Auburn University
Southern Forest Nursery
Management Cooperative

RESEARCH REPORT 18-03

OVER-THE-TOP APPLICATIONS OF MARENGO® ON BAREROOT EASTERN REDCEDAR (*JUNIPERUS VIRGINIANA*)

by
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INTRODUCTION

When indaziflam was registered in 2010, it was the first of a new Mode of Action Group 29 herbicide. Marengo® (7.4% indaziflam) was introduced to the market in 2013 by OHP, Inc. and the product was subsequently purchased by Bayer CropScience. Its development was of interest as growers across the country recorded increased incidences of weed resistance to multiple modes of action herbicides. Indaziflam has been shown to control some glyphosate-resistant weed species and is marketed for ornamental nurseries, Christmas trees and under-bench greenhouse applications. Several brand names of indaziflam are currently marketed by Bayer. These include Specticle® for the turf and landscape ornamental markets, Alion® for citrus, grape, olive and tree nuts markets, Esplande® for industrial vegetation management, and DuraZone®, a combination of indaziflam, diquat and glyphosate for the home garden market.

As part of its continued mission in evaluating weed control options for member nurseries, the Southern Forest Nursery Management Cooperative (SFNMC) first tested Marengo® in 2013 to target commonly found weeds and to determine loblolly pine seedling tolerance to the herbicide. Management Implications from the original trial, published in Research Report 14-04, stated that Marengo® should not be applied at the time of sowing, but at a minimum of 6 weeks post-sowing to avoid damage to seedlings. Additional evaluation of Marengo® continued in 2014, 2015 and 2016 to include trials installed in both bareroot and container nurseries. These trials included over-the-top applications to loblolly, longleaf, shortleaf and slash pine and eastern redcedar, and a directed spray application to pin oak. Results of these trials are included in Research Reports 15-01, 16-04 and 17-01 and show that the effect on pine is species-dependent and caution growers of reduced plug weights and herbicide-induced stem swelling in containerized growing systems.

However, one aspect of the 2015 trial (Research Report 16-04) presented interesting results. When Marengo® was applied over-the-top of eastern redcedar at 20 weeks post-sowing (due to its winter sowing schedule), seedling densities and growth were significantly increased in treated plots when compared to non-treated plots. Eastern redcedar is listed as a tolerant ornamental on the Marengo® label, but most herbicides are not expected to increase growth in non-targeted plants. Auxin herbicides are an exception, as they are designed to increase plant growth to the extent that plants are lethally damaged by explosive cell growth. However, indaziflam is not an auxin herbicide.

Because of the unique growth enhancement observed, the SFNMC was asked to repeat the trial with Marengo® on bareroot eastern redcedar (*Juniperus virginiana*) to confirm previous results.

METHODOLOGY

The trial was installed at the Georgia Forestry Commission's Flint River Nursery in a loamy sand. Applications of Marengo® were made on June 14, 2017 on 20 week old seedlings. Eastern redcedar beds received 4 treatments: 0.0 oz./ac, 3.75 oz.ac, 7.5 oz./ac and 11.25 oz./ac. that represented control, ½, 1 and 1.5 times the lowest label rate, respectively.

SFNMC personnel sprayed the herbicide with a CO_2 hand sprayer calibrated to broadcast spray 25 gallons per acre. Watering-in, as recommended on the Marengo® label, was done operationally on the nursery's irrigation schedule. Each treatment was one seedling bed wide by 10 feet in length, replicated four times in available bed space. Seedling density measurements were made from each plot on November 1, 2017. Samples of 50 seedlings from each treatment plot were removed and evaluated at the SFNMC laboratory for tolerance to the herbicide. Measurements of shoot height, root collar diameter, stem swelling (if present), root dry weight and shoot dry weight were made and compared to those from seedlings in non-treated control plots. Statistical analyses using Duncan's Multiple Range test, Dunnett's T-test and Wilcoxon Method for Nonparametric Comparisons, all at alpha = 0.05, were made on data collected.

RESULTS AND DISCUSSION

In eastern redcedar, the use of Marengo® (7.4% indaziflam) at all three rates (3.75 oz./ac, 7.5 oz./ac, and 11.25 oz./ac) significantly increased seedling growth when compared to non-treated control seedlings (Table 1). Density, as measured by the number of seedlings per square foot, was not statistically significant. At the lowest rate (3.75 oz./ac), shoot heights and root collar diameters of treated seedlings were significantly larger than those of non-treated control seedlings. Root and shoot dry weights were not significantly different at the lowest rate. At the 7.5 oz./ac and 11.25 oz./ac rates, treated seedlings were significantly larger than non-treated control seedlings in four seedling characteristics measured: shoot height, root collar diameter, root dry weight and shoot dry weight. One does not expect an application of herbicide to *increase* plant growth, so this effect of Marengo® on eastern redcedar is not understood. Auxin herbicides are designed to stimulate growth processes of targeted plants to cause unregulated tissue growth to the point of lethality, but Marengo® does not fall into this class of herbicides.

MANAGEMENT IMPLICATIONS

Because the use of Marengo® on eastern redcedar seedlings has shown to *increase* seedling density and growth in two replicated studies, this may be an option for both increased production of eastern redcedar as well as weed control. Recognize that this action of increasing seedling growth is not understood by the SFNMC and that the two replicated studies were installed at the same nursery with its inherent biological attributes. Prior to the use of Marengo® on eastern redcedar on a larger scale, care should be taken to TEST the product in a small area. Due to the inexplicable action of this herbicide on eastern redcedar, factors such as soil type, soil pH, percent organic matter, irrigation water chemistry, geographic location, temperature and weather patterns may affect the

ability to reproduce similar results at different nurseries. The product label of Marengo® specifically cautions its use in excessively coarse and sandy soils due to the possibility of excessive downward movement of the herbicide into non-target plants' root zone, causing root damage.

ACKNOWLEDGEMENTS
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Table 1. Eastern redcedar seedling characteristics treated with Marengo®, Georgia Forestry Commission Nursery, Byromville, Georgia.

Rate	Oz./acre	Density/square foot	Shoot height (cm)	Root collar diameter (mm)	Root weight (g)	Shoot weight (g)
Control	0.00	10.4	13.6	2.04 a	0.27 a	0.85
Low	3.75	17.3	17.4	2.34 b	0.38 ab	1.22
Medium	7.50	12.4	18.2	2.45 b	0.53 bc	1.33
High	11.25	13.5	19.4	2.68 c	0.57 c	1.74

Different letters (a, b) within a seedling characteristic column indicate significant treatment differences in rates according to Duncan's Multiple Range test at alpha = 0.05.

Single underlined means within a seedling characteristic indicate significant treatment difference from that of the non-treated control at that rate according to Dunnett's T-test at alpha = 0.05.

Double underlined means within a seedling characteristic indicate a significant treatment difference from that of the non-treated control at that rate according to nonparametric Wilcoxon test at alpha = 0.05.

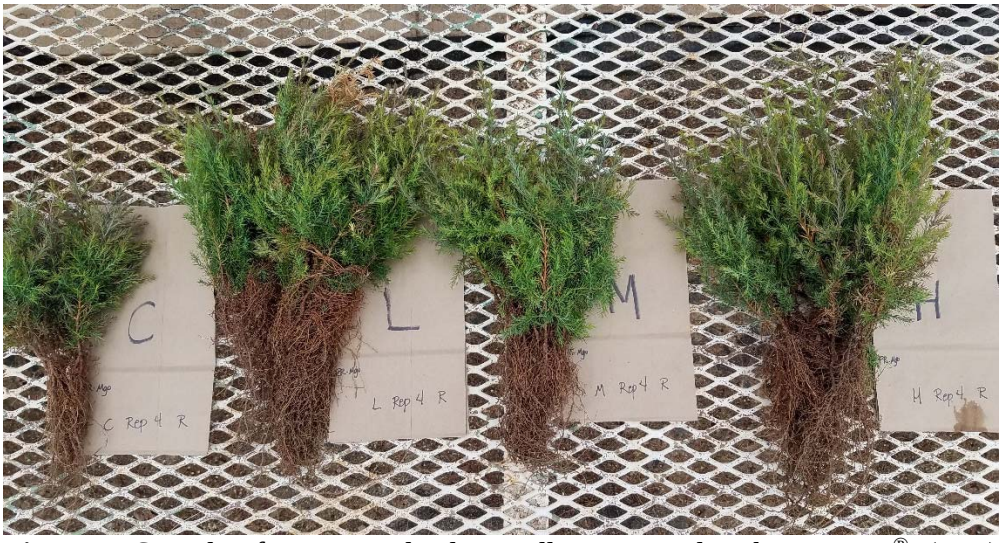

Figure 1. Sample of eastern redcedar seedlings treated with Marengo®: (L-R) non-treated control seedlings, low rate (3.75 oz./ac), medium rate (7.5 oz./ac), high rate (11.5 oz./ac).