

## Northern Willowherb Control in Nursery Containers

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### Introduction

Northern willowherb (*Epilobium ciliatum* Rafin, syn. *E. adenocaulon* Hauss.) is a perennial in the family Onagraceae and is native to North America. Northern willowherb is one of the most prevalent weed species in west coast container nurseries and is becoming increasingly problematic in cooler regions along the east coast. *E. ciliatum* is wrongly, but commonly, referred to as fireweed by many west coast nurserymen. Northern willowherb is also known by the common names hairy willowherb, slender willowherb, or fringed willowherb depending on the region where it is found.

A single plant can produce up to 60,000 seeds per plant per season. Seeds are attached to a tuft of hair which aid in wind dispersal allowing for widespread seed dissemination in container nurseries. Northern willowherb germinates in dry to water logged soils, and is particularly well suited for establishing in dry soils compared to other species in the same genera. Northern willowherb seeds germinate readily in full sun (100%) or darkness (84%), making them well adapted to germination in containers with little or complete cover from crop canopies. Seeds can germinate over a range of temperatures from 4 to 36C, although germination is reduced as temperatures approach 30C. This allows for germination to occur throughout the spring and summer growing season in northern climates, and virtually year-round in protected container crops. It also explains why its spread has been primarily limited to cooler summer climates typical of the west coast and northeast U.S. Northern willowherb seed that mature during the summer have no dormancy. Germination of seed from recently ripened seed pods occurred within four days of sowing (personal observation). Plants can flower in 5 to 6 weeks and then produce mature seed 4 weeks later. This species only requires 9 to 10 weeks for seeds to germinate, mature, and produce another generation of seeds. This allows multiple generations during a single growing season in most nursery producing regions.

This species demonstrates strong apical dominance growing rapidly up to 1.5 m tall; taller than all other common container weeds and many crops common to container production. Rapid growth allows this weed to out-compete many smaller container shrubs and herbaceous perennials for light.

While some European research has addressed control of this weed in orchard systems and other field-grown crops, none has addressed its control in nursery containers. The objective of these experiments was to identify effective preemergence herbicides currently labeled in the U.S. for control of northern willowherb in nursery containers.

## Materials and Methods

*Experiment 1.* On May 6, 2004, #1 containers were filled with 100% Douglas fir (*Pseudotsuga menziesii* (Mirbel) Franco) bark amended with 9.5 kg/m<sup>3</sup> Osmocote 18-6-12 and 0.9 kg/m<sup>3</sup> Micromax micronutrients. Granular herbicides (Table 1) were applied May 17 with a handheld shaker. All herbicides were applied at the highest labeled rate. A non-treated control group was also maintained. Containers were irrigated immediately after herbicide application with 1.2 cm water and thereafter with the same volume split in two equal applications per day. Twenty northern willowherb seeds were applied to each container May 18. There were eight single pot replications per treatment arranged in a completely randomized design.

*Experiment 2.* On July 28, 2004, #1 containers were filled with the same substrate used in Expt. 1. Herbicides (Table 2) were applied to all containers July 30. Sprayed herbicides were applied with a CO<sub>2</sub> backpack sprayer equipped with a three-nozzle boom containing 8004 flat fan nozzles. The sprayer was set at 2.46 kg/cm<sup>2</sup> and calibrated to deliver 467 L/ha. Granular herbicides were applied with a handheld shaker. Herbicides were applied to 12 containers per treatment. Seeds were applied to six of the 12 containers immediately after herbicide application (0 WAT), then to six different containers per treatment at 4 WAT. All containers were arranged in completely randomized design.

## Results and Discussion

*Experiment 1.* Ronstar G, OH2, and RegalStar reduced northern willowherb numbers 3 WAT the most (Table 1). Snapshot, Kansel+ and RegalKade did not reduce weed numbers compared to non-treated controls. While OH2 reduced weed numbers 3 WAT, subsequent growth of those weeds was similar to non-treated controls by 8 WAT. Ronstar G numerically reduced weed growth the most, but was similar to Rout, BroadStar, and RegalStar. Northern willowherb control seemed to be responsive to oxadiazon rate. Ronstar G, RegalStar, and Regal O-O reduced SDW by 89, 63, and 33%, respectively, compared to non-treated controls. Ronstar G contains 2% oxadiazon resulting in 4.48 kg/ha oxadiazon; RegalStar contains 1% oxadiazon resulting in 2.24 kg/ha oxadiazon; Regal O-O contains 1% oxadiazon and thus only 1.12 kg oxadiazon/ha was applied.

*Experiment 2.* Among containers in which seeds were applied immediately after herbicide application, Ronstar G reduced weed numbers in containers through 4 WAT more than all other herbicides (Table 2). Among granular herbicides, Ronstar G reduced weed numbers lower than Rout and RegalKade throughout the experiment, both of which did not reduce weed numbers compared to non-treated controls. This concurs with other research by the author, in which Ronstar G consistently reduced weed number and shoot dry weight compared to RegalKade and Rout, although differences weren't always significant.

At 1 WAT and throughout the experiment, adding Gallery to Devrinol, Barricade, or Surflan did not improve control over any of those herbicides alone (Table 2). Furthermore, Gallery alone did not reduce weed numbers compared to non-treated controls. Devrinol with or without Gallery did not reduce weed numbers compared to non-treated controls; however, weed

heights in these containers were small. Surflan treatments reduced weed numbers compared to non-treated controls, although weed numbers were still relatively high. However, SDW data show that established seedlings were not able to grow far beyond the cotyledon stage. Devrinol alone and Devrinol + Gallery reduced SDW by 91% and 83%, respectively. While there were weeds in the Surflan + Gallery treated pots, these weeds were so small that average SDW rounded to 0.0 g.

Among containers in which seeds were applied 4 WAT, no sprayed herbicides reduced weed numbers throughout the experiment compared to non-treated controls. However, all sprayed treatments except for Gallery alone reduced weed SDW. Surflan provided effective preemergence northern willowherb control in terms of growth reduction. Ronstar G reduced weed number more than all other herbicide treatments and reduced SDW numerically lower than other treatments.

In summary, northern willowherb disseminates seeds via wind and thus a few local plants have the potential to infest many containers. Where appropriate, granular Ronstar G should be applied soon after potting new plants or hand-weeding existing plants. Ronstar G provided the most effective control in terms of reduction of northern willowherb seedlings and their subsequent growth. While Ronstar G provided excellent control of northern willowherb, the active ingredient oxadiazon is not effective on all weed species. It is particularly ineffective on weeds in the family Caryophyllaceae, most notable are pearlwort (*Sagina procumbens*) and chickweed (*Stellaria media*) which commonly infest nursery containers.

The authors recommend that nursery producers aggressively control northern willowherb plants growing within and around the production site using a combination of hand pulling or postemergence applications of glyphosate. Ronstar G can be used in containers to prevent establishment within the crop, particularly in mid-summer when plants in surrounding areas are mature and disseminating seeds into the production site. Ronstar G can be used in rotation with other labeled preemergence herbicides.

## Literature

- Bailey, J.A. and D. Hoogland. 1984. The response of *Epilobium* species to a range of soil and foliar-acting herbicides. *Aspects Appl. Biol.* 8:43-52.
- Bailey, J.A., W.G. Richardson, and A.G. Jones. 1982. The response of willowherbs (*Epilobium adenocaulon* and *E. obscurum*) to pre- or post-emergence herbicides. *Proc. Brit. Crop Protection Conf.* 1:299-305.
- Bentley, R.A. and A.J. Greenfield. 1987. Herbicides on newly planted rootstock and budded trees. *Proc. Brit. Crop Protection Conf.* 2:625-631.
- Bulcke, R., F. Verstraete, M. Van Himme, J. Stryckers, and M. Van Himme. 1986. Variability of *Epilobium ciliatum* Rafin. (Syn.: *E. adenocaulon* Hausskn.). *Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent.* 51: 345-353. (Abstr.)

- Bulcke, R., F. Verstraete, M. van Himme, J. Stryckers, and M. van Himme. 1987. Biology and control of *Epilobium ciliatum* Rafin. (syn. *E. adenocaulon* Hausskn.). Proc. European Commission Experts Group. (Abstr.)
- Grime, J.P, G. Mason, A.V. Curtis, J. Rodman, and S.R. Band. 1981. A comparative study of germination characteristics in a local flora. *J. Ecol.* 69:1017-1059.
- Myerscough, P.J and F.H. Whitehead. 1966. Comparative biology of *Tussilago farfara* L., *Chamaenerion angustifolium* (L.) Scop., *Epilobium montanum* L., and *Epilobium adenocaulon* Hausskn. I. General biology and germination. *New Phytologist* 65:192-210.
- Myerscough, P.J and F.H. Whitehead. 1967. Comparative biology of *Tussilago farfara* L., *Chamaenerion angustifolium* (L.) Scop., *Epilobium montanum* L., and *Epilobium adenocaulon* Hausskn. II. Growth and ecology. *New Phytologist* 66:785-823.

Table 1. Preemergence northern willowherb (*Epilobium ciliatum*) control with granular herbicides.

Herbicide	Common name	Rate (kg ai/ha)	Number <sup>z</sup>		SDW (g)	
			3 WAT <sup>y</sup>		8 WAT	
BroadStar	flumioxazin	0.42	2.9	cd <sup>x</sup>	10.2	bcd
Kansel+	oxadiazon+pendimethalin	3.64	7.6	ab	18.4	ab
OH2	oxyfluorfen+pendimethalin	3.36	2.0	de	14.5	abc
Regal O-O	oxyfluorfen+oxadiazon	3.36	4.8	bcd	13.9	abc
RegalStar	oxadiazon+prodiamine	2.69	1.6	de	7.8	cd
RegalKade	prodiamine	1.68	6.3	abc	12.0	bc
Ronstar G	oxadiazon	4.48	0.1	e	3.0	d
Rout	oxyfluorfen+oryzalin	3.36	2.4	d	9.6	cd
Snapshot 2.5TG	isoxaben+trifluralin	5.6	6.9	ab	12.7	abc
Control			9.8	a	20.8	a

<sup>z</sup> Number of northern willowherb germinated in containers. Data were square root transformed prior to analysis, but actual data are presented.

<sup>y</sup> Weeks after treatment.

<sup>x</sup> Means with the same letter within a column are not different according to Fisher's Protected LSD ( $\alpha = 0.05$ ).

Table 2. Preemergence northern willowherb (*Epilobium ciliatum*) control with granular and sprayed preemergence herbicides.

Herbicide	Common name	Rate (kg ai/ha)	Seeds applied 0 WAT <sup>z</sup>			Seeds applied 4 WAT	
			Number <sup>y</sup> 1 WAT	Number 4 WAT	SDW (g) 8 WAT	Number 8 WAT	SDW (g) 12 WAT
<b>Granular products</b>							
RegalKade	prodiamine	1.68	10.3 ab <sup>x</sup>	10.3 bcd	14.3 a	8.8 ab	1.5 abc
Ronstar G	oxadiazon	4.48	1.7 d	2.2 e	3.5 cd	1.8 c	0.2 c
Rout	oxyfluorfen+oryzalin	3.36	7.3 bc	9.0 cd	14.2 a	6.5 b	0.8 bc
<b>Sprayed products</b>							
Devrinol + Gallery	napropamide + isoxaben	6.72 + 1.12	8.7 ab	11.5 abc	2.6 d	10.2 ab	1.0 bc
Barricade + Gallery	prodiamine + isoxaben	1.68 + 1.12	8.2 bc	8.5 cd	7.6 bc	10.0 ab	0.8 bc
Surflan + Gallery	oryzalin + isoxaben	4.48 + 1.12	4.2 c	6.7 d	0.0 d	12.8 a	0.6 c
Devrinol	napropamide	6.72	10.5 ab	13.3 ab	1.4 d	13.3 a	0.9 bc
Barricade	prodiamine	1.68	10.0 ab	9.2 cd	11.0 ab	11.5 a	1.2 bc
Surflan	oryzalin	4.48	6.0 bc	8.0 cd	0.4 d	11.5 a	1.4 bc
Gallery	isoxaben	1.12	9.8 ab	14.2 ab	13.4 a	9.8 ab	2.1 ab
Control			13.3 a	15.5 a	15.1 a	11.5 a	2.8 a
Contrast analysis							
RegalKade vs. Barricade			NS	NS	NS	NS	NS
Gallery +/-			*	NS	NS	NS	NS
<sup>z</sup> Weeks after treatment.							
<sup>y</sup> Number of northern willowherb germinated in containers. Data were square root transformed prior to analysis, but actual							
<sup>x</sup> Means within a column with the same letter are not different, Duncan's multiple range test ( $\alpha = 0.05$ ).							