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(*Sedum spp.*)
Tolerance to
Gemini G
(Isoxaben +
Prodiamine)
and Basagran
T&O
(Bentazon)
Herbicides**

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Stonecrops (*Sedum spp.*) Tolerance to Gemini G (Isoxaben plus Prodiamine) and Basagran T&O (Bentazon) Herbicides

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ABSTRACT

In two separate container experiments, tolerance of two sedum species to different preemergence (PRE) and postemergence (POST) herbicides was evaluated. The first experiment evaluated different rates of Gemini G applied PRE for safety to Jenny's stonecrop (*Sedum rupestre* subsp. *rupestre* 'Blue Spruce') and white stonecrop (*Sedum album* subsp. *album* 'Red Ice'). The second experiment evaluated tolerance of Jenny's stonecrop to different rates of Basagran T&O herbicide applied POST. Results revealed that both *sedum rupestre* and *sedum album* tolerated well two sequential applications of Gemini G at 200 lb/acre. Jenny's stonecrop was tolerant to a single application of Basagran T&O up to 128 fl oz/acre. A second application of Basagran T&O at ≥ 32 fl oz/acre resulted in commercially unacceptable chlorotic (>3.0) and necrotic (≥ 4.0) injury to *Sedum rupestre*.

INTRODUCTION

Gemini G is a newly introduced prepackaged mixture of isoxaben (0.25%) and prodiamine (0.40%) herbicides. Isoxaben controls several annual broadleaf weeds and has no activity against grassy weeds and sedges. Prodiamine is primarily a grass herbicide but it also controls a limited range of broadleaf weeds. The prepackaged mixture, therefore, provides preemergence control of both broadleaf and grassy weeds. Gemini G is registered for use in container or field grown nursery crops, landscape plantings, Christmas tree farms, ornamental bulbs, and bare ground application. However, information is lacking on its safety to sedums grown as groundcover.

Basagran T&O (Bentazon 44%), a member of the benzothiadiazole chemical family, is a selective, postemergence broadleaf herbicide. It also suppresses yellow and purple nutsedges but has no activity against grassy weeds. Basagran T&O works by inhibiting photosynthesis through binding to the QB-binding niche of the D1 protein in photosystem II of plant chloroplasts (Vencill 2002). Basagran T&O is a contact herbicide and, therefore, requires thorough plant

coverage to achieve acceptable weed control (OMAFRA 2002). Basagran T&O is registered for use in ornamentals, landscape plantings, turfgrass, and noncropland sites. It can be applied as an over-the-top or a directed treatment depending upon plant species. The objectives of this research were 1. To evaluate different rates of Gemini G for tolerance of *sedum rupestre* and *sedum album*. 2. To evaluate different rates of Basagran T&O for tolerance of *sedum rupestre*.

MATERIALS AND METHODS

Experiment 1: Container experiments were conducted at the Valley Laboratory of the Connecticut Agricultural Experiment Station at Windsor, CT in 2018 and 2019. Two sedum species; Jenny's stonecrop (*Sedum rupestre* subsp. *rupestre* 'Blue Spruce') and white stonecrop (*Sedum album* subsp. *album* 'Red Ice') were transplanted into 1-gallon plastic plots containing a soilless potting media (Sun Gro Horticulture, Vancouver, BC, Canada) on 27 June 2018 and 14 June 2019. The plug size was 17-cm and 13-cm in 2018, and 2019, respectively. During both study years, the experiment was established in a completely randomized design with 12 plants per treatment. Plants were fertilized with a foliar application of 100 ppm solution of Jack's professional fertilizer mix (20N: 20P: 20K) at 10 days interval. Two broadcast applications of Gemini G spaced at 5 to 6 weeks interval were made per growing season. Gemini G was applied over-the-top with a shaker bottle at 0, 200, 400, and 800 lb per acre rate on July 4, 2018 and again August 10, 2018. In 2019, Gemini G was applied once on 21 June and subsequently on 2 August. An overhead irrigation (0.5-inch) was applied immediately after each application. Data were recorded on initial and final plant height and width. Phytotoxicity ratings for chlorosis, necrosis, and stunting were recorded on a 0-10 scale at 7, 14, and 28 days after each application.

Experiment 2: Container experiments were conducted at the Valley Laboratory of the Connecticut Agricultural Experiment Station at

Windsor, CT in 2019. A sedum species; Jenny's stonecrop (*Sedum rupestre* subsp. *rupestre* 'Blue Spruce') was transplanted into 1-gallon plastic plots containing a soilless potting media (Sun Gro Horticulture, Vancouver, BC, Canada) on 10 June 2019. The plug size was 13-cm. The experiment was established in a completely randomized design with 12 plants per treatment. Plants were irrigated with 0.25 inch overhead irrigation twice a week until July 12. Plants were fertilized with a foliar application of 100 ppm solution of Jack's professional fertilizer mix (20N: 20P: 20K) at 10 days interval. Basagran T&O was applied twice over-the-top at 4 (July 12, 2019) and 6 weeks after transplanting (July 26, 2019) with a compressed CO₂ sprayer fitted with single flat fan nozzle (AI 80025) at 40 psi delivering 20 gallons spray solution per acre. Basagran T&O was applied to the fully expended fresh flush (dry foliage) at 0, 32, 64, and 128 fl oz per acre. No adjuvants/surfactants were added. An overhead irrigation (0.5-inch) was applied 8 hours after each herbicide application. Subsequently, 0.5 inch overhead irrigation was applied at 7 to 10 days interval depending on the rainfall. Data were recorded on initial and final plant height and width. Phytotoxicity ratings for chlorosis and necrosis were recorded on a 0-10 scale at 7 and 14 days after each application.

STATISTICAL ANALYSIS: Data on various response variables were analyzed using the PROC GLIMMIX procedure in SAS (Version 9.4, SAS Institute, Cary, NC). Means comparisons were made using the *Adj-simulate* option in PROC GLIMMIX at the 5% significance level.

RESULTS AND DISCUSSION

Experiment 1: Results showed that Gemini G herbicide was tolerated very well by both sedum species in 2018. No chlorotic, necrotic, or stunting injury was observed at any evaluation timing with application rates up to 800 lb/acre following two sequential applications spaced 5 weeks apart. In 2019, an application rate main effect was highly significant ($P=0.113$). Following the first application, both sedum species were injured significantly with 400 lb/acre and higher application rates (Tables 2 & 3). The necrotic and stunting injury ratings were highest at 28 days after first application and 14 days after second application (Tables 2 & 3). Similar treatment differences were seen in final plant height and width measurements (Table 3). Based on these results, it may be concluded that both *sedum repustre* and *sedum album* can tolerate two sequential applications of Gemini G herbicide at 200 lb/acre.

Experiment 2: Jenny's stonecrop variety 'Blue Spruce' was highly tolerant to a single Basagran T&O application regardless of application rate. No phytotoxicity was observed by 14 DAT following the first application with Basagran T&O rates up to 128 fl oz/acre. Following the second application, Jenny's stonecrop (*Sedum repustre*) showed commercially unacceptable chlorotic (>3.0) and necrotic (≥ 4.0) injury to Basagran T&O applied at 32 fl oz/acre and higher rates (Table 4). Final plant height and width data also showed significant reduction in plant size with all rates of Basagran T&O compared to the non-treated control (Table 5). Results showed that Jenny's stonecrop (*Sedum rupestre*) may tolerate a single application of Basagran T&O herbicide up to 128 fl oz/acre.

INFORMATION SOURCES:

- [OMAFRA] Ontario Ministry of Agriculture, Food, and Rural Affairs. 2002. Guide to Weed Control. Publication 75. Toronto, ON, Canada: Ontario Ministry of Agriculture, Food, and Rural Affairs.
- Vencill, W. K., ed. 2002. Herbicide Handbook, 8th ed. Lawrence, KS: Weed Science Society of America. 493 p.

Table 1: Gemini G pre-emergence over-the-top safety to Jenny's stonecrop in 2019.

Variable	Gemini G (lb/acre)	First application			Second application		
		7 DAT	14 DAT	28 DAT	7 DAT	14 DAT	28 DAT
Chlorosis	200	0.0	0.0	0.0	0.0	0.0	0.0
	400	0.0	0.0	0.0	0.0	0.0	0.0
	800	0.0	0.0	0.0	0.0	0.0	0.0
Necrosis	200	0.0	0.0 b	0.0 b	0.0 b	0.0 c	0.0 c
	400	0.0	1.1 a	2.7 a	0.8 a	2.8 b	2.5 b
	800	0.0	1.8 a	3.3 a	1.3 a	4.3 b	3.6 a
Stunting	200	0.0	0.0 b	0.0 c	0.0 b	0.0 c	0.0 c
	400	0.0	1.8 a	1.6 b	2.1 a	3.7 b	3.2 b
	800	0.0	2.2 a	2.4 a	2.7 a	4.8 a	4.4 a

Table 2: Gemini G pre-emergence over-the-top safety to white sedum in 2019.

Variable	Gemini G (lb/acre)	First application			Second application		
		7 DAT	14 DAT	28 DAT	7 DAT	14 DAT	28 DAT
Chlorosis	200	0.0	0.0	0.0	0.0	0.0	0.0
	400	0.0	0.0	0.0	0.0	0.0	0.0
	800	0.0	0.0	0.0	0.0	0.0	0.0
Necrosis	200	0.0	0.0 b	0.0 b	0.0 b	0.0 c	0.0 c
	400	0.0	2.0 a	3.3 a	1.4 a	3.8 b	3.5 b
	800	0.0	2.3 a	3.7 a	1.9 a	4.6 a	4.8 a
Stunting	200	0.0	0.0 b	0.0 b	0.0 b	0.0 c	0.0 c
	400	0.0	2.4 a	1.9 a	1.9 a	2.5 b	2.2 b
	800	0.0	2.3 a	2.1 a	2.2 a	3.3 a	4.1 a

Table 3: Jenny's stonecrop and white sedum final height and width during 2019.

Gemini G (lb/acre)	Height (cm)		Width (g)	
	<i>S. album</i>	<i>S. rupestre</i>	<i>S. album</i>	<i>S. rupestre</i>
0	26.3 a	23.3 a	36.8 a	32.3 a
200	25.8 a	23.6 a	38.7 a	30.9 a
400	19.3 b	16.5 b	25.3 b	23.1 b
800	16.7 b	16.2 b	26.2 b	22.7 b

Table 4: Jenny’s stonecrop response to Basagran T&O at 7 and 14 DAT after first and second application.

Variable	Basagran T&O (fl oz/acre)	First application		Second application	
		7 DAT	14 DAT	7 DAT	14 DAT
Chlorosis	0	0.0	0.0	0.0 b	0.0 c
	32	0.0	0.0	3.3 a	3.4 b
	64	0.0	0.0	3.8 a	4.2 b
	128	0.0	0.0	4.5 a	5.9 a
Necrosis	0	0.0	0.0	0.0 c	0.0 c
	32	0.0	0.0	4.0 b	5.4 b
	64	0.0	0.0	5.9 a	6.9 a
	128	0.0	0.0	5.7 ab	6.9 a

Table 5: Jenny’s stonecrop initial and final width and height measurements.

Plant	Basagran T&O (fl oz/acre)	Width (cm)		Height (cm)	
		Initial	Final	Initial	Final
Jenny’s stonecrop	0	12.7 a	17.1a	13.3 a	16.2 a
	32	13.1 a	13.4 b	13.5 a	14.1 b
	64	13.8 a	11.2 c	14.1 a	10.4 c
	128	12.8 a	10.4 c	13.3 a	10.8 c

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