Southern Forest
Nursery Management Cooperative
Spring 2014

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Director's Report

Another winter and lifting season have 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. Auburn had four "snow days" this year and, having grown up in Minnesota, I was somewhat bemused by all the fuss a few inches of snow brought to the area. However, one particular morning, when I felt the need to water the plants in the greenhouse, I was kicking myself all the way into town: "You should not be on the road, you should not be on the road... You are an idiot, Scott, for driving into town!" Thankfully, I did not end up either in the ditch or piled into someone's front yard. Prior to the wintery weather, all of the nursery studies were taken down and data collected and are now being put into Research Reports that will be published this year. A special thanks to Barry Brooks and undergraduate worker Win Timberlake for their efforts this past winter with measuring and processing all the herbicide studies that were installed by Ben Whitaker, who was not around to help take them down. With Ben's replacement on board this past January (more on that later), new studies have been worked out and those are getting ready to be installed this spring as outlined in the Work Plan that was approved last November. Other items of interest include the Contact Meeting (more on that in a moment), a lot of nursery related research that was was finished last fall, and a few pesticide issues that are looming on the horizon. We continue to work on the soil fumigant issue with respect to the re-registration of those pesticides starting again. Many of these topics are discussed in more detail throughout the newsletter and I encourage everyone to read and digest the information carefully.

Membership

Erratum. In the Fall 2013 Newsletter, I mistakenly omitted, not one, but two organizations from the list of current members. These include Plum Creek Timber Company and Native Forest Nursery. Plum Creek has been a member since 1999 and currently operates 3 nurseries. Native Forest Nursery operates out of the old Bowater Nursery in Chatsworth, Georgia and has been a member since 2010. I apologize for omitting these two important research cooperators.

2014 Contact Meeting

The 2014 Nursery Cooperative Contact meeting is scheduled for Monday, July 21, 2014 from 12:00 PM to 5:00 PM in Williamsburg, Virginia. The half-day meeting will be in conjunction with the biennial Southern Forest Nursery Association meeting that begins Monday evening, July 21 and runs through noon on Thursday, July 24, 2014. Dwight Stallard and George Herandez have been working with speakers and an agenda is close to being finalized. Registration for the Contact Meeting will be separate from SNFA registration and will be following as soon as we have the agenda set and the meeting space secured. As is the normal practice, we will have a half-day indoor session of Nursery Cooperative staff members presenting their most recent research findings and are working with Dwight Stallard of the Virginia Department of Forestry for the nursery tour. These would include a 1- and 2 year- fumigation trial that we have been participating in at the Virginia nursery. Put that week on your calendar so that you can plan to attend.

2014 Advisory Meeting

The Advisory Meeting is scheduled for

Contents

Wednesday and Thursday, November 12 & 13, 2014 at the School of Forestry and Wildlife Sciences Building. Mark those dates on your calendar and more information will be available in the Fall Newsletter.

Personnel Notes

This has been a winter of change at Auburn with two new faces working for and closely with the Nursery Cooperative. After a lengthy review process, we were able to hire Nina Payne to replace Ben Whitaker.

Nina Dowling Payne

As a registered forester and part owner of family timberland, I'm bringing a different perspective to the Nursery Cooperative - from that of one of your customers. Now, in my role as the Cooperative's newest Research Assistant, I am tasked with addressing herbicide and weed concerns of our nursery members. Filling the position held by Paul Jackson and Ben Whitaker, I'm working on my learning curve in the nursery area and know that I'll have plenty of questions when I visit your nursery or speak with you.

I am a graduate of Auburn University's School of Forestry and Wildlife Sciences, a Registered Forester in Georgia, an American Tree Farm Inspector, and a member of the SAF, Association of Consulting Foresters, Georgia Forestry Association and Alabama Forestry Association. My four children are pleased to see 'mama' back in Auburn and are already campaigning for football tickets! My family has actively managed our timberland in southwest Georgia for over 35 years, so we are directly impacted by the quality of seedlings we have purchased and planted over the years. Your efforts, as Nursery Cooperative members, can be seen in the plantations on private and publicly-owned timberland and on family farms like ours throughout the southern United States. I'm pleased to be a part of an organization that ultimately leads to these healthy, productive stands of timber. I look forward to meeting all of you at the upcoming Contact Meeting in Virginia and as I make my way through the region installing herbicide trials. In the meantime, if you have any questions, feel free to call or email me using the contact information listed on page 14.

In addition to Nina, we were also able to hire a Post-Doctoral Fellow, Dr. Ryan Nadel. A long-standing issue with seed and seedlings is the infestation by the pitch canker fungus, *Fusarium circinatum*. Using a newly discovered molecular tool developed at the University of Florida by Dr. Tyler Dreaden, Ryan's goal is to be able to sample a batch of seed and within two days give an "infected" or "uninfected" certificate. This method of disease detection will negate any need for the current seed-blotter technique that takes up to 4 weeks per seed lot. We were able to hire Dr. Nadel as a result of a three-year US Forest Service grant.

Ryan Nadel

Dr. Ryan Nadel recently joined the Forest Health Dynamics laboratory as a Post-Doctoral Fellow. His current research focus is on tree health and fungal transmission on seed and seedlings. Funded through a 3-year Cooperative Agreement with the USDA Forest Service, his current research project focuses on testing pine seed for the presence of *Fusarium circinatum* using a newly developed rapid molecular screening technique compared to the blotter paper method currently used by the International Seed Testing Association (ISTA). With this new technique, we hope to be able to rapidly (days) and positively confirm or deny the presence of *Fusarium circinatum* on Pinus plant material.

Ryan is from South Africa where he was employed as a Senior Research Scientist and Project Leader for Integrated Pest Management (IPM) Research at the Institute for Commercial Forestry Research (ICFR). Ryan has worked on numerous pests and pathogens (including *Fusarium circinatum*) that impacted the growth and survival of non-native Eucalypt, Pine and Wattle tree species grown in commercial forestry plantations. He is a graduate of the University of the Witwatersrand where he was awarded a BSc, BSc (Hons) in Ecology, Environment and Conservation and an MSc in the School of Animal, Plant and Environmental Sciences. In 2010, he was awarded a PhD degree from the University of Pretoria in the Department of Genetics after conducting research at the Forestry and Agricultural Biotechnology Institute (FABI). He has published several articles in international scientific journals and presented at several National and International conferences. If you need to get in contact with Ryan, his information is also listed on page 14 of this newsletter.

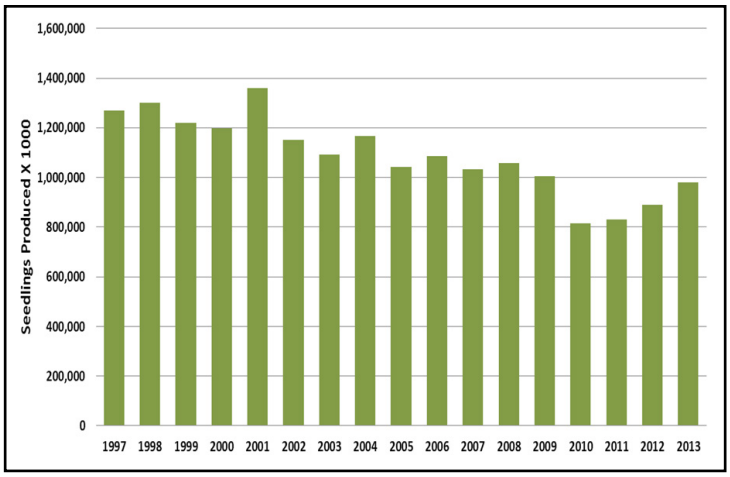
Nursery Production Survey

Now into our 11th year, the Nursery Cooperative will again survey regional seedling production 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 are published as Technical Note 13-01.

This can be accessed on the Nursery Cooperative web site or you can always drop Elizabeth Bowersock a note 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 761,345,000 bareroot conifers, 179,572,000 container conifers, 38,077,000 bareroot hardwoods and 1,949,000 container hardwoods during the 2012-2013 growing season. This is up from the previous year's production of 718,344,000 bareroot conifers, 178,817,000 container conifers, 34,896,000 bareroot hardwoods and 2,688,000 container hardwoods during the 2011-2012 growing season. The total forest-tree seedlings produced in 2012-2013 was 980,943,000 seedlings and it's the fourth year in row since 1971 that the southern region of the United States produced fewer than 1 billion seedlings annually for reforestation. The increase of 4.8% in seedling production (46.2 MM) this past planting season continues to increase and ends 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.

Figure 1. Seedling production (x 1000) for all species and stock types in the southern United States; 1997-2013.



Risk-Mitigation of Soil Fumigants – Phase II. EPA and the registrants continue to gather data on the second phase of risk mitigation. 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 and will be used to address EPA's concerns on bystander safety at a later date.

Pesticide News

VIF or TIF plastic? There are two types of plastic available at this time for soil fumigation: VIF, which is Virtually Impermeable Film, and TIF, which is Totally Impermeable Film. From EPA's perspective, both plastics will give nursery managers a 60% buffer credit, however, TriEst uses TIF in their application methods. Under the new rules these plastics must remain down for 5 days which should not be a problem as they are tougher and lay tighter on the field. If tarps are perforated within 14 days, tarp removal must not begin until at least 2 hours after tarp perforation is complete. After 14 days, restrictions on perforation and monitoring are not needed. We strongly recommend that the plastic be kept down as long as possible, e.g. 14 days, to maximize the area under the curve and exposure times. The plastic is going to cost more than HDPE but, by using these plastics, nurseries are able to reduce the fumigant rates (ai) to compensate for the increased plastic costs.

80:20 When the new labels were released, the stringent PPE regulations meant that you will most likely not find an applicator willing to apply 98:2 MBr/Chloropicrin. Therefore, 80:20 MBr has become the most common formulation for nurseries which has minimal PPE requirements. Suggested rates of 80:20 under TIF or VIF should be 225 – 275 lbs/acre range. If weed control is lacking, then it would be possible to increase the rate as long as you are content with the buffer zone restrictions.

QPS

An ongoing process within the Nursery Cooperative has been to continue to stress to EPA, USDA and APHIS the need to use quarantine pre-shipment (QPS). It has been 3 years since EPA rejected our CUE application under the premise that "seedling producers have access to QPS MBr". Thus, there is nothing new 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.

Herbicide Trial Updates

With Nina Payne now on staff, we have been wrapping up the 11 different herbicide trials that were installed by Ben Whitaker and Barry Brooks last spring. A complete summary for each trial will be published as Research Reports, but a sampling of the initial findings for a few of the tests are discussed below.

Pendulum AquaCap (PAC) Outplanting Trial. Used at the time of sowing, PAC has shown control of prostrate spurge, but if applied as much as 3 weeks post sowing, the formation of herbicide galls on the stem have occurred in some nurseries. The formation of the galls appears to be a nursery soil effect as well as timing. Nonetheless, to determine what effect these herbicide galls have on seedling survival and seedling growth after out-planting, 1200 seedlings, 600 with and 600 without PAC-induced galls (June 2012), were out-planted in an unused part of a nursery (November 2012). Half of the seedlings were planted normal, below the root collar (deep) while the other half were planted at the ground line (shallow). In addition to gall vs. non-gall and deep planting vs. shallow planting, half the seedlings were irrigated over the duration of the trial while the other half did not receive any irrigation other than normal rainfall.

In January 2014, 14 months after out-planting and 18 months after treatment with PAC, seedlings were measured for height, diameter at ground line and survival. The hypothesis tested was that galled seedlings, planted shallow and non-irrigated, would have less survival then non-galled seedlings planted under similar conditions. The take home message was that there was no effect of herbicide gall on seedling survival, ground line diameter or height when planted either deep or shallow. The results of loblolly pine with and without galls planted either deep or shallow under irrigation are shown in Figure 2.

However, without irrigation, there was an effect of herbicide gall on seedling survival, RCD and height when planted shallow - just not what we expected. Loblolly pine with herbicide galls that were planted shallow and not irrigated had larger RCD, were taller, and had greater survival than seedlings WITHOUT herbicide galls. The results of loblolly pine with and without galls planted either deep or shallow without irrigation is shown in Figure 3. There is statistical evidence to suggest that PAC-induced galled seedlings survive better than non-galled seedlings when planted shallow in dry soil conditions (Figure 2 – shallow planted). *This is noted by the asterisk*. Like the irrigated seedlings, galls or no galls without irrigation were similar in RCD, seedling height and seedling survival.

Thus, the take home message is that loblolly pine with PAC-induced herbicide galls are just as likely to survive and grow as well as non-galled seedlings under a wide range of planting conditions (deep, shallow, wet, dry). However, we do not recommend producing galled seedlings to improve seedling survival after outplanting.

Appliction of PAC Timing. Having shown that PAC-induced galls do not affect seedling survival, it is still the Nursery Cooperative's recommendation to use PAC at the time of sowing. Numerous trials have shown that galls are formed when PAC is used from 8-10 weeks post sowing. The next question then is, "Is there a later time in the growing season when seedlings are not susceptible to PAC-induced herbicide galls?" To answer that question, we implemented a timing trial that examined two rates of PAC (34 & 68 oz/a) applied at 8, 12, and 16 weeks post sowing. At the end of the growing season, seedlings were removed from the plots and seedling characteristics measured: density, root and shoot biomass, and formation of galls. As previously observed, the use of PAC at 68 oz/a at 8 and 12 weeks resulted in a significant number of herbicide-galled seedlings (Figure 4).

In contrast, however, the use of PAC (34 oz/a) at 16 weeks post sowing resulted in no herbicide galls formed. PAC (68 oz/a) at 16 weeks, while not significantly different from either the Check or PAC 34, did result in 0.4 seedlings per sq ft with a gall. As discussed above, these galls do not affect seedling quality or survival, but galls on seedlings are generally considered a fusiform rust infection. Care should therefore be taken if one were to use the higher rate at 16 weeks post sowing. Overall, it is possible to use PAC at the time of sowing and again 16 weeks post sowing to prevent further spurge developement.

PAC Operational Tank Mix. Pendulum AquaCap has been shown to be a useful herbicide for the control of prostrate spurge. As part of the Nursery Cooperative's mission to develop economically sound practices, a small-scale operational trial was established in the spring of 2013 to evaluate loblolly pine (*Pinus taeda*) seedling tolerance to gall formation and prostrate spurge control following pre-emergent applications of Goal® 2XL (22.3% oxyfluorfen) and Pendulum® Aquacap (38.7% pendimethalin) applied simultaneously with soil stabilizer. The treatments were as shown in the table below and applied to 4 nursery units in a randomized complete block design. Treatments were applied using operational equipment at the time of sowing. Afterwards, permanent plots were installed to count the number of spurge plants and to collect seedling data over time.

Weed data across all four units was collected on July 10, 2013 and is summarized in Figure 5. The predominate weed in the Goal-treated beds was spurge, while the Goal 2XL+ PAC treatments contained broadleaf weeds.

At the end of the growing season there were no herbicide galls on any of the Goal+PAC treatment rates. Thus, the application of PAC at the time of sowing, like previous trials, did not result in herbicide gall formation (Figure 6). Seedling densities at the high rate of PAC (68 oz/a) were similar to the Goal alone treatment. For some reason, the addition of PAC 34 resulted in significantly fewer seedlings per sq ft than either the Goal or Goal+PAC 68.

A more thorough discussion with more information on these PAC trials along with Marengo®, Clearcast® and Ronstar® will be forthcoming in Research Reports.

Figure 2. Loblolly pine seedling characteristics with and without herbicide galls 12 months after planting either deep or shallow with irrigation.

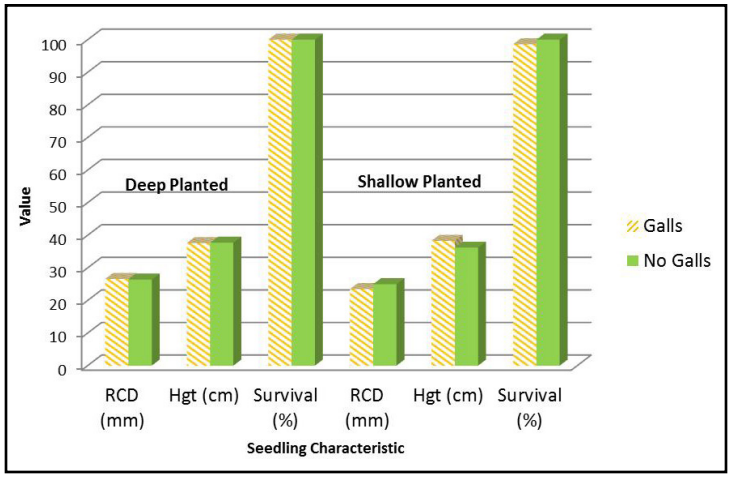


Figure 3. Loblolly pine seedling characteristics with and without herbicide galls 12 months after planting either deep or shallow without irrigation.

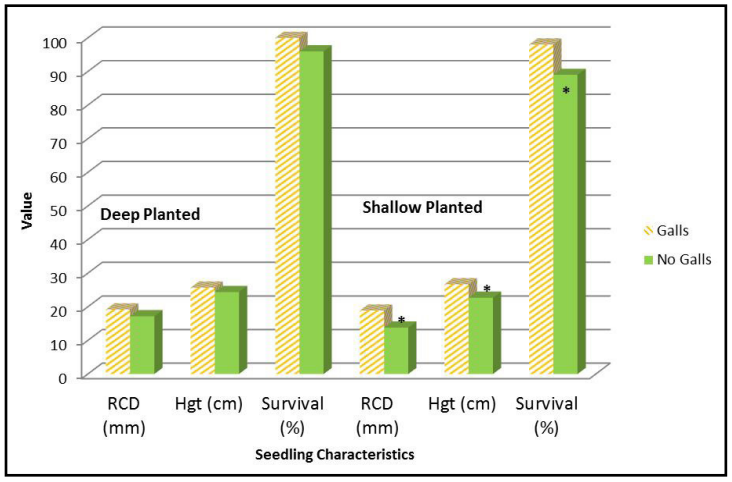


Figure 4. The effect of PAC timing and rate on the formation of galls.

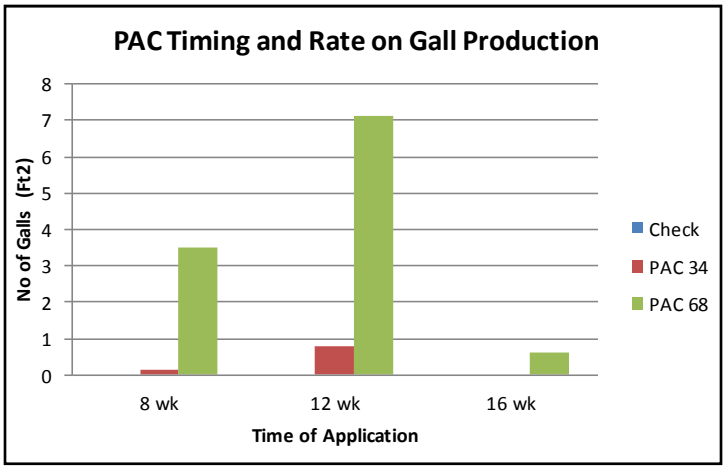


Figure 5. Number of prostrate spurge weeds present in seedling beds treated with Goal and combinations of Goal and Pendalum Aquacap.

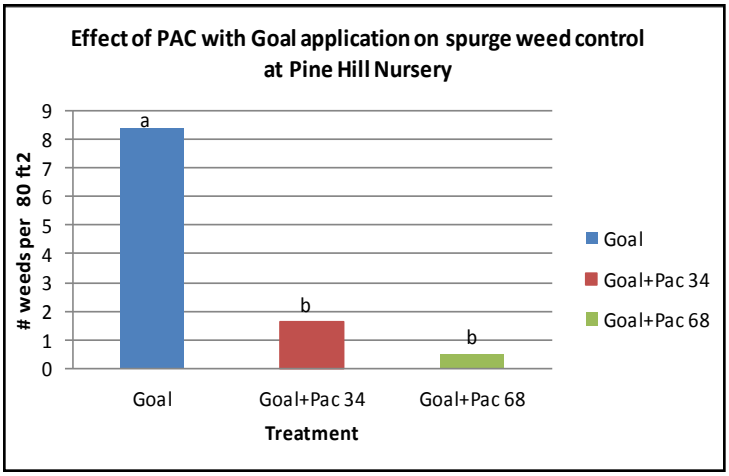


Figure 6. Seedling densities over the growing season operationally treated with Goal and PAC at the time of sowing.

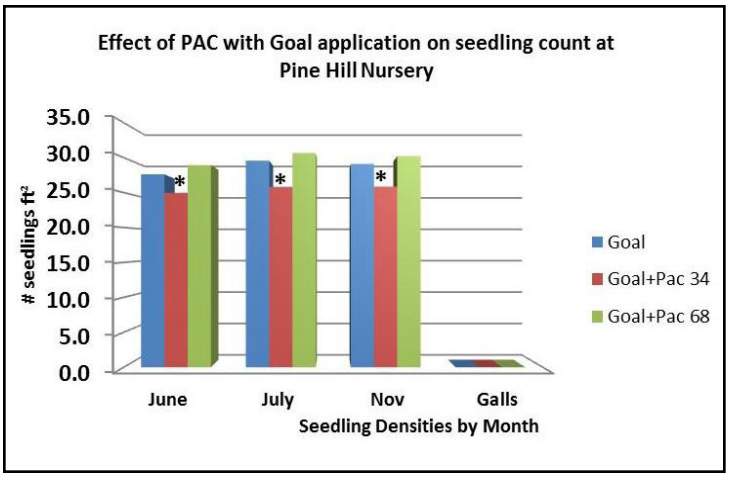


Table 1. Treatment and rate herbicide used in the PAC Operational Trial.

Treatment *(No.)*	Pre-emergent Herbicide *(Trade Name)*	Product *(oz/ac)*
1	Goal® 2XL	32
2	Goal® 2XL+Pendulum® AquaCap	32+34
3	Goal® 2XL+Pendulum® AquaCap	32+68

Research News

TE-3 or Trifecta® - New Product, Old Ingredients

In 2012 when we finished the USDA Area-wide project looking for alternatives for methyl bromide (MBr) we felt that the testing of new soil fumigants in the future would be a rare event. With no new chemistries available and methyl iodide pulled from the market, we figured nothing new was coming. Well…. we were both right and wrong. Before the ink dried on the new soil fumigant labels, a potentially "new" product was being tested by Dr. Stanley Culpepper on vegetables in Tifton, GA. This new product began under the name of TE-3 and has since been labeled as Trifecta® by TriEst (Hendrix & Dail). Several nurseries within the Nursery Cooperative put in nursery watch trials using TE-3. The comments on both first and second year ground were positive with respect to seedling quality and weed control. While Trifecta is a "new" product, it is composed of MBr alternatives that have been tested numerous times in Nursery Cooperative research studies. Trifecta® is a blend of Telone II, chloropicrin and DMDS (dimethyl disulfide). It is shank injected under TIF plastic and uses chloropicrin rates as the buffer zone determination. The mixture of the

compounds is approximately 44% DMDS, 33% Telone and 23% chloropicrin.

When we were testing MBr alternatives, we found several fumigants that produced seedlings similar to MBr. However, none of the alternatives were as broad-spectrum as MBr and generally required the use of additional pesticides, generally herbicides. One of the benefits of Trifecta® is that it controls weeds better than any one of the individual components alone. The specific formulation can be somewhat customized for your nursery problems by altering the percentages of the ingredients.

In 2013, in preparation for the Southern Forest Nursery Conference meeting this summer in Williamsburg, the state of Virginia nursery in Courtland put in a watch trial using Trifecta® that we will be able to view during the nursery tour. The same loblolly pine seedlot was sown in nursery beds that were either fumigated with Trifecta®, MBr or had no soil fumigation (Thank you, Dwight, for this control.) This spring (2014) the nursery will again repeat the fumigation study as outlined above again. At the meeting this summer we will be able to observe seedlings from Trifecta® and MBr of 2nd year land (fumigated 2013) and seedlings from 1st year Trifecta® and MBr land (fumigated 2014).

In cooperation with the nursery staff in Courtland we have evaluated seedlings from the 2013 fumigation in June and then this past December. In December, seedlings were collected from four beds in each of the Trifecta® and MBr fumigated land. Although these would be considered as pseudoreplications we did analyze the RCD, height and dry weights which are presented in Table 1. Since only a small area was left non-fumigated, only one sample was taken from this area and was not analyzed, but is presented in the table and figures that follow.

In Figure 1, Trifecta® had a greater percentage of larger seedlings than either the MBr or the nonfumigated plots. Further analysis of the data is presented in Table 1. Although the Trifecta® RCD was not significantly greater than the MBr, the top and total seedling biomass were significantly different.

At the end of the first year, Trifecta® seemed to be a strong candidate as a replacement for MBr. However, its performance in the second year will be the important evaluation. At the meeting this summer, be sure to ask Dwight, Justin, and staff for their evaluation of the study. See you in Williamsburg! - **TES**

Figure 1. Histograms root collar distribution for the seedlings collected in Trifecta, MBr and non-fumigated plots

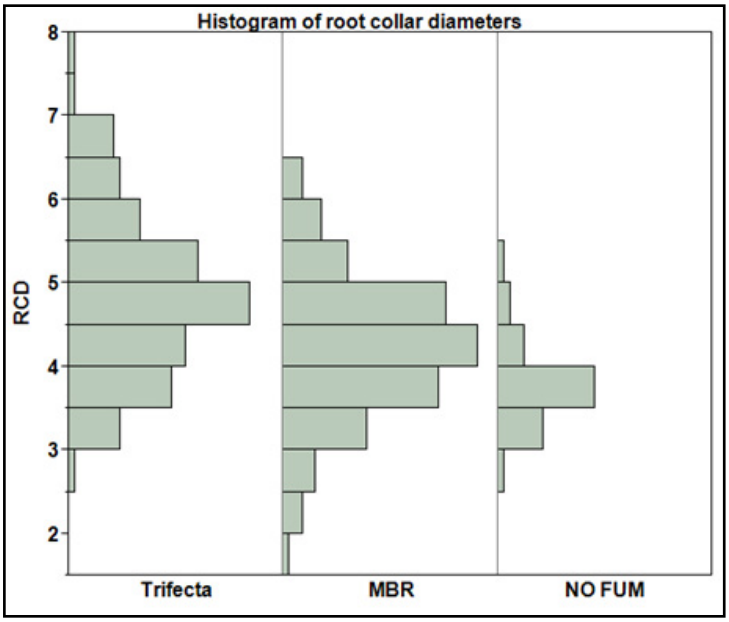


Table 1. Root collar diameter, 95% confidence interval and dry biomass of Trifecta®, MBr and nonfumigated seedlings

TRT	RCD Mean	Lower 95% Cl	Upper 95% Cl	Top Dry Wt (g)	Root Dry Wt (g)	Total Dry Wt (g)
Trifecta	4.8	4.7	5.0	4.1	0.87	5
MBr	4.2	4.0	4.3	2.8	0.74	3.6
Pr>F	*0.12*			*0.03*	*0.51*	*0.06*
lsd (.05)	*0.96*			*1.1*	*0.56*	*1.6*
No Fum	3.8	3.6	4.0	2.50	0.44	3.00

Cultural Control Options for Black Willow

If you grow container seedlings you already know the problems black willow (*Salix nigra*) can cause. In the 2012 nursery practice survey, 70% of container nurseries indicated this was their number one weed problem. Once it is established in the container, commonly used herbicides, such as Goal®, seems only to burn it back. Other control methods include withholding water to the container set in mid-summer to severely stress the pine and kill out the more water-loving willow. Other nurseries have tried to physically remove the willow from the root plug, many times destroying the plug integrity. Other nurseries have tried to cut out the willow with clippers with limited success. Black willow trees are prolific seeders and have large seed crops of up to 2.3 million seeds per pound. Good seed crops occur almost every year. The small, cottony seeds are produced on catkins until they are dispersed by wind

in the spring. The seeds are widely disseminated and are viable for up to 8 weeks. Germination is highest on the surface of very moist, exposed growing media, which our container operations conveniently provide! Black willow seed viability is reduced by a few days of dry conditions.

This deciduous tree is highly adaptive and prefers moist, poorly drained sites, so if you have these sites around the margins of your operations, you most likely will have black willow. It is distinguished by thin narrow leaves that are equally green on both sides, has deeply fissured bark and twigs that are notably shiny red-brown in color.

There have been some empirical reports that if clipped from the plug and planted deep, black willow will not re-sprout. Last September, the Nursery Cooperative brought 20 container loblolly pine seedlings with a black willow seedling in each plug back to Auburn. All the willow seedlings were clipped from the plug about ¼" below the plug surface. One half of the loblolly pine seedlings were planted with the plug at or just below ground line. The other half were planted about 3" deep. On November 1st, 60% of those loblolly pine seedlings planted at the ground line had a new black willow re-sprouting from the plug. Of those loblolly pine plugs planted deep, none of the black willow seedlings had resprouted. We will monitor these seedlings once growth begins this spring and will also repeat this study this year by sampling at an earlier date.

If willows can be controlled by cutting it out of the seedling plug and planting deep, this could be viable control option for loblolly, slash and shortleaf pine. However, since most longleaf are grown in containers and willows are a major problem in longleaf container culture also, this method of control is not viable since longleaf cannot be planted deep. Another control approach that most nurseries have tried is the removal of black willow trees around the nursery production area. These trees provide a large percentage of the willow seed in the spring that become seedlings in the container nursery. Dr. Stephen Enloe, Extension Specialist and Associate Professor in Agronomy and Soils at Auburn University, has provided the following tips on controlling willow trees around the nursery:

1) A hack and squirt injection method may be the best treatment for larger trees, but it should be done soon before heavy sap starts to flow in the spring. (The sap flowing out of the wound in the tree can interfere with the absorption of the chemical. Use a 20% vol/vol solution of imazapyr (such as Arsenal AC) and inject with 1 hack per 3" dbh and 1 ml per hack. Here are 3 links for using the hack and squirt method - an article, a YouTube video demonstration, and a specialized tool that can be purchased, although a hatchet or small axe and spray bottle works just as well.

   http://www.forestry.state.al.us/Publications/TREASURED_Forest_Magazine/2011%20Fall/Hack%20&%20Squirt.pdf

   http://www.youtube.com/watch?v=-th5Ks4b2Gg

   https://www.forestry-suppliers.com/product_pages/Products.asp?mi=6348&title=&itemnum=

2) Basal bark treatment can be used on smaller trees (less than 6" dbh) using a 25% solution of triclopyr (such as Garlon 4). If you want to cut the trees down, treat the stumps immediately in the same manner. These methods will be more costly than injection. Here are links on basal bark and cut stump treatments:

   http://www.aces.edu/pubs/docs/A/ANR-1466/ANR-1466.pdf

   http://www.aces.edu/pubs/docs/A/ANR-1465/ANR-1465-low.pdf

3) For any trees you have already pulled up or cut, when you see resprouts, wait until those resprouts get about 3'-4' tall and use a foliar spray of 2% vol/vol glyphosphate (such as Roundup) with surfactant. This is a cheap and effective method of controlling those resprouts from the trees you've already pulled up or cut down.

You've got the best chance of getting rid of those black willow on the margins in close proximity to the nursery with the hack and squirt method. When you remove that seed source, you should see fewer black willows in your containers in that area. - **NDP, TES**

http://www.floridata.com/ref/s/sali_nig.cfm

Controlling Height Growth of Eucalyptus Using Growth Regulators

Anyone that has grown Eucalyptus will know that achieving target height growth is not a problem and that top pruning is required to maintain a manageable seedling height. In the horticultural industry, growth regulators, which are a class of hormones known as auxins, are commonly used to control height growth, branching, budding and flowering. Customers want small, compact plants that are easily repotted into landscape settings. Last year, one of our members asked if "growth regulators could be used to control height growth and/or improve seedling quality." To determine the effects of growth regulators on seedling production, we tested four commercially available growth regulators.

We contacted Dr. Gary Keever, in Auburn University's Department of Horticulture, who has studied ornamental plant response to growth regulators and he recommended four products (Table 1). In our first test of four growth regulators in the greenhouse on Eucalyptus seedlings, we established a dosage range that resulted in no phytotoxicity. In our second test we conducted a nursery study testing one application of four growth regulators at the rate specified in Table 1. One half of two container sets with 128 seedlings each were sprayed with each growth regulator approximately 6 weeks after sowing on July 29, 2013. The other half of each set was sprayed with water.

In late September 2013, seedlings from each treatment were collected and evaluated for seedling biomass, RCD and height. A statistical analysis comparing sprayed and non-sprayed within each growth regulator was made for each of the four growth regulators. We did not compare the different treatments with each other. A graphical representation of the seedling data measured is shown in the following graphs: RCD, Seedling Height and Seedling Biomass.

Bonzi was the only growth regulator that showed a significant difference between sprayed and non-sprayed for root collar diameter.

There were no significant differences in the growth regulators between sprayed and not sprayed for height growth. One month after application, observable differences were seen with Toplfor and Bonzi being shorter than controls. In the following graphs, the Bonzi-sprayed seedlings were slightly smaller than the non-sprayed controls. However, by the end of the season, the treatment effect was not detected. It is possible that a second application of Bonzi would produce shorter seedlings at the end of the season.

At the season end, there were no significant differences between the treated and non-treated seedlings when comparing shoot biomass.

Here are some thoughts on the use of growth regulators in the production of Eucalyptus seedlings:

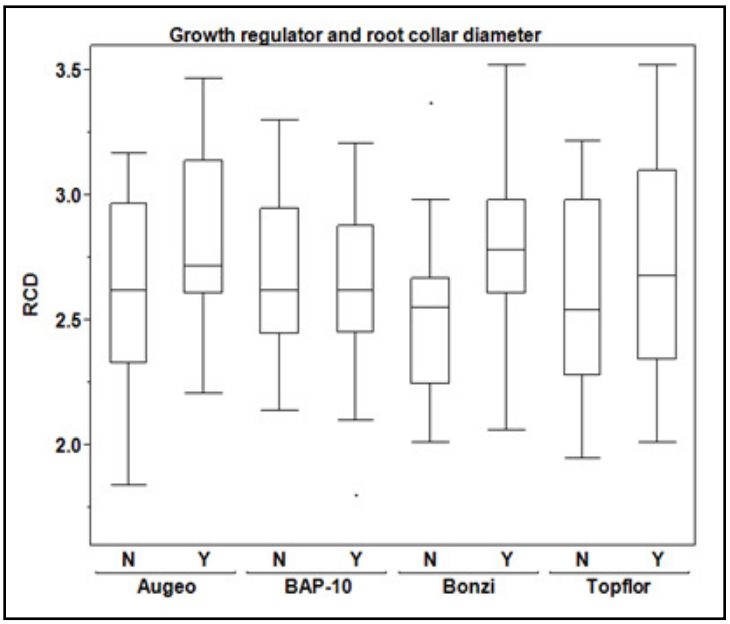
- Currently, the same system for top pruning pine in container nurseries works for Eucalyptus. So, controlling height growth should not be an issue.
- Since the seedlings in our test were not clonal material, there was considerable variation in seedling height. Multiple applications of growth regulators may keep small seedlings small and result in those seedlings being culled.
- If height growth is more uniform with clonal material, growth regulators may be beneficial.
- Opportunities for further research with Bonzi as to rates and frequency of applications exist. - **TES**

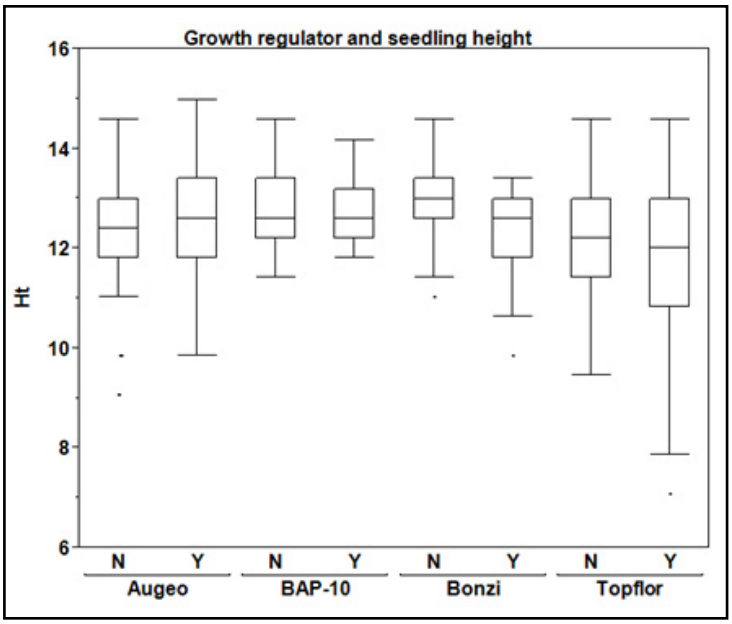
Table 1. Growth regulators used and rate applied to Eucalyptus seedlings in the greenhouse - 2013

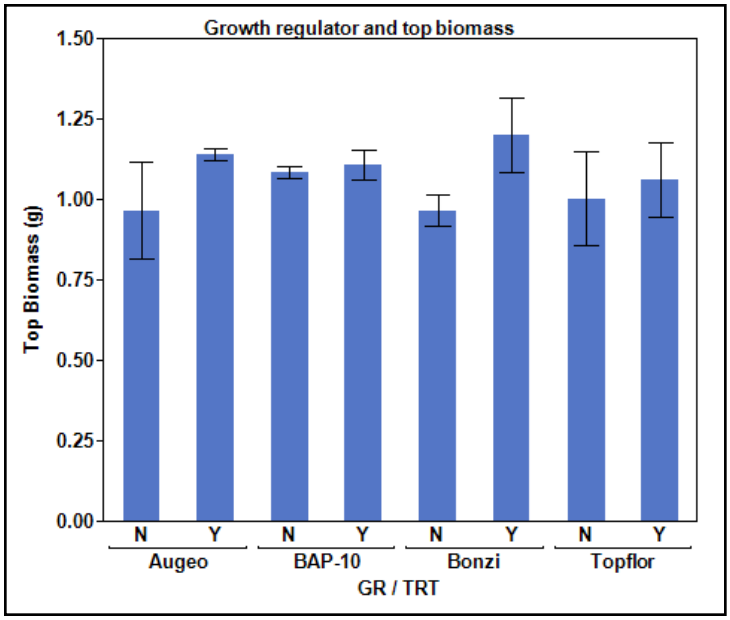
Trade Name	Common Name	Rate/100 ml water
Augeo	dikegulac-sodium	1 ml
BAP-10	benzyladenine	0.75 ml
Bonzi	paclobutrazol	2.5 ml
Topflor	fluprimidol	4 ml

20 Years Ago

In the Spring 1994 newsletter, note was made that the Director of the Nursery Cooperative passed from Walt Kelley to Dean Gjerstad to Ken McNabb. Research topics included: discussion of alternative fumigants, specifically the use of tarps for applications with Basamid and chloropicrin; the use of top clipping to increase seedling survival; relationship of seedling density and seedling size; evaluation of cyproconazole as a seed treatment for rust control. A note was made that temperatures in January, 1994 fluctuated from 24 degrees below normal to 21 degrees above normal. A new research tool was described – Root Growth Potential. New fumigations studies were described testing Basamid, chloropicrin, and Sectagon, tarped and nontarped on heavy soils. A 24(c) label was announced for the use of Reflex in SC. Tank mixing Goal and fertilizer use at three nurseries was described. The implementation of Worker Protection Standards was postponed until January 1995. - **TES**





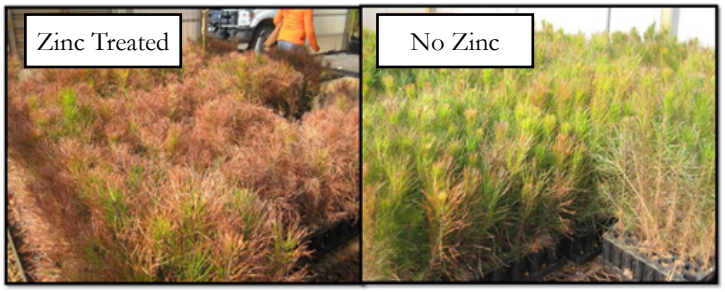


Final Evaluation of Zinc-Coated Container Trays

In the Spring 2013 Nursery Cooperative Newsletter, I discussed some preliminary results using zinc as a cell wall coating material for container trays. Sherwin-Williams Paint is marketing a product called Root Perfect®, containing 14% zinc oxide that could be used to produce a more fibrous root system similar to copper-coated container trays. The company treated a number of container trays for the nursery's evaluation over a growing season.

The container sets we examined were the Stuewe & Sons hard plastic FT135 tray with a cell volume of 6.9 cu in and a cell depth of 5 in. We asked the nursery not to top prune a certain number of container trays containing loblolly pine for our evaluation. When I visited the nursery in early August, the trays with the zinc coating could easily be identified on the benches. Within each zinc-coated tray, the loblolly seedling height was less and was more variable than non-coated trays. In addition, it was difficult to extract the zinc-coated seedlings in early August without destroying the root plug.

While noting a large amount of height variation within the zinc-coated trays in August, I expected that these seedlings would remain alive but smaller in our January evaluation. What we saw in January can be seen in the picture below:

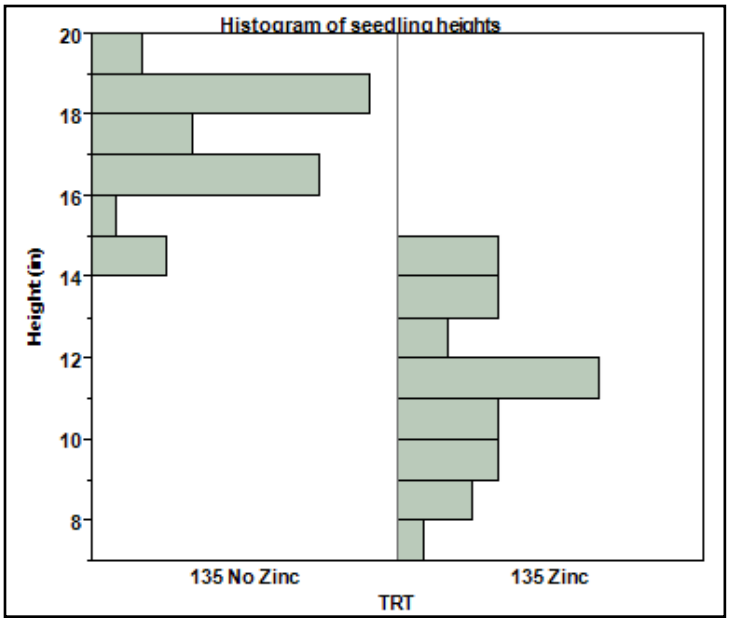


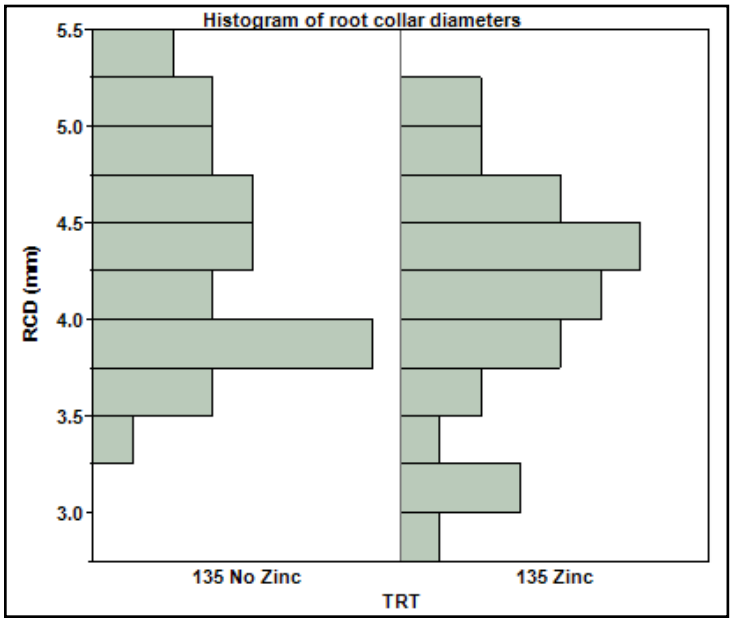
It was apparent that the smaller seedlings within the zinc-treated trays had not survived. In addition, the seedlings that appeared "normal" in August would most likely be categorized as culls in January. Due to the extensive number of culls and mortality in the zinc-coated trays, we had to scrap our original sampling plan.

In the following graphs, the zinc treatment affected seedling height more than root collar diameter.

In Table 1, two statistics stand out: First, the zinc treated trays had shorter seedlings, which was also observed in August. Second, the most significant difference in the two treatments, was the zinc content in the soil. The high media zinc levels resulted in the culls and seedling mortality.

Should zinc be considered as an alternative to copper for root pruning in containers based on these results? While





cost and seeding quality may be a factor, this study brought up several further areas that could be explored before a final decision on zinc is considered:

1. The volume of material may have been too high based upon its appearance on the container sets.
2. The concentration of zinc used could be altered to possibly reduce the phytotoxic effects.
3. The method of applying the material to a container set should be examined to provide a uniform coverage.

Table 1. Loblolly pine seedling characteristics grown in not treated and zinc-treated containers - 2013.

	Average Height (in)	Average RCD (mm)	Lower 95% Cl	Upper 95% Cl	Dry Wt Top (g)	Dry Wt Root (g)	Soil Zn Content (ppm)
135 No Zinc	17.4	4.3	4.1	4.5	3.8	1.0	66
135 Zinc	11.4	4.1	3.9	4.3	3.2	0.7	1821

Since we do not hear container nurseries clamoring for new chemicals for root pruning in containers, we do not see a need to investigate this product further. - **TES**

Barry's Blog

We have been busy here at the Nursery Cooperative laboratory (my office) this past year and want to share what has been happening.

In the 2013 growing season, we installed herbicide trials and other trials on loblolly pine, slash pine, longleaf pine and various hardwood species at 11 different nurseries, at our stress facility and in our greenhouse. Even though the Area-wide study is complete, we are still looking at some alternatives in conjunction with two nurseries. This year, a total of 22,891 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. If lined up one behind the other, the seedlings would stretch approximately 7 miles!

Again this year we have had some personnel changes since my last blog. Ben Whitaker, who replaced Paul Jackson, has moved on taking a position with Regions Bank in Birmingham. We all wish Ben the best in his new job. January 8, 2014 Nina Payne replaced Ben.

Scott, Tom and Nina are busy planning our herbicide trials for the 2014 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.

Leadership 101

10 Tips for Dealing with Upset Customers

Source: modified from Kelly J. Watkins, www.keepcustomers.com

1. **It is cheaper to solve the problem.** It costs six times more to obtain a new customer than it does to retain a current one. Keep the customers you have.

2. **Realize complaints are good.** Only 4% of upset customers complain. The other 96% simply leave and never come back. A complaint gives you the opportunity to resolve the situation.

3. **Create a customer for life.** When you solve a problem by meeting (or exceeding) expectations, you develop customer loyalty. I recently bought tires from Pep Boys assuming that the tires were "buy one, get one free." When I sent in my request for a rebate, it was rejected for a technicality. The local store could have stood by Corporate's decision but instead provided me with a rebate directly. They will now have my business for not only tires but also for oil changes.

4. **The customer is always . . . the customer.** Do not say to yourself "the customer is right." That implies you are wrong. Instead, remind yourself that this person is a valued customer, and you need to do whatever it takes to satisfy them.

5. **Offer alternatives.** Instead of saying, "This is the only thing I can do," try saying, "Here are two options..." The customer may not be thrilled with the selections, but at least they get to make the choice.

6. **Ask questions.** Get the facts you need from the customer and then gather additional facts related to nursery and shipping conditions. It is always a good habit to make notes on your copy of the shipping tickets as to how the seedlings were shipped, type of transportation and weather conditions when the seedlings were picked up.

7. **Do not solve the problem right away.** What?!?! Fight the urge to jump in and solve the problem. The customer's initial objective is to "vent" and express emotion. Listen first, and then offer solutions. If you interrupt too soon, the person may not be ready to listen to you or to accept your resolutions. This is true for teenagers as well!

8. **Do not get defensive.** When you hear the words "upset customer," it is natural to put up your guard. Instead, keep an open mind. You'll be more receptive to listening. Remember, history has shown that regardless of the cause of the problem, the nursery is usually the first to get blamed whether or not it is their fault.

9. **Do not take it personally.** Easier said than done! Keep in mind that most people have not been taught how to "complain properly." Customers know they are upset, but they do not know how to tell you nicely. Even if it sounds as though you are being attacked, customers are not mad at you personally. They are upset at the situation and their lack of control. See Number 5 above.

10. **Keep it in perspective.** You may have shipped seedlings to 50 happy customers that day. Do not let one bad-tempered person ruin the whole day - **TES**

Nursery 101

Soil Organic Matter: Are We Improving Our Soils?

As Scott and I were visiting nurseries in Louisiana and Arkansas, the topic of organic matter augmentation frequently came up in our discussions. It was apparent that, due to mill closings and shifts in agriculture, finding an economical effective source of organic matter can be a challenge.

According to our recent nursery practice survey, the median soil organic matter (SOM) is 1.6%, which has not changed since the last survey in 1980. What is interesting, if not scary, is that nurseries are putting less organic matter on their land now than 30 years ago. In 1980, a 1:1 rotation was commonly used in the larger industrial nurseries. This meant that organic matter was being applied to the fields every other year. Over the last 30 years, rotations have shifted to 2:2 or 3:1, which means augmentation of organic matter is now every 3 or 4 years.

Table 1.

SOM Classification	How Long it Lasts	C/N Ratio	% of Total Soil Organic Matter	Rate of Decomposition
Active	Weeks - 2 yrs	15 - 30	10 - 20%	Rapid
Slow	15 - 100 yrs	10 - 25	10 - 20%	Slow
Passive	500 - 5000 yrs	7 - 10	60 - 80%	Extremely Slow

Soil organic matter has many benefits that include providing a surface area for soil chemical reactions to occur, promoting aeration, improving soil structure, improving drainage, and increasing moisture and nutrient holding capacity. Organic matter in the soil is a continuum that can be categorized into three classes as described in Table 1, adapted from Richard Stehouwer, Department of Crop & Soil Sciences, Penn State University.

At any time, all three sources of SOM exist in your soil. The Active SOM results from recently deposited organic matter such as a cover crop. The Passive is the most stable source in the soil profile.

Can you grow quality seedlings without organic matter? David South answered that question with a good metphor. "You can grow seedlings without organic matter, but it's like walking a tightrope: the more organic matter you have, the wider the rope becomes and the easier life is."

All sources of SOM are not equal. Relying solely on a cover crop to increase your SOM will rarely result in an increase SOM over time. The only way to substantially increase SOM is application of organic amendments such as bark or sawdust. Chuck Davey has made the same recommendation for years – that being "apply a little frequently and consistently. It takes time but will pay off in the long run."

In 1980, David South described to the Nursery Cooperative why pine bark is a good choice for long term increases in SOM. Pine bark contains approximately 50% lignin in comparison to immature grasses, rye or legumes that only contain 4-12% lignin. Lignin is important because it decomposes at a slower rate than cellulose, hemicellulose or other carbohydrates. In a study examining corn stalks, 70% of the dry matter was lost in six months but only 33% of the lignin was lost. The following table (Table 2) is an informative partial list David provided in his talk of frequently used organic amendments.

In a 1971, USFS Research Note FPL – 091 titled "Bark and its Possible Uses," the authors describe the advantages of bark. The decomposition rate of bark is considerably slower than wood allowing it to last longer and consume less nitrogen when incorporated into the soil. Bark has no intrinsic value as a fertilizer but its benefits as a soil conditioner are appreciable. In sandy or silty soils it will lend body and loosen up clay soils improving the tilth, structure and aeration.

Even if increasing your soil organic matter is not a high priority with you, the benefits as a soil conditioner, especially in problem areas, is well worth your consideration.

For those interested in reading further on SOM may wish to read a good 1995 reference paper on the RNGR web site http://www.rngr.net/publications/omm titled: "Organic Matter Management in Forest Tree Nurseries: Theory and Practice" by Robin Rose, Diane Haase and Dan Boyer. Or "Bark and its possible uses" http://www.fpl.fs.fed.us/documnts/fplrn/fplrn091.pdf by John Harkin and John Rowe. - **TES**

Table 2.

Species	Plant Part	Age	% Lignin	% Cellulose
pine	bark	old	62.0	
pine	bark	new	50.0	23.7
cotton mill waste		decomposed	38.0	
pine	needles		28.6 - 33.6	42.5
pine	sawdust	new	25.0 - 30.0	42 - 46
cotton	hulls		26.6	60.0
wheat	straw	mature	25.7	
jute	fiber	mature	24.7	
just	fiber	flowering	22.5	
corn	cobs	mature	23.9	
sorghum-sudangrass	hay	mature	13.6	31.9
sorghum-sudan	entire	mature	4.6 - 6.6	
sorghum	entire	mature	3.7 - 5.1	
sunflower	seedheads		12.0	
clower-Landidno	hay	mature	11.7	
soybean	hay	mature	11.4	31.1
soybean	hulls		6.5	52.1
rye		mature	11.3	36.3
rye		medium	7.2	
rye		young	4.0	
clover		mature	8.4	
Kentucky bluegrass	top	early bloom	4.6	28.3
pearl millet	entire	mature	3.2 - 4.5	

Other News

Seedling Quality Evaluation - January 2015

For years, the Oregon Nursery Cooperative provided a seedling evaluation service for nurseries throughout the country. Although this cooperative folded a couple years ago, Robin Rose continued some of the evaluations until his recent retirement. We have been approached several times by our membership to provide some of these same seedling quality evaluations. Due to the way the By-laws of our Nursery Cooperative are written and how the University views our research Cooperative, we have not felt it feasible to provide these types of services. However, we have now determined a way to provide this service that ties the research priorities of the Cooperative to the University fiducial requirements.

Beginning in January 2015, we will offer a seedling quality evaluation service that will provide the following information: root collar diameter (RCD), height, seedling dry biomass, root weight ratio and histograms of RCD, height, and various statistics including averages, coefficients of variation and confidence levels. We feel that with this data you can effectively evaluate and compare seedlots. The cost of this test will be $35 per sample. We will not share seedling results outside of your organization. The Nursery Cooperative staff will only offer this service after January 1st of each year since we are actively measuring seedlings from Cooperative research studies during the time period from October to December.

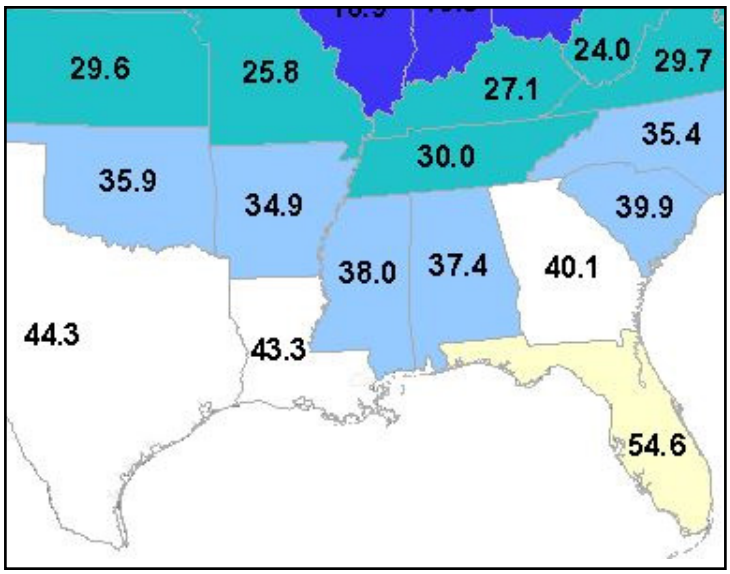
We will provide further information on this service (sample size, logistics and output) at the Contact Meeting in Virginia this July. - **TES**

Just How Cold Was It?

The topic of discussion with every nursery we visited or nursery manager we spoke with was how cold it was in January and how many lifting days were lost due to frozen ground. Be thankful you did not work in the greenhouse industry and needed to heat your greenhouses! The temperatures in the southern region averaged -6°F below the 100 year average of 46°F. Region- wide, January 2014 was the coldest in 29 years and the 8th coldest in the last 120 years.

Variations in the average January temperatures varied by state as can be seen on the map below.

Although we all agree January was cold, it was consistently cold, which meant we did not have the widely fluctuating temperatures characteristic of the past couple of years that can deacclimate seedlings. Hang in there. Spring is coming, probably with a whole new set of challenges. - **TES**



Greg Pate Sworn in as State Forester for Alabama

As of February 18, 2014, Alabama has a new State Forester. Many of you remember Greg Pate when he was Program Head for Nurseries and Tree Improvement for the North Carolina Division of Forest Resources. Greg was the Advisory Member for the North Carolina state nurseries.

Greg brings with him over 30 years of professional forestry experience to the Alabama Forestry Commission, including 25 years in state government and the remainder in the private sector.

Originally from Anniston, AL, Greg received his Bachelor of Science degree in Forest Management in 1981 from Auburn University (War Eagle!). He began his career as a contractor with forestry consultants. Then, in 1988, he joined the North Carolina Forest Service spending the next 25 years in various capacities including forest management, fire suppression, as well as nursery and genetics. He served as Regional Forester for five years in the Coastal Plain Region. The culmination of his career in North Carolina came in 2012 when he was named as that state's ninth State Forester. Currently a registered forester in both Alabama and North Carolina, Pate also holds the distinction of being one of only a few people who have held the position of State Forester in two states.

So…. is there a life after nurseries? Just ask Greg – Congratulations Greg!

Just for Fun!

Where is the Nursery?

There is an app for smart phones that shows you a picture and you have to guess where it was taken. You win by getting the closest in miles. So….. where are the two

Know Weeds

Liverwort (*Marchantia polymorpha*) - Just the name of this weed makes you want to get rid of it! It has even been called 'the cockroach of weeds' by some growers. This plant is not new – it has been identified in ancient fossil records and is closely related to mosses and ferns.

The name of this plant comes from the Old English "lifer," meaning liver and "wyrt," meaning plant. It was commonly applied to a genus of plants whose branching margins resembled the lobes of a liver and was once believed to be useful for treating liver ailments. Liverwort does have its role as a food source for some animals and helps in the decay process of logs. It also aids in the disintegration of rocks by retaining moisture while it grows in cracks and crevices.

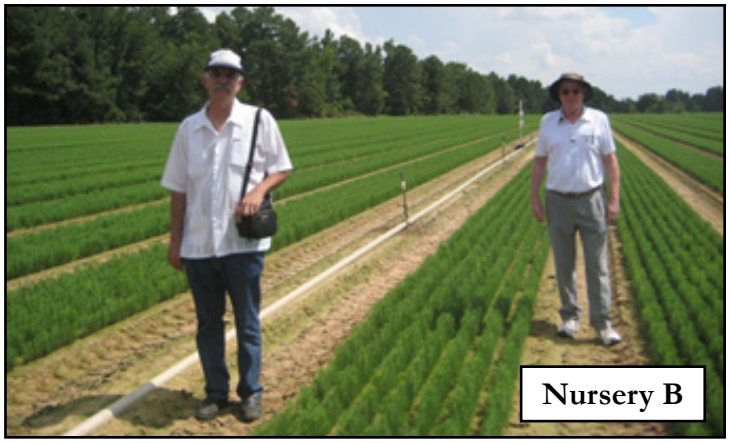
Liverwort has a small prostrate body with a flattened stem and overlapping leaves in two or more ranks. Most leaves are deeply lobed or segmented and the lack of a differentiated stem is obvious. Liverwort does not have a vascular system, which may be a factor in the lack of effectiveness of herbicides. It grows in almost every habitat on earth, but favors moist, humid environments. Over 10,000 species have been identified.

http://extension.umass.edu/landscape/sites/landscape/files/weeds/stems/mhtpo5420w.jpg

The same nursery container conditions of moisture, fertility and temperature that favor tree seedling growth also encourage liverwort growth. It reproduces both sexually through microscopic spores and asexually through clonal fragments. Liverwort creates problems in containers by forming mats over the container material, competing with the seedlings for water and nutrition. One effective method to control liverwort in ornamental container nurseries is by controlling the availability of water at the surface of the container, allowing containers to dry out or applying layers of quick-drying surface mulch. Another effective method is to lower nitrogen levels by not top-dressing or over fertilizing. The number of herbicides for controlling liverworts is very limited. The staff at the Nursery Cooperative will be installing an herbicide trial this spring to measure the effectiveness of pre- and postemergent herbicides on liverwort in containers. These include TerraCyte, SureGuard, RonStar G and Sporatec. - **NDP**

nurseries pictured here located? Any guess? Send your answer to tom.starkey@auburn.edu

The winner of the Fall 2013 edition of "Just for Fun" article is Drew Hinnant, from the Claridge State Nursery! He correctly identified the photo from the Fall 2013 Newsletter as being a piece of equipment used for pulling weeds at the Rayonier Nursery in Glennville in 2007. This was the first nursery conference Drew had attended.



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"Everybody can be great because anybody can serve. You don't have to have a college degree to serve. You don't have to make your subject and verb agree to serve. You only need a heart full of grace; a soul generated by love." ~ Martin Luther King, Jr.