

Weed Control and Phytotoxicity of Selected Herbicides for Container Production

Principle Investigators: Dr. Hannah Mathers and Luke Case

Significance to the Industry: Weed control is always a concern for nursery managers and landscapers. Due to the large costs of developing new chemistries, very few companies develop herbicides explicitly for ornamentals. However, companies do look at available chemistries for use in ornamentals and are constantly trying to develop the best strategy for each herbicide. The objectives of this study was to compare a new formulation of Dimension Ultra 2EW(dithiopyr, Dow AgroSciences) with and without a tank mix with Gallery (isoxaben, Dow AgroSciences) and Showcase (isoxaben+trifluralin+oxyfluorfen, Dow AgroSciences) to other granular and liquid formulations currently available for phytotoxicity and efficacy evaluations.

Materials and Methods: Herbicide treatments consisted of Showcase at 100 lb/ac (2 lb ai/ac), 150 lb/ac (3 lb ai/ac), and 200 lb/ac (4 lb ai/ac), Rout (oxyfluorfen+oryzalin, Scott's Co.) at 100 lb/ac (2 lb ai/ac), OH-2 (oxyfluorfen+pendimethalin, Scott's Co.) at 100 lb/ac (2 lb ai/ac), Ronstar G (oxadiazon, Bayer Corp.) at 150 lb/ac (3 lb ai/ac), Regal O-O (oxadiazon+oxyfluorfen, Regal Chemical Co.) at 100 lb/ac (3 lb ai/ac), RegalStar (oxadiazon+prodiamine, Regal Chemical Co.) at 200 lb/ac (2.4 lb ai/ac), Dimension Ultra 2EW at 32 fl oz/ac (0.5 lb ai/ac), Surflan (oryzalin, Dow AgroSciences) at 2 qt/ac (2 lb ai/ac), Gallery 75DF at 21.33 oz/ac (1.0 lb ai/ac), Dimension 2EW + Gallery at 32 fl oz/ac + 21.3 oz/ac, respectively, Surflan + Gallery at 2 qt/ac + 21.3 oz/ac, respectively, and untreated control. Granular formulations were applied with a handheld shaker jar and liquid formulations were applied with a CO₂ backpack sprayer with 8002 evs nozzles delivering 25 gallons/ac at 45 psi. Herbicides were applied on 31 May 2007 on phytotoxicity and efficacy containers. Evaluations were conducted at 15, 30, 60, and 90 DAT (days after treatment). For phytotoxicity evaluations, herbicides were applied to hydrangea 'Nikko blue' (*Hydrangea macrophylla* 'Nikko blue') in #1 containers, arborvitae (*Thuja occidentalis* 'Smaragd') in #2 containers, and boxwood (*Buxus* 'Green Velvet') in #2 containers. Phytotoxicity was evaluated by a visual rating on a scale of 1-10 with 1 being no phytotoxicity, 10 death, and ≤ 3 commercially acceptable. Plants were upshifted into the respective containers on 24 May 2007 and Osmocote (Scott's Co.) 19-5-8 slow release fertilizer (one tablespoon on #1 containers and two tablespoons on #2 containers) was applied at the same time.

Efficacy evaluations were performed on two plots; plot one consisted of #1 containers that were seeded with 20 seeds each of annual bluegrass (*Poa annua*), and bittercress (*Cardamine* spp.) and 1/8 tsp. large crabgrass (*Digitaria sanguinalis*) (because of very low seed germination), and plot two consisted of #1 containers seeded with 20 seeds each of common groundsel (*Senecio vulgaris*), prostrate spurge (*Chamaesyce prostrata*), and common yellow woodsorrel (*Oxalis stricta*). Two plots were utilized because there is too much competition when more than three species of weeds are grown in the same pot. Efficacy was evaluated using visual ratings on a scale of 0-10 with 0 being no control, 10 perfect control and ≥ 7 commercially acceptable, and weed counts taken at 15 and 60 DAT. Phytotoxicity and efficacy containers were set up in a

randomized complete block design with 3-single pot replications per treatment. Data was analyzed using ANOVA in Proc Mixed procedure in SAS (SAS Institute). Treatments from the phytotoxicity portion were compared to the control using Dunnett's t-test ($\alpha = 0.05$) and treatments from the efficacy portion were compared using least squares means ($\alpha = 0.05$).

Results and Discussion:

Phytotoxicity. Two treatments caused injury to *Thuja* averaged over all evaluation dates: Regal O-O (4.4) and RegalStar (6.4) (Table 1.) These treatments caused burning on the foliage, sometimes severe. There were no treatments that caused injury to *Buxus*, although several gave significantly higher visual ratings than the control: Showcase at the 100 lb/ac rate (2.0), Showcase at the 200 lb/ac rate (2.4), RegalStar (2.6), Dimension Ultra 2EW (1.9), and Dimension Ultra 2EW+Gallery (2.4). There was some stunting on the *Buxus* from the Showcase applications, although it was not evident in all replications. Dimension causes chlorosis in the growing points of some species, and it was seen on the *Buxus*. *Hydrangea* suffered severe losses over the entire experiment which was not treatment related, which can be seen with the controls (8.7, 2 of 3 replications died). *Hydrangea* is a good species for testing herbicides, so their death was unfortunate. Death was speculated to be from desiccation. Plants were obtained bare root and possibly lacked water in storage.

Efficacy. Grass and broadleaf efficacy were divided, with the exception of bittercress, which was included with the grasses. From previous experiments, bittercress has been found to not compete well when any other weeds are present in the container. This could be seen with Surflan; Surflan controlled the grasses and bittercress up to 60 DAT; however, by 90 DAT, the Surflan no longer controlled the bittercress (Table 2). The two plots also make it easier to see if the herbicide is primarily a grass herbicide, broadleaf herbicide, or both because a herbicide may have high ratings in one plot but not the other. Regal O-O and Gallery did not control grasses well (Table 2), but did control broadleaves (Table 3). The addition of Dimension or Surflan to Gallery increases control of grasses (Table 2). However, it seemed that control of grasses decreased somewhat when Gallery was added to Dimension (Table 2) when compared to Dimension alone. Showcase, Rout, OH-2, Regal O-O, and RegalStar are all preformulated combination herbicides, with Regal O-O being the only one not containing a Dinitroaniline (DNA) herbicide (which are primarily grass inhibitors). OH-2 and RegalStar did not do well with controlling either grasses or broadleaves (Table 2 and 3). Increasing the rate of Showcase had a slight, but non-significant effect on improving control of grass at 15 and 30 DAT (Tables 2 and 3). At 60 DAT, the 200 lb/ac rate of Showcase provided significantly improved grass control over the 100 lb/ac rate (Table 2), so more testing may be necessary to justify the increased rate from 100 lb/ac to 200 lb/ac. From this and previous studies (data not presented), it is evident that 60 DAT is when most preemergence herbicides quit having residual control; and increasing the application rate of Showcase from 150 to 200 lb/ac may not be warranted. It is also necessary to use a combination of grass and broadleaf herbicides (either preformulated or mixed by the applicator) when grasses and broadleaves are present.

Table 1. Phytotoxicity of *Thuja occidentalis* 'Smargd', *Buxus* 'Green Velvet', and *Hydrangea macrophylla* 'Nikko blue' to selected herbicides averaged over 15, 30, 60 and 90 DAT.

Treatment	Thuja	Buxus	Hydrangea
	Visual rating		
Showcase 100 lb	1.2 ^z	2*	7.4
Showcase 150 lb	2.2	1.3	7.8
Showcase 200 lb	1.8	2.4*	4.8
Rout	1.1	1.6	5.8
OH2	2.2	1.2	4.2
Ronstar	1.6	1.5	8.7
Regal O-O	4.4*	1.8	6.9
RegalStar	6.4*	2.6*	7.5
Dimension Ultra 2EW	1.9	1.9*	6
Dimension Ultra + Gallery	1.2	2.4*	7.8
Surflan	1.1	1.7	2.8
Surflan + Gallery	1.8	1.4	7.1
Gallery	1.5	1.2	9.2
Untreated	1.3	1.0	8.7

z= Phytotoxicity visual ratings based on a scale of 1-10 with 1 being no phytotoxicity, 10 death, and ≤3 commercially acceptable

* Indicates significance from the control ($\alpha = 0.05$)

Table 2. Efficacy of selected herbicides on annual bluegrass, bittercress, and large crabgrass at 15, 30, 60, and 90 DAT.

Treatment	15 DAT ^z	30 DAT	60 DAT	90 DAT
Showcase 100 lb	8.7 ^y ab ^x	7.3 ab	3.7 d	2.3 ef
Showcase 150 lb	8 abc	7.7 ab	5 bc	4 cde
Showcase 200 lb	9.7 a	8 ab	6.3 b	4.7 cd
Rout	7.3 bcd	5.7 bc	4 cd	3.7 de
OH2	5 de	3.3 de	1 e	0.7 fg
Ronstar	6 cd	3.3 de	0 e	0 g
Regal O-O	2.7 e	1.7 ef	0.7 e	0 g
RegalStar	5.3 d	4 cd	0 e	0 g
Dimension Ultra 2EW	10 a	8.7 a	9 a	8 ab
Dimension Ultra + Gallery	9.7 a	8.7 a	6.3 b	6 bc
Surflan	9 ab	7.7 ab	9.3 a	6 bc
Surflan + Gallery	9.7 a	9.3 a	9.3 a	9 a
Gallery	1.7 ef	0.3 f	0 e	0 g
Untreated	0 f	0 f	0 e	0 g

z= Days after treatment

y= Efficacy visual ratings based on a scale of 0-10 with 0 being no control, 10 perfect control, and ≥7 commercially acceptable

x= Treatment averages followed by the same letter in the same column are not significantly different ($\alpha = 0.05$)

Table 3. Efficacy of selected herbicides on common groundsel, common yellow woodsorrel, and prostrate spurge averaged over 15, 30, 60, and 90 days after treatment.

Treatment	15 DAT ^z	30 DAT	60 DAT	90 DAT
Showcase 100 lb	9 ab ^y	8.7 ab	7.7 abc	3.7 bc
Showcase 150 lb	9 ab	9.7 a	8.3 ab	5.3 ab
Showcase 200 lb	8.3 abc	8 abc	7.3 bcd	5.3 ab
Rout	9.3 a	9 ab	8 abc	5 abc
OH2	6 c	6 c	5.7 cde	1.3 def
Ronstar	6.7 bc	3.7 d	4.3 e	0.3 f
Regal O-O	9.7 a	9.7 a	8.7 a	6 a
RegalStar	7 bc	6 c	5.7 cde	3.3 bcd
Dimension Ultra 2EW	6.7 bc	7 bc	5 de	1 ef
Dimension Ultra + Gallery	8.3 abc	8 abc	7.3 bcd	2.3 cde
Surflan	7.7 abc	8 abc	7 bcd	3 cde
Surflan + Gallery	8.7 ab	9 ab	7.7 abc	3.7 bc
Gallery	9.3 a	8 abc	6 bcde	3 cde
Untreated	1.3d	1 e	0 f	0 f

z= Efficacy visual ratings based on a scale of 0-10 with 0 being no control, 10 perfect control, and ≥ 7 commercially acceptable

y= Treatment averages followed by the same letter in the same column are not significantly different ($\alpha = 0.05$)