Chemistry Updates

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Fusiform Rust Control Fungicides

AUBURN
UNIVERSITY

SCHOOL OF FORESTRY
AND WILDLIFE SCIENCES

Fusiform rust

- *Cronartium quercuum* f. sp. *fusiforme* the causal agent of Fusiform rust is still of major concern to many loblolly and slash growers
- Both genetic and cultural options are available to reduce the risk of this disease but the most effective control is the use of fungicides
- The Nursery Coop in 1980 was instrumental in the registration of Bayleton ® with the incidence of rust fell from 2.5% to 0.1% due to the use of this compound. Fungicide usage fell from 4 lbs/ac/yr to less than 1lb/ac/yr due to the reduced number of applications
- The Nursery Coop continued to look for alternative chemistries to assist with Fusiform control and was instrumental in the registration of Proline ® in 2011

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Proline® as a seed treatment

- As a seed treatment, current labelled rate is 10 fl oz./50 lb of seed
- These labelled rate have now been tested and shown to provide optimum activity

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Greenhouse trials

SCHOOL OF FORESTRY
AND WILDLIFE SCIENCES

2019 Active ingredients tested for foliar spray in greenhouse study

Fungicide	Manufacturer	Active Ingredient	Rate tested
BanBanner Max II®	Syngenta	Propiconazole - 14.3%	6 fl oz. per 100 gallons of water
Mural®	Syngenta	Azoxystrobin - 30% Benzovindiflupyr - 15%	3 oz. per 50 gallons of water
Proline®	Bayer Cropscience	Prothioconazole – 41%	5 fl oz. per acre

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

2020 Active ingredients tested for foliar spray in greenhouse study

Fungicide	Manufacturer	Active Ingredient	Rate tested
Protect® DF	Nufarm	Mancozeb - 75%	4 oz. per 1000 ft^2
Hurricane®	Syngenta	Fludioxonil - 32% Mefenoxam - 16%	3/4 oz. in 100 gallons of water
Proline®	Bayer Cropscience	Prothioconazole – 41%	5 fl oz. per acre

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Seedling treatment study

- Fungicide treatments applied to seedlings at Auburn Laboratories at 2 weeks post germination
- Seedlings sent to Asheville, NC Rust Lab
- Seedlings challenged with rust spores at 3 weeks post germination
- 3 and 6 month evaluations made by NC Rust Center

Southern Forest Nursery Management Cooperative

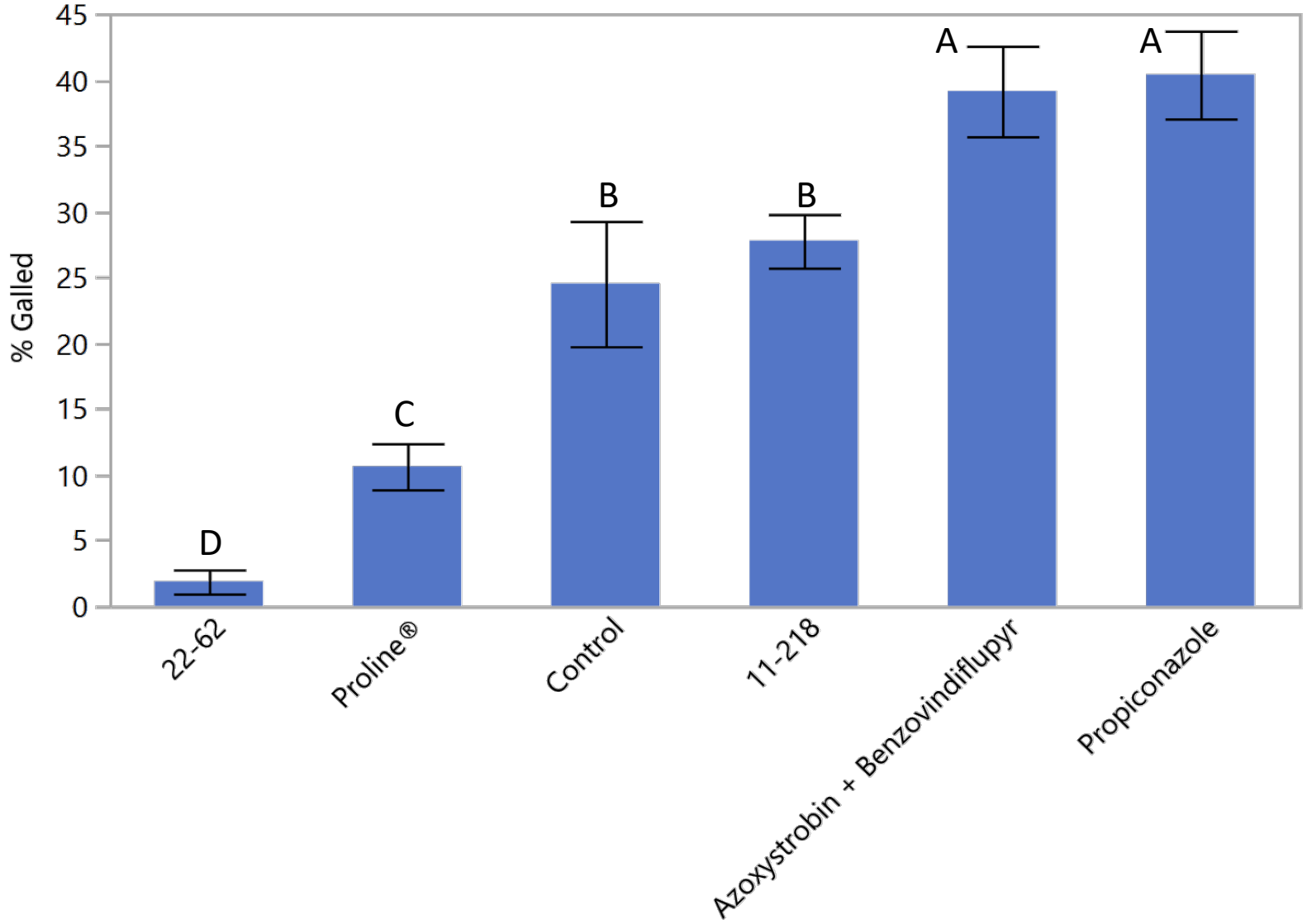
AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Southern Forest
Nursery Management Cooperative

AUBURN
UNIVERSITY
SCHOOL OF FORESTRY
AND WILDLIFE SCIENCES

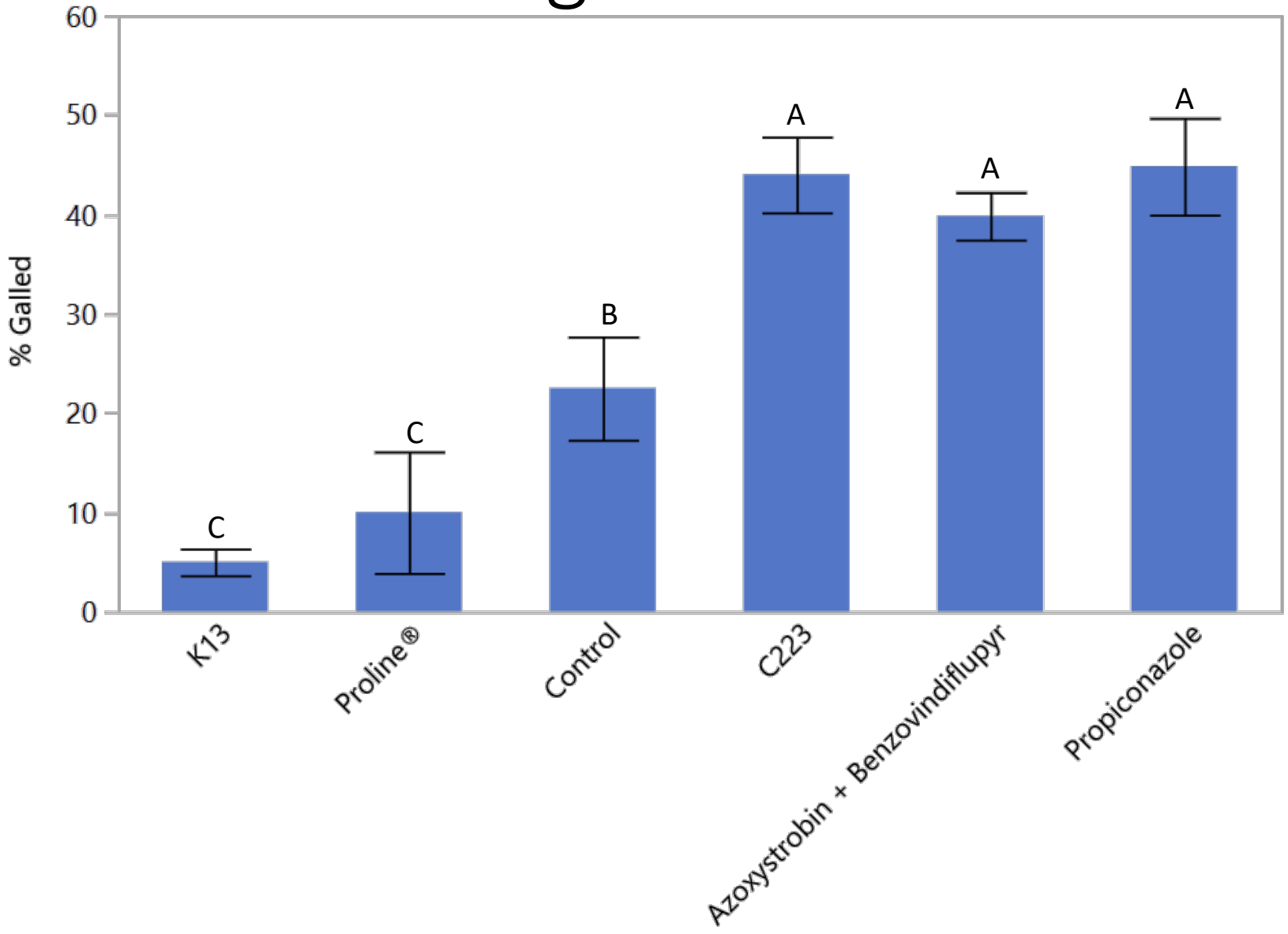
2019 Loblolly seedling treatment results



Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

2019 Slash seedling treatment results



Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

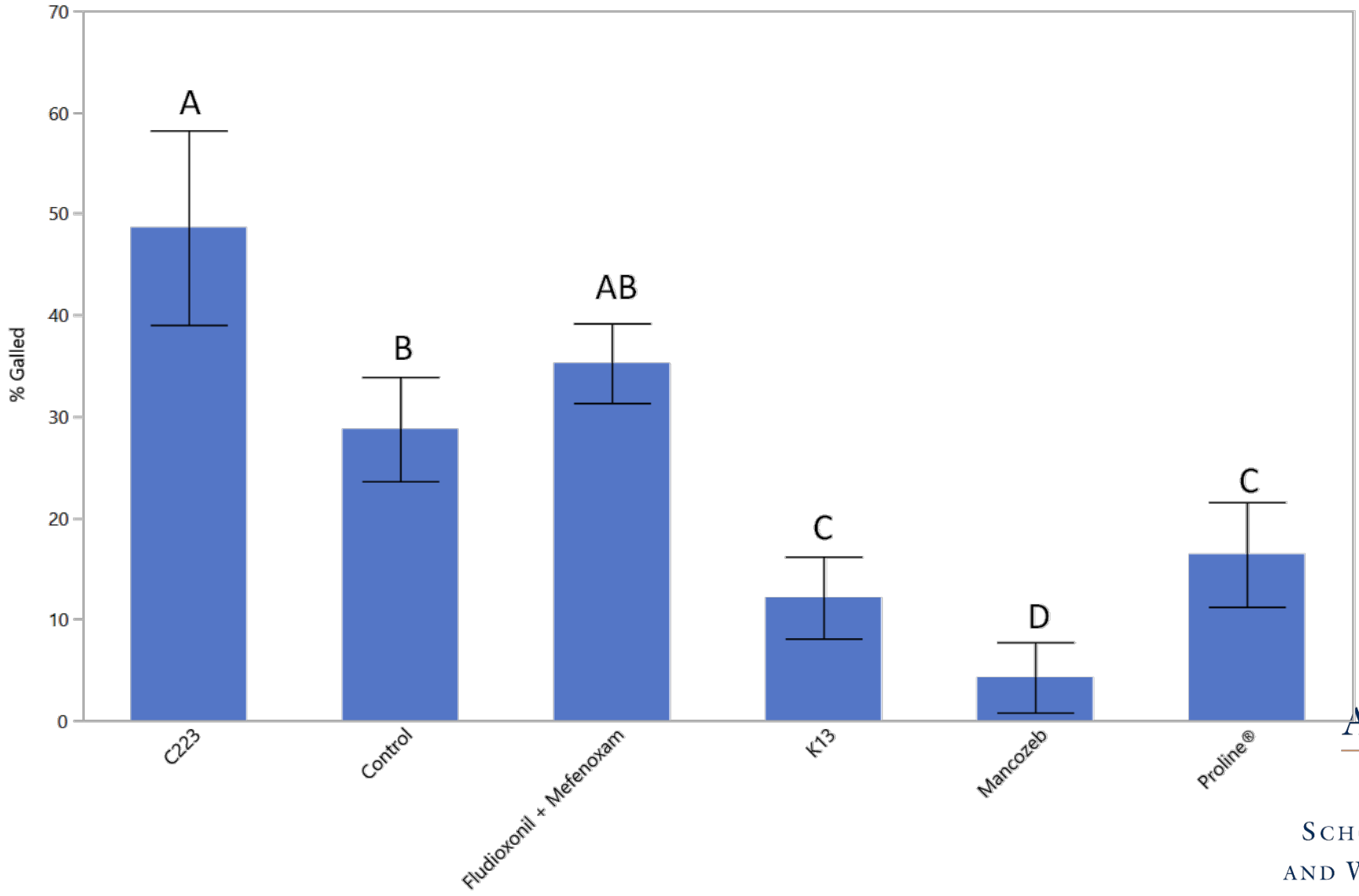
2019 Seedling treatment results

- Results from this greenhouse study indicate that the active ingredients Azoxystrobin + Benzovindiflupyr and Propiconazole were found to have worse results compared to that of the untreated controls and are therefore ineffective in reducing the incidence of Fusiform galls.

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

2020 Slash seedling treatment results



Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

2020 Seedling treatment results

- Results from this greenhouse study indicates that the active ingredient Mancozeb is effective in reducing the incidence of Fusiform galls on slash pine.

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Field trial

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Active ingredients tested as foliar spray

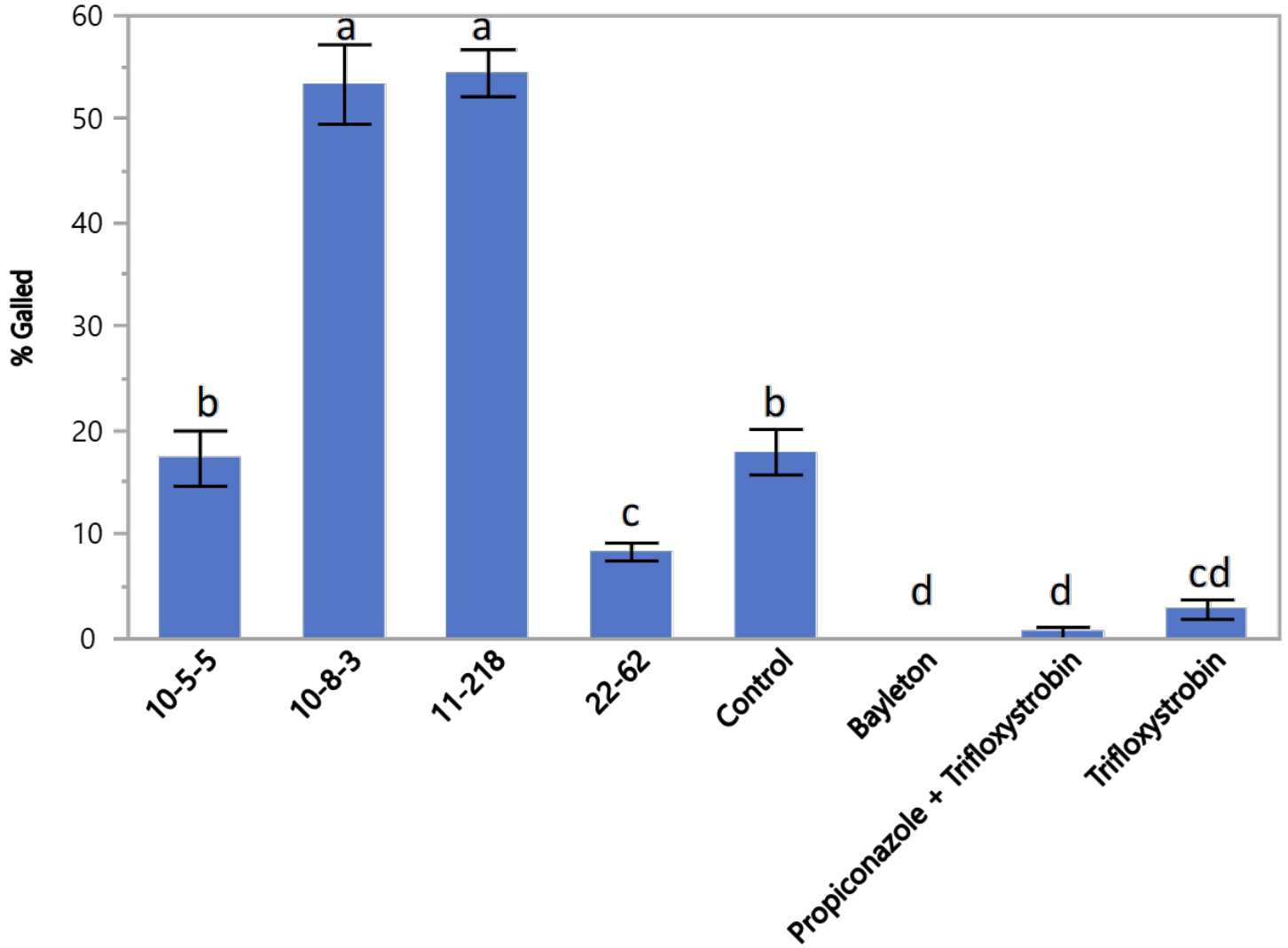
Fungicide	Manufacturer	Active Ingredient	Chemical Class	Rate tested
Bayleton®	Bayer Cropscience	Triadimefon - 50%	Triazoles	8 oz. per acre
Compass®	Bayer Cropscience	Trifloxystrobin – 50%	Oximino acetates	3 oz. per acre
STRATEGO® 250EC	Bayer Cropscience	Propiconazole – 11.4% Trifloxystrobin – 11.4%	Oximino acetates + Triazoles	10 fl oz. per acre
Proline®	Bayer Cropscience	Prothioconazole – 41%	Triazoles	5 fl oz. per acre

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

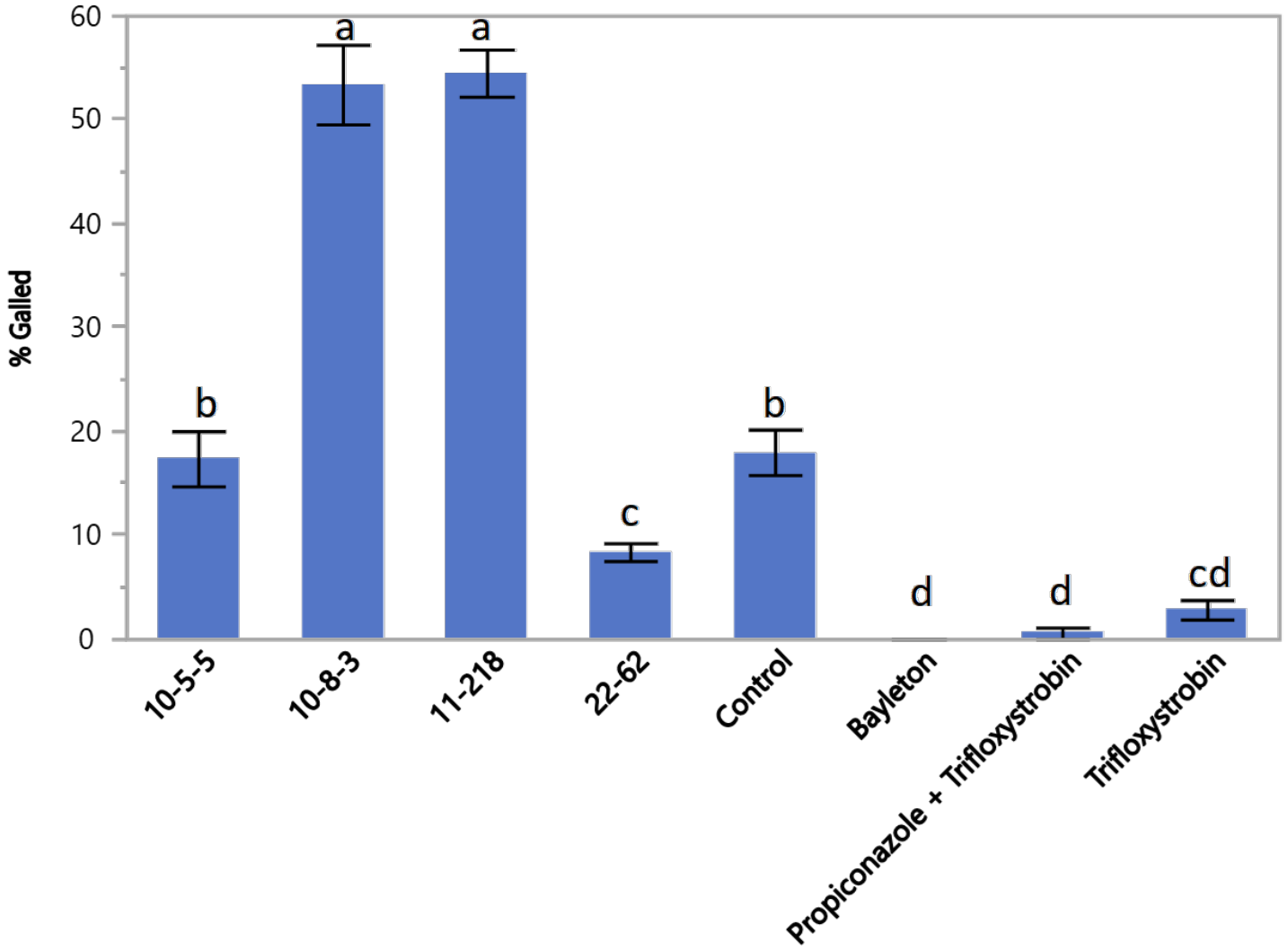
Loblolly pine seedlings treatment results



Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Slash pine seedlings treatment results



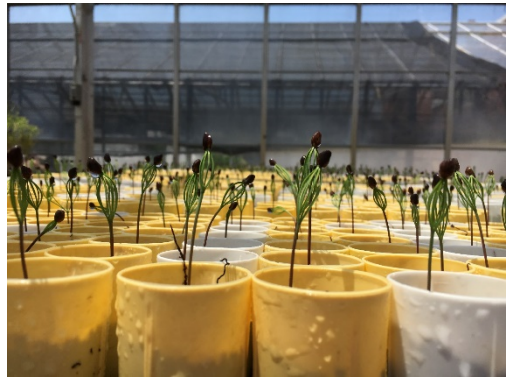
Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Seedling treatment

- The new chemistries tested as a seedling control were found to be effective in reducing Fusiform rust in the greenhouse study
- The active ingredients Trifloxystrobin (Compass®) and Propiconazole + Trifloxystrobin (STRATEGO®) were found to be as effective as Triadimefon (Bayleton®)



Southern Forest Nursery Management Cooperative

Auburn University School of Forestry and Wildlife Sciences

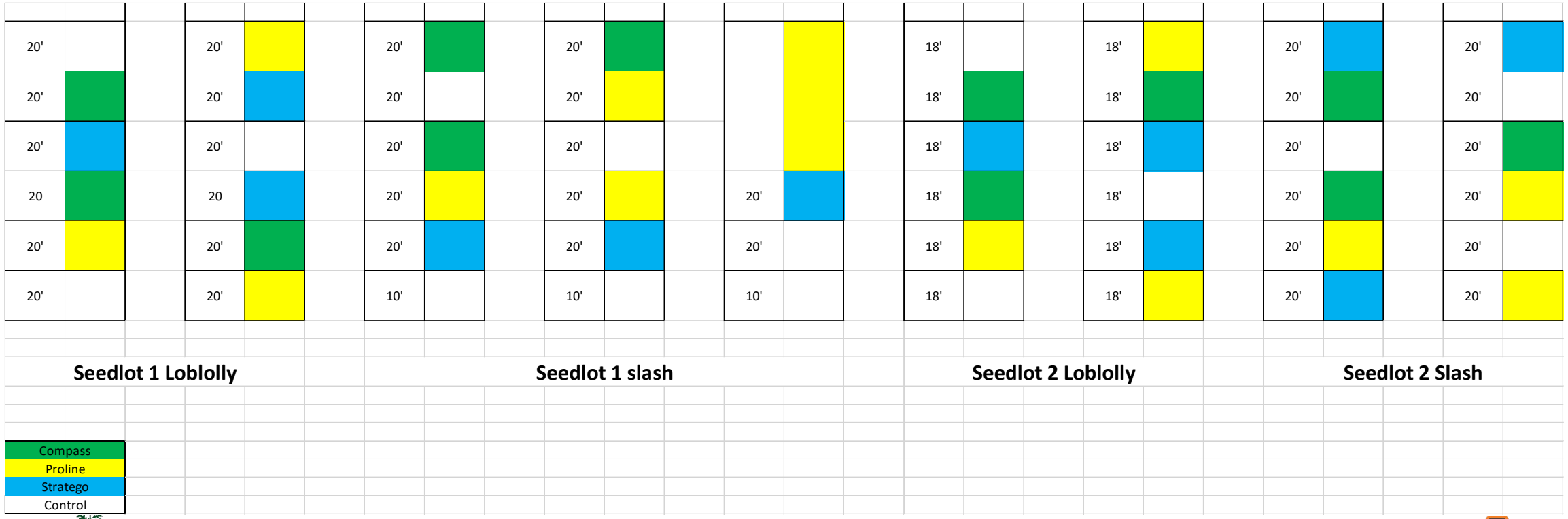
Field test- trial layout

- 4 seedlots tested: 2 loblolly and 2 slash
- Seedlings were sprayed on 5 occasions –
  - 1st spray commenced 21 days following seed sowing as all seed was treated.
  - Subsequent sprays were 14 days apart.
  - Spraying commenced at the end of April until the end of June 2019.
- Products to sprayed
  - Control – No control
  - Proline – Operational control (5oz/acre)
  - Compass – (3oz/ acre)
  - Stratego – (10 fl oz/ acre)

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Trial layout



Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

2019 Field test

- 2019 undertook a field performance trial to assess alternative chemistries that showed promise
- At the end of the growing season for each seedlot we assessed:
  - Seedling quality
  - Number of rust galls
  - Root morphology

Southern Forest Nursery Management Cooperative

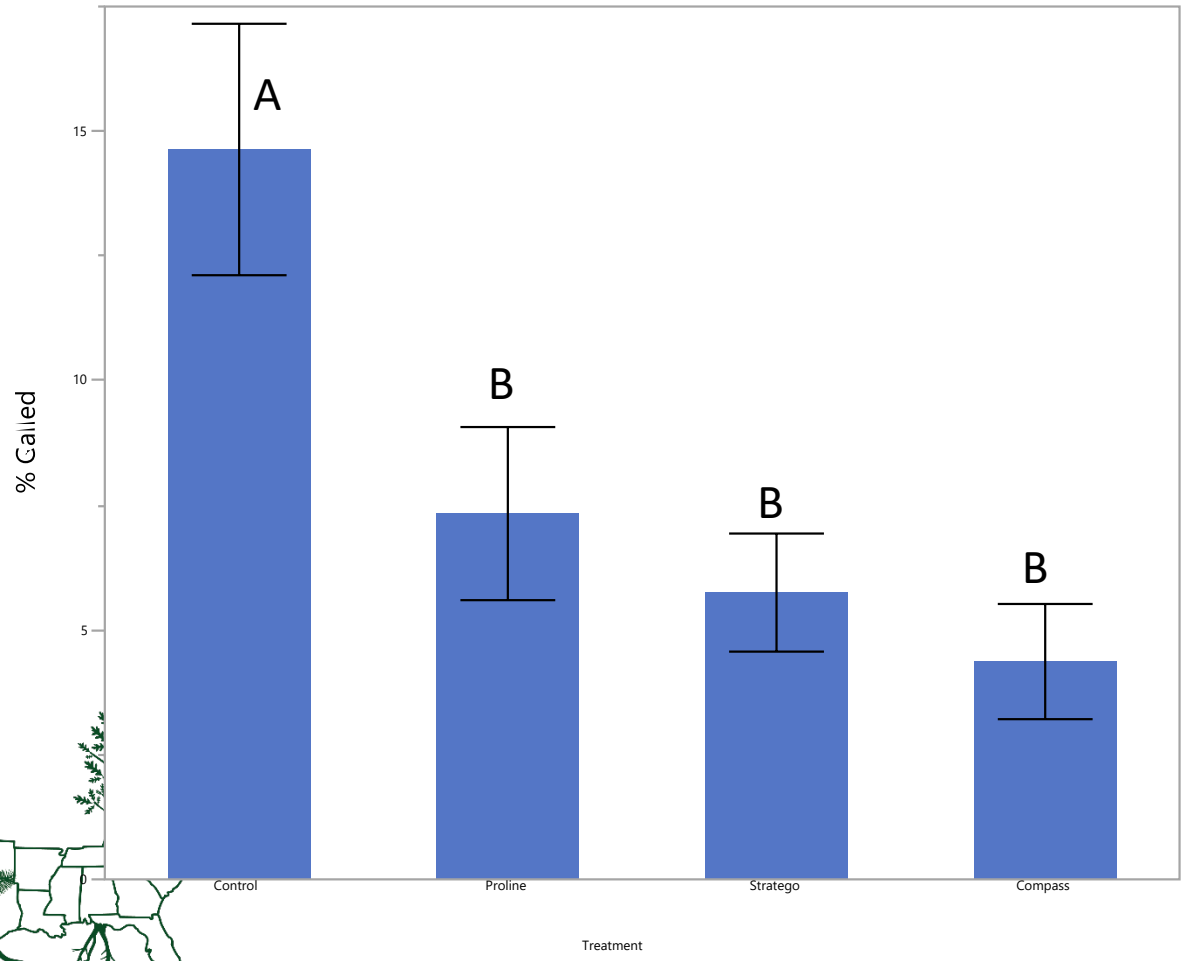
AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Southern Forest
Nursery Management Cooperative

AUBURN
UNIVERSITY
SCHOOL OF FORESTRY
AND WILDLIFE SCIENCES

Results – Seedlot 1 Loblolly



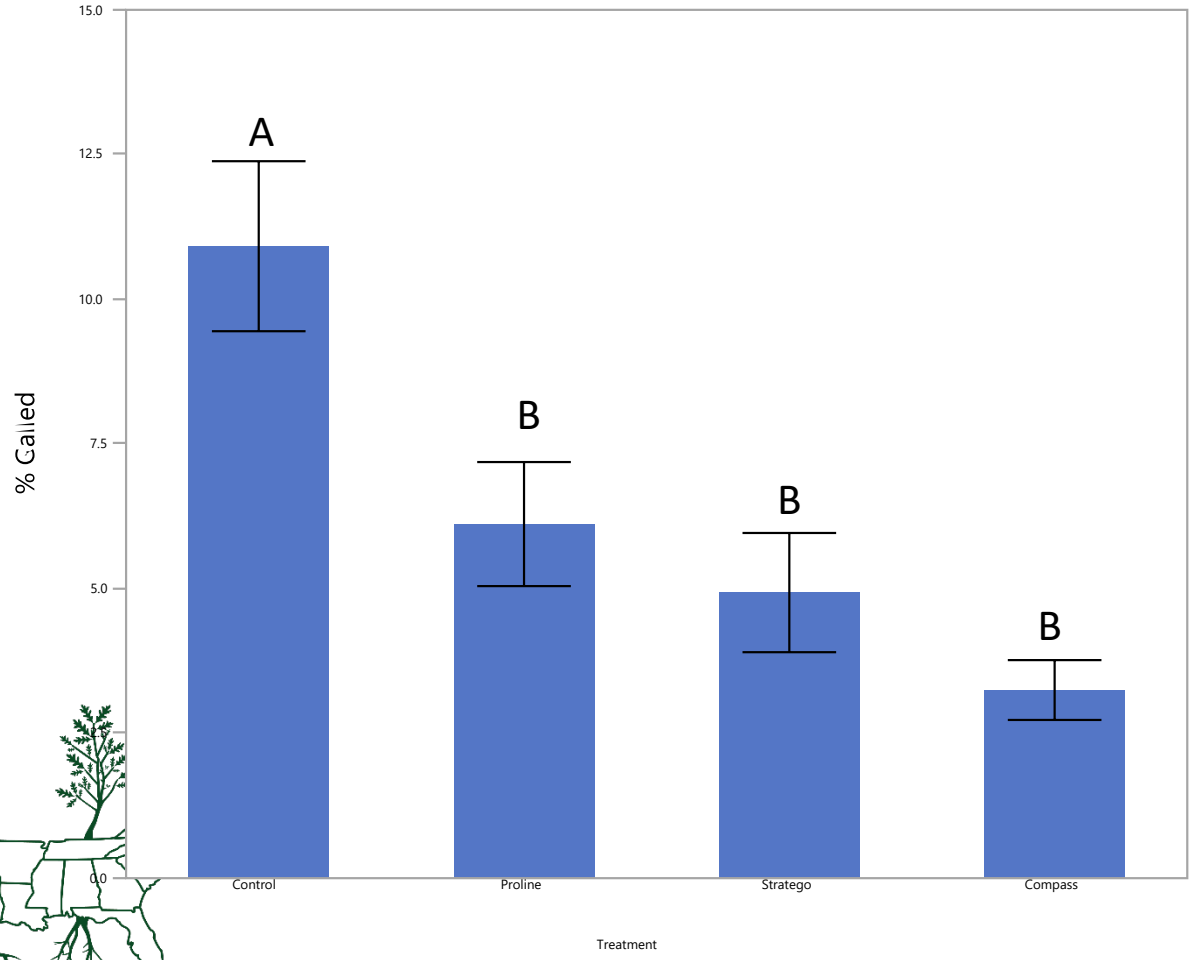
Treatment	Height (cm)	RCD (mm)	Shoot weight (g)	Root weight (g)
Control	37.38 ± 5.7	5.45 ± 1.20	4.7	0.96
Proline®	38.25 ± 4.56	5.92 ± 1.24*	5.41*	1.12*
STRATEGO®	38.38 ± 4.54	5.65 ± 1.11	5.25	0.96
Compass®	38.72 ± 5.25	5.71 ± 1.16	5.19	1.06

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Results – Seedlot 2 Loblolly



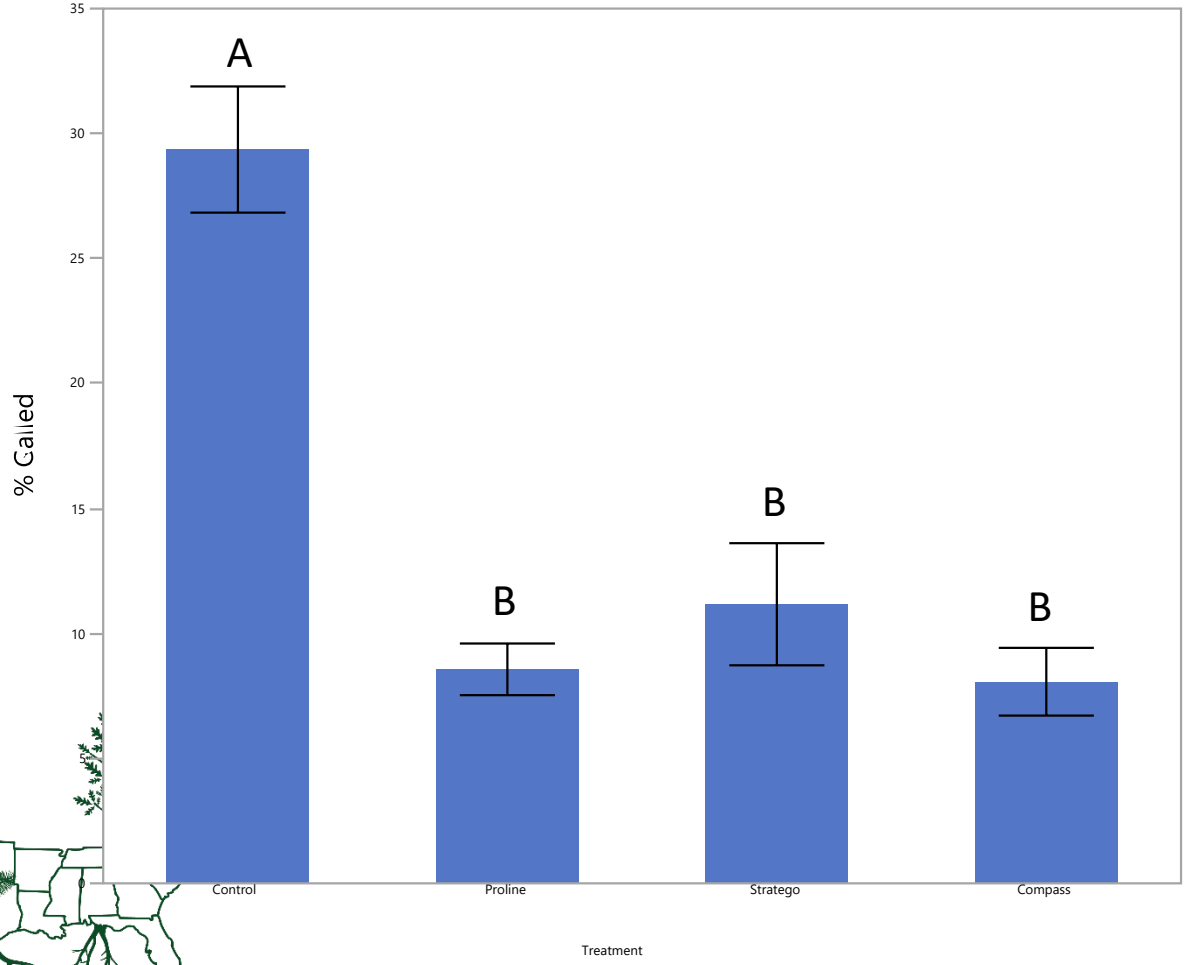
Treatment	Height (cm)	RCD (mm)	Shoot weight (g)	Root weight (g)
Control	38.24 ± 4.37	5.91 ± 1.12	4.95	0.83
Proline®	37.27 ± 5.06	6.20 ± 1.60	5.78	1.02
STRATEGO®	38.83 ± 3.81	5.91 ± 1.36	5.33	0.85
Compass®	37.10 ± 3.6	5.82 ± 1.32	4.95	0.85

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Results – Seedlot 1 Slash



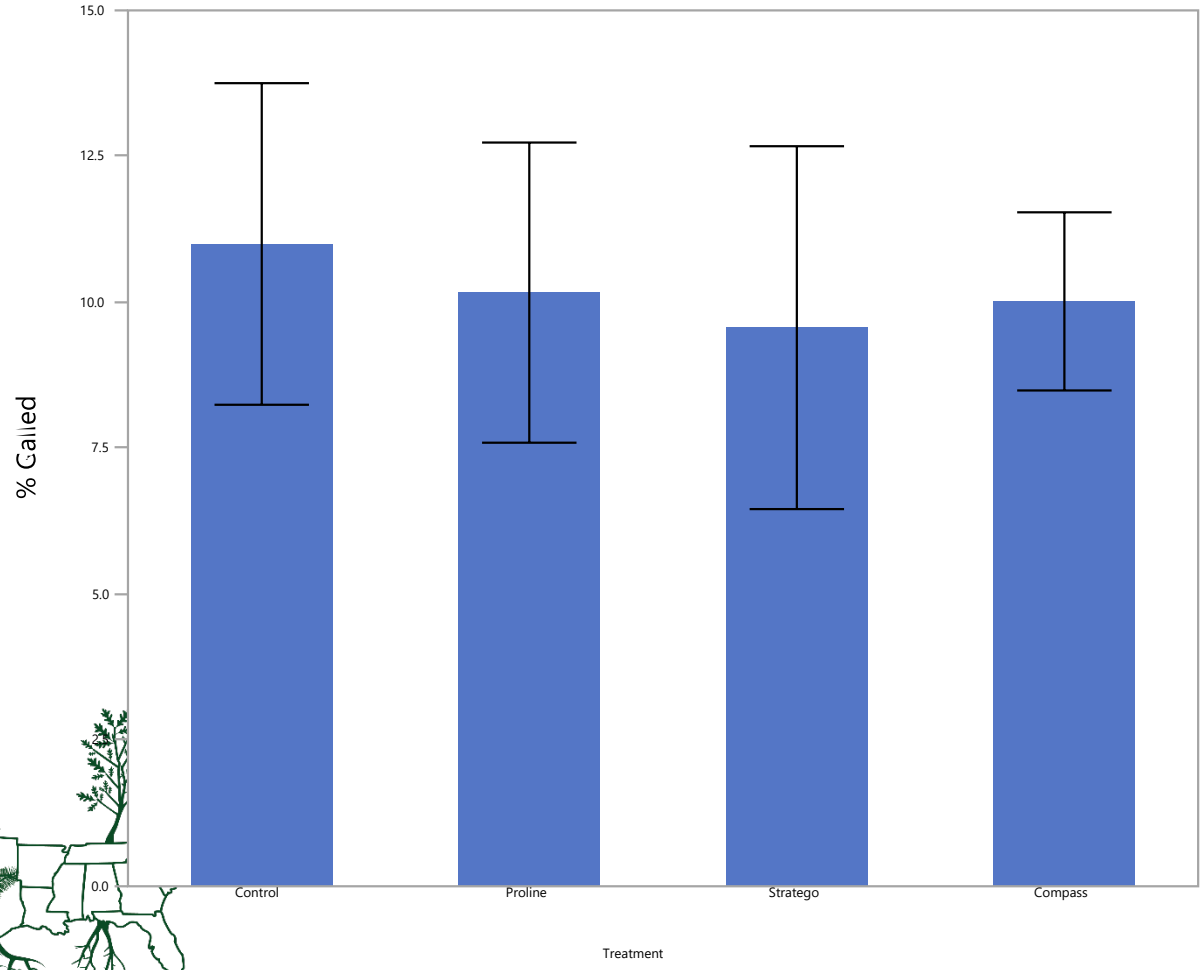
Treatment	Height (cm)	RCD (mm)	Shoot weight (g)	Root weight (g)
Control	34.09 ± 4.48	7.40 ± 1.65	6.82	1.33
Proline®	35.54 ± 3.96	7.84 ± 1.81*	7.54	1.48
STRATEGO®	34.83 ± 3.37	7.95 ± 2.1*	8.39*	1.72*
Compass®	34.51 ± 3.59	7.45 ± 1.66	7.11	1.32

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Results – Seedlot 2 Slash



Animal browsing (deer and squirrel) resulted in low seedling survival in two of our three control plots resulting in these results for this seedlot

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Seedling treatment

- The new chemistries tested as a seedling control were found to be effective in reducing Fusiform rust
- The active ingredients Trifloxystrobin (Compass®) and Propiconazole + Trifloxystrobin (STRATEGO®) were found to be as effective as Prothioconazole (Proline®)
- New chemistries show promise to potential alternatives as a Fusiform rust seedling treatment after successful greenhouse and field trials.
- These chemistries, however, require registration prior to being used commercially.

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Acknowledgement

- We wish to thank the staff of the Resistance Screening Center USDA Forest Service, Asheville, North Carolina for their assistance with this study
- ArborGen, Shellman Georgia nursery

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Fumigation trial

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Weyerhaeuser: Magnolia, Arkansas
March 2019

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Fumigation trial

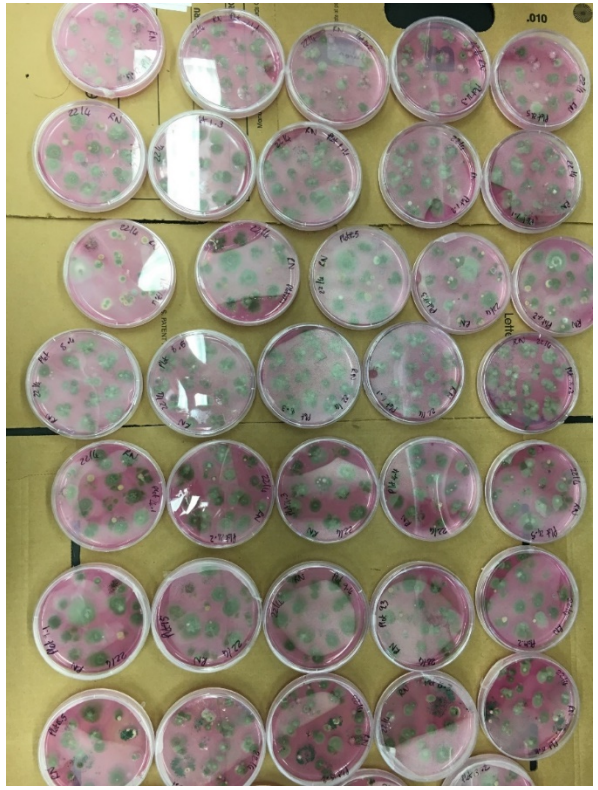
Treatment	Rate
Methyl Bromide (80/20)	300 lbs./ac
Sulfuryl Fluoride + Chloropicrin	350 + 100 lbs./ac
Sulfuryl Fluoride + Chloropicrin	400 +100 lbs./ac
Dimethyl disulfide (DMDS) 60:40	375 lbs./ac
DMDS 60:40	425 lbs./ac
Chloropicrin (Pic) 80	350 lbs./ac

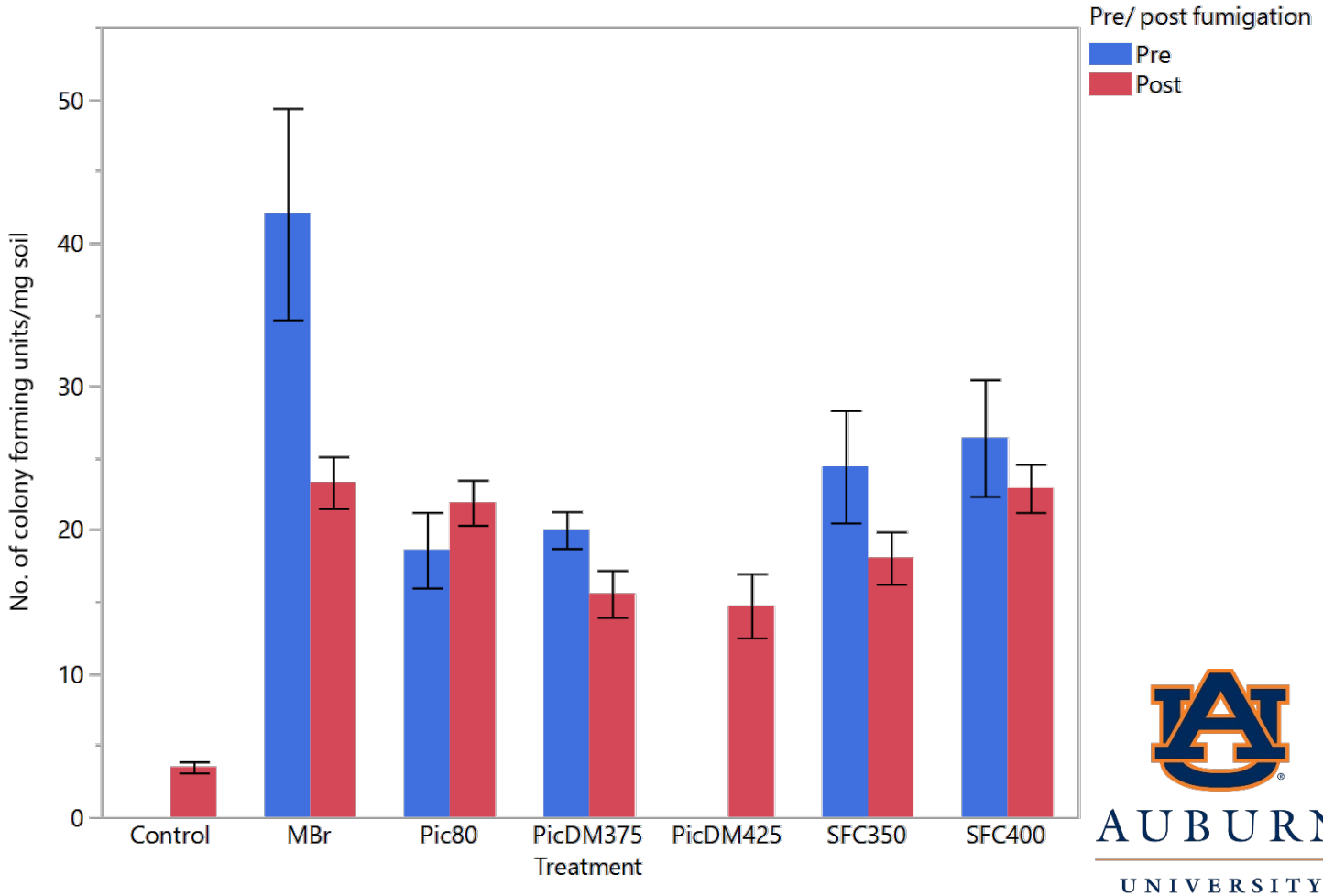
Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Trichoderma – Pre Fumigation





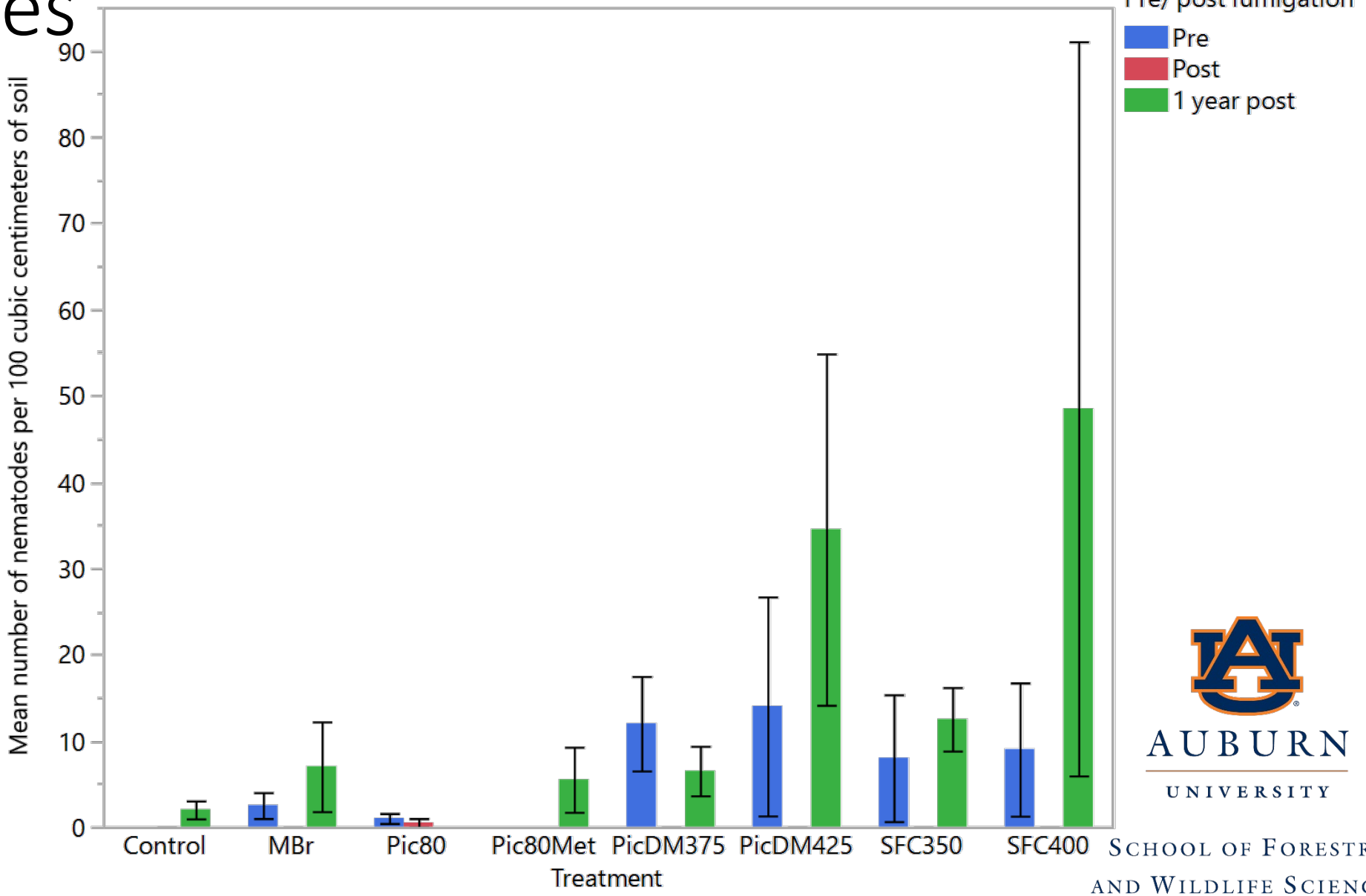
Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Nematodes

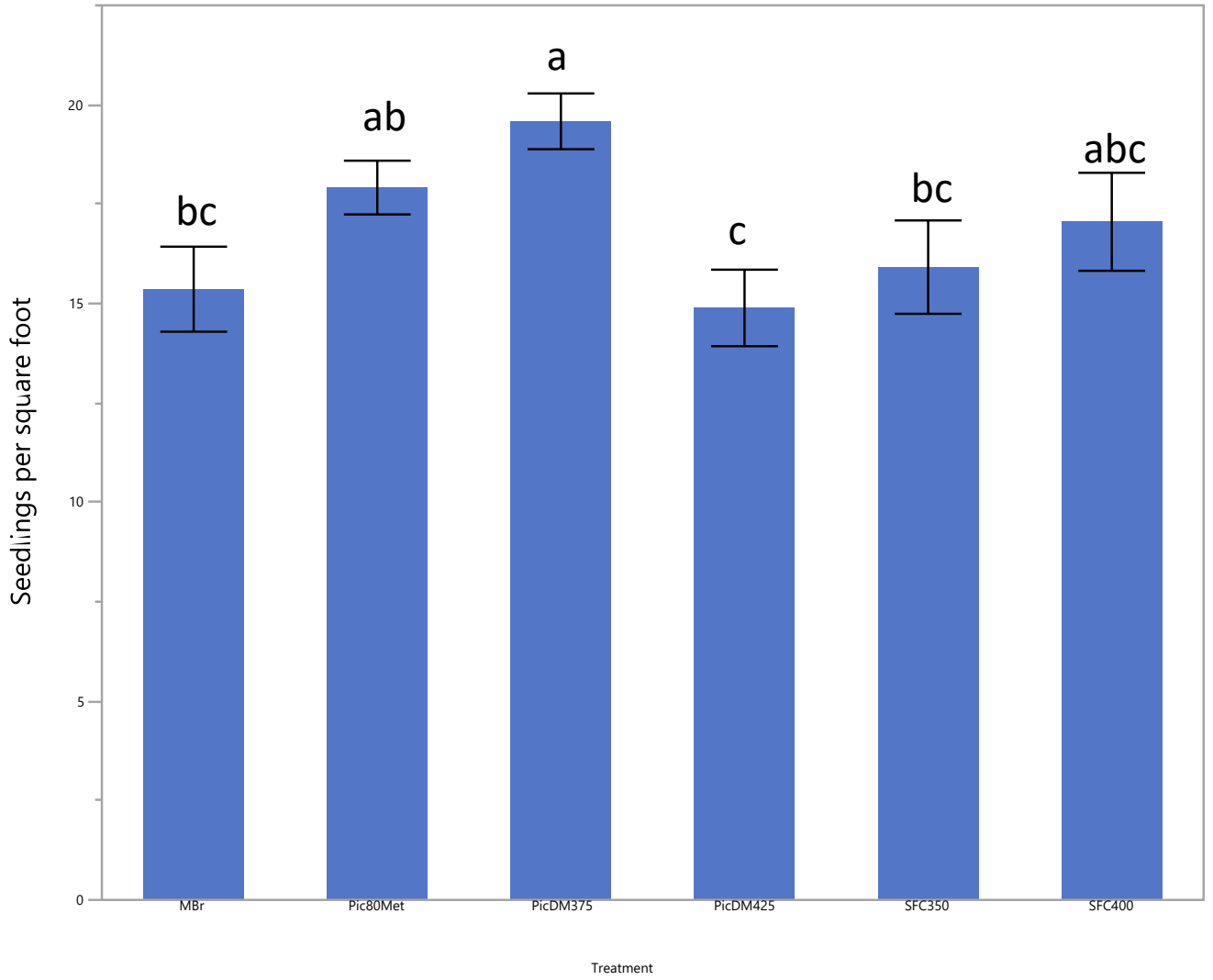
http://extension.uga.edu/publications/detail.html?number=C834&title=Guide%20for%20Interpreting%20Nematode%20Assay%20Results



Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Seedling densities



Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

RCD

Treatment	Rate	RCD (mm)
Methyl Bromide (80/20)	300 lbs./ac	5.31[b]
Sulfuryl Fluoride + Chloropicrin	350 + 100 lbs./ac	5.33[b]
Sulfuryl Fluoride + Chloropicrin	400 +100 lbs./ac	5.28[b]
Dimethyl disulfide (DMDS) 60:40	375 lbs./ac	5.01[c]
DMDS 60:40	425 lbs./ac	5.54[a]
Chloropicrin (Pic) 80	350 lbs./ac	5.50[a]

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

RWR

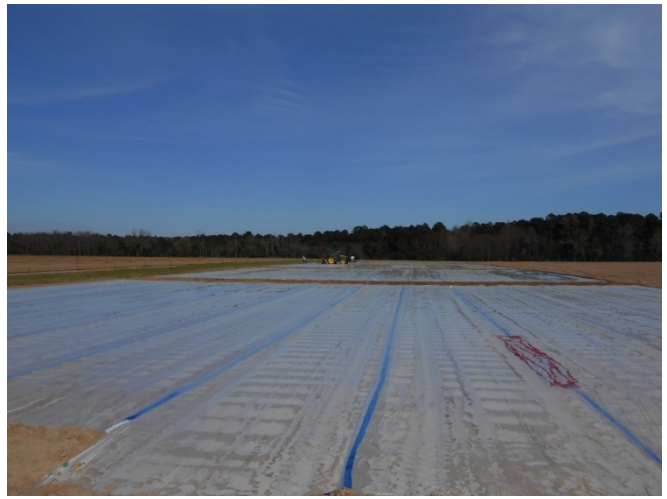
Treatment	Rate	RWR %
Methyl Bromide (80/20)	300 lbs./ac	17.30[bc]
Sulfuryl Fluoride + Chloropicrin	350 + 100 lbs./ac	17.84[b]
Sulfuryl Fluoride + Chloropicrin	400 +100 lbs./ac	18.88[a]
Dimethyl disulfide (DMDS) 60:40	375 lbs./ac	17.54[b]
DMDS 60:40	425 lbs./ac	18.03[ab]
Chloropicrin (Pic) 80	350 lbs./ac	16.50[c]

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Acknowledgement

- We wish to thank Alex Hoffman and the staff of the Weyerhaeuser Magnolia nursery, particularly Brian Finch and Bobby Catrett for their assistance with this trial.



Southern Forest Nursery Management Cooperative

Auburn University

School of Forestry and Wildlife Sciences

Nanocellulose

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES




Southern Forest
Nursery Management Cooperative

AUBURN
UNIVERSITY
SCHOOL OF FORESTRY
AND WILDLIFE SCIENCES

Questions from USDA on the use, usage and benefits of certain chemistries

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Prothioconazole (Proline) in Forest Nurseries

- One of the most widely used fungicides for the management of diseases
- Diseases typically targeted by prothioconazole application
  - *Cronartium quercuum* f. sp. *fusiforme* (fusiform rust)
  - *Fusarium* spp. (pitch canker)
  - *Rhizoctonia* spp. (Rhizoctonia foliar blight)
- Nursery coop research demonstrated that we have investigated optimal application rates in addition to testing alternatives active ingredients.

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Oxyfluprfen (Goal Tender) in Forest Nurseries

- One of the most important herbicides in forest seedling nurseries.
- Currently no alternative on the market.
- Used for the control of undesired plants growing within bed and/ or containers and in non production areas throughout the growing season
- Nursery coop research demonstrated that we have investigated and tested alternatives active ingredients.

Southern Forest
Nursery Management Cooperative

AUBURN UNIVERSITY
SCHOOL OF FORESTRY AND WILDLIFE SCIENCES

Acknowledgement

- Wish to thank all the nursery managers for their rapid response to Nina’s request regarding the current use and application methods of these chemistries.

Southern Forest Nursery Management Cooperative

AUBURN UNIVERSITY

SCHOOL OF FORESTRY AND WILDLIFE SCIENCES