Fusiform Rust Control Fungicides

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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

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

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Greenhouse trials

2018 Active ingredients and rates tested for foliar spray in greenhouse study

Fungicide	Manufacturer	Active Ingredient	Rate/s tested
Companion® Biological Fungicide	Growth Products	*Bacillus subtilis* GB03 – 0.03%	16 fl. oz. / acre in 22 gal water (x) 32 fl. oz. / acre in 22 gal. water (2x)
Orkestra™ Intrinsic	BASF	Fluxapyroxad - 21.26% Pyraclostrobin – 21.26%	8 fl. oz./ 100 gal

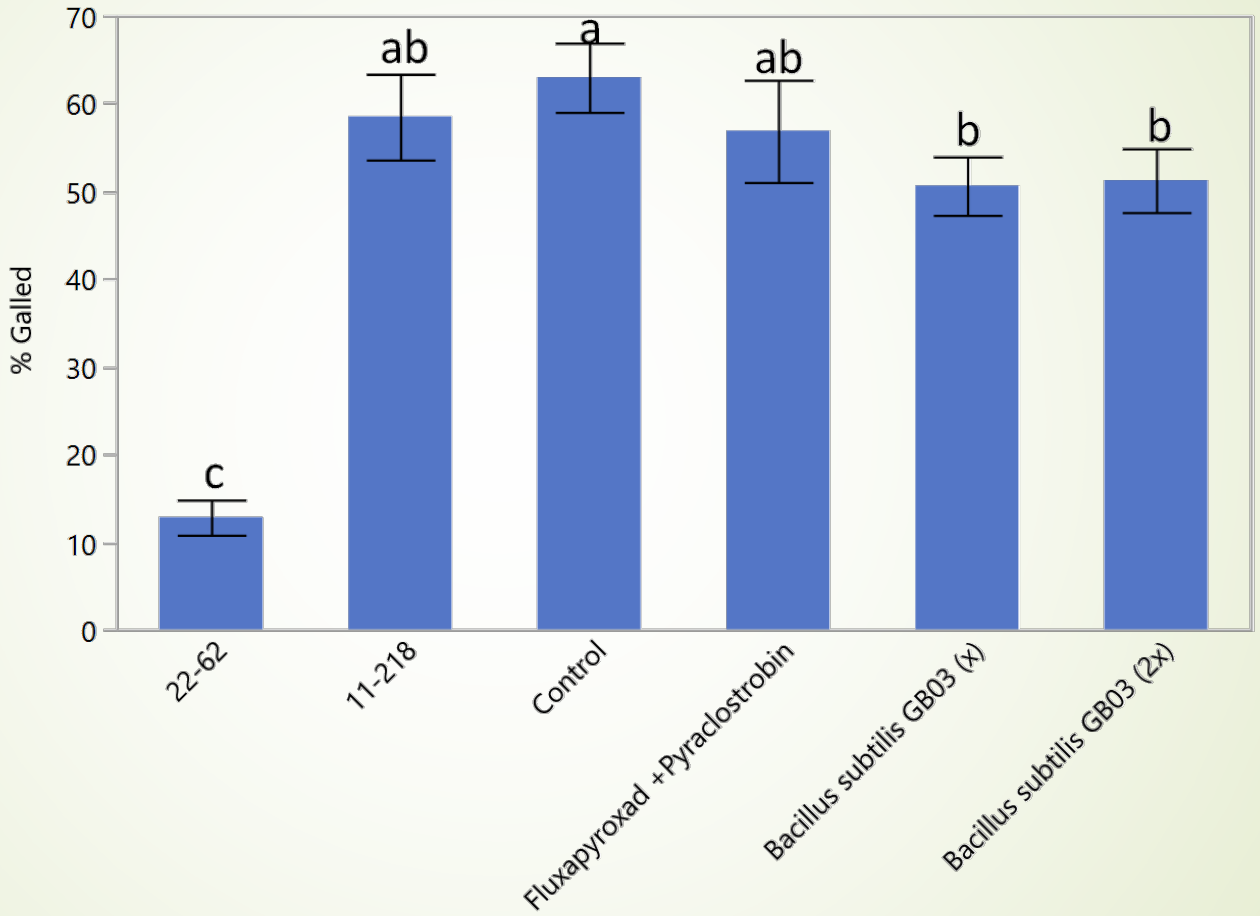
2019 Active ingredients tested for foliar spray in greenhouse study

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

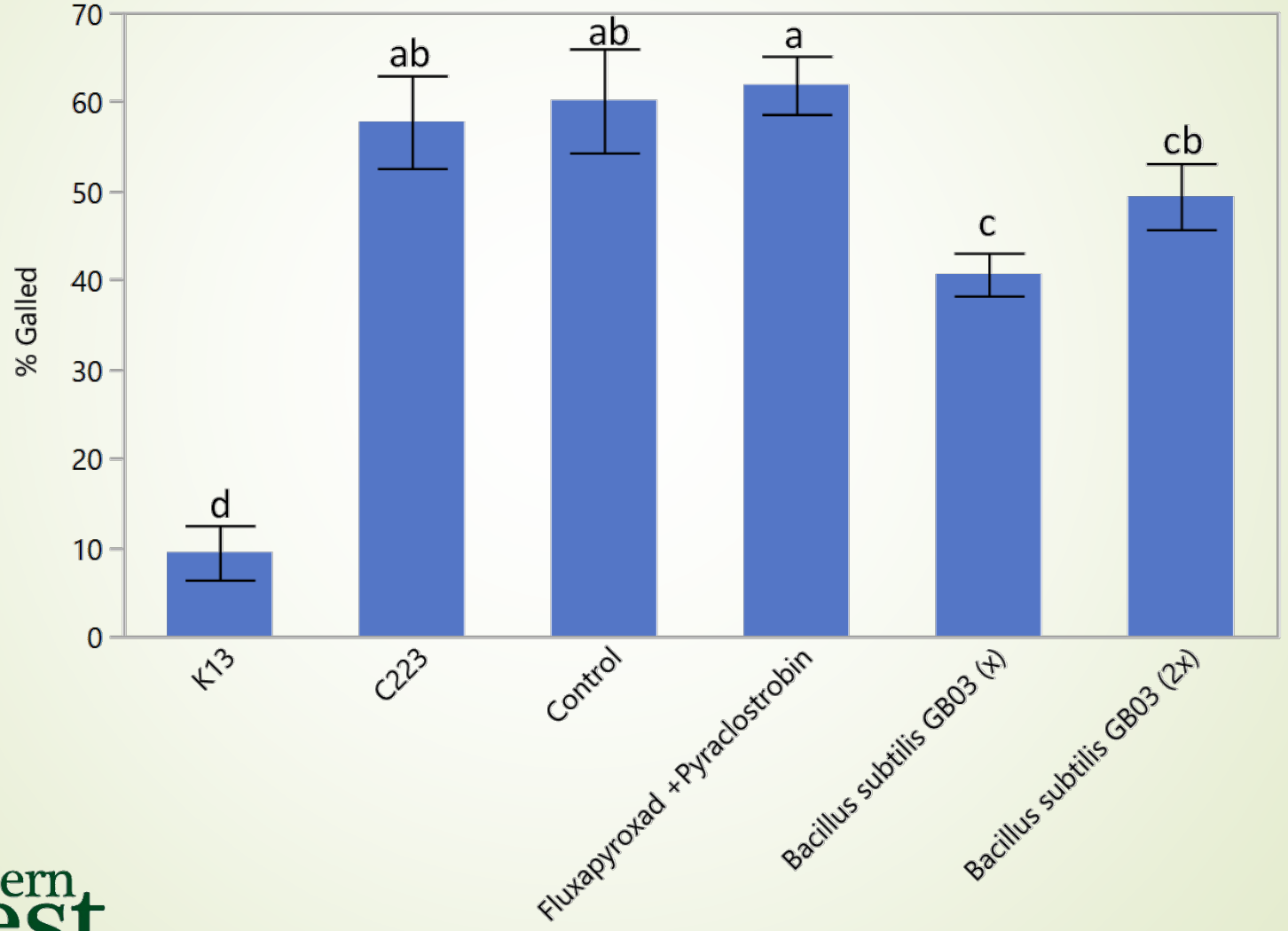
Seedling treatment study

- 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

2018 Loblolly seedling treatment results



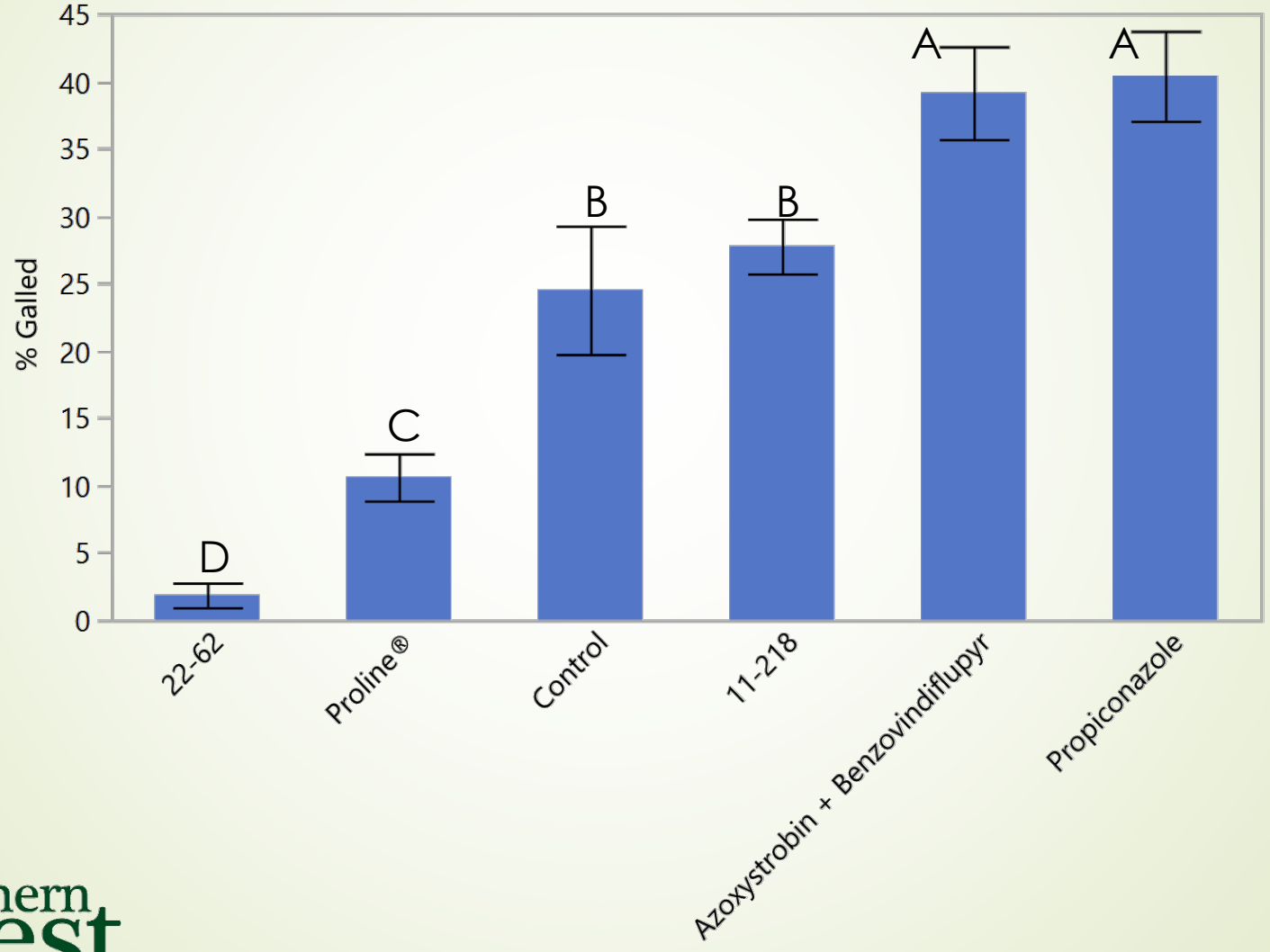
2018 Slash seedling treatment results



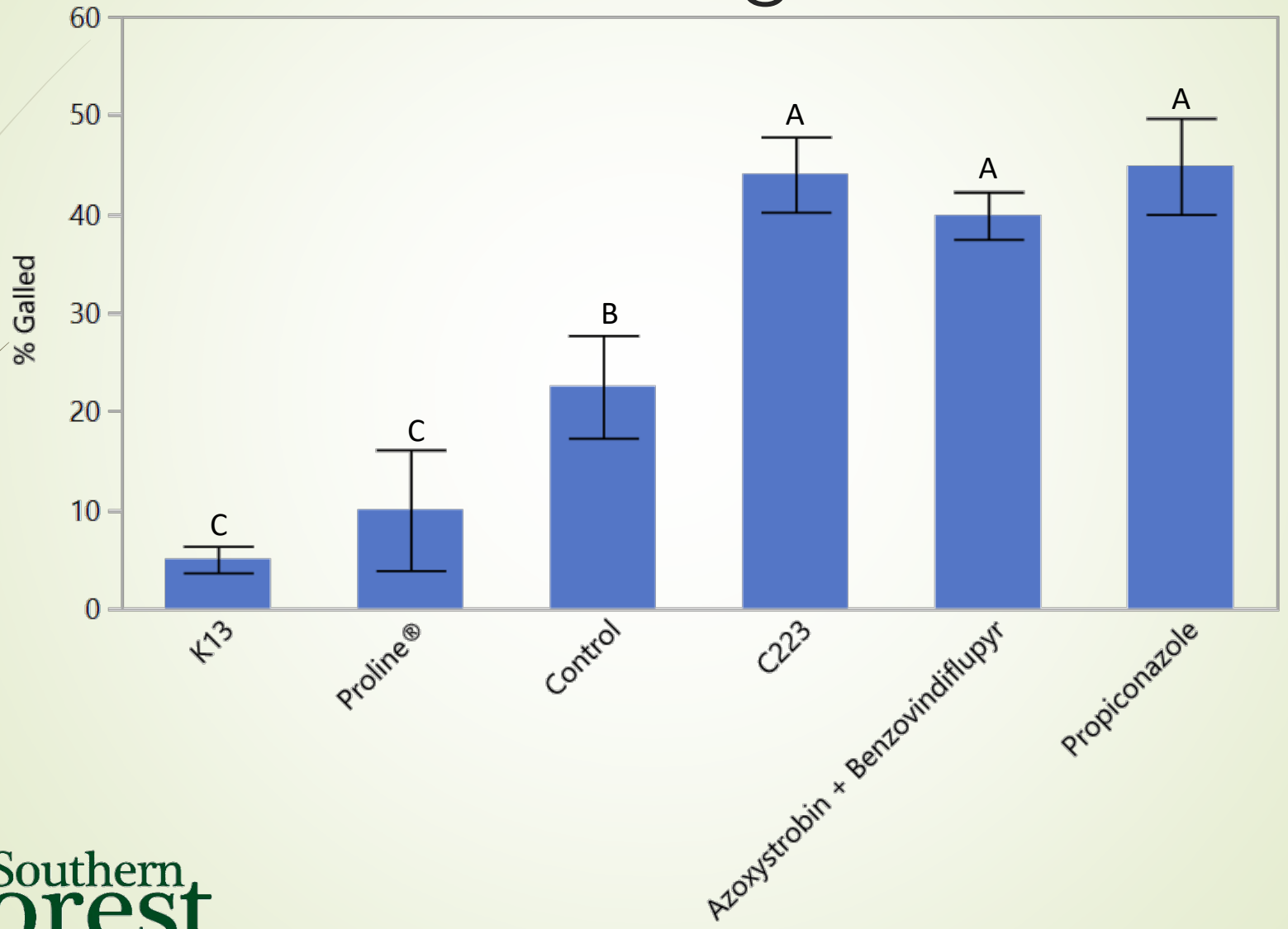
2018 Seedling treatment results

- Results from this study indicate that the active ingredients Fluxapyroxad + Pyraclostrobin were found to give similar results to that of the untreated controls and are therefore ineffective in reducing the incidence of Fusiform galls.
- The biological fungicide (a.i. *Bacillus subtilis* GB03) although producing fewer galls than the untreated controls, levels were still too high to be considered providing protection against fusiform rust.
- *Bacillus subtilis* GB03 applied at both the recommended and double the recommended rate did not reduce the galling incidence to resistant family levels.

2019 Loblolly seedling treatment results



2019 Slash seedling treatment results



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.

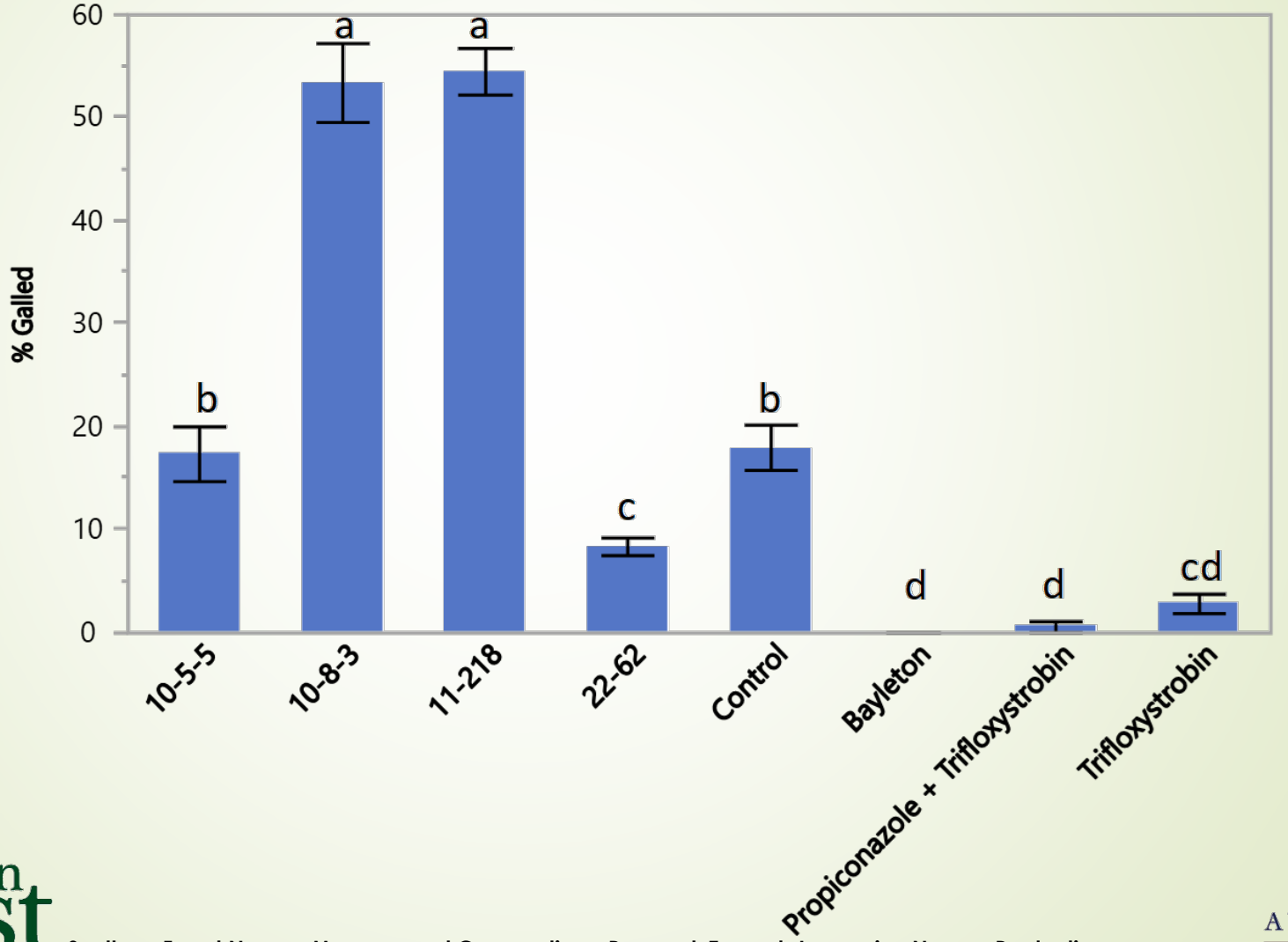
Field trial

Active ingredients tested as foliar spray

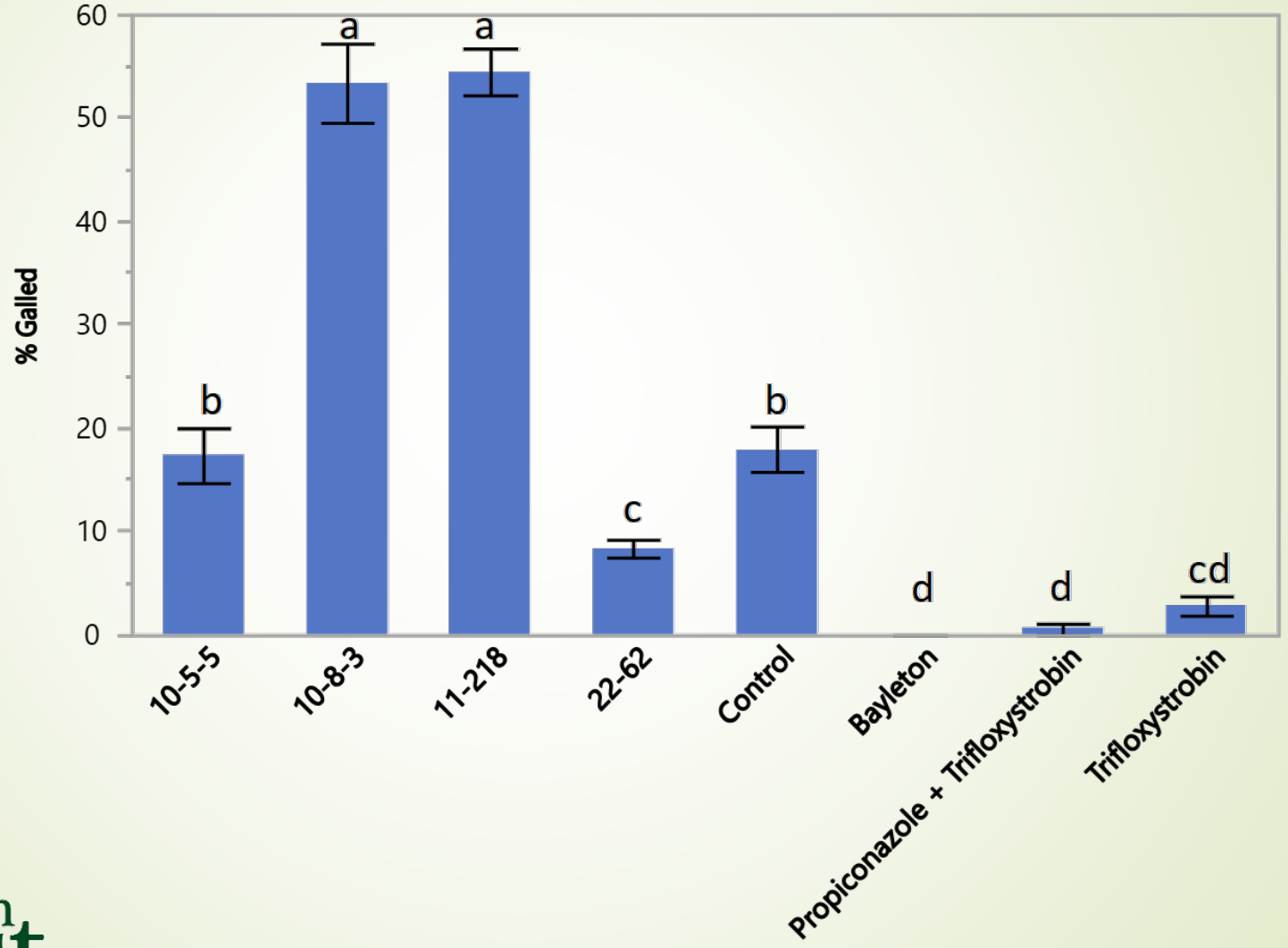
Fungicide	Manufacturer	Active Ingredient	Chemical Class	Rate tested
Bayleton®	Bayer Cropscience	Triadimefon - 50%	Triazoles	8 oz. per acre
Compass®	Bayer Cropscience	Trifloxystrobin – 50%	Oximino acetates	3 oz. per acre
STRATEGO® 250EC	Bayer Cropscience	Propiconazole – 11.4% Trifloxystrobin – 11.4%	Oximino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

Greenhouse study results

Loblolly pine seedlings treatment results

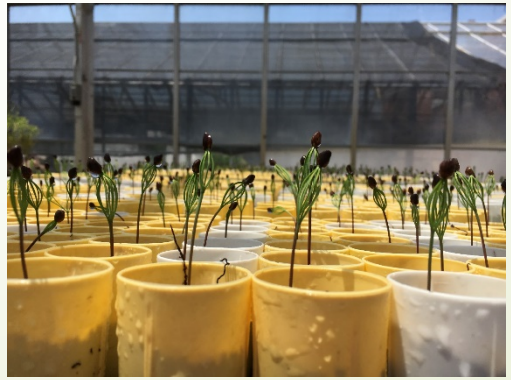


Slash pine seedlings treatment results



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®)



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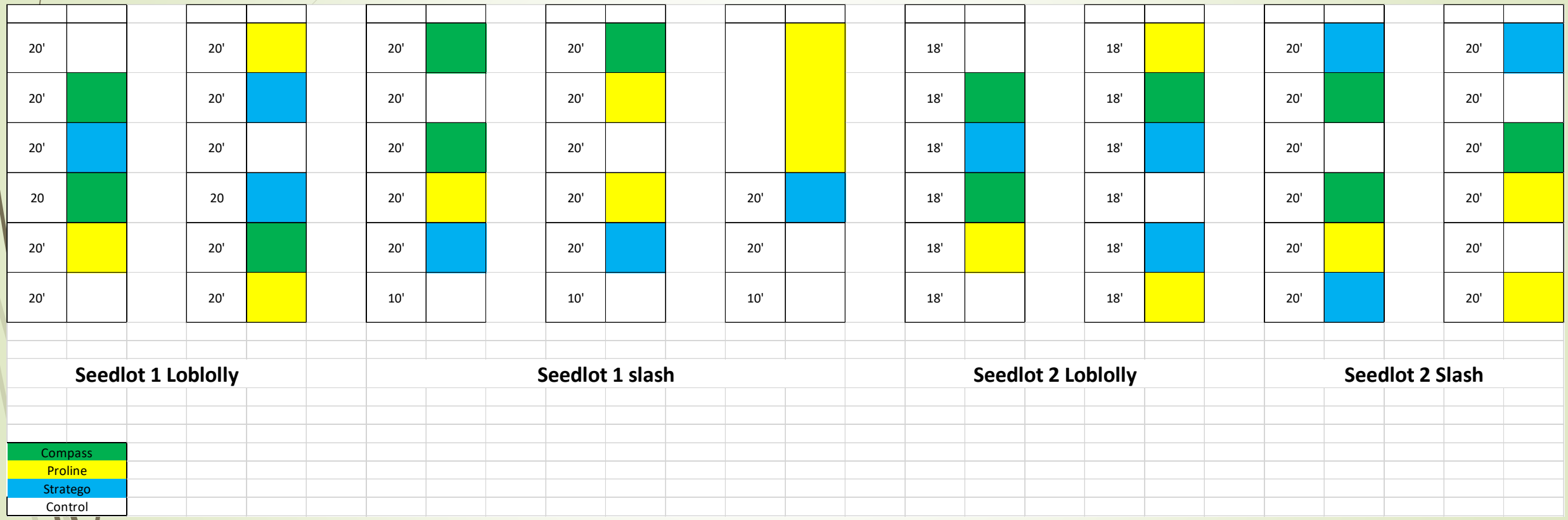
2019 Field test

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)

Trial layout



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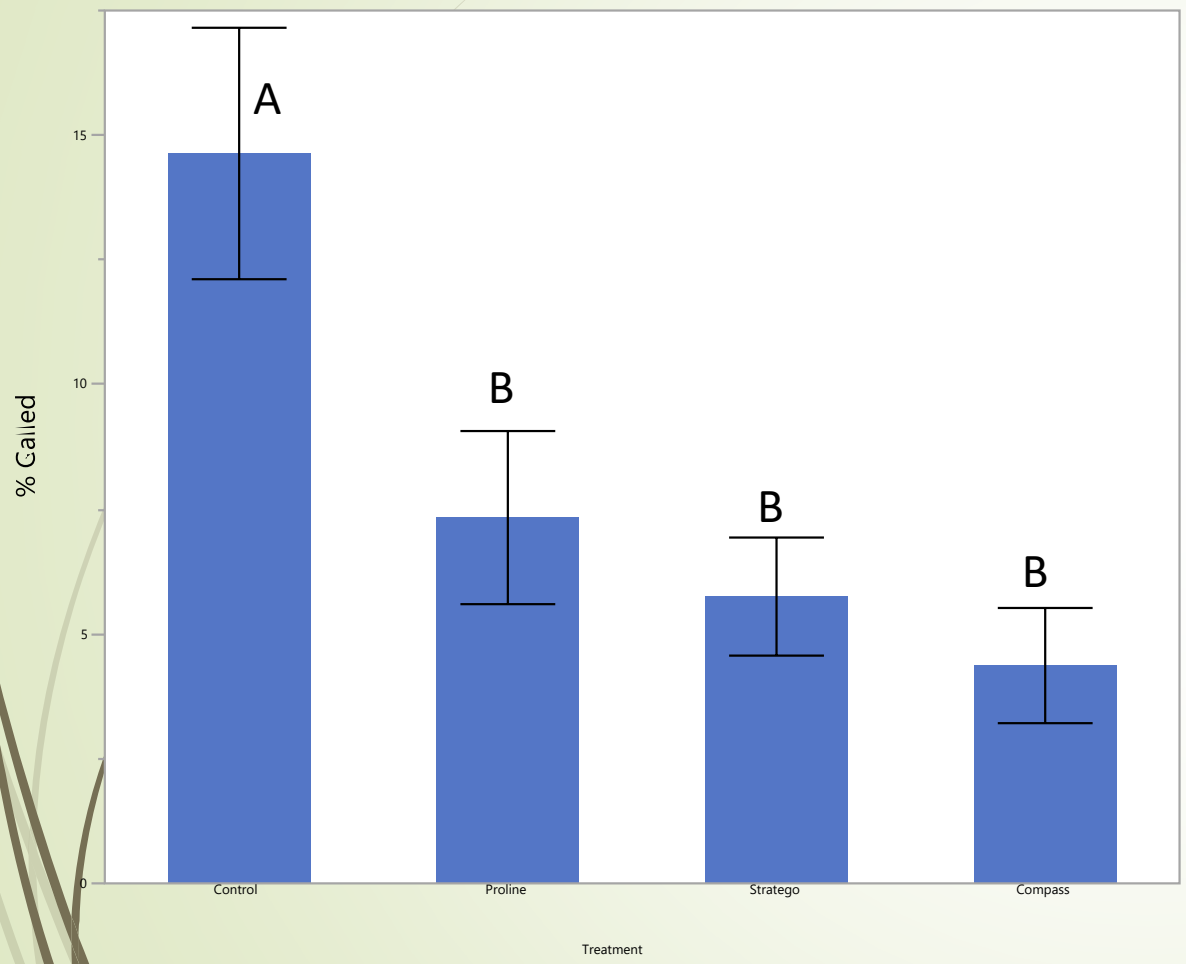
2019 Field tests

- 2019 undertake field performance trials to assess alternative chemistries that show promise
- At the end of the growing season for each seelot we assessed:
  - Seedling quality
  - Number of rust galls
  - Root morphology

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

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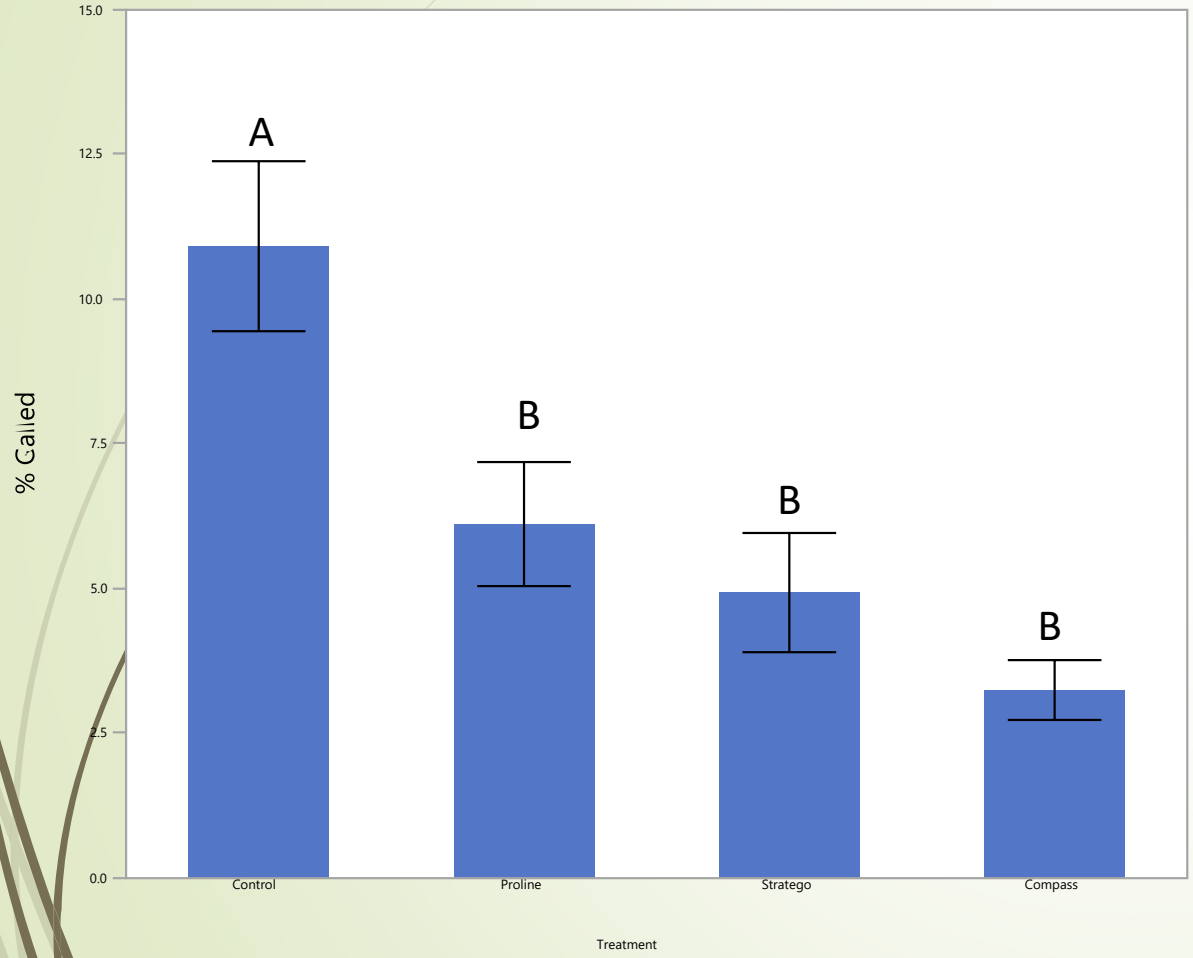
Results – Seedlot 2 Loblolly



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

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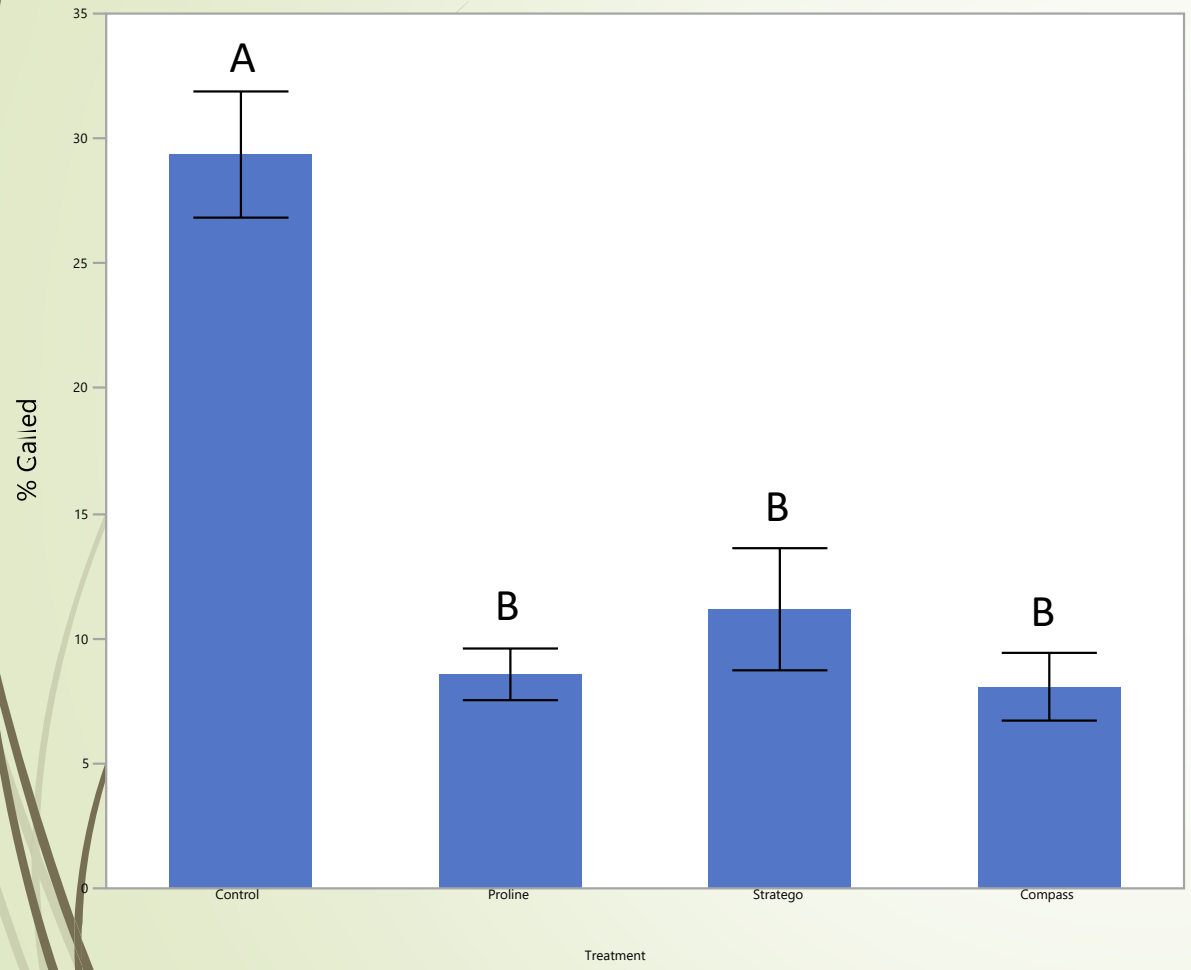
Results – Seedlot 1 Slash



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

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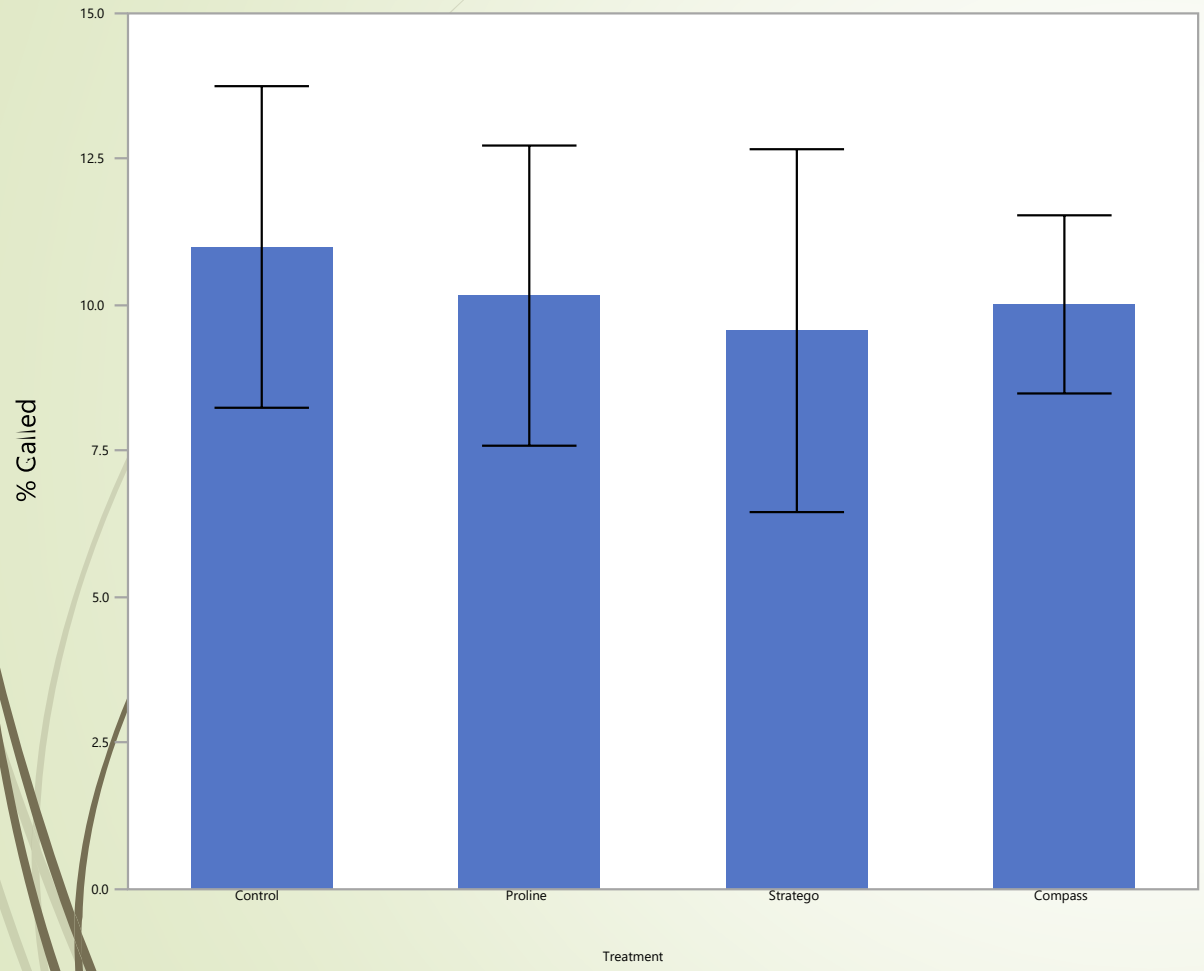
Results – Seedlot 2 Slash



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

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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.

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