Southern Forest Nursery Management Cooperative™

RESEARCH REPORT 23-06

A SECOND TRIAL OF OXADIAZON IN OVER-THE-TOP APPLICATIONS ON CONTAINERIZED LONGLEAF PINE (*PINUS PALUSTRIS*) SEEDLINGS

by
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INTRODUCTION

In 2022, approximately 287,000,000 containerized pine seedlings were grown for forestry use in nine southeastern and south-central U.S. states (Pike et al, 2022). As production and innovations in these growing systems have increased, so has the need for operations specific to container nurseries. One major concern of growers is the lack of transferable weed control methods from bareroot growing systems to containerized operations. To fill this need, the Southern Forest Nursery Management Cooperative (SFNMC) began testing herbicides in container-grown seedlings in 2014.

Since that time, three herbicides have been tested at SFNMC member container nurseries in ten trials in four pine species. These herbicides include indaziflam tested as Marengo® (SFNMC Research Reports 15-01, 16-04, 17-01), pendimethalin tested as Pendulum®AquaCap (SFNMC Research Reports 16-03, 17-03, 18-02), and oxadiazon tested as Ronstar®Flo (SFNMC Research Reports 18-01, 19-05, 20-02, 22-04). Of these herbicides, oxadiazon was found to be the most tolerated by the four pine species tested while also controlling black willow and other weeds, when applied at the time containers were sown. This chemical controls weeds by killing plants as they germinate and contact the herbicide during emergence, so is an appropriate choice for application to newly sown containers.

Because the product label of Ronstar®Flo (oxadiazon) provides for its use in conifer nurseries and its application to bare soils prior to weed seed germination in over-the-top (crop) applications, the SFNMC conducted its first trial testing oxadiazon at later application dates (after sowing) in 2021 (SFNMC Research Report 22-04). It was installed at Meeks Nursery near Kite, Georgia over trays of longleaf pine (*Pinus palustris*), loblolly pine (*Pinus taeda*), and slash pine (*Pinus elliottii*). Results were promising in that no biologically significant differences were found between treated and nontreated control seedlings from measurements of seedling samples at the end of the growing season. To continue testing of the effect of oxadiazon applied at later dates (after sowing), a second trial was installed in May 2022.

METHODOLOGY

This oxadiazon trial was installed at Meeks Farm and Nursery near Kite, Georgia in May of 2022 in longleaf pine seedlings. Applications of 40 ounces per acre of Ronstar®Flo were made by SFNMC staff using a handheld spray wand and CO_2 tanks on two sets of trays containing 112 cells each: 7-week-old longleaf pine and 8-week-old longleaf pine. These ages were selected to determine the tolerance of younger longleaf pine seedlings than previously tested (9-week-old and 10-week-old seedlings) in 2021.

For each age, ten trays were designated as nontreated control trays and ten trays sprayed with the herbicide were

designated as treatment trays. Each tray represented a replication in the study design and statistical analysis. A total of 40 trays of seedlings were used in the trial. Prior to herbicide applications, counts of pine seedlings per tray were made to determine percent fill at the initiation of the study.

On December 5, 2022, all trays included in the trial were identified and separated for field analysis. In each of the 40 trays, counts of seedlings per tray and black willow (*Salix nigra*) seedlings (as the primary target weed) per tray were recorded. Random samples of ten seedlings per tray (400 trees total) were removed, labeled, and taken to the SFNMC laboratory for measurements. These included seedling height, root collar diameter, shoot dry weight, and root dry weight. Data was analyzed using R Statistical Software (v4.1.2; R Core Team 2021) with Tukey's Honest Significant Difference (HSD) post hoc test. A significance level at alpha = 0.05 was used for these comparisons between nontreated control seedlings and treated seedlings.

RESULTS

Longleaf pine treated at 7 weeks post-sowing: No statistical differences were identified when comparing seedlings from nontreated control trays to those from treated trays, in any seedling characteristic measured. Similarly, no difference in percent fill of trays (calculated from May tray counts and December tray counts) was found. Mean measurements and analyses are shown in Table 1.

Longleaf pine treated at 8 weeks post-sowing: As in the 7-week-old installation, no statistical differences were found between seedlings from nontreated control trays and those from treated trays, in any seedling characteristic measured. Also, no difference in percent fill of trays (calculated from May tray counts and December tray counts) was identified. Mean measurements and analyses are shown in Table 2.

Black willow control: No statistical differences were identified when comparing the number of willows per tray in those identified as control or treatment trays. It should be noted that the black willow population in trays was relatively low at the nursery in 2022.

MANAGEMENT IMPLICATIONS

Both the 2021 and 2022 Ronstar®Flo trials using later applications in longleaf seedlings showed that the seedlings are tolerant of oxadiazon when applied at 40 ounces per acre at the seedling ages tested. These trials are the first two studies of over-the-top oxadiazon application trials conducted by the SFNMC and should be viewed in their limitations in scope of species tested, seedling ages, and rates of product applied.

If interest in using Ronstar®Flo in this application method exists among SFNMC members, then two factors must be considered:

1) The limitations on commercial conifer nursery species listed on the Ronstar®Flo product label for over-the-top applications, and
2) Additional testing needed to include other species, ages, and rates in over-the-top applications.

The limitations on commercial conifer nursery species are found on the product label under Ornamental and Conifer Nurseries, Plant Tolerance section, and read:

> "Ronstar® Flo herbicide may be used as an over the top spray in a minimum of 1 gallon of water per 1000 sq. ft., at the labeled rates, on the following ornamental species only: Arborvitae, Japanese Barberry, Boxwood, Baby's Breath, Eastern Red Cedar, Cranberry, Hinoki Cypress, Nootka Sound Cypress, Sawara Cypress, Evergreen Euonymus, Douglas Fir, Fraser Fir, Grand Fir, Noble Fir, Gladiolas, Canadian Hemlock, Chinese Holly, Japanese Holly, Kurogane Holly, Purple Hopseed Bush, Andorra Juniper, Blue Rug Juniper, Common Juniper, Creeping Juniper, Oleander, Ophiopogon, Eastern White Pine, Mugho Pine, Scotch Pine, Raphiolepis, Blue Spruce, Statice."

The four pine species most commonly grown in containers by SFNMC member nurseries are **notably absent** from this list. Their omission indicates that labeling efforts with the manufacturer will be required prior to any larger scale use by forestry container seedling nurseries.

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Table 1. Container longleaf pine seedling characteristics and black willow populations in trays treated with oxadiazon (Ronstar®Flo) at 7 weeks post-sowing on May 25, 2022, at Meeks Farm and Nursery.

Treatment	Percent fill of tray[1]	Shoot height (cm)	Root collar diameter (mm)	Shoot dry weight (g)	Plug dry weight (g)	Mean number of willows per tray[2]
Control	98.2 ± 0.53	31.4 ± 0.28	7.20 ± 0.11	3.50 ± 0.09	11.94 ± 0.08	0.3 ± 0.15
Ronstar®Flo 40 oz/ac	98.5 ± 0.60	31.0 ± 0.27	7.02 ± 0.11	3.40 ± 0.08	11.92 ± 0.08	0.3 ± 0.15
p>f	*0.776*	*0.292*	*0.225*	*0.437*	*0.862*	*1.000*

[1] Calculated from difference in cells containing seedlings from May 25 to December 5, 2022.

[2] Black willow seedlings counted in trays on December 5, 2022.

Table 2. Container longleaf pine seedling characteristics and black willow populations in trays treated with oxadiazon (Ronstar®Flo) at 8 weeks post-sowing on May 25, 2022, at Meeks Farm and Nursery.

Treatment	Percent fill of tray[1]	Shoot height (cm)	Root collar diameter (mm)	Shoot dry weight (g)	Plug dry weight (g)	Mean number of willows per tray[2]
Control	94.0 ± 1.03	34.0 ± 3.17	6.69 ± 0.12	3.38 ± 0.10	11.44 ± 0.17	0.8 ± 0.25
Ronstar®Flo 40 oz/ac	93.9 ± 1.51	30.6 ± 0.28	6.78 ± 0.10	3.31 ± 0.09	11.43 ± 0.12	0.5 ± 0.17
p>f	***0.961***	***0.303***	***0.525***	***0.602***	***0.981***	***0.332***

[1] Calculated from difference in cells containing seedlings from May 25 to December 5, 2022.

[2] Black willow seedlings counted in trays on December 5, 2022.