,603	11	13	6,728	11	-6
Texas	83,891	5	-5	88,280	6	12
Virginia	29,234	9	12	26,072	9	1

Pesticide News

Risk-Mitigation of Soil Fumigants – Phase II. EPA and the registrants continue to gather data on the second phase of risk mitigation as to how well the buffer zones and new application rules are working for growers and applicators. I want to thank everyone who responded to Barry Brooks' request for soil fumigation information that has been conducted so far. That information is being compiled into a table and will be used to address EPA's concerns on bystander safety as they work on the re-registration rules.

Herbicide Trial Updates

During the 2014 field season, the Nursery Cooperative staff installed two different herbicide trials in member nurseries. This past winter, the final weed and seedling measurements have been completed and the results of these will be published as Research Reports. A brief summary of each trial is discussed below:

Looks Can Be Deceiving! Last fall, after visual inspections of our Marengo® trials at IFCO's Moultrie, Georgia nursery, I was busy congratulating myself on a successful study to control black willow seedlings in container-grown seedlings. This trial was installed on loblolly, longleaf, shortleaf and slash pine using three different rates of Marengo® applied only in June, only in July, or in a double application made in both June and July. In the field, we observed that black willow seedlings had been either killed, burned back or stunted at all rates and application times. In addition, there was a noticeable absence of other weeds in the treated container trays when compared to non-treated control trays. Most importantly, as far as tolerance to the herbicide, the treated seedlings appeared to be as healthy as those in the non-treated control trays.

However, when we began collecting seedling samples for evaluation, some detrimental effects of Marengo® became evident. Most noticeably was that when we tried to extract longleaf pine from the container, the root plug fell apart. Also, several species showed slight stem swelling at ground line. Further analyses in the Nursery Cooperative laboratory showed that the effect of Marengo® on seedling quality is species-dependent. The herbicide had no negative effects on shoot height or dry weights of loblolly or slash pine when compared to the non-treated control seedlings. However, shortleaf pine was less tolerant than loblolly or slash pine but treatment effect was not consistent across rate and time of applications. In contrast, treated longleaf seedlings had shorter shoots, smaller shoot and root weights and smaller root collar diameters than those of non-treated seedlings, indicating a negative effect by Marengo® on longleaf pine.

In another test (Root Growth Potential - RGP) of Marengo's effect, samples of seedlings treated in both June and July of each tree species were placed in water tanks for one month to induce white root tip growth. Differences in the quantity of new white root tips between the two treatments (treated vs. non-treated) would be a good indication of root growth potential. Ideally, one would like the treated and non-treated seedlings to have the same RGP, e.g. the herbicide had no effect on the ability of the seedlings to produce new roots. At the end of the four week RGP trial, few new root tips were present on the non-treated control and treated seedlings. Typically, one can expect tens, if not hundreds of new white root tips to form in an RGP test. In these trials, most of the seedlings had less than 10 new white root tips. One possible explanation for the lack of white root tip growth is that there may have been residual herbicide in the root plugs, and because all four rates (control, low, medium and high) were placed into one tank together, any residual herbicide would have affected all seedlings in that tank. Therefore, the root growth potential (RGP) test was inconclusive and will need to be repeated.

In addition to the smaller root growth observed in the longleaf pine seedlings, stem swelling in other species at the ground line was observed as seedlings were being collected. While measuring seedlings in the laboratory, a stem swelling rating was assigned to each seedling ranging from 0 to 3 (0=none, 1=slight, 2=moderate, 3=severe). As the rate and number of herbicide applications increased, loblolly, shortleaf and slash all exhibited swelling. Slash pine was the most susceptible to the herbicide's effect on stem swelling, with severe swelling at the highest rate. Stem swelling on longleaf was more difficult to determine and identify due to its stem morphology.

This Marengo trial was successful in that it provided some answers on the ability to control willow seedlings in containerized production systems. Black willows were controlled when Marengo® was applied early when willow seedlings were small. However, there are some detrimental effects of the herbicide that are species-dependent. These results can be found in a forthcoming Research Report. We plan to continue this container study this year as well as expand it to bareroot nurseries. Also, there are plans to install a container study using applications of Pendulum® AquaCap™ at sowing to determine if it can control black willow.

Shifting Gears. This year's trial to study the control of moss with Ecotec® and TerraCyte®PRO initially began as a liverwort control study using Sporatec®. None of the member nurseries had a sufficient liverwort population last year to determine efficacy, but the North Carolina Forest Service had previously used Sporatec® for moss control. Then we learned that the manufacturer of Sporatec® had discontinued its production and suggested a replacement product, Ecotec®, which contains a similar ingredient (rosemary oil).

The study was installed at the North Carolina Forest Service's Linville River Nursery in Newland over Frasier fir in the greenhouse. Applications of Ecotec® and TerraCyte®PRO at two rates (low and high) were made in June 2014 and then half of the treated trays were treated again in July 2014. Cell counts of moss present were made at the initial treatments and at the end of the trial in December 2014. Random seedling samples from each tray were collected and evaluated for effects of either product on Frasier fir.

The amount of moss within the container trays indicated that neither product was effective in eradicating moss. There was some evidence that multiple treatments slowed the rate of spread of moss when compared to single applications. More frequent applications (weekly vs monthly) may be needed to keep the moss growth in check. Frasier fir was not negatively affected by Ecotec® or by the low rate of TerraCyte®PRO. However, at the high rate of TerraCyte®PRO, a trend was seen in lower seedling height, RCD, and shoot and root weight.

Control options include controlling seedling irrigation, applying chemical treatments early before the moss population can become established, and incorporating slow-release fertilizer into the media. These actions may help to reduce the problem of moss in containers. **-- NDP**

Research News

Comparison of Loblolly Pine Grown in Six Container Types

The second phase of the Plexiglass Box Trial discussed at the 2014 Contact Meeting in Williamsburg, VA was initiated to compare seedling quality over a 4 month time period. Briefly, in April 2104 Loblolly pine (7-56) was sown by a container nursery into six different containers with the same artificial media. All seedlings were grown using standard nursery practices. The specific cell characteristics of each container are outlined in Table 1 and are coded as C1 through C6.

Table. 1 Specifications of containers used in study.

	C1	C2	C3	C4	C5	C6
Seedling/sq foot	49.4	51.7	49.0	52.0	52.0	54.0
Cavity Diameter (in)	1.40	1.50	1.60	1.55	1.55	1.50
Cavity Length (in)	5.9	4.7	3.4	5.3	6.0	5.0
Cavity Volume (ml)	108	110	93	110	131	113
Cavities/tray	115	128	120	128	128	135
Chemical root pruning?	Yes	No	No	No	No	No
Side root pruning holes?	No	Yes	No	Yes	No	No
# root pruning holes	0	8	0	4	0	0

Beginning in September 2014 and continuing each month through December, seedlings were collected from the nursery, returned to Auburn University, where seedling quality, including root collar diameter (RCD), height and root growth potential (RGP) were measured and analyzed. In December 2014, seedlings were outplanted in Moultrie, GA and Evans, LA in a randomized block design replicated five times. Survival and growth will be monitored at both locations over the next year.

Table 2. Seedling quality data by container type and date.

	September			October		
Container	RCD (mm)	HT (cm)	WRT	RCD	HT	WRT
C1	3.8 A	30.8 B	32.0 AB	3.9 AB	30.3 AB	41.6 A
C2	3.2 D	28.4 C	37.5 AB	3.7 BC	30.3 AB	44.1 A
C3	3.3 CD	26.6 D	44.7 A	3.5 C	28.9 C	33.7 A
C4	3.5 B	29.7 BC	46.1 A	3.6 BC	31.4 A	42.0 A
C5	3.4 BC	28.5 C	33.3 AB	3.9 A	28.7 C	39.4 A
C6	3.7 A	32.7 A	27.9 B	3.8 AB	29.9 B	36.1 A

	November			December		
Container	RCD	HT	WRT	RCD	HT	WRT
C1	4.9 A	30.2 C	50.7 BC	4.9 A	32.9 A	57.3 A
C2	4.3 B	32.4 A	51.1 BC	4.3 B	34.1 A	43.2 BC
C3	4.0 C	32.3 A	42.3 C	4.2 B	34.0 A	33.0 BC
C4	4.4 B	31.8 AB	64.5 A	4.3 B	33.0 A	45.1 AB
C5	4.2 BC	30.0 C	57.0 AB	4.3 B	29.4 C	41.1 BC
C6	4.2 BC	31.0 BC	54.1 ABC	4.2 B	31.4 B	30.1 C

Seedling RCD seedling height and RGP (WRT = # of white root tips) for the four month trial is outlined in Table 2. The type of container had no effect on any of the seedling quality parameters measured (Table 2). The number of white root tips and the RCD between container sets and over time are shown in Figures 1 and 2.

Container C1 was the only container type that showed a correlation between sampling date and RCD and white root tips with RCD and RGP increasing over time. If the last sampling date (December) is a bench mark of potential field performance using number of white root tips, C2, C3, C5 and C6 had significantly fewer white root tips than C1.

Summary: Based on the seedling quality measurements collected, none of the container types could be categorized as a "poor" performer. The seedling outplanting phase of this study will show if there is long-term impact between container type in survival or performance.

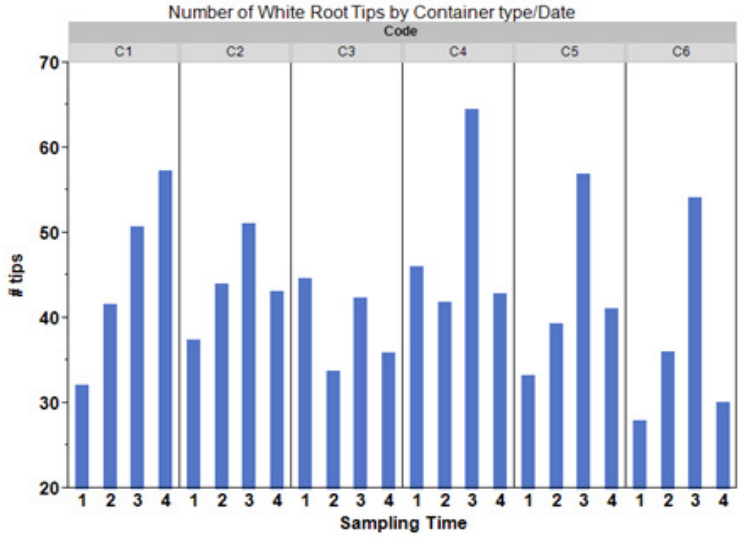

Figure 1. Number of white root tips, a measure of root growth potential (RGP) by container and date. Sampling time 1 = Sept., 2=Oct., 3=Nov., 4=Dec.

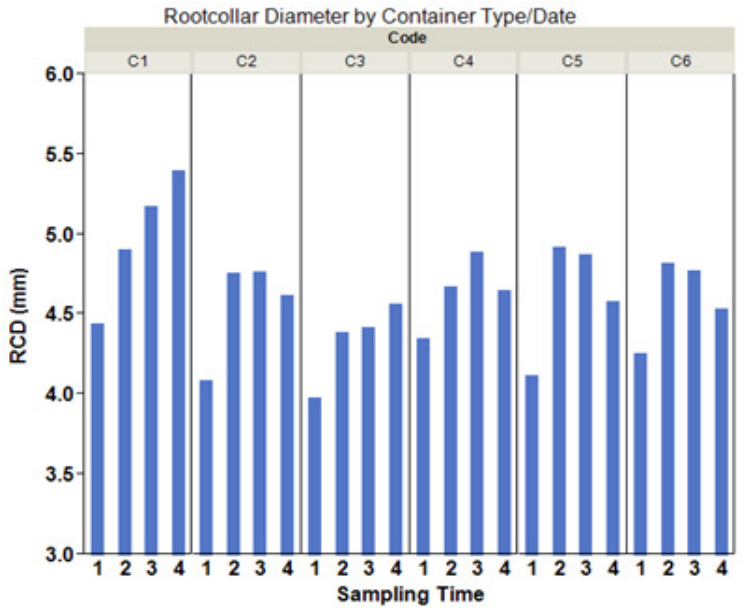

Figure 2. Root collar diameters (RCD) by container and date. Sampling time 1 = Sept., 2=Oct., 3=Nov., 4=Dec.

Can Seed Dye Affect Germination?

In early 2013 Nursery Cooperative staff began a series of studies on the use of seed polymers as a possible replacement for latex used in seed treatment for sowing. Studies with CF Clear from BASF indicated that this product was effective in evenly distributing and holding seed treatments on the seed. In the series of studies trying to duplicate nursery protocol one of the treatments, was the addition of a colorant to the seed as is frequently done by many nurseries. Seed dyes aid production by

increasing seed visibility during the sowing operation and later during sowing checks/history plots. Following an initial study using Beckunderwood Red, we were surprised to see a reduction in seed germination over then non-treated control seed. Following these results, a number of nursery managers were queried to see if this germination reduction had previously been observed. The most common response received was "*We have never done a study at our nursery to determine if the dye effected germination.*" However, one Nursery Cooperative member had conducted small test the previous growing season and noticed a similar reduction in germination. The following year they substituted Tempera paint without any negative germination. Tempera paint is a fast-drying painting medium consisting of colored pigment mixed with a water-soluble binder medium usually in a glutinous material such as egg yolk. Tempera paint is what most of you used to paint model cars planes or posters as a child.

Following these germination reduction observations, a replicated study was conducted on slash pine looking at several seed treatments, two of which contained Beckerunderwood Red. These trials indicated that the two treatments containing Beckerunderwood Red (Becker Red) significantly reduced germination of slash pine. The graph and data from that study are shown in Figure 1 and Table 1.

At this point we contacted all Nursery Cooperative managers describing our results and suggesting that any nursery using this product should set up a small test to verify the results. At the 2014 Nursery Cooperative Advisory Meeting a study was proposed to look at several commercial seed dyes. Due to the time critical need (prior to spring 2015 sowing) it was agreed that this study be completed in the greenhouse before the 2015 sowing season. Following is a summary of those results and an explanation as to why some seed dye may effect germination of nursery seed: Longleaf, slash, shortleaf and two seedlots of loblolly pine differing in germination were stratified, treated and sown in heated germination flats in the greenhouse and replicated 4 times (Figure 2).

The commercial dyes chosen for this seed germination study are listed in Table 2 on the following page.

Germination was recorded at the same time daily until approximately

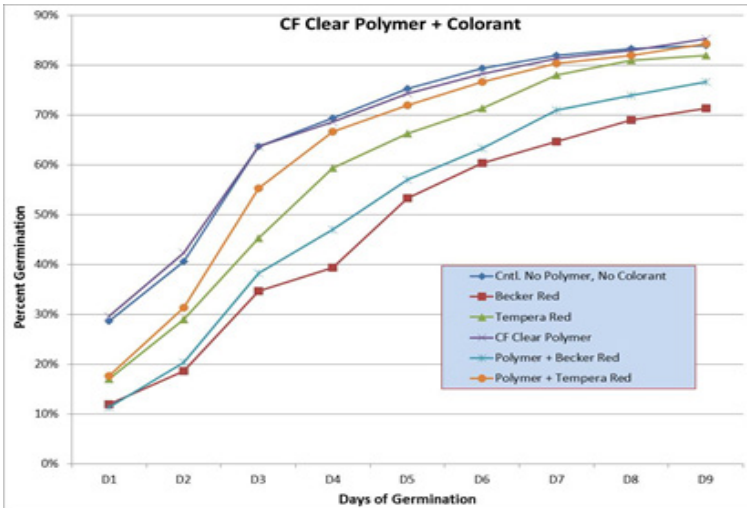

Figure 1. Germination of slash pine seed following seed treatment

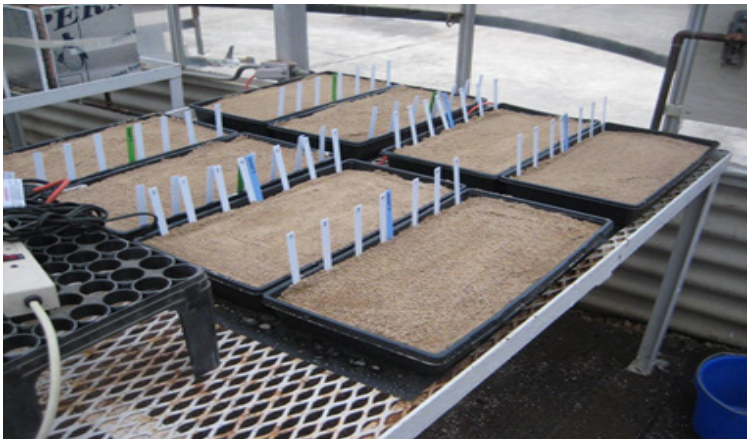

Figure 2. Seed flats of treated pine seed.

85- 90% of the seed had germinated. Treatment data was analyzed, put into a Power Point presentation and distributed to the Nursery Cooperative members in early February. If you did not get the results of this study, please contact Tom Starkey.

In summary:

- Beckerunderwood Red showed a reduction in germination over the non-treated seed. Caution is urged with this product. Try small seedlots. Collect germination data in your nursery situations.
- The powered dyes were harder to apply to seed than the liquid dyes.

Table 1. Germination of slash pine seed by day following seed treatment

Treatment	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
CF Clear Polymer	30% A	42% A	64% A	69% A	74% A	78% A	81% A	83% A	85% A
Control	29% AB	41% A	64% A	69% A	75% A	79% A	82% A	83% A	84% A
CF Clear + Tempera Red	18% ABC	31% AB	55% AB	67% A	72% A	77% A	80% AB	82% AB	84% A
Tempera Red	17% BC	29% AB	45% AB	59% A	66% AB	71% AB	78% AB	81% AB	82% A
CF Clear + Becker Red	12% C	20% B	38% C	47% B	57% B	63% BC	71% BC	74% CB	77% AB
Becker Red	11% C	19% B	35% C	39% B	53% B	60% C	65% C	69% C	71% B
lsd 0.05	*12%*	*14%*	*13%*	*11%*	*12%*	*9%*	*9%*	*8%*	*8%*

- The Prism Scarlet from Precision Lab had consistently good germination. Try small seedlot tests in your nursery situation. At least one nursery manager currently uses this dye on all their seed
- The liquid dye from Chromatech, "Chromatint Red X_3353 Dispersion" dramatically reduced germination. When the company was informed of our results I received the following email: *"Our technical director just returned from vacation and looked at your results. After investigating, he discovered that a biocide was added to the dispersion by accident. This is what affected the germination of the seeds."* These colorants could be tested again without the biocide.

A working hypothesis as to why seed dye may impact the germination of forest nursery seed:

- When dyes are used on agricultural seeds the internal moisture of the seed is less than 10% since agricultural seeds are not commonly stratified (soaked and stored) prior to sowing. In the nursery industry, seed, (which is also less than 10% moisture), is soaked in water from 4 to 24+ hours raising the internal moisture >30% , and placed in a refrigerator for up to 45 days during which time the internal biochemical and physiological process necessary for germination begin. Then prior to sowing, the seed is treated with fungicides, maybe a repellant, seed dye and a coating agent.
- It is possible that the dye may be absorbed into the seed coat and thus interfere with the ongoing germination process. One seed specialist suggested acetic acid used in the manufacture of certain dyes as a possible culprit of reduced germination.
- Realize that anything added to stratified seed may potentially alter germination **-- TS**

Table 2. List of commercial dyes used in seed germination study.

Dye (TRT) Number	Name	Company	Form
1	FD&C Red #40	Organic Dyestuffs	Powder
2	Orcobrite Pigment Red Bryn 6002	Organic Dyestuffs	Liquid
3	Prism Scarlet	Precision Lab	Liquid
4	Chromatint Red X_3353 Dispersion	Chromatech	Liquid
5	FD&C Red 40 Dustmaster 2000	Chromatech	Powder
6	Red	Beckerunderwod	Liquid
7	CONTROL (WATER)		

Confirmation and Development of a Rapid PCR Screening Test of Seed and Plant Material

Internationally, Pitch Canker is one of the most detrimental diseases in terms of pine tree mortality, caused by the fungal pathogen *Gibberella circinata* (anamorph *Fusarium circinatum*). As this pathogen is transmitted on both pine seed and seedlings, seed certification is required to indicate the absence of the pathogen when seed is to be exported. The USDA Forest Service Resistance Screening Center in Asheville, NC uses the International Seed Testing Association (ISTA) protocol for pine seed certification.

The currently approved ISTA seed certification method is both time consuming and often results in false negatives when testing for the presence of *G. circinata*. A faster yet more accurate method of identifying the pathogen was required. The main aim of this project was to develop a rapid screening protocol for the presence of *G. circinata*, the causal agent of pitch canker on both seed and plant material. Objectives of the project include (1) To identify PCR primers within the *G. circinata* that are specific to this species. (2) Develop a rapid screening protocol that would positively confirm the presence or absence of the pathogen on pine planting material that can be used for pest risk assessment of the invasive fungal pathogen.

To date a rapid molecular technique, using specific primers, has been developed. We have shown that these primer are effective in accurately identifying *G. circinata* on both seed and planting material (Figure 1). In addition, the DNA extraction and PCR amplification protocol has been optimized and currently being used to screen the 162 seed lots collected from across the entire Southeastern US (10 States), representing 8 of the most commonly planted pine species. Using this technique, preliminary results indicate the detection of the pathogen in 14% of Loblolly and 10% of Slash seed lots screened.

Contact has been made with the International Seed Testing Association (ISTA) to ensure that the developed protocol is tested in accordance their certified screening protocols. For this purpose all collected seed lots are concurrently be screened using an ISTA approved and certified methods for comparison purposes. In accordance with the ISTA the detection limits for the rapid detection protocol are now being determined.

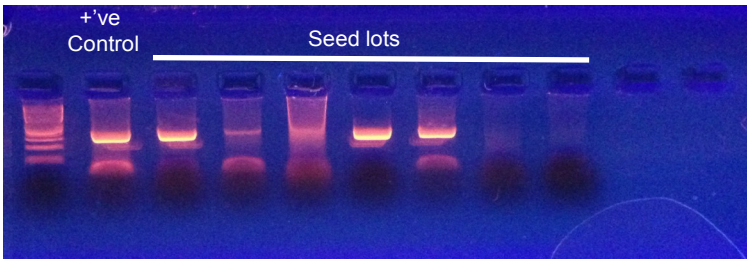

Figure 1. PCR amplification for the presence of *G. circinata* from pine seed lots tested to determine the efficacy of the molecular identification protocol. A 2% agarose gel shows either the presence or absence of a band after PCR.

Can Eucalyptus Be Planted Deep?

Several years ago the Nursery Cooperative staff evaluated a container eucalyptus outplanting failure. We observed three possible causes for the failure. First, the seedlings were planted in June. Second, the seedlings were not "balanced" (shoot :root) as the root weight ratio was much less than expected due to shoots that ranged up to 20" tall. Third, the seedlings were planted no more than 1" deep.

After discussing the results with the company, we learned that the company previously had fairly good success planting in June in past years due to the predictable rain showers. However, this particular year the weather had unexpectedly turned dry. Further discussion with this company and other eucalyptus growers revealed that there are no industry standards for eucalyptus seedling quality. As long as the root ball held together when extracted from the container, the shoot height was not a major concern. When we questioned the company about the shallow planting we were told that the standard practice was to plant eucalyptus not more than 1"deep. This planting depth appears to be a common recommendation from other reports.

Since the Nursery Cooperative and members had good success with planting conifer seedlings deep we initiated a two-year study to determine if eucalyptus could also be planted deep. Both years the company supplied us with similar quality 18" tall *Eucalyptus benthamii*.

2013 Trial: Seedlings were planted in the Auburn University Seedling Stress Boxes and the Trophatron in a soil of nearly 100% sand. Thus, the soils would be considered well-drained and light. Seedlings were planted in a replicated randomized complete block design with two treatments; seedlings planted at the top of the root ball (shallow) or approximately 9" (approximately ½ of the shoot) above the root ball (deep).

2014 Trial: Seedlings were planted in a non- pine crop area at the ArborGen SuperTree Nursery in Selma, AL where the soil type was a Wickham fine sandy loam. Thus, the soils would be considered, poorly drained and heavy. Seedlings were planted in a replicated randomized complete block design with the same two treatments; shallow at the root ball and deep. The deep planted seedlings were planted above the root collar as far as the soils and the planting tool would allow.

In both trials, root collar or ground line diameter, height and survival were measured three times during the growing season from May to October. At the end of the study, seedlings were removed at the ground line and shoot biomass was determined.

The results of the 2013 Trial (sand) were presented at the 2014 Advisory Meeting in Auburn (https://nurserycoop.auburn.edu/membersonly/Meetings/Advisory/FY2014/Spolidorio-Eucalyptus Study Presentation_Advisory Meeting_2013.pdf).

The results of both trials will be combined and presented in a 2015 Research Report.

In the 2013 Trial, Eucalyptus growth was greater in the deep planted seedlings compared to the shallow planted seedling. A measure of seedling volume growth showed that deep planted eucalyptus had nearly 12% and 8% more volume at the end of the season in the Trophatron and Seedling Stress Boxes respectively. There was no difference in seedling survival between the two planting depths.

In the 2014 Trial, the poorly-drained soil resulted in muddy conditions at time of planting and added an additional stress factor. The 2014 Trial had 4 replications of 3 rows of 10 seedlings of each treatment (deep vs shallow). The shallow seedlings were easier to plant, with the deep seedlings more difficult to reach desired depth. Also, the soil conditions at the time of planting made assuring good root to soil contact in the deep planted seedlings presented more of the challenge. Survival of Eucalyptus seedlings at the end by treatment and replication is show in Table 1. There was a wash-out area with in replication 2 which may have account increase in the number of dead seedlings.

Table 1. Mortality by Replication

Replication	Deep	Shallow
1	6	9
2	10	4
3	5	3
4	5	5
Total	**26**	**21**

Three times during the 2014 growing season (May 2, Jul 9 and Oct 16) seedling height and ground line diameter were measured for each living seedling (Table 2). To compare seedlings, the average volume for each treatment and time was calculated (Table 3).

Table 2. Height and ground line diameter for each treatment at three times during growing season

	2-May		9-Jul		16-Oct	
Treatment	**Height (in)**	**[1]GLD (mm)**	**Height (in)**	**GLD (mm)**	**Height (in)**	**GLD (mm)**
Shallow	18.2*	3.7*	24.3*	5.7*	37.3	12.1
Deep	14.7	3.1	19.8	4.0	36.0	11.7
Pr>F	**0.003**	**0.002**	**0.002**	**0.003**	**0.52**	**0.59**

[1]GLD is ground line diameter.
*Indicates significant difference at alpha = 0.05

The shallow planted Eucalyptus seedlings had greater seedling volumes than the deep planted Eucalyptus seedling for the May and July sampling periods. However, by the end of the season in October, there were no differences between the shallow and deep

planting treatments for seedling height, GLD and volume.

In the 2013 Trial, by season end, the volume of the deep planted Eucalyptus seedlings exceeded the shallow planted seedlings.

Table 3. Volume calculation for three times during growing season.

	Volume (cm^3)		
Treatment	**2-May**	**9-Jul**	**16-Oct**
Shallow	2.00*	6.65*	61.18
Deep	1.16	2.70	64.30
Pr>F	**0.0008**	**0.003**	**0.82**

*Indicates significant difference at alpha = 0.05

From these two studies, it appears that deep planting Eucalyptus seedlings may be an option as the benefits of deep planting are that the root systems are closer to a source of water which can increase the survival and growth of the seedlings. **-- TS**

Year 1 Results: Bareroot and Container Seedling Quality Analysis

In the Fall 2014 Nursery Cooperative Newsletter, the efforts to provide member nurseries with an evaluation of seedling quality was brought forward. For years the Oregon Nursery Technology Cooperative (NTC) provided an evaluation of various seedling quality parameters to their members. However, when the NTC phased out their operations a couple years ago, these assessments of seedling quality were no longer available. This type of information falls within our Nursery Cooperative goal to provide research toward increasing nursery productivity. We began evaluating seedlings this past December to February, providing a two-page report for each sample. You can refer back to the Fall 2014 Newsletter for a sample of the type of report and analysis provided.

The following table summarizes the number of reports provided for the 2014 growing season:

Stock Type	Pine Species	Number of Nurseries	# of Reports
Bareroot	2	8	178
Container	1	4	61
	Total	**12**	**239**

We hope that your organization will continue to take advantage of this research service in the future as the information provided for each seedling sample can provide valuable information. Each report provides numerous statistics as to measures of central tendency, sample variation and seedling parameter ratios. Histograms of root collar diameter, height and the height:diameter ratio frequency are also provided.

How can your organization use this data? The underlying premise that validates these reports is the assumption that the samples a nursery provides are truly a random sample of that particular seedlot. If a nursery selectively removes small or overly large seedlings then the data is biased and the results do not truly represent that seedlot.

To provide the most valuable data for comparison, all the seedlings should arrive within a "short" time frame. Seedlings collected and analyzed in December will not allow some important comparisons such as root collar diameter or root biomass to seedlings collected in February. If all seedlings are collected (or even stored in the cooler at the nursery) and shipped to us over a 2 to 3 week period, the number of possible comparisons will be greater. Below are some bullet points of possible comparisons and uses your organization may want to consider with respect to seedling quality provide by these reports.

Possible Comparisons & Uses:

- Compare the same seedlot grown at different company nurseries
- Compare the same seedlot grown in different media or containers types
- Compare the same seedlot year to year
- Compare the same seedlot grown in different nursery units or at different densities
- Compare the same seedlot sown early versus late
- Comparing the variability (Coefficient of Variation) between seedlot or among the same seedlot in different locations
- Comparing the root weight ratio of different seedlots
- Comparing the variability of root collar diameters using the range, confidence intervals and the RCD histogram
- Comparing root weight ratios (or root biomass) for the same seedlot hand lifted to machine lifted
- Provide selected customers with all or part of analysis for the seedlots they purchased
- Indicate to customers how you are trying to improve seedling quality by reducing variation in a particular parameter.
- Use RCD histogram to explain to customers why an average RCD of 5 mm does not imply all seedlings will have the same RCD

Change in procedure for container seedlings: This past season the root systems from container seedlings were repeatedly washed to remove the all artificial media in order to expose the root mass. Some ingredients of the soilless media were difficult to remove by gentle washing. As a result, it was believed some of the fine roots were removed during the processing. Consequently, the washing of container seedlings created variability between seedlots that could not be attributed to the seedling.

In the future, for all container seedlings, when samples are sent

20 Years Ago

The Spring 1995 Newsletter began with the director, Ken McNabb, announcing the reorganization of the Research Reports into the format currently used. Previously they were called "Coop Notes". Some years they were published, other years not. If you visit the Nursery Cooperative web site today you will notice that 1995 is the first year listed for Research Reports under the Publications and Documents tab. Janusz Zwolinski announced that after three years of working with the Nursery cooperative he had accepted a position in South Africa working of seedling quality issues. The Advisory Committee approved the "Associate Member" category of membership in the Cooperative. A number of new studies were described including herbicides, seedling quality, fumigation alternative and stock type differences. Most notable in these proposed studies were the number of faculty, not associated with the Nursery Cooperative, that were participating. Bill Carey arranged a test of Hot Water as a Methyl Bromide substitution at the Camden AL nursery. (Even today, this technology has not significantly improved taking one day to treat one acre). Philip Wilson, manager of the Hauss Nursery at Atmore, Al, contributed an article on Weed Control in Hardwoods. Noting that the tort law system in the country was "over the edge", South and McNabb urged members to think long and hard before suing a chemical company over phytotoxic damages. They concluded that the wrong decision would have permanent and most likely negative effects on not only the South, but he whole country. Paul Ensminger was promoted from Nursery supervisor at the Delano, TN nursery to Deputy Director of the Plant Industry in Tennessee. Dean McCraw was promoted to Regeneration Manager at the Rayonier, Glennville Nursery.

in for seedling quality analysis a sample of 10 plugs (10 Ziploc bags) taken within the same container type that does not contain a seedling will be requested. These plugs do not have to be intact. The 10 samples plugs with media will be dried and the average weight subtracted from each sample plug to estimate root biomass. This will negate the need to remove the soilless media from the root systems of the container seedlings. This procedure (weighing the media) has been conducted previously in other container studies and the results more accurately reflect the true root biomass. **-- TS**

Leadership 101

HELP! I need a mentor.

Your organization has just hired a new employee. As the company begins to work with and train this person is your approach one of "Sink or swim; they will learn the ropes eventually" or is it "What can I do to make this person a success?" Have you ever considered developing a mentoring relationship or finding another employee with whom the new hire can develop a mentoring relationship?

Mentoring is an effective tool to help inexperienced individuals develop and progress in their profession. The dictionary definition of a mentor is one who is a trusted counselor or guide. However there is more involved in developing a mentor relationship which if done correctly will greatly benefit your organization. A mentor is always an individual, generally older, always with more experience who will step along side of the new employee (mentee) to provide advice, guidance and support by seeking to improve the persons abilities and skills through observation, evaluation, modeling feedback. Here are 5 qualities of a good mentor:

1. **A mentor must be willing to share skills, knowledge, and expertise.** Whether you are seeking to become a mentor or wanting to link someone in your organization to the mentee, you need to be emotionally secure in your position. You cannot have the attitude "If I share with them what I know, they may eventually take over my job." Where would you be today if when you started your position there was no one to "show you the ropes"?
2. **A mentor should be one with a positive role model and has a positive attitude.** There is nothing worse that linking a new hire with a mentor that has a bad attitude about their job, your organization or is a poor role model. Doing this, you have just paved the way for the loss of two employees due to resignation or having to be fired and thus validated the parables the "one bad apple spoils the whole bushel". If a mentor is enthusiastic about their job, the mentee will most likely "catch" this enthusiasm. Pick a mentor who is productive and successful and who demonstrates specific traits you find valuable in your organization. Generally a good mentor is one that is respected by other employees in and out outside your organization.
3. **A mentor is one who should be able and willing to make a relationship commitment.** Mentoring takes time and commitment to properly train and mentor someone. The mentor in addition to having experience and a positive attitude should have good communication skills. The mentee does not need a mother who tells them every move they need to make, but rather a person who will allow the mentee to make decisions and grow in their skills. A mentor should not strive to make a person just like themselves, but rather one that has developed their own strengths, beliefs and personal attitudes.
4. **A mentor's view of his job is never stagnant but rather one that offers ongoing learning and growth.** A new employee wants to feel that the time and effort they will be spending in your organization will be rewarded and ultimately provide career satisfaction. A good mentor is

one that never feels (and acts) like they have mastered the skills and knowledge required for the position. A good mentor is one who seeks to expand their knowledge base by reading trade or professional journals. A good mentor should be one who even after working for years in their positon still gets excited when they learn something new and wants to share it with others. A good mentor should be one that enjoys interaction with their peers at professional or trade meetings.

5. **A mentor is one that is capable of providing constructive guidance and feedback.** A mentee will make mistakes. A good mentor will use each mistake as training opportunity by providing constructive guidance and appropriate feedback. A good mentor does not seek to provide "Happy, Happy, Happy" (after Duck Dynasty) feedback, but rather truthful, instructive and encouraging feedback. A good mentor should be one that is able to adjust their communication skills to mesh with the personality of the mentee. A good mentor should seek to instill in the mentee a feeling of accomplishment in learning the necessary skills required in the field. **-- TS**

Nursery 101

How to Detect Snake Oil, Myths, Frauds & Carpetbaggers

Wikipedia defines "Snake Oil" as "an expression that originally referred to fraudulent health products or unproven medicine but has come to refer to any product with questionable or unverifiable quality or benefit. By extension, a snake oil salesman is someone who knowingly sells fraudulent goods or who is their self a fraud, quack, charlatan, or the like." While not all biological soil inoculants (BSI) or their salesmen fall into this illustrious category, it's like trying to separate a good car salesman for the

rest. Biological soil inoculants are products composed of microorganisms and other organic compounds sold to control soil pathogens, enhance plant growth, or bolster the physical, chemical and nutritional status of the soil environment. These products are generally safe when applied as directed, however, a nursery manager must decide if the benefits (increased seedling numbers or quality and consistency) from applying BSI outweigh the treatment costs or an alternative.

The use of BSI to protect plants from pathogenic soil micro-organisms is not a new idea but one that continues to appear in our email or on our front steps. In 2009, a Goggle® search of the term "soil inoculants" yielded 6,100 web pages; in 2015 the same search term yielded 243,000 web pages. Based upon the significant increase in the market availability of BSI products in the past several years one fact is certain, you will be contacted by a BSI salesmen.

In preparing this article I came across an internet link by Jim Downer, Cooperative Extension Service, Ventura County, University of California who very colorfully and with picturesque language portrays the problems with snake oil, frauds and carpetbaggers. It is surprising how many of his comments we have shared with Nursery Cooperative members in the past. I have modified some of his thoughts below for application in our nurseries. http://ceventura.ucanr.edu/Environmental_Horticulture/Landscape/Problems/Snake_oil/

In the nursery business we grow seedlings. When things go wrong and nothing seems to be working, growers will sometimes turn to products affectionately termed as "snake oil". These products make many claims, but usually without refereed research reports

Barry's Blog

We have had a busy year at the Nursery Cooperative laboratory (my office) and I want to share what has been happening.

In the 2014 growing season, we installed herbicide trials and other trials on loblolly pine, slash pine, longleaf pine, shortleaf pine, Frasier fir and eucalyptus at different nurseries, in our stress facility and our greenhouse. Something new this year we began a Seedling Quality evaluations program which several nurseries utilized. We have continued to look for new MBR alternatives at several nurseries. This year, a total of 18,714 seedlings were processed in the Nursery Cooperative laboratory. Seedling measurements included height, root collar diameter, shoot and root dry weights, root growth potential and pesticide injury.

We also began a fumigation survey in the event EPA should require information from our members. I have sent out e-mails requesting your help by filling out a survey form on your fumigation. Thank you for your cooperation without you this program could not be maintained. A Forest Nursery Label spreadsheet is also in the works to help the nurseries know the availably of approved herbicides, insecticides and fungicides.

Scott, Tom and Nina are busy planning our herbicide trials for the 2015 growing season. I look forward to seeing some of you this year as we install these trials in the spring and lift seedlings in the fall.

from Universities. They also almost always include copious testimonials to support their use. Seldom are these testimonials from researchers.

The "red flag" of snake oil products are that their product is a "new" never before used ingredient or a combination of ingredients. The sad things about many of these claims are that there may be a shred of truth in the claim. However, as you dig deeper and ask questions, the phrase "its proprietary" pops up. Discussion ended.

Some products make extensive claims. Usually none are published in peer-reviewed journals. Many of the research results are conducted by in-house and contracted third party researchers. This type of research is not a substitute for University trials and research since they may not have the same degree of objectivity as University based research projects. Some products refer to University studies but never mention that the research found no effect from the product. Sometimes outright lies about the efficacy are reported. Other times, a University researcher will retire and start selling a product based on research they have done in the past with the product, but with little bearing on the efficacy of the current product or material.

How often have you heard the phrase "If it's too good to be true, it probably is". There are no miracles. Rarely do efficacious biological soil inoculants, amendments, new pest management practices or products come to market without some kind of University based research.

When we look at a nursery bed we see the tops of the seedlings, seldom do we see look at the roots while they are growing. There is a lot of BSI that concerns soils and soil treatments. Polymers, growth activators, hormones, vitamins, fertilizers, worm castings, composts, are just a few of the products that fall into this category. Since none of these are pesticides, they are not labeled or required to provide efficacy testing that is required for registration, thus claims of their efficacy can run to the extreme.

Some of the most convincing products actually have solid scientific basis for their efficacy but no direct evidence that they work in the field. A good example of this is the abundance of mycorrhizal inoculants on the market. Scientific evidence does not dispute that mycorrhizae are needed for proper growth and development. However, it does not follow that those organisms are necessarily lacking from most soils (except perhaps coal mine spoil banks) or that the products that claim to add them to soil have a viable scientific basis.

Biological control is an elusive thing that we chase constantly, catch glimpses of in the field, study intensively and fail to consistently recreate when and where we want it to happen. A considerable amount of time is spent each year by companies producing biological control micro-organisms such as *Trichoderma*. The Nursery Cooperative has shown for many years the need for this organism in seedling growth. Others have also shown good efficacy in laboratory or greenhouse trials but few of these products are capable of producing consistent results year in and year out.

Sometimes a product claims great things because of the interactions of its ingredients. A combination of a polymer, a fertilizer, wetting agent derived from a special plant, or a mycorrhizal/ soil organism cocktail in a humic acid carrier will be the ticket to success. Unfortunately we can't separate out the effects (called confounding effects) of the wetting agent, the fertilizer, the humic acid or the biological component as the efficacious ingredient. Any one of the individual products could have stimulated seedling growth especially if added to a simple all-purpose fertilizer at 1/10 the cost of an elaborate unknown (and proprietary) mixture.

Biological soil inoculants will come and go; many times when their efficacy fails to materialize or produce the consistency you require. Regardless, these salesmen will continue to appear at the front door of the nursery or in your email inbox. Remember, marketing does not equal research. Learn to ask the correct questions and request research that is statistically valid and repeatable. After a while, you will be able understand the potential impact and use of the product. Be careful – don't get snake bit. **-- TS**

Other News

News from Member Nurseries

North Carolina Forest Service – James West reported that Drew Hinnant will replace Maxie Maynor who retired last year as the new manager at the Claridge Nursery in Goldsboro. Drew was formerly responsible for the container operation at the nursery

USFS – George Hernandez reported that his predecessor, known to many in the nursery industry, Clark Lanz, passed away on October 13, 2014. Clark received his education at Williams College in Williamstown, Mass., Gettysburg College in Gettysburg, Pa., and Yale University, where he received his Master's Degree in Forestry. Served two years as a lieutenant in the U.S. Army, and later received a PhD in Forest Genetics. In 1975, took a position with the U.S. Forest Service where he was a specialist for 13 states and Puerto Rico until his retirement.

Georgia Forest Commission – Jeff Fields: David Veal, who was a Ranger 1 at the Laurens County unit, was hired in January to fill a vacancy as Seed Processing Supervisor. David has been a district seedling coordinator, in charge of district seedling deliveries for the Ogeechee district. David has hit the ground running, and has learned a lot in a short time.

International Forest Company – Wayne Bell: IFCO will be increasing production at DeRidder Nursery by 12 million seedlings

this spring due to market interest. DeRidder's production will now be 20 million seedlings brining IFCO's total company production to 82 million. Stephen Goodfellow has been hired at DeRidder as Breeding and Testing Supervisor. Stephen who is a recent Forestry graduate of Stephen F. Austin University started in December 2014.

Know Weeds

With common names like "Cotton Candy", "Scarlett O'Hara," and "Heavenly Blue," it appears that some folks in the U.S. actually *want* to grow morning glory rather than get rid of it. When it grows in forest-tree nurseries, most would prefer names like 'dead' or 'gone'. Most information available on this genus of plants concerns its growth and maintenance rather than its eradication. This plant's name comes from the colorful trumpet-shaped flowers that appear early in the morning and then close as the day progresses.

The USDA Plant Database lists 69 native and introduced species of morning glory in the genus *Ipomoea* that also includes the sweet potato (*Ipomoea batatas*). Morning glory is often confused with field bindweed although bindweed is in a different genus and has a different leaf shape and method of reproduction. Morning glory leaves are alternate, usually heart-shaped or three-lobed (even on the same plant), and are about 2 - 5" long. The most recognizable feature of morning glory are its trumpet- shaped flowers ranging in color from pink, purple-blue, magenta, white and red to multicolored striated varieties.

Morning glory is considered an annual plant but reseeds itself so successfully that most believe the plant is a perennial. One website promoting morning glory gardening mentions that it is such an 'excellent' reseeder that it will never need to be replanted once it is established. Seeds are found in round pods hanging from vines and are wedge-shaped, dark brown to black in color, ranging from ⅛" to ¼" in size. They can remain viable for years in soil under favorable conditions. The seeds contain compounds that can produce an LSD-like hallucinogenic effect if ingested by the hundreds (and some people do this intentionally), but also act as neurotoxins that can be harmful to livestock if ingested in larger quantities. Morning glory grows best in moist areas with full sun; dense vines grow quickly and can easily reach lengths of 10 feet or more. This plant is frequently grown on arbors or fences as screen material. One aptly named species is the mile-a-minute vine (*Ipomoea cairica*).

World's tallest "Green Curtain" of Sugunami (Tokyo) - Built in order to reduce cooling costs, the net structure supports vines of morning glory, gourd, loofah and cucumber.

It is critical to gain control over these weeds in nurseries **early** before the plants get a foothold in the seedling beds. Unfettered growth and the plant can eventually cover portions of the beds. Spraying nursery beds while the morning glory plant is at the small seedling stage, and spraying often, is the only reliable method of control. Morning glory is not a weed that can be treated one time with herbicide and expect any measure of control. The Nursery Cooperative installed trials in 2012 and 2013 in order to study the effectiveness of four herbicides for control of morning glory. Both of these trials sprayed herbicide applications over the top of hardwood seedlings. In both trials, however, the effectiveness of the herbicides was difficult to determine due to the lack of morning glory in the treatment areas or the hardwood seedlings covering up the morning glory (Research Reports 13-05 and 14-05). This year, studies will be installed using directed sprayers testing Pendulum® AquaCap™, Clearcast® and Marengo® in hardwood beds to determine herbicide effectiveness on morning glory. **-- NDP**

Contact Us!

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