

Project Number: 13K-3419-3298

Title: Herbicide Combinations for Weed Control in Ornamental Bulbs

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Reporting Period: 2011-12

Accomplishments: The herbicide combination project was conducted at WSU Mount Vernon NWREC from fall 2011 through summer 2012. The focus of the trial was to test the effects of several herbicide combinations in ornamental bulb crops.

Bulbs ('Il de France' tulip, 'Flower Carpet' daffodil, and 'Blue Diamond' iris) were planted at WSU Mount Vernon NWREC September 29, 2011. Roundup at 2 pt/a was applied to all plots (including those plots not otherwise treated) to control emerged weeds. Herbicides were applied February 6, 2012; some iris foliage was emerged at the time of application. Percent weed control was evaluated May 2 and June 12, 2012. Flowers were counted and stem length of five random blooms were measured (daffodil, April 10; tulip, April 25; and iris, April 29, 2012). Tulip bulbs were dug July 6 iris July 23, and daffodil July 26-27, and these bulbs were cleaned, sized, counted, and weighed. The trial was a split-plot randomized complete block with four replicates.

Weed control in May was excellent for all treatments, ranging from 94 to 100%, with the exception of Roundup only (63%; Table 1). The two major weed species found in the plots were henbit (*Lamium amplexicaule*), shepherd's-purse (*Capsella bursa-pastoris*). Other species included hedgemustard (*Sisymbrium officinale*), common chickweed (*Stellaria media*), ladysthumb (*Polygonum persicaria*), and pale smartweed (*P. lapathifolium*). All treatments were still relatively weed-free by mid-June, ranging from 88 to 100%.

Bulb foliage was not visually injured by any treatment (data not shown). Flower height and number for a given species did not differ by treatment (Table 2). Tulip, daffodil, and iris bulb yield was also similar within a species for total bulb yield, total bulb number, and average bulb weight (Tables 3, 4, and 5, respectively). These indexes indicate that bulbs were tolerant to all the herbicide combinations tested during 2011-12.

Based on these data, it appears that Dimension offers superior weed control, whether mixed with other products or not. Tenacity also was a very good tank mix partner with Devrinol, Surflan, or Pendulum Aquacap. Dimension and Tenacity are good targets for registration for use in tulip, daffodil, and iris.

Table 1. Weed control in ornamental bulbs (tulip, daffodil, and iris) after treatment with various herbicides (2011-12).

Treatment	Rate	Weed control ^a	
		May 2	June 12
	product/a	%	%
Tenacity	8 floz	99 a	88 de
Tenacity	12 floz	100 a	88 de
Dimension	1 pt	98 a	91 bcd
Dimension	2 pt	98 a	94 abc
Dimension + Devrinol	1 pt + 8 lb	100 a	99 a
Dimension + Surflan	1 pt + 1.5 pt	99 a	97 ab
Dimension + Pennant Magnum	1 pt + 2 pt	100 a	95 abc
Dimension + Pendulum Aquacap	1 pt + 4 pt	94 a	88 de
Tenacity + Devrinol	8 fl.oz + 4 lb	100 a	99 a
Tenacity + Surflan	8 fl.oz + 1.5 pt	100 a	98 a
Tenacity + Pennant Magnum	8 fl.oz + 2 pt	100 a	90 cde
Tenacity + Pendulum Aquacap	5 fl.oz + 4 pt	100 a	94 a-d
Devrinol + Surflan + Pennant	2 lb + 0.5 pt +	99 a	97 ab
Magnum + Pendulum Aquacap	0.5 pt + 1 pt		
Devrinol + Surflan + Pennant	4 lb + 0.8 pt +	99 a	96 abc
Magnum + Pendulum Aquacap	1 pt + 2 pt		
Devrinol + Surflan + Pennant	6 lb + 1 pt +	100 a	99 a
Magnum + Pendulum Aquacap	1.5 pt + 3 pt		
Devrinol + Surflan	8 lb + 1.5 pt	100 a	100 a
Devrinol + Pennant Magnum	8 lb + 2 pt	100 a	99 a
Devrinol + Pendulum Aquacap	8 lb + 4 pt	99 a	100 a
Surflan + Pennant Magnum	1.5 pt + 2 pt	100 a	95 abc
Roundup (check)	2 pt	63 b	85 e

Means in the same column followed by the same letter are not significantly different ($P < 0.05$).

^aHerbicides applied November 10, 2011 (Roundup) and February 6, 2012 (all other residual herbicides).

Table 2. Flower number and flower stem length after treatment with various herbicides (2011-12).

Treatment	Rate	Flower number ^a			Stem length ^a		
		Daffodil	Tulip	Iris	Daffodil	Tulip	Iris
	product/a	no./plot	no./plot	no./plot	Inches	inches	inches
Tenacity	8 floz	17.5	34.5	10.8	15.3	22.5	7.6
Tenacity	12 floz	18.5	33.0	6.5	15.8	22.9	7.2
Dimension	1 pt	22.3	32.8	5.5	16.7	22.7	7.4
Dimension	2 pt	21.0	33.3	6.3	15.6	22.9	7.6
Dimension + Devrinol	1 pt + 8 lb	16.3	32.5	7.5	15.6	22.6	7.6
Dimension + Surflan	1 pt + 1.5 pt	22.8	33.5	7.3	16.2	23.4	7.7
Dimension + Pennant Magnum	1 pt + 2 pt	21.8	33.5	7.3	16.2	22.9	7.5
Dimension + Pendulum Aquacap	1 pt + 4 pt	22.0	32.8	6.0	15.8	22.5	7.1
Tenacity + Devrinol	8 fl.oz + 4 lb	15.8	32.8	11.3	15.7	21.9	7.6
Tenacity + Surflan	8 fl.oz + 1.5 pt	17.5	34.3	6.3	15.4	22.7	7.5
Tenacity + Pennant Magnum	8 fl.oz + 2 pt	20.8	33.3	9.3	15.7	22.4	7.7
Tenacity + Pendulum Aquacap	5 fl.oz + 4 pt	16.8	34.0	9.3	15.5	22.5	7.2
Devrinol + Surflan + Pennant	2 lb + 0.5 pt +	23.3	33.5	6.8	16.3	22.6	7.1
Magnum + Pendulum Aquacap	0.5 pt + 1 pt						
Devrinol + Surflan + Pennant	4 lb + 0.8 pt +	22.8	32.5	7.8	16.2	22.3	7.1
Magnum + Pendulum Aquacap	1 pt + 2 pt						
Devrinol + Surflan + Pennant	6 lb + 1 pt +	19.0	31.5	7.3	16.0	22.1	7.7
Magnum + Pendulum Aquacap	1.5 pt + 3 pt						
Devrinol + Surflan	8 lb + 1.5 pt	24.0	33.3	7.0	16.3	22.0	7.4
Devrinol + Pennant Magnum	8 lb + 2 pt	22.0	32.8	5.0	17.2	22.2	7.6
Devrinol + Pendulum Aquacap	8 lb + 4 pt	23.3	32.5	8.3	16.2	21.9	7.3
Surflan + Pennant Magnum	1.5 pt + 2 pt	24.5	35.0	8.0	16.5	22.5	7.4
Roundup (check)	2 pt	19.3	32.5	6.0	16.0	22.5	7.5

Means in the same column with the same letter, or not followed by a letter, are not significantly different ($P < 0.05$).

^aFlower number and stem height measured for daffodil (April 10), tulip (April 25), and iris (April 29, 2012).

Table 3. Tulip bulb number and weights after treatment with various herbicides (2011-12).

Treatment	Rate	Total bulb number	Total bulb weight	Average bulb weight
	product/a	no./plot	g/plot	g/bulb
Tenacity	8 floz	110	1496	13.6
Tenacity	12 floz	105	1396	13.3
Dimension	1 pt	99	1248	12.5
Dimension	2 pt	105	1377	13.3
Dimension + Devrinol	1 pt + 8 lb	106	1369	13.0
Dimension + Surflan	1 pt + 1.5 pt	101	1383	13.7
Dimension + Pennant Magnum	1 pt + 2 pt	106	1417	13.4
Dimension + Pendulum Aquacap	1 pt + 4 pt	127	1437	11.8
Tenacity + Devrinol	8 fl.oz + 4 lb	96	1330	13.9
Tenacity + Surflan	8 fl.oz + 1.5 pt	112	1390	12.9
Tenacity + Pennant Magnum	8 fl.oz + 2 pt	106	1411	13.4
Tenacity + Pendulum Aquacap	5 fl.oz + 4 pt	107	1382	13.0
Devrinol + Surflan + Pennant	2 lb + 0.5 pt +	115	1528	13.3
Magnum + Pendulum Aquacap	0.5 pt + 1 pt			
Devrinol + Surflan + Pennant	4 lb + 0.8 pt + 1	114	1434	12.6
Magnum + Pendulum Aquacap	pt + 2 pt			
Devrinol + Surflan + Pennant	6 lb + 1 pt + 1.5	107	1326	12.6
Magnum + Pendulum Aquacap	pt + 3 pt			
Devrinol + Surflan	8 lb + 1.5 pt	96	1264	13.2
Devrinol + Pennant Magnum	8 lb + 2 pt	106	1298	12.4
Devrinol + Pendulum Aquacap	8 lb + 4 pt	105	1373	13.2
Surflan + Pennant Magnum	1.5 pt + 2 pt	109	1504	13.9
Roundup (check)	2 pt	104	1435	14.0

Means in the same column followed by the same letter, or not followed by a letter, are not significantly different ($P < 0.05$).

^aTulip bulbs harvested July 6, 2012.

Table 4. Daffodil bulb number and weights after treatment with various herbicides (2011-12).

Treatment	Rate	Total bulb number	Total bulb weight	Average bulb weight
	product/a	no./plot	g/plot	g/bulb
Tenacity	8 floz	25	1707	65.9
Tenacity	12 floz	28	1721	62.5
Dimension	1 pt	29	2140	74.5
Dimension	2 pt	29	1956	68.4
Dimension + Devrinol	1 pt + 8 lb	26	1669	63.7
Dimension + Surflan	1 pt + 1.5 pt	29	2021	69.1
Dimension + Pennant Magnum	1 pt + 2 pt	28	1761	64.4
Dimension + Pendulum Aquacap	1 pt + 4 pt	25	1830	74.1
Tenacity + Devrinol	8 fl.oz + 4 lb	26	1589	62.7
Tenacity + Surflan	8 fl.oz + 1.5 pt	23	1655	73.1
Tenacity + Pennant Magnum	8 fl.oz + 2 pt	30	1960	66.2
Tenacity + Pendulum Aquacap	5 fl.oz + 4 pt	25	1545	61.5
Devrinol + Surflan + Pennant	2 lb + 0.5 pt +	31	2121	68.7
Magnum + Pendulum Aquacap	0.5 pt + 1 pt			
Devrinol + Surflan + Pennant	4 lb + 0.8 pt +	27	1966	73.7
Magnum + Pendulum Aquacap	1 pt + 2 pt			
Devrinol + Surflan + Pennant	6 lb + 1 pt +	26	1737	66.3
Magnum + Pendulum Aquacap	1.5 pt + 3 pt			
Devrinol + Surflan	8 lb + 1.5 pt	27	1958	71.5
Devrinol + Pennant Magnum	8 lb + 2 pt	28	1891	68.4
Devrinol + Pendulum Aquacap	8 lb + 4 pt	27	2050	75.8
Surflan + Pennant Magnum	1.5 pt + 2 pt	26	2138	83.5
Roundup (check)	2 pt	27	1873	68.8

Means in the same column followed by the same letter, or not followed by a letter, are not significantly different ($P < 0.05$).

^aDaffodil bulbs harvested July 26-27, 2012.

Table 5. Iris bulb number and weights after treatment with various herbicides (2011-12).

Treatment	Rate	Total bulb number	Total bulb weight	Average bulb weight
	product/a	no./plot	g/plot	g/bulb
Tenacity	8 floz	155	1363	8.8
Tenacity	12 floz	153	1339	8.8
Dimension	1 pt	153	1392	9.1
Dimension	2 pt	154	1290	8.4
Dimension + Devrinol	1 pt + 8 lb	155	1415	9.1
Dimension + Surflan	1 pt + 1.5 pt	154	1401	9.1
Dimension + Pennant Magnum	1 pt + 2 pt	167	1409	8.4
Dimension + Pendulum Aquacap	1 pt + 4 pt	149	1322	8.9
Tenacity + Devrinol	8 fl.oz + 4 lb	171	1452	8.5
Tenacity + Surflan	8 fl.oz + 1.5 pt	172	1558	9.1
Tenacity + Pennant Magnum	8 fl.oz + 2 pt	169	1415	8.4
Tenacity + Pendulum Aquacap	5 fl.oz + 4 pt	170	1544	9.1
Devrinol + Surflan + Pennant	2 lb + 0.5 pt +	158	1421	9.1
Magnum + Pendulum Aquacap	0.5 pt + 1 pt			
Devrinol + Surflan + Pennant	4 lb + 0.8 pt +	163	1404	8.6
Magnum + Pendulum Aquacap	1 pt + 2 pt			
Devrinol + Surflan + Pennant	6 lb + 1 pt +	171	1528	9.0
Magnum + Pendulum Aquacap	1.5 pt + 3 pt			
Devrinol + Surflan	8 lb + 1.5 pt	156	1276	8.2
Devrinol + Pennant Magnum	8 lb + 2 pt	163	1395	8.6
Devrinol + Pendulum Aquacap	8 lb + 4 pt	158	1456	9.2
Surflan + Pennant Magnum	1.5 pt + 2 pt	169	1478	8.8
Roundup (check)	2 pt	157	1336	8.5

Means in the same column followed by the same letter, or not followed by a letter, are not significantly different ($P < 0.05$).

^aIris bulbs harvested July 23, 2012.