

Preemergent Herbicide Timing Trials: Year 2 Updates

Mike Basedow and Janet van Zoeren, Cornell Extension



Should I apply pre-emergent products in the fall instead of the spring?

+ Excellent weed control

- Alion, Casoron, Goaltender, Matrix, Chateau + Prowl

+ One less “to-do” come spring

+ Adequate rainfall

- How does fall applied efficacy compare to the same product applied the following spring?
- What if we only use post-emergent herbicides?
- How do these practices impact the trees?

Managing Apple Orchard Weeds in the Fall

Deborah Breth¹, Elizabeth Tee¹, Dan Donahue², and Anna Wallis³

¹Cornell Cooperative Extension, Lake Ontario Fruit Program, Albion, NY

²Cornell Cooperative Extension, Eastern NY Commercial Horticulture Program, Hudson Valley Research Laboratory, Highland, NY

³Cornell Cooperative Extension, Eastern NY Commercial Horticulture Program, Plattsburgh, NY

This research was partially supported by the New York Apple Research and Development Program

Springtime in the orchard is very labor-intensive, with many horticultural and pest management needs to address. Growers are still pruning, chopping brush, applying fertilizer, planting new orchards, and installing trellis

“Just after harvest in the fall can be the best time to apply herbicides for weed control, depending on your farm operation, labor situation, and weed problems.”

in the spring, all while keeping up with weekly scab sprays, fire blight blossom sprays, weed control and fruit thinning sprays. Often, weed management is on the bottom of the priority list. By the time we can take action against weeds under the trees, they have grown too tall and have already robbed the orchard of nutrients meant for the trees. Research continues to show that the critical timing for clean herbicide strips in low AND high density apple plantings is May through July (Merwin 1994; Breth 2014, 2015). Just after harvest in the fall can be the best time to apply herbicides for weed control, depending on your farm operation, labor situation, and weed problems. Make plans based on the weed problems you need to address, and read the labels.

The advantages of fall weed control

- Fall weed control removes a time-sensitive task from the early spring that competes with many other time-sensitive tasks. The use of fall herbicides helps prevent weeds from getting ahead of us in the spring. If weeds are not treated in the early spring, they are generally too tall and have passed their susceptible treatable stage. The taller the weeds, the greater the risk of herbicide damaging tree trunks and foliage.
- Our normally reliable rains in the fall help to incorporate the residual herbicides into the weed seed germination zone. Sometimes we get a dry spring, which does not facilitate herbicide incorporation, allowing weed seeds to germinate.
- Fall weed control will remove the winter annuals and help control some persistent perennials. Winter annuals typical in orchards are hoary bittercress, annual bluegrass, purple deadnettle, and chickweed. We are also targeting rosettes of mare's tail, shepherd's purse, and other winter annuals that flower in the spring. It is unclear how much competition winter annuals pose in the fall and early spring for nutrients.

- Often a trashy, weedy surface in the fall prevents an even distribution of residual herbicides, and fails to uniformly stop weed seed germination. Dropped apples, rootsuckers, and leaves will also prevent even distribution of the herbicide to the soil surface. This may require a sweeping or raking implement under trees to clear the herbicide strip before herbicide application.
- Low hanging branches are common after harvest and will be sprayed with herbicide.
- Winter annuals are considered good cover crops to hold the soil in place and prevent soil erosion in the winter, especially on sloped ground. Therefore, fall weed control may not be the best option in all parts of the state where soil erosion would be an issue.
- Using glyphosate in the fall is very risky, due to the potential uptake in the trees and transport to the root systems; therefore, it is not advisable, unless you use every precaution, including shielding the boom, and preventing contact with the bark of the trees. Do not spray across the herbicide strip in one pass under a tree row when using glyphosate, especially in the fall!

Materials and Methods

The Apple Research and Development Program funded a fall weed control trial in 2014 through 2016 to look at several of the options registered in apples. One trial was established at Ledge Rock Farms, Medina, NY. In 2014-15, a second trial was conducted by Dan Donahue (CCE-ENY Commercial Hort Program) in Highland, NY. A third trial was conducted by Anna Wallis (CCE-ENYCHP) in the Champlain Valley in 2015-16. Thirteen treatments were applied at the Medina site with a CO₂ backpack sprayer on 6 November 2014, in a random block design in 5-tree plots, 4 feet wide, with 4 replicates per treatment. Rep 1 was 2 rows of Gingergold, established in 2011, that had no pre-plant weed control and with primarily perennial weed problems, including bindweed, yellow toadflax, and dandelion. Rep 2 (NY1) and Rep 3 and 4 (NY2) were established in 2012 after pre-plant weed control was implemented, mainly with annual weeds like prostrate knotweed, common mallow, and perennial yellow toadflax. Trees were planted on a 3 x 13 ft spacing.

All treatments and rates are listed in Table 1. All treatments included a post-emergent herbicide, but not all treatments in 2014 included a residual herbicide. AMS (sprayable ammonium sulfate at 10 lb/100 gal) was added, as required by the glyphosate and

Objective 1

Evaluate the effects of three commonly used herbicide programs on weed species density and diversity throughout the year, over multiple growing seasons, in two commercial field trials.

Field Layout

- 2 rows of NY-1 on M.26 (Albion) or G.935 (Peru) rootstock, planted in 2017 (Albion) and 2018 (Peru)
- 12 trees in each treatment plot
- 6 of 12 trees in each plot also fitted with a Tyvek trunk guard
- Treatment plots randomly distributed in each replicate running down the rows



Peru Treatment Timeline

2022 Peru Treatment Calendar			
Date	Treatment 1: Fall Applied	Treatment 2: Spring Applied	Treatment 3: Posts Only
11/4/2021	Alion 5 fl oz /Acre + Rely 280 48 fl oz/Acre		
4/26/2022	Select Max 16 fl oz / Acre	Select Max 16 fl oz / Acre	Select Max 16 fl oz / Acre
4/30/2022		Alion 5 fl oz /Acre + Rely 280 48 fl oz/Acre	
5/11/2022			Rely 280 48 fl oz/Acre
5/20/2022	Rely 280 48oz/Acre		
5/31/2022	Select Max 16 fl oz / Acre	Select Max 16 fl oz / Acre	Select Max 16 fl oz / Acre
6/3/2022	Milkweed hand cut	Milkweed hand cut	Milkweed hand cut
6/16/2022	Milkweed hand cut	Milkweed hand cut	Milkweed hand cut
6/28/2022	Milkweed hand cut	Milkweed hand cut	Milkweed hand cut
7/7/2022	Glystar Plus 3qt/Acre	Glystar Plus 3qt/Acre	Glystar Plus 3qt/Acre
8/12/2022	Milkweed and rootsucker hand cut	Milkweed and rootsucker hand cut	Milkweed and rootsucker hand cut
8/16/2022	Gramoxone 3pt/Acre	Gramoxone 3pt/Acre	Gramoxone 3pt/Acre

*Salmon colored treatments applied with a backpack CO₂ sprayer, using a single 8004 nozzle at 34PSI at a volume of 60 GPA. All other treatments applied by grower's boom sprayer at 60 GPA.

Albion Treatment Timeline

2022 Albion Treatment Calendar			
Date	Treatment 1: Fall Applied	Treatment 2: Spring Applied	Treatment 3: Posts Only
10/22/2021	Alion 5 fl oz /Acre + Interline 48 fl oz/Acre		
4/30/2022		Alion 5 fl oz /Acre + Interline 48 fl oz/Acre	
6/8/2022	Select Max 16 fl oz / Acre	Select Max 16 fl oz / Acre	Select Max 16 fl oz / Acre
6/25/2022			Interline 48 fl oz/Acre
7/29/2022		Interline 48 fl oz/Acre	
8/18/2022			Interline 48 fl oz/Acre

*all treatments applied with a backpack CO₂ sprayer, using a single 8004 nozzle at 34PSI at a volume of 60 GPA.

Seasonal Weed Monitoring

Weed cover

Maximum weed height

Weed counts by species at four $.25\text{m}^2$ transects randomly within the plot, straddling the drip line

Twice in early spring, every other week May through July (weed-free period), twice in August, twice in late fall



Weed Composition by Site



Peru – Perennials

Quackgrass
White Campion
Sowthistle
Milkweed

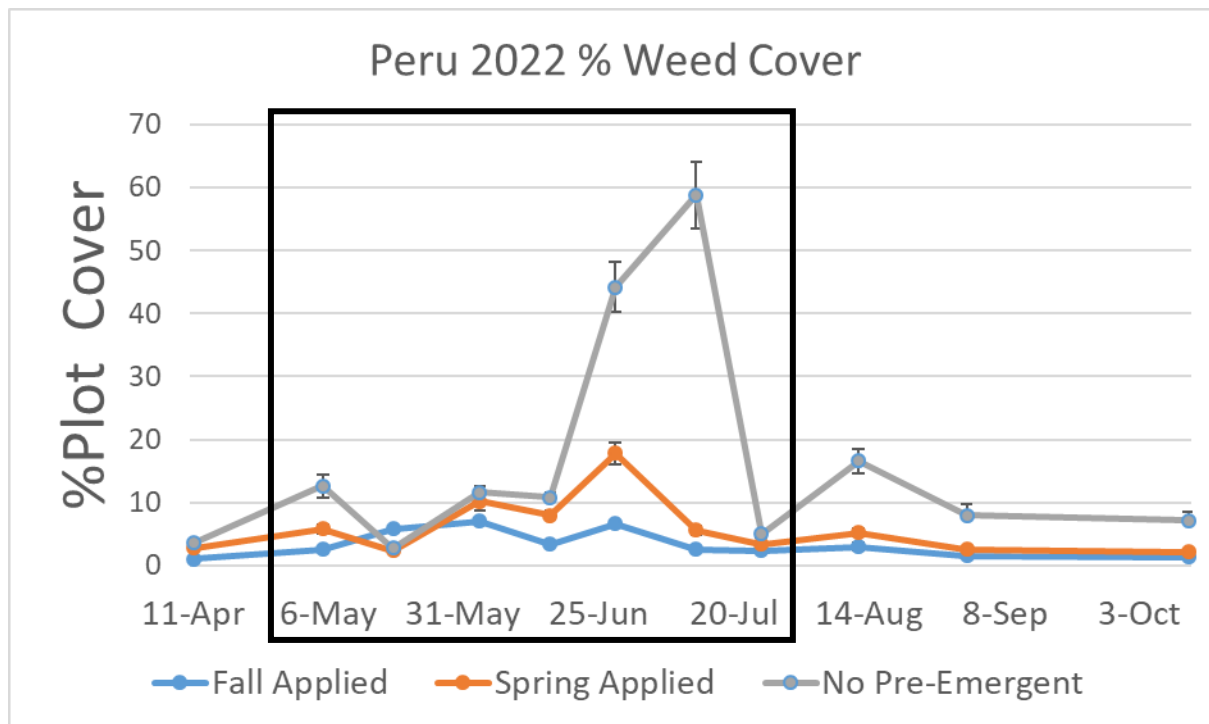


Albion – Winter Annuals

Annual bluegrass
Common chickweed
Common mallow



Peru Seasonal Weed Monitoring



Applications

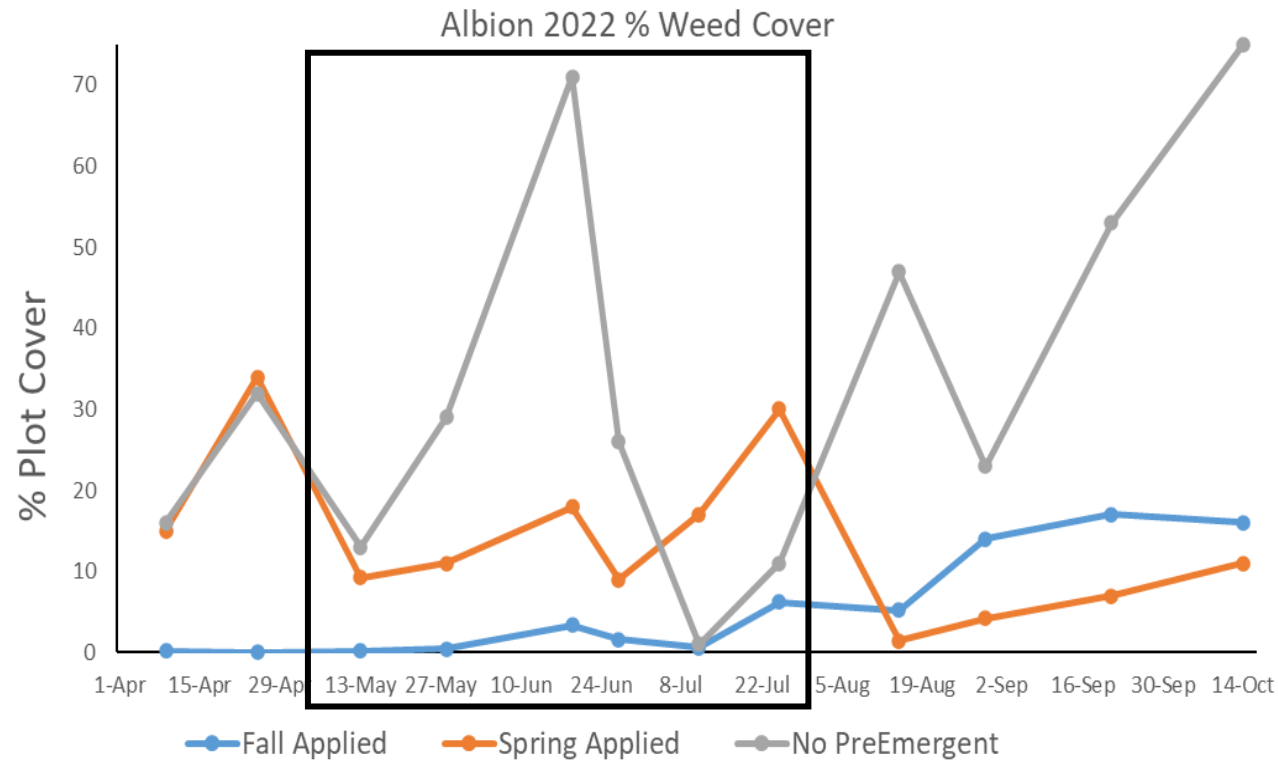
Fall (6): 11/4, 4/26, 5/20, 5/31, 7/7, 8/16

Spring (5): 4/26, 4/30, 5/31, 7/7, 8/16

Post-only (5): 4/26, 5/11, 5/31, 7/7, 8/16

- Across the weed free period, fall gave the best control, followed by spring, then post only.
- Weed cover was lowest in the fall-applied plots on 7 of the 11 dates. Equivalent to spring plots on 3 dates, highest on 1.
- Post-emerge plots had highest cover on 6 of the 11 dates, equivalent to spring on the other 5, lower than fall on 1.

Albion Seasonal Weed Monitoring



Applications

Fall (2): 10/22, 6/8

Spring (3): 4/30, 6/8, 7/29

Post-only (4): 4/30, 6/8, 6/25, 8/18

- Across the weed free period: fall controlled the best, followed by spring, then control (post-emergent only).
- Weed cover was lowest in the fall-applied plots on 4 of the 12 dates. Equivalent to spring plots 6 dates, and to control plots on the other 2 dates.
- Post-emerge plots had highest weed cover on 3 of the 12 dates.

11 months of annual weed control



Post-emerge Only Program

Fall- Applied Alion Program

Seasonal Weed Monitoring

Takeaways from Year 2 with Alion:

- Fall-applied Alion gave excellent weed control, surpassing the spring applied program throughout much of the weed free period at both sites
- Fall applications take one more thing off the spring to do list
- Alion is a finicky material
 - Needs to be applied to bare ground for good activation
 - Needs to be applied when it won't rain for a solid two days after
 - Needs to then receive moisture to activate
- While Alion gave very good control, we saw similar trends from our Chateau + Prowl combo last year, though did not last as long as Alion
- Post-emergent only program can be done, but constant battle to fight newly emerging annuals

Other preemergent materials recommended for the fall

Table 4. Summary of the seasonal average PWC for each treatment for each year and for the 2-year duration.

	TREATMENT 2014-15	Treatment 2015-16	14-15 AVG Percent Weed Cover	15-16 AVG Percent Weed Cover	2014-2016 Average Weed Cover
A	Casoron*, Gly+Venue+MSO	Sandea + Prowl*, Gly+Unison	15 CDE	29 BC	20 CDE
B	Sandea + Prowl*, Spot Unison	Sinbar*, Gly+CleanAmine	9 EF	34 B	19 DEF
C	Goaltender*, Rely	Alion*, Rely	2 F	3 G	3 G
D	Chateau + Prowl*, Spot Unison	Matrix*, Gly+Rely	5 EF	21 BCDE	11 EFG
E	Alion*, Spot Unison	Casoron*, Gramoxone+Aim	1 F	6 FG	3 G
F	Matrix*, Gly+Treevix+MSO	Sinbar + diuron*, Gly+Unison	11 DEF	25 BCD	17 DEF
G	simazine + diuron*, Gly+CleanAmine	Chateau + Prowl*, Gly+CleanAmine	8 EF	17 CDEF	11 EFG
H	Sinbar*, Gly+Unison+Aim	Alion+Matrix*, Gly+Unison+Aim	10 DEF	11 EFG	10 FG
I	Unison + Gly, Gly + Rely	Alion*, Stinger+Unison	24 BC	27 BCD	25 CD
J	Gramoxone, Gly	Alion+Matrix*, Gly+CleanAmine+Aim	38 A	15 DEFG	29 BC
K	Glyphosate, Stinger+Unison	Alion+Matrix*, Gly+Aim	44 A	24 BCDE	36 B
L	Stinger, Gly+CleanAmine	Goaltender*, Gramoxone+Aim	21 CD	18 CDEF	20 CDEF
M	Untreated, Gly+Unison	Untreated, Stinger+Unison	34 AB	88 A	55 A

Numbers followed by the same letters are not statistically different.

Breth et al., 2016

Goaltender, Alion, Chateau + Prowl, Matrix, Casoron, Simazine + diuron, Sinbar, Alion + Matrix all gave excellent control in the fall

Objective 2:

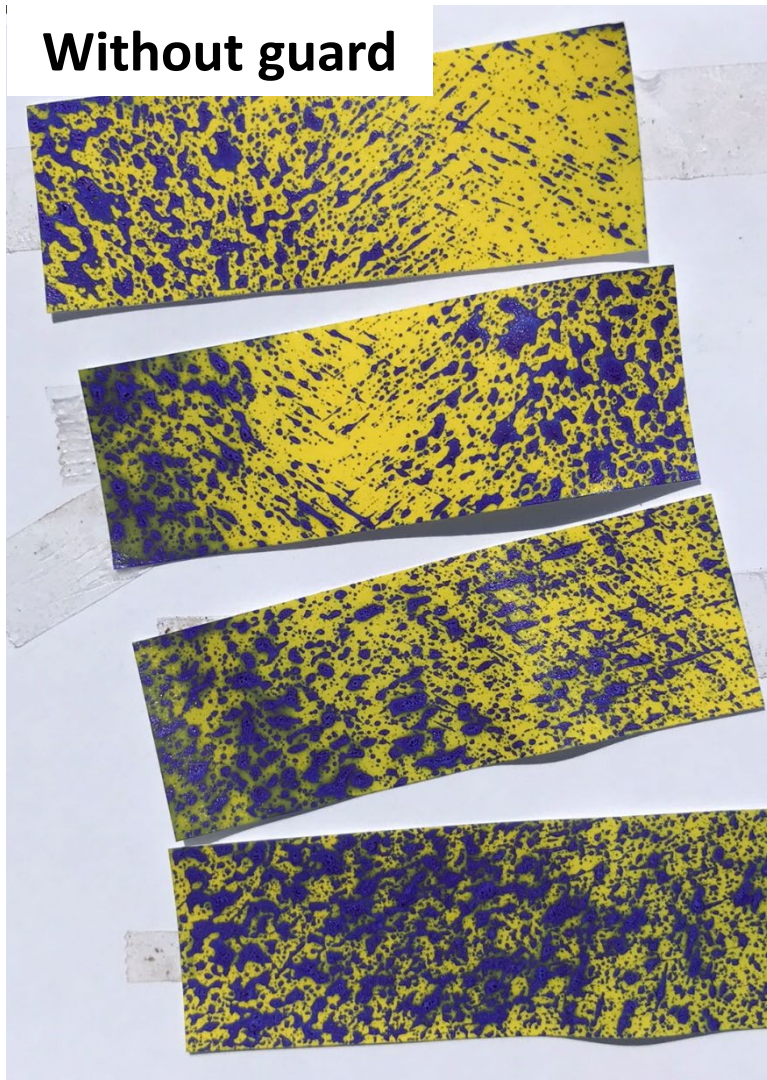
Evaluate the effects of herbicide treatments and trunk guards on tree health.

Can we prevent spray from reaching trunks?

- 10-inch tall Tyvek trunk guards
- Placed on ½ of trees in research block

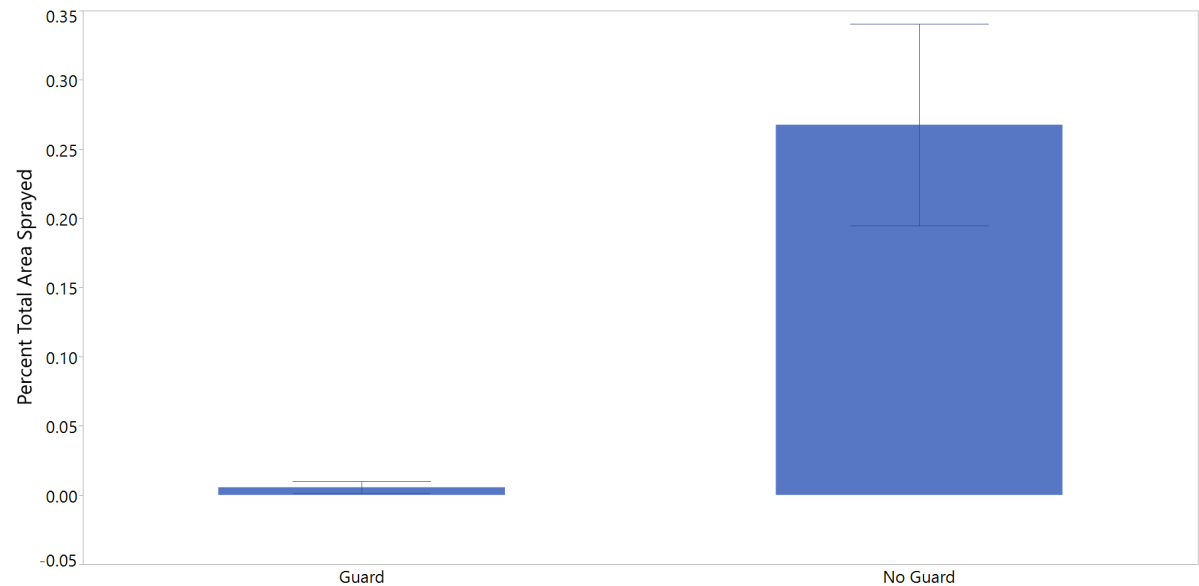


Trunk guards prevent spray deposition.



Can we prevent spray from reaching trunks?

- Guards led to 98% less contact in WNY ($p=0.0125$), and 98.7% less in ENY ($p=.0008$)



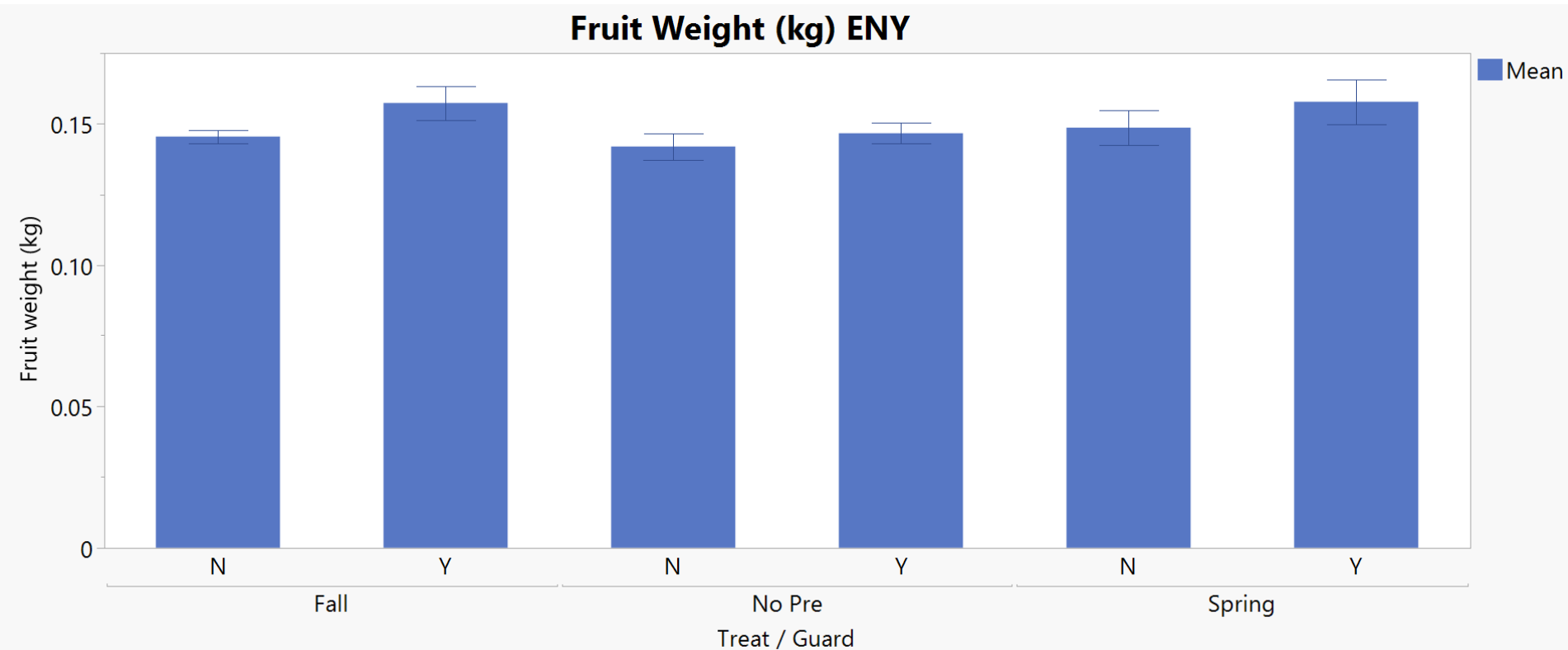
WNY

What's it worth?

- Estimated \$326 per acre for materials
(high density planting at ~1200 trees/acre)
- Time spent to cut to size and staple in place
- Expected to last 3-5 years
- **~\$81/yr/acre + time**
- Trunk guards do prevent spray contacting trunk.
- **How much does that spray contact affect tree health?**

What's the impact on yield and fruit quality?

ENY

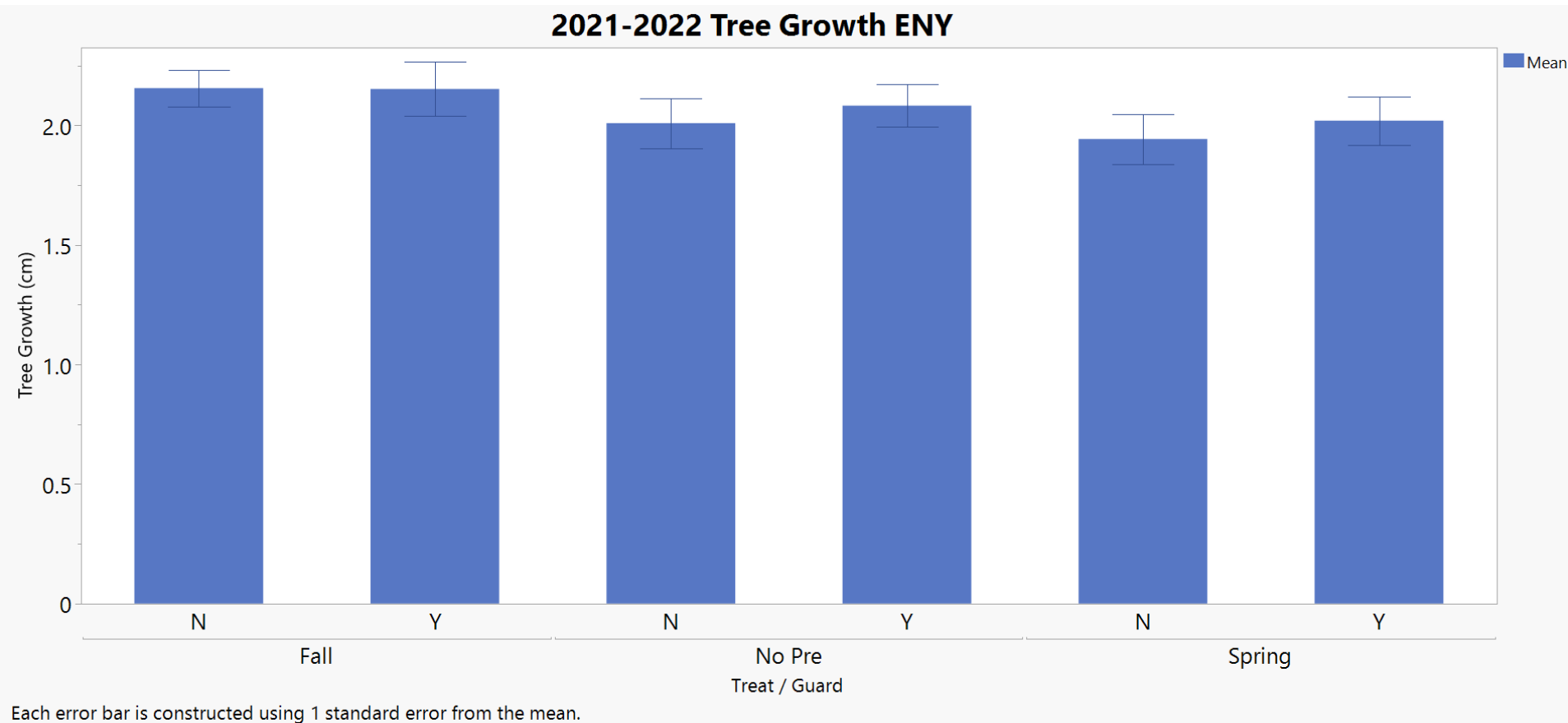


Each error bar is constructed using 1 standard error from the mean.

Guarded trees had marginally greater fruit weight in ENY ($p=.0427$). No significant effects of herbicides or guards on harvest values in WNY.

What's the impact on tree growth?

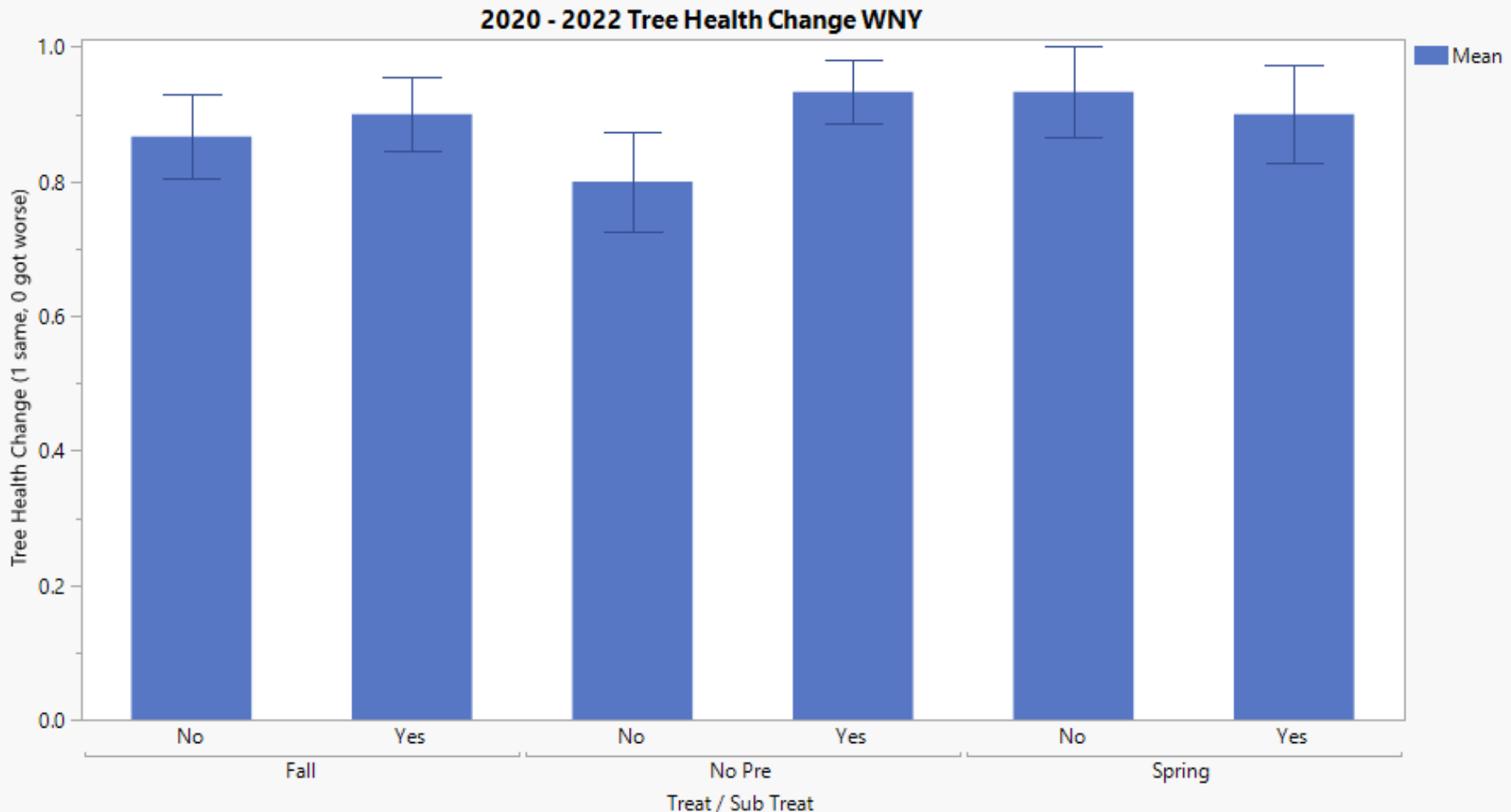
ENY



No significant effects of herbicides or guards on tree growth in 2022.

Impacts on tree survival?

WNY



Each error bar is constructed using 1 standard error from the mean.

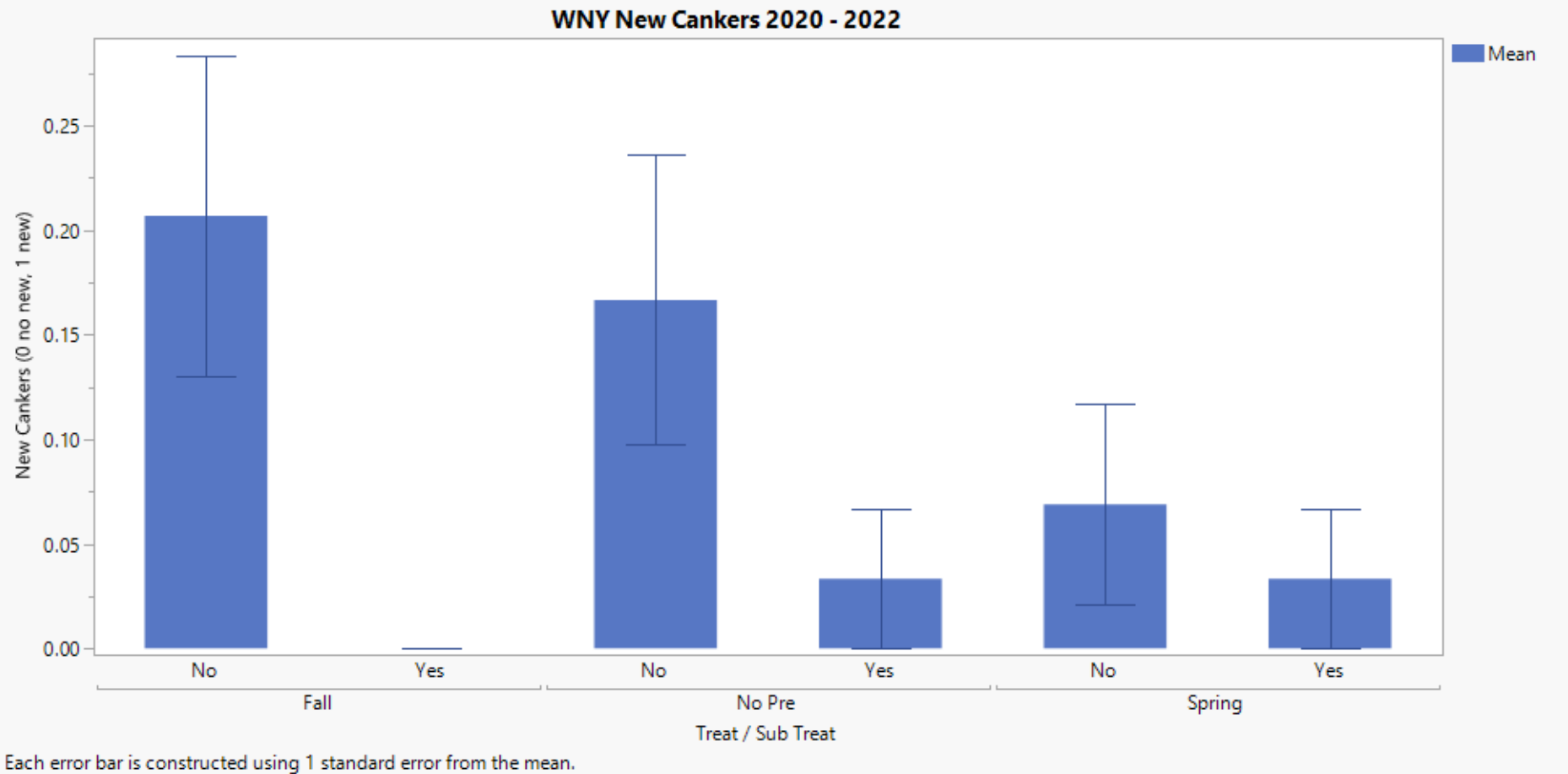
No significant impact of herbicides or guards on tree survival.

Trunk Cankers



What's the impact on canker development?

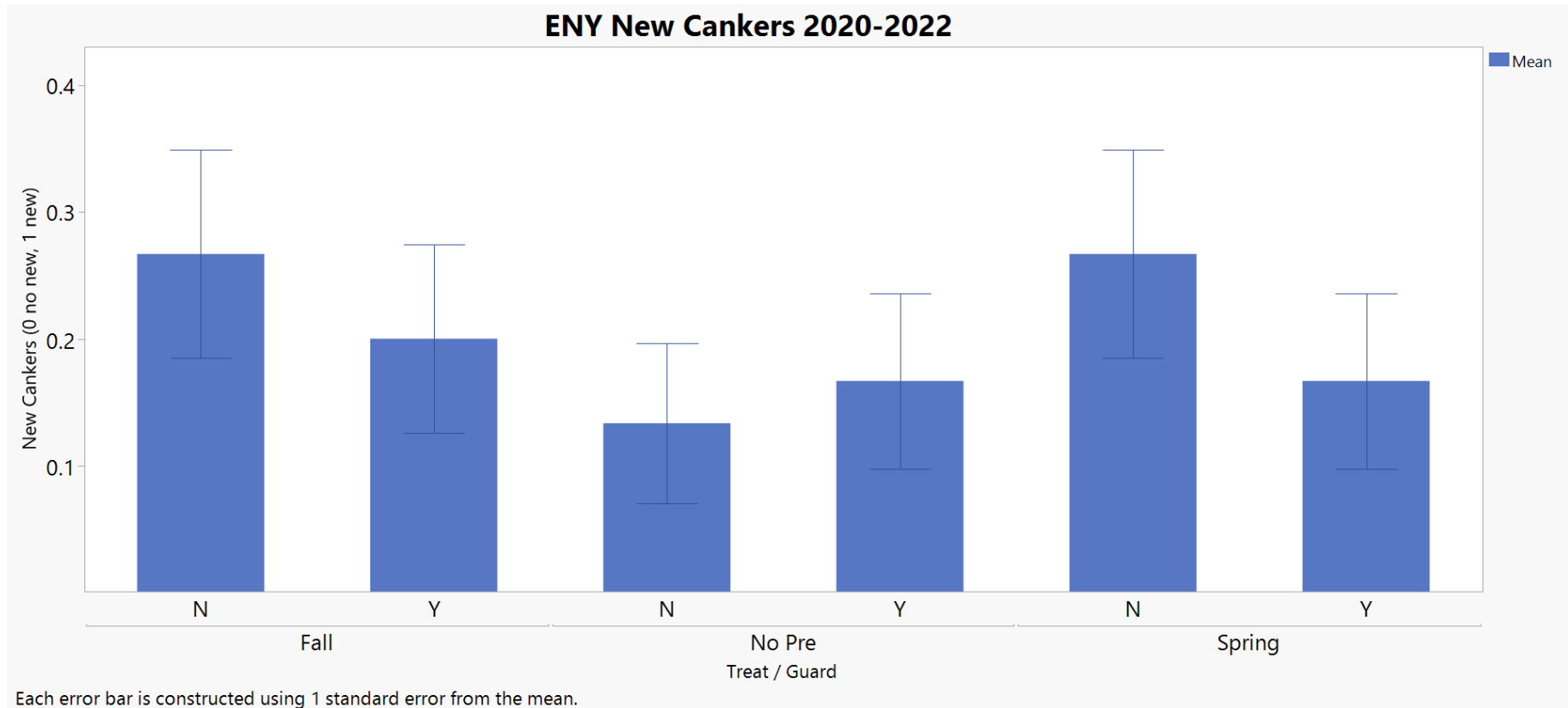
WNY



Trees protected with guards had significantly fewer cankers in WNY ($p=.0418$)

What's the impact on canker development?

ENY



No significant impact of herbicides or guards on canker development in ENY.

Takeaways on Tree Health:

- From 2 years of data, inconclusive impacts of herbicides and guards on canker development
- Effects are expected to be from chronic herbicide exposure, so more years' data is needed
- Follow-up trial comparing Tyvek guards, vs latex paint, vs no trunk guard is already in the ground

Overall Study Takeaways

- Fall pre-emergent applications = effective weed control with Alion or Chateau + Prowl, no negative effects on tree health to date. We highly recommend putting on a fall material if field conditions permit.
- Consider rotating pre-emergent materials in fall and spring applications, tank-mixed with appropriate post-emergent as needed.
- Trunk guards keep herbicides off trunks, which may reduce canker development, but still somewhat inconclusive results between the two sites. Other concerns like borers and WAA.
- We have submitted a new proposal to evaluate systemic herbicide materials for perennial weed control and for long term trunk protection product evaluation.

Tips for fall preemergent applications:

- Scout your fields. Choose, mix, and rotate products that will best control your weed species mix.
- Apply to unfrozen, bare ground, at the appropriate rate for your soil texture(s).
- Treatments should receive enough water (at least 0.5") within 7 to 10 days after application so that herbicide can be "activated" (penetrate into the ground) and protected from photo-degradation or volatilization.
- Apply with a "conventional" fixed-boom sprayer calibrated to accurately deliver 40 to 60 gals. of water/A using flat fan nozzles and 30 to 40 psi, unless otherwise stated.
- Apply before targeted weeds germinate. If weeds have already emerged, use a pre-emergent herbicide with post-emergence activity or tank-mix a post-emergence herbicide.

Post-emergent product review

Contact materials

Gramoxone and generics (Paraquat) – small annual broadleaves and grasses

Rely and generics (Glufosinate) – annual broadleaves and grasses

Group 14's

- Aim, Treevix, Venue – small annual broadleaves

Organic Materials

- Fatty acid derivatives (Final-San-O, Homeplate)
- Caprylic acids (Suppress)

Post-emergent product review

Grass systemics

Group 1's – Select Max, Poast, Fusilade

Broadleaf systemics

Group 4's

- 2,4-D (annual and perennial broadleaves)
- Stinger (leguminous weeds and thistles)

Non-selective systemic

- Glyphosate – annual and perennial weeds except sedges

Post-emergent timings

Contacts – when weeds are small

- 6" for paraquat, 4" for venue etc.

Systemic herbicides – apply at appropriate growth stage listed on the label

- Stinger when Canada thistle between the **rosette up to bud stage**
- Weeds are most sensitive to 2,4-D while **vigorously growing and before flowers appear. Post harvest prior to frost** for tough perennials has also worked well in NY



Thank you!

- Thank you NYS Apple Research and Development Program for funding this project!
- Thank you to Drs. Lynn Sosnoskie, Juliet Carroll and Bryan Brown; Andy Galimberti, Liz Tee, and our grower collaborators for their efforts in this project!
- Questions?
 - Janet van Zoeren – jev67@cornell.edu
 - Mike Basedow – mrb254@cornell.edu

Peru Seasonal Weed Monitoring

