Oregon Department of Agriculture and Oregon Association of Nurseries
Nursery Research Pre-proposal

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Project Title: Screening Postemergence herbicides for Field Grown Ornamental

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Project background:

A cost-effective weed control program is essential for sustainable nursery production to remain a reality. Herbicides, including pre and postemergence herbicides, are in common use in field-grown ornamentals. Glyphosate and paraquat are two postemergence products that offer broad-spectrum weed control and lower costs. However, herbicide resistance and regulatory hurdles undermine the usefulness of these products. The Willamette Valley hosts a population of Italian ryegrass that is resistant to glyphosate and paraquat. Recent regulatory changes require additional training and label restriction for these products, making their use cumbersome. Nurseries need alternatives to paraquat and glyphosate for effect. Shade tree production is an essential subsector of Oregon's nursery industry, with leads for value in the state (ODA, 2020).

Three new herbicidal active ingredients, tiafenacil, tolpyralate, and florpyrauxyfen-benzyl have been identified as having the potential to replace or complement postemergence control in nurseries. Tiafenacil is a protoporphyrinogen IX oxidase (PPO) and a WSSA Group 14 herbicide. It is a postemergence (POST) herbicide that controls grasses and broadleaves and has reduced toxicity to humans. In South Korea, for example, where paraquat is banned, Tiafenacil has replaced paraquat (Park et al. 2018). Although group 14 herbicides are registered for nurseries (e.g., Aim (carfentrazone)), tiafenacil is active in grasses as POST, thus contributing to control of such tenacious weeds as Italian ryegrass. Tolpyralate is a 4-hydroxyphenylpyruvate dioxygenase (HPPD) inhibitor herbicide in WSSA Group 27. It has low volatility and predominantly foliar activity on grasses and broadleaves. It is mode-of-action previously not used in field-grown nursery production. Florpyrauxifen-benzyl is a synthetic auxin with low volatility and low toxicity to humans. It is active against sedges, grasses, and broadleaves, including Canada thistle. Florpyrauxifen-benzyl has a short half-life and supports greater flexibility in crop rotation. The results from the 2021 season indicate that both tiafenacil and tolpyralate are safe when applied with a shield sprayer to newly planted There is no information on the tolerance of field-grown plants to these compounds. This project will initiate the evaluation of crop tolerance to the sequential application of these compounds to newly established field-grown woody ornamentals over three years.

Project objectives:

1) Evaluate efficacy and crop safety of tiafenacil, tolpyralate, and florpyrauxifen in a multi-species planting at Lewis Brown Research farm (continued form 2020)
2) Test efficacy and crop safety of tiafenacil and tolpyralate in commercial tree nursery

settings during the growing season.

Methods & Timeline:

Obj.1. A field study was initiated in 2021 at the Oregon State University Lewis Brown Research farm in Corvallis. The experiment evaluates crop tolerance to postemergence basal-directed applications of tiafenacil, tolpyralate, and Florpyrauxifen-benzyl.

Plant materials. Plants were sourced from local nurseries, and a list of species and transplant sizes are in Table 1.

Table 1. List of species and size of transplants used in the study.	
Acer rubrum	¼ trunk caliper
Cercis canadensis	3/16 trunk caliper
Fraxinus latifolia	24” seedling height
Gleditsia triacanthos	6-12 seedling height
Picea sitchensis	12” seedling height
Prunus laurocerasus	4” pot
Quercus rubra	¼ trunk caliper
Thuja occidentalis	2.25” pot
Tilia americana	6-12” seedling height

Treatments
Study 1. Tolerance to POST application. The plant species used in this study were transplanted on May 26, 2021. Plants were arranged in two rows, 5 ft apart and 2.5 ft between plants. The herbicides selected included tiafenacil applied at 75 and 150 g ai ha-1, tolpyralate at 39 and 79 g ai ha-1, and florpyrauxifen-benzyl at 5.5 and 38.6 g ai ha-1. Tiafenacil was also tested in a mixture with either tolpyralate or Florpyrauxifen benzyl. A nontreated was included for reference. Treatments were applied using a CO2 backpack sprayer equipped with a shielded boom with two nozzles DG8003 and calibrated to deliver 20 GPA. The application was directed to the base of the plants to minimize foliar uptake. Treatments will be applied in the spring, summer, and fall of 2022.

Obj.2. We proposed to validate the crop safety and efficacy of tolpyralate and tiafenacil alone and in combinations in commercial settings. The experiment will be conducted on crops at two ages. The first timing is 16-20 months after planting applied with shielded boom, and the second age is plants that are 2-year or older using directed spray with direct contact to the tree bark and buds in the lower 20 inches of the plant.

Table 2. Proposed treatments for testing in commercial nursery

1. Nontreated
2. Farm standard
3. Tiafenacil with MSO at field rate
4. Tiafenacil with MSO at twice field rate
5. Tolpyralate with MSO field rate

6. Tolpyralate with MSO at twice field rate
7. Tolpyralate plus Tiafenacil with MSO
8. Tolpyralate plus Tiafenacil at twice the field rate with MSO

Treatments will be applied in the spring and reapplied 30 days later to document crop response after two applications in season. This will generate data to support a potential two applications in season. Assessments will include weed control by species and crop injury every two weeks up to 12 weeks after treatment. Tree trunk caliper and canopy size measurements will be recorded at the end of the summer to compare the impact on plant growth.

The benefit to Nursery Industry:
This project's findings will initiate the evaluation of new compounds for nurseries that may ultimately result in new labels. This project intends to provide nursery growers with alternatives to glyphosate and paraquat by providing new tools to manage herbicide resistance and hard to control weeds. Unfortunately, this research was not prioritized during the 2021 IR-4 Environmental Horticulture priority setting conclude on September 30, 2021. It will be resubmitted in the next biennial meeting.

Budget summary:

	Description	Requested
Personnel		
Salary	0.21 FTE (46,500/yr)	$ 9,750
Employee benefits (OPE)	77%	$ 7,500
Supplies and Expenses		
Miscellaneous	PPE, co2, stakes, bags, sampling supplies.	$ 650
Plot fee	$1,200/A	$ 1,200
Travel ($0.56/mile)	(1,552 miles8 round trip Corvallis-Boring 184 mile)	$900
TOTAL REQUEST		$ 20,000

References

Park J, Ahn YO, Nam J-W, Hong M-K, Song N, Kim T, Yu G-H, Sung S-K (2018) Biochemical and physiological mode of action of tiafenacil, a new protoporphyrinogen IX oxidase-inhibiting herbicide. Pesticide biochemistry and physiology 152:38-44

Oregon Department of Agriculture. September 2020. Oregon Agricultural Statistics. https://www.oregon.gov/oda/shared/Documents/Publications/Administration/ORAgFactsFigures.pdf