Survey of Bareroot and Container Forest Seedling Nursery Practices in the Southern Region

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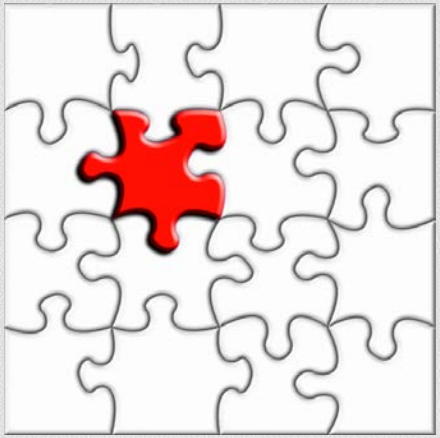
AUBURN
FORESTRY AND WILDLIFE SCIENCES

Survey of Forest Nursery Practices

- **1954** Abbott – Forest Tree Nursery Practices.
  Survey of all bareroot nurseries in US.
- **1964** Abbott & Eliason – Forest tree Nursery
  Survey of all bareroot nurseries in US.
- **1974** Abbott & Fitch – Forest Nursery
  Survey of all bareroot nurseries in US.
- **1980** Boyer & South (1984)
  Survey of bareroot nurseries 13 southern states.

What has happened since 1980*???

- We have a good estimate on production.
- Missing changes in nursery practices
  - Methods of sowing
  - Cultural practices
  - Pesticides
  - Pests
  - Sources of labor
  - Impact of government regulations
  - Container nursery practices (never done)



*Boyer, J.N.; South D.B. 1984. Forest nursery practices in the South. Southern Journal Applied Forestry. 8: 67–75.

Why this survey was needed……

- EPA, USDA, APHIS, State Plant Boards, State Departments of Agriculture and other government agencies ask questions.
  - Verify pesticide usage
  - Answer registration questions on how chemicals are used in nursery culture.
  - Identify and quantify pests in nurseries
  - Provide species and acreage information
  - Provide information of cultural activities
  - EPA – *"What is the impact of bird predation at sowing? "How does nursery culture minimize this threat?"*
    - "Is this the most recent data you have?" … EPA

Nursery Response

Survey results are being mailed this week to all participants

- Survey mailed June 2012:
  - Bareroot – 40 (28 page)
  - Container – 17 (23 page)
- Geographic Region - 13 states of the USDA Forest Service's Southern Region
- Surveys Returned: 79%
  - Bareroot – 35
  - Container – 10
- SFNMC vs non-SFNMC - 73% vs 27%

Surveys included....

Bareroot

- Nursery background
- Fumigation
- Weed, Disease Insect Control
- Soils
- Cover Crop/fallow
- Sowing
- Fertilization
- Irrigation
- Pine Culture
- Lift Pack & Ship
- Labor

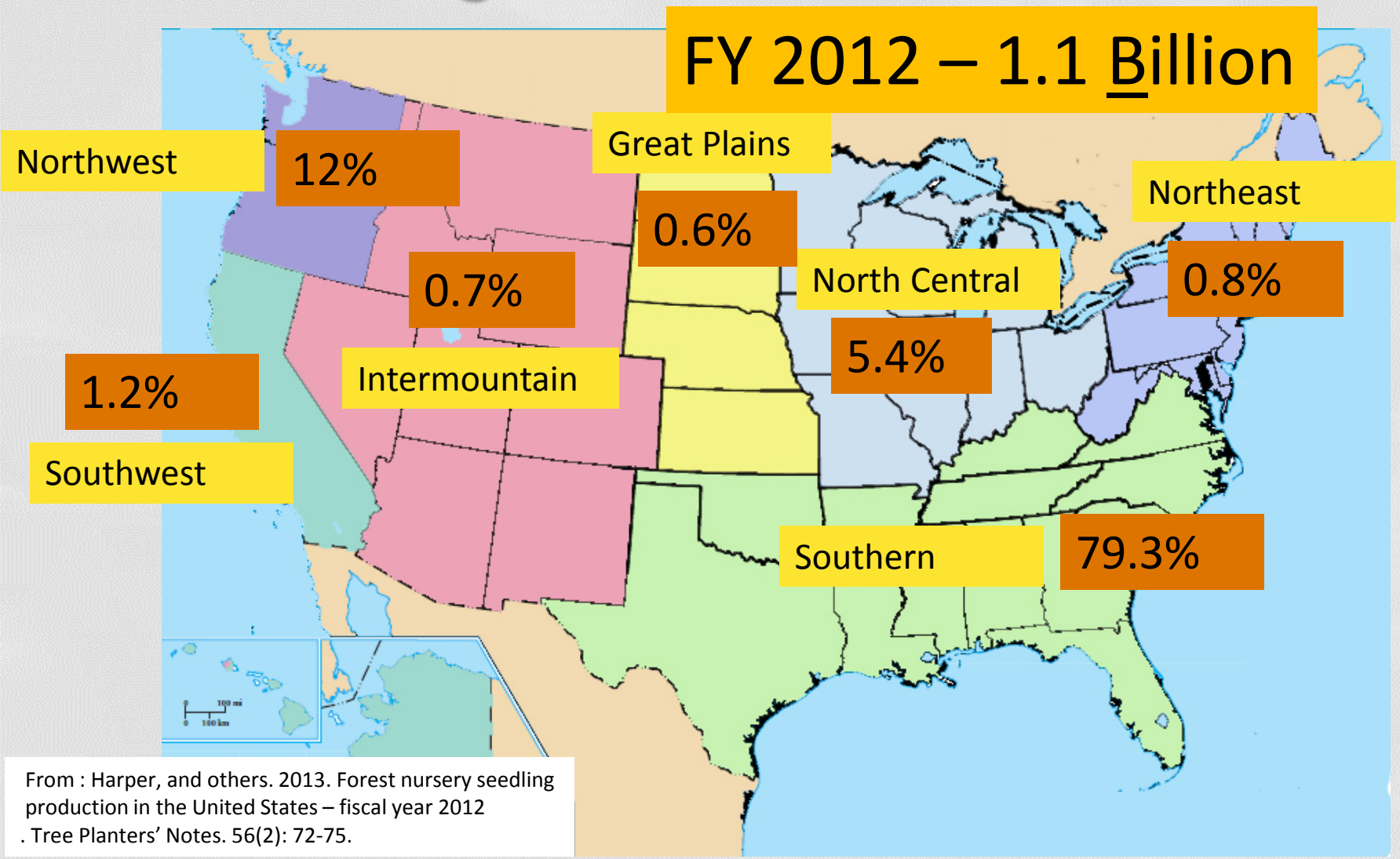
Container

- Nursery background
- Container sets & media
- Sowing
- Weed, Disease Insect Control
- Fertilization
- Irrigation
- Pine Culture
- Shipping
- Labor

Outline for today

1. Seedling production in the South
2. Bareroot nursery practices and changes since 1980
3. Container nursery practices in the South

Total Seedling Production in the US



From : Harper, and others. 2013. Forest nursery seedling production in the United States – fiscal year 2012 . Tree Planters' Notes. 56(2): 72-75.

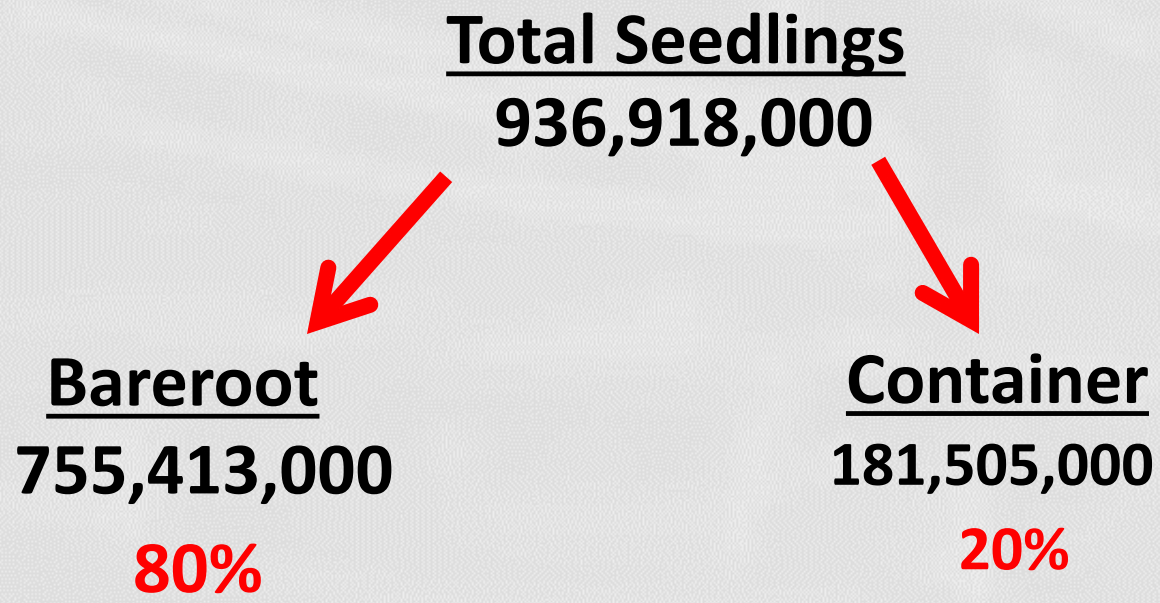
How Many Seedlings Do We Grow?

Region	**Bareroot**	Bareroot % by region	**Container**	Container % by region	**Total seedling produced**	Total % by region
Southern	**755,413,000**	**82.4%**	**181,505,000**	**68.4%**	**936,918,000**	**79.3%**
Northeast	8,828,000	1.0%	1,198,000	0.5%	10,026,000	0.8%
North Central	57,701,000	6.3%	6,168,000	2.3%	63,869,000	5.4%
Great Plains	5,430,000	0.6%	1,109,000	0.4%	6,539,000	0.6%
Intermountain	3,301,000	0.4%	4,879,000	1.8%	8,180,000	0.7%
Pacific Northwest	85,890,000	9.4%	56,041,000	21.1%	141,931,000	12.0%
Pacific Southwest	-	-	14,323,000	5.4%	14,323,000	1.2%
Totals	**916,563,000**		**265,223,000**		**1,181,786,000**	

FY 2012

from : Harper, R.A.; Hernández, G.; Arseneault, J.; Bryntesen, M.; Enebak, S.; Overton, R.P. 2013. Forest nursery seedling production in the United States – fiscal year 2012. Tree Planters' Notes. 56(2): 72-75

Stock type breakdown in South




Bareroot Survey Results - What has happened since 1980?
Research Toward Increasing Nursery Productivity

Bareroot Survey Response vs Production

- Those returning bareroot surveys grew **97%** of all bareroot production in the south

Southern Forest Nursery Management Cooperative

1980

- Industry – 19 members
- State – 12 members
- Federal – 1 member
- Private – 0 members

59

2012

- Industry – 3 members
- State – 8 members
- Federal – 1 member
- Private – 4 members

29

Nursery closure since 1995

Initial loss – 617 MM

- Industry – 11 nurseries
- State – 9 nurseries
- Federal – 1 nurseries
- Private – 7 nurseries

Source: Doug Sharp, Plum Creek
David South, Retired Auburn Univ.

Bareroot Conifer Production in the South

1980

- 1,251,669,000

- Loblolly Pine - 77%
- Slash Pine - 13%
- Longleaf Pine - 0.8%
- White Pine - 1.8%
- Sand Pine - 0.7%
- Shortleaf Pine - 1%

2012

- 788,344,000

- Loblolly Pine - 86%
- Slash Pine - 11%
- Longleaf Pine - 0.7%
- White Pine - 0.3%
- Sand Pine - 0.9%
- Shortleaf Pine - 0.2%

Enebak, S.A. 2012. Forest tree seedling production in the south for the 2011–2012 planting season. Auburn, AL: Auburn University Southern Forest Nursery Management Cooperative. Technical Note 2012-01: 10 p.

Bareroot Nursery Size & Ownership

1980

- Avg. - 17 million
- State & Federal
  22 million - 54% * #
- Industry
  18 million - 46%

2012

- Avg. - 13 million
- State
  6 million – 13%
- Industry
  29 million – 38% *
- Private
  25 million - 48% #

* Largest nursery
# Largest production

Bareroot Nursery Soil Texture

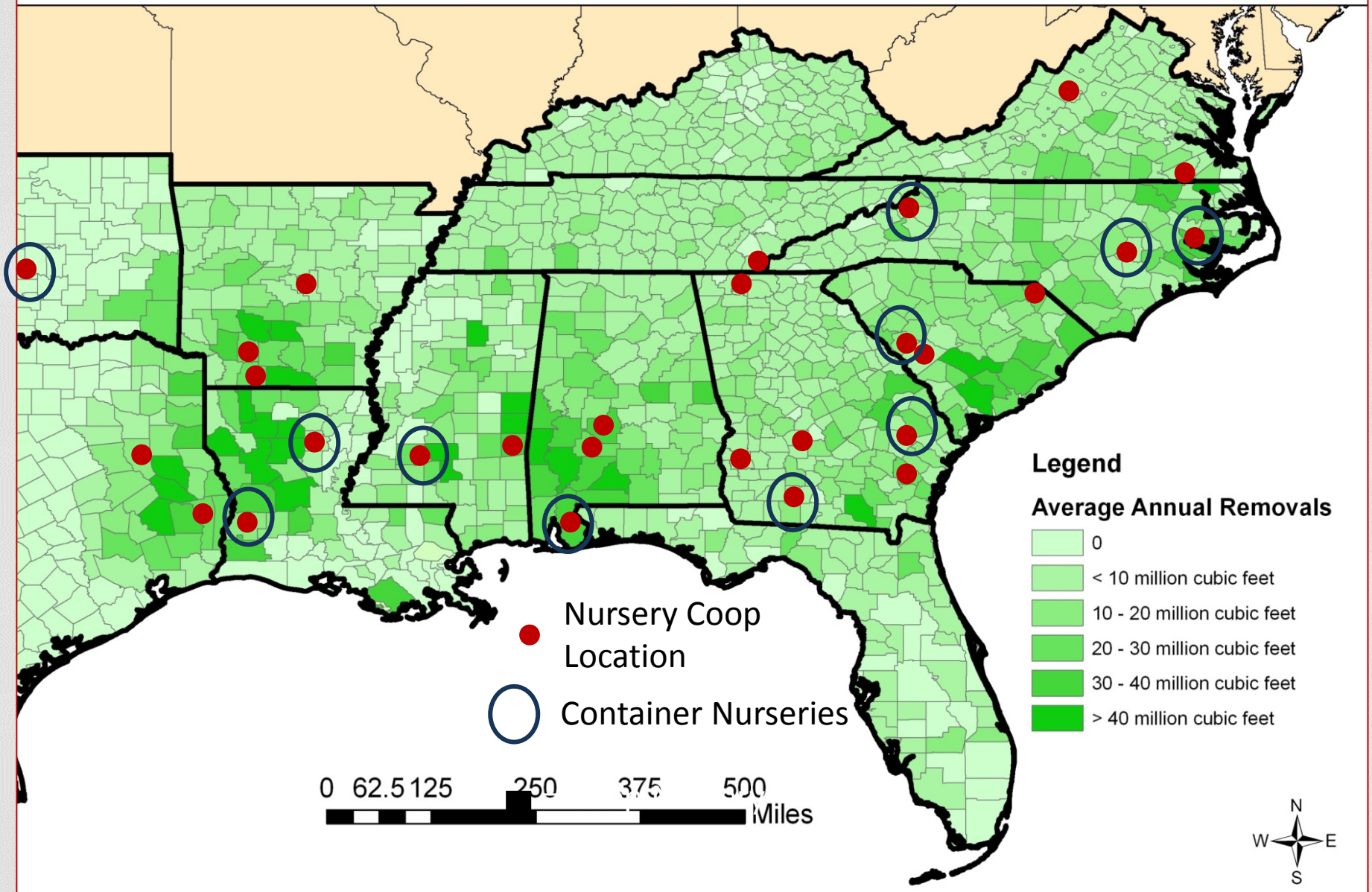
1980

- 33% located > 75% sand

2012

- 38% located >75% sand
- 13 new nurseries
  - 6 of 13 on land >88% sand

Southern Forest Nursery Management Cooperative



Fumigation in Bareroot Nurseries

1980

- 98:2 MBr:Pic @357 lb/acre
- MBr – primary fumigant 88%
- Cost of fumigation = no change
- 50% fall fumigation
- 60% fumigated every other year

2012

- 80:20 MBr:Pic @364 lb/acre
- MBr – primary fumigant 97%
- Cost of fumigation = no change
- 68% fall fumigation
- 17% every other year
  56% every two years
  27% every 3+ years
- Operational use of alternative 16%

Cover Crop/Fallow in Bareroot Nurseries

1980

- 53% on land in cover crop/fallow
- Industry – 57%
- Rotation:
  - Industry 56% = 1:1
- Winter cover crop - Rye

2012

- 53% on land in cover crop/fallow
- Industry – 35%
- Rotation:
  - Industry 2:1 or 3:1
- Winter cover crop - Rye

Soil Organic Matter in Bareroot Nurseries

1980

- 1.6% Organic Matter
- 66% regularly add OM

2012

- 1.7% Organic Matter
- 85% regularly add OM

Organic Matter*	1980 n=50	2012 n=27
Sawdust	54%	38%
Bark	24%	32%
Gin Compost	0%	6%
Wood Chips	12%	6%
Mill Grit	0%	3%
Other	10%	24%
None	34%	15%

*** some managers listed more than one material**

Sowing Bareroot Nurseries

1980

- Gravity-drop sowers
  - Whitfield
  - Love-Oyjord
  - Stanhay
  - Planet Junior

2012

- Gravity-drop sowers*
  - Whitfield
  - Love-Oyjord
- Vacuum Drum sowers
  - Summit
  - Love
  - Silver Mt.

Sowing Bareroot Nurseries

Soil/bed Stabilizers

1980

- Hydromulch
- Pine straw
- Sawdust
- Bark

2012

- Synthetic Soil Stabilizers
  - 72% of nurseries
  - 3 nurseries used both bark and synthetic soil stabilizers

Irrigation in Bareroot Nurseries

1980

- Impact head sprinklers
- 33% managers monitor soil moisture

2012

- Impact head sprinklers &/or Center Pivot
- 100% managers monitored soil moisture 75% “Touch & Feel”

Fertilizing in Bareroot Nurseries

1980

- Ammonium nitrate or sulfate
- Fall application of Potassium

2012

- 83% liquid fertilizer
- Urea – primary N – 60%
- 55% - Fall application of Potassium

Weed Control in Bareroot Nurseries

Weed*	Scientific Name (genera)	1980 n=47	2012 n=31
Crabgrass	Digitaria	64%	12%
Nutsedge	Cyperus	62%	44%
Bermuda grass	Cynodon	36%	6%
Morningglory	Ipomoea	28%	35%
Sicklepod	Arabis	23%	18%
Goose grass	Acrachne	23%	3%
Fennel	Eupatorium	13%	3%
Flathead sedge	Cyperus	4%	12%
Spurge	Euphorbia	2%	65%
Coffee weed	Senna	-	15%
Water weed	Eclipta	-	6%
Willow	Salix	-	9%
*** Some managers listed more than one species**			

- Spurge #1 – 19% of nurseries
- Nutgrass – decrease since 1980

Weed Control in Bareroot Nurseries

1980

- Mineral Spirits – 59% (130 gal/a/yr)
- Goal® - 73% (Registered 1979)

2012

- Goal® 2XL – 100%

Mortality in Bareroot Nurseries

Factor	1980	2012
Pre-emergent damping -off	6	6
Post-emergent damping-off	2	1
Fusiform rust	6	9
Rhizoctonia Foliar Blight	-	7
Rhizoctonia Crown Blight	-	9
Nematode	9	8
Animals	-	2
Herbicide	3	5
Insect	8	3
Birds	7	3
Hail	-	8
Rain splash	4	4
Nutrient deficiency	5	8
Wind	7	9
Bed Washing	1	9
Hand weeding	8	9
Drought	-	9

Mortality in Bareroot Nurseries

Fusiform Rust Control

1980

- Ferbam®
- Up to 54 applications
- 2.5% incidence of rust
- >4 lb ai/acre/yr

2012

- Bayleton® and or Proline®
- 4-5 applications
- <0.1% incidence of rust
- Bayleton® 1 lb ai/acre/yr
- Proline® 10 oz ai/acre/yr

Insect Control in Bareroot nurseries

1980

- Losses 1-2%

2012

- Losses <1%
- Tarnished Plant Bug (Lygus and or Taylorilygus) 25% (first reported 1983)

Pine Culture in Bareroot Nurseries

1980

- Root and top pruning used by several nurseries

2012

- Top pruning 91%
- Root Pruning 89%
- The only nurseries not top pruning were 4 state nurseries
- The only nurseries not root pruning were 3 state nurseries
- 76% of nurseries top prune 2-3 times a summer
- 83% of nurseries lateral prune 1 time

Lift, Pack and Ship in Bareroot Nurseries

1980

- Belt Lifters – 38%
  - Mathis - 60%

2012

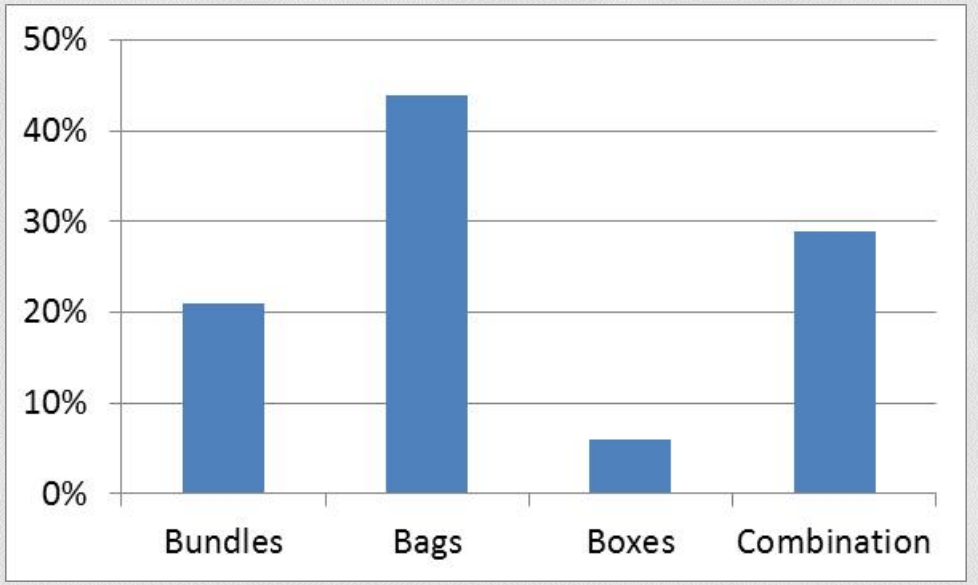
- JE Love Full Bed Belt Lifters – 75%
- Machine:Hand lift – 62%:38%

Lift, Pack and Ship in Bareroot Nurseries

1980

- Packing in seedling bundles

2012




More information on bareroot practices in the south will be presented in a forthcoming publication.

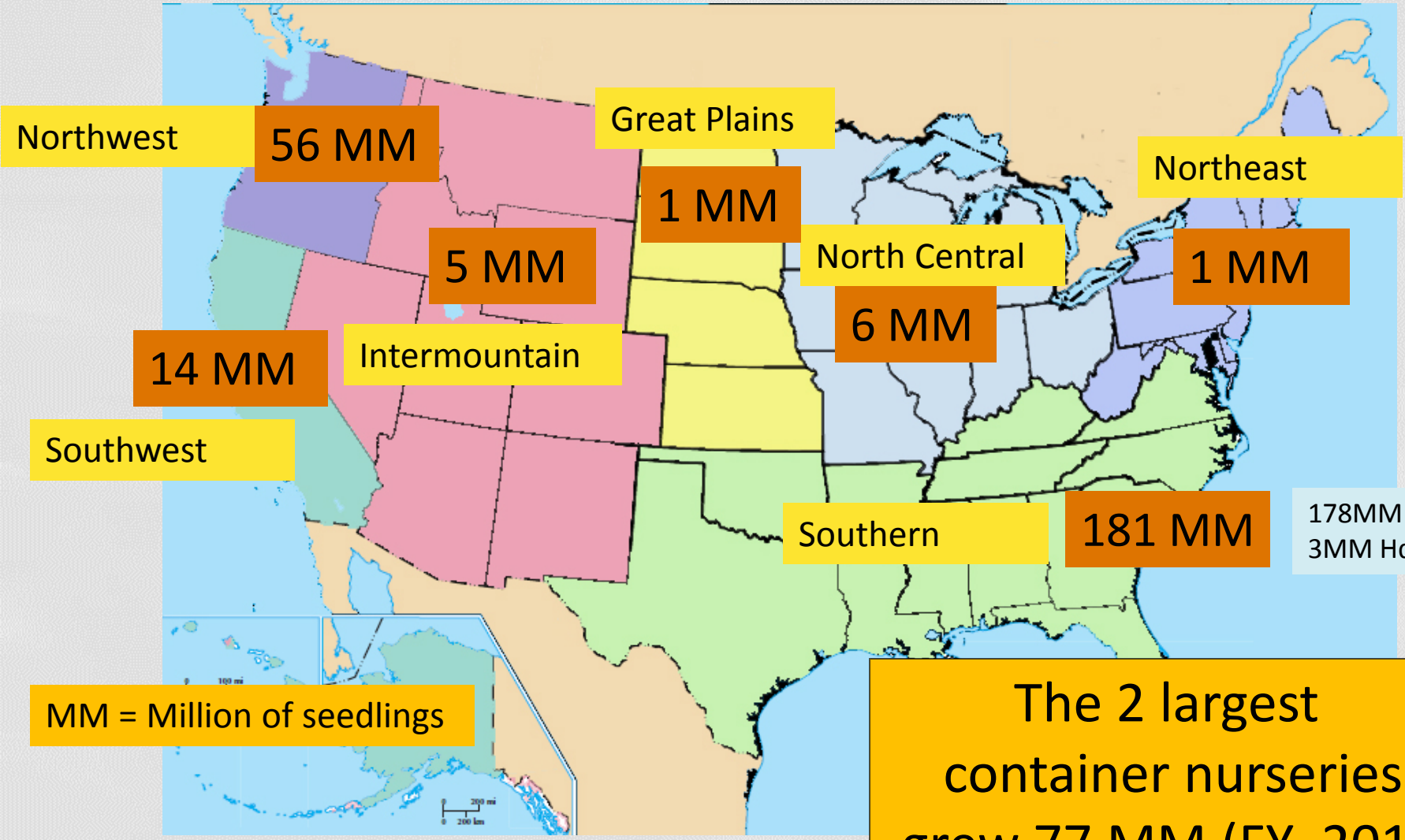
Container Nursery Survey Results

Research Toward Increasing Nursery Productivity

Container Survey Response vs Production

- Those returning container surveys grew **61%** of all container production in the south

Container Seedling Production in the US



The 2 largest container nurseries grew 77 MM (FY 2012)

Container Conifer Production in the South

- 1974 - est 400,000
- 1980 – est 3,500,000
- 2012 – est 178,000,000

+775%

+5,000%

Container Conifer Production in the South

Container 2012

- Loblolly Pine - 34%
- Slash Pine - 2%
- Longleaf Pine - 63%

178,317,000

Bareroot 2012

- Loblolly Pine - 86%
- Slash Pine - 11%
- Longleaf Pine - 0.7%

718,344,000

Container Nursery Size & Ownership

- Avg. - 6 million - Range of 50,000 – 55 million
- State – 6% of container production
- Industry – 11% of container production
- Private – 83% * of container production

- Grow container stock only – 60%
- Grow container & bareroot stock – 40%

* Largest nursery

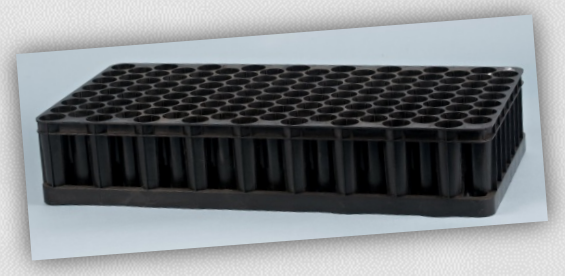
Container Seedlot Genetics

Species	Genetics	Percent Sown
Loblolly pine	1st gen	4%
(n=7)	2nd gen	33%
	3rd gen	24%
	Advanced	39%
Slash Pine	1st gen	48%
(n=2)	2nd gen	48%
	Advanced	4%
Longleaf Pine	Wild	73%
(n=9)	Improved	27%

Bareroot 19%

Growing Containers

- Nurseries:
  - 60% Hard plastic
  - 10% Styroblock
  - 30% - combination
- Production:
  - >80% Hard Plastic



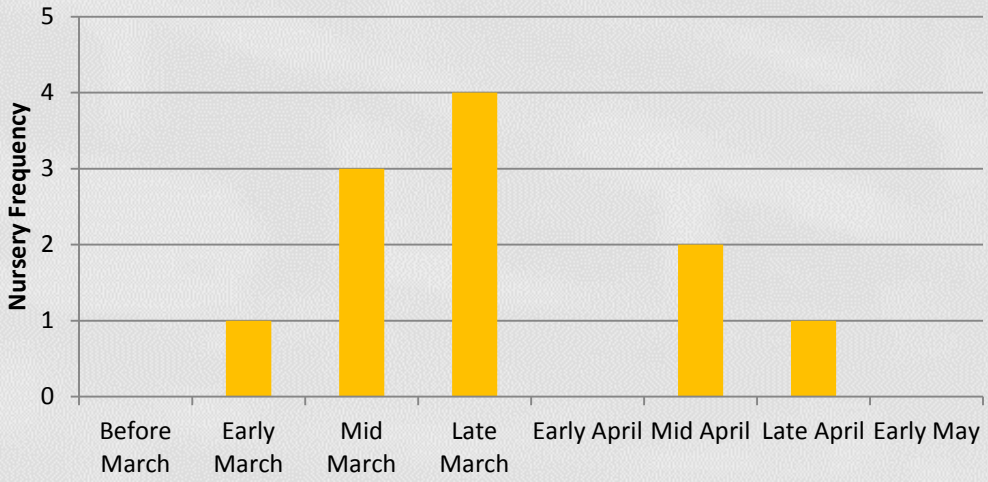
- <u>Hard plastic</u>
  - 52.9 seedlings/sq ft
  - 6.7 cu in cell volume
- <u>Styroblock</u>
  - 49 seedlings/sq ft
  - 6.6 cu in cell volume

Growing Media

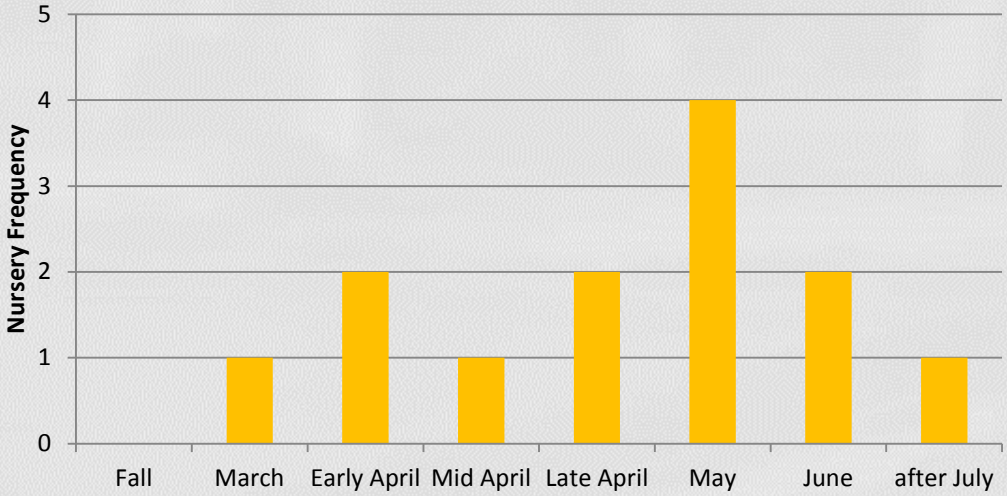
- 68% Peat Moss
  - + Vermiculite and Perlite used by 80% of nurseries
- 1 nursery reported using composted bark as an ingredient
- 50% of nurseries use tall compressed bales
- pH at sowing 4.7
- One nursery reported mixing own ingredients as opposed to buying premix

Sowing a Container Nursery

Date of Start
Sowing Conifers

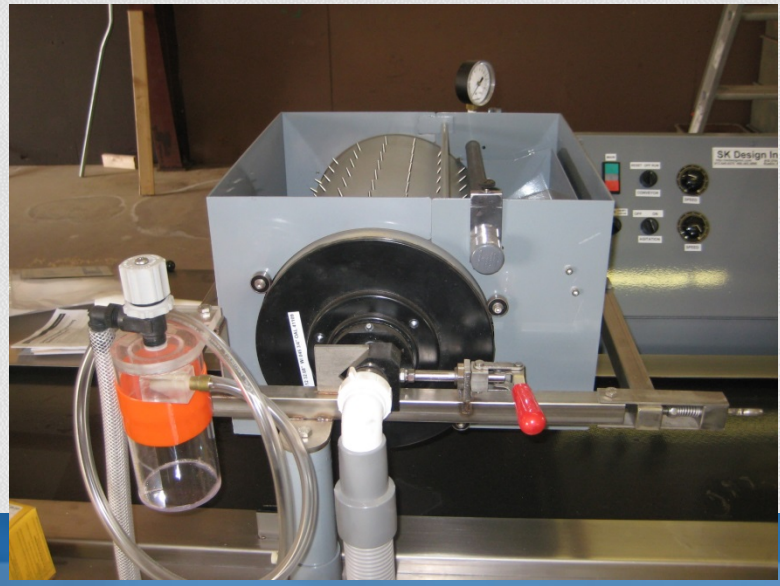


Date of Start
Sowing Native Plants



Sowing a Container Nursery

- Vacuum-drum sowers are most common in nurseries > 6 million
- Avg – 300,000 – 400,000 cavities per day
- Smaller nurseries, especially longleaf nurseries hand sow
- Capping material
  - Vermiculite
  - Sawdust



Sowing a Container Nursery

- 50% of nurseries use shade cloth after sowing until germination is complete
- Seedling are not grown under cover (plastic/glass) in the south

Irrigation in a Container Nursery

- Types of irrigation
  - Stationary head – used exclusively by 6/10 nurseries
  - Center pivot – used by 4/10 nurseries
  - Traveling horizontal boom

Fertilization in a Container Nursery

Fertilization Method	% of nursery managers responding
Slow release fertilizer only	10%
Combination of slow release plus tractor/spray	40%
Combination of slow release, injector plus tractor/spray	30%*
Only injector-applied	20%*

* Greatest Production

Fertilization in a Container Nursery

- 2 formulations of slow release fertilizer
  - 3-4 month (most common with nurseries also using an injector (fertigation)
  - Full season
- In a previous study, nurseries using only slow release fertilizer had the lowest foliar nitrogen levels a time of shipping (Oct – Jan)

Weed Control in Container Nurseries

1. Black willow
2. Spurge

- Hand weeding done primarily by nonpermanent employees
- One exception…..
- Herbicides:
  - For broadleaf weeds - Goal® (oxyfluorfen), GoalTender® (oxyfluorfen) and Cobra® (lactofen).
  - For grasses - Sethoxydim

Mortality in a Container Nursery

Factor	2012
Preemergent damping -off	2
Postemergent damping-off	2
Fusiform rust	6
Rhizoctonia Foliar Blight	4
Rhizoctonia Crown Blight	4
Animals	5
Herbicide	4
Insect	3
Birds	1
Rain splash	5
Nutrient deficiency	5

Pine Culture in Container Nursery

- 66% of mangers indicate they top prune loblolly
- Only one manager indicated he does not top prune his longleaf
- 66% top prune more than once

Shipping in Container Nursery

Month	Percent shipped
Before September	3%
September	17%
October	4%
November	27%
December	29%
January	20%
February	9%

51%

Bareroot

Shipping in Container Nursery

- 40% pack seedlings in a shed
- 30% pack seedlings in the field
- All responding nurseries shipped in wax-coated boxes
- Average number seedlings packed per day - 175,000 (15,000 to 350,000)
- Target RCD – for loblolly seedling:
  - November – 4.0mm
  - January - 4.5 mm

BR - 5.5 mm

Labor used in a container nursery

	Nursery Activity		
Labor	Sowing	Summer	Shipping
Permanent	33%	40%	27%*
Local	36%	32%	32%
Migrant	33%	22%	45%

Permanent = Fulltime employees

Local = Includes US Nationals and legal foreign nationals

Migrant = Include H1A and H2B labor, etc.

*** More than one labor source was listed by most nurseries**

Summary

- Total seedling production in the south reached a low in 2010 but has continued to increase each year since.
- Bareroot will be the primary stock type for loblolly and slash pine.
- Container will be the primary stock type for longleaf pine.
- Container share will continue to increase each year, especially if companies reserve their advanced genetics for container stock.

Summary – Container Future

- Reduce costs:
  - Media composition
  - Sowing efficiency
    - Longleaf
    - Native plants
  - Weed control
  - Packing/shipping

- Seedling Quality:
  - Seed treatments
  - Root ball capture
  - Better height management
  - Better nutrition @ shipping
  - More shipping on front end of season