

Project Number: 13K-3419-3298

Title: Herbicide Combinations for Weed Control in Ornamental Bulbs

Personnel: Timothy W. Miller, WSU Mount Vernon NWREC
Carl R. Libbey, WSU Mount Vernon NWREC

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Accomplishments: The herbicide combination project was conducted at WSU Mount Vernon NWREC from fall 2010 through summer 2011. The focus of the trial was to test the effects of several herbicide combinations in ornamental bulb crops.

Bulbs were planted at WSU Mount Vernon NWREC October 1, 2010. Herbicides were applied November 10, 2010; some iris foliage was emerged at the time of application. Roundup at 2 pt/a was applied to all plots (including those plots not otherwise treated) to control emerged weeds. Percent weed control was evaluated April 23 and June 15, 2011. Flowers were counted and stem length of five random blooms were measured (daffodil, April 11; tulip, April 26; and iris, May 7, 2010). Tulip bulbs were dug June 28 and daffodil and iris July 22, and these bulbs were cleaned, sized, counted, and weighed. The trial was a split-plot randomized complete block with four replicates.

Weed control in mid-April was excellent for most treatments, ranging from 96 to 100% (Table 1). Exceptions were with Pendulum Aquacap (91%) and Pennant Magnum (80%). 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*). By mid-June, however, treatments still providing excellent weed control included Dimension and all tank mixtures with Dimension, Callisto + either Devrinol or Surflan, and Surflan + Pennant Magnum. Other products were providing only 54 to 81% weed control by June, while Roundup alone was at 8% control.

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 2010-11.

Based on these data, it appears that Dimension offers superior weed control, whether mixed with other products or not. Callisto also was a very good tank mix partner with Devrinol or Surflan. Dimension and Callisto should be considered 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 (2010-11).

| Treatment | Rate | Weed control | |
|------------------------------|------------------|--------------|---------|
| | | April 23 | June 15 |
| | product/a | % | % |
| Callisto | 8 floz | 100 a | 64 ef |
| Callisto | 12 floz | 98 a | 65 def |
| Devrinol | 8 lb | 96 a | 71 cde |
| Surflan | 2 pt | 99 a | 80 bc |
| Pennant Magnum | 2 pt | 80 c | 54 f |
| Pendulum Aquacap | 6 pt | 91 b | 56 f |
| Dimension | 2 pt | 100 a | 96 a |
| Dimension + Devrinol | 2 pt + 8 lb | 100 a | 100 a |
| Dimension + Surflan | 2 pt + 1.5 pt | 100 a | 99 a |
| Dimension + Pennant Magnum | 2 pt + 2 pt | 100 a | 95 a |
| Dimension + Pendulum Aquacap | 2 pt + 4 pt | 100 a | 95 a |
| Callisto + Devrinol | 8 fl.oz + 4 lb | 100 a | 89 ab |
| Callisto + Surflan | 8 fl.oz + 1.5 pt | 100 a | 95 a |
| Callisto + Pennant Magnum | 8 fl.oz + 2 pt | 100 a | 81 bc |
| Callisto + Pendulum Aquacap | 5 fl.oz + 4 pt | 100 a | 71 cde |
| Devrinol + Surflan | 8 lb + 1.5 pt | 97 a | 78 bc |
| Devrinol + Pennant Magnum | 8 lb + 2 pt | 98 a | 73 cde |
| Devrinol + Pendulum Aquacap | 8 lb + 4 pt | 97 a | 76 cd |
| Surflan + Pennant Magnum | 1.5 pt + 2 pt | 100 a | 89 ab |
| Roundup (check) | 2 pt | 53 d | 8 g |

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

Table 2. Flower number and flower stem length after treatment with various herbicides (2010-11).

| Treatment | Rate product/a | Flower number ^a | | | Stem length ^a | | |
|------------------------------|-------------------|----------------------------|-------------------|------------------|--------------------------|-----------------|----------------|
| | | Daffodil no./plot | Tulip no./plot | Iris no./plot | Daffodil inches | Tulip inches | Iris inches |
| Callisto | 8 floz | 22.3 | 35.5 | 30.0 | 18.4 | 18.3 | 19.3 |
| Callisto | 12 floz | 19.3 | 35.8 | 28.0 | 18.4 | 18.4 | 18.0 |
| Devrinol | 8 lb | 17.8 | 34.8 | 26.0 | 18.6 | 18.0 | 17.6 |
| Surflan | 2 pt | 18.0 | 34.3 | 30.3 | 17.5 | 18.2 | 18.9 |
| Pennant Magnum | 2 pt | 13.8 | 35.5 | 29.5 | 18.1 | 18.7 | 18.3 |
| Pendulum Aquacap | 6 pt | 15.8 | 35.0 | 28.8 | 17.5 | 18.5 | 18.9 |
| Dimension | 2 pt | 17.3 | 36.5 | 27.0 | 17.8 | 18.8 | 18.3 |
| Dimension + Devrinol | 2 pt + 8 lb | 18.0 | 36.0 | 28.5 | 18.3 | 18.0 | 18.3 |
| Dimension + Surflan | 2 pt + 1.5 pt | 17.0 | 35.8 | 28.8 | 19.0 | 18.7 | 18.5 |
| Dimension + Pennant Magnum | 2 pt + 2 pt | 17.8 | 34.5 | 29.5 | 19.0 | 18.0 | 18.7 |
| Dimension + Pendulum Aquacap | 2 pt + 4 pt | 18.0 | 36.0 | 23.3 | 18.6 | 18.6 | 16.4 |
| Callisto + Devrinol | 8 fl.oz + 4 lb | 18.3 | 35.3 | 28.3 | 18.0 | 18.3 | 18.5 |
| Callisto + Surflan | 8 fl.oz + 1.5 pt | 16.3 | 35.0 | 31.5 | 18.4 | 18.6 | 17.8 |
| Callisto + Pennant Magnum | 8 fl.oz + 2 pt | 15.3 | 35.8 | 27.3 | 17.8 | 18.3 | 17.8 |
| Callisto + Pendulum Aquacap | 5 fl.oz + 4 pt | 19.0 | 34.5 | 28.3 | 18.7 | 18.7 | 16.9 |
| Devrinol + Surflan | 8 lb + 1.5 pt | 18.0 | 36.3 | 28.8 | 18.3 | 18.0 | 18.2 |
| Devrinol + Pennant Magnum | 8 lb + 2 pt | 18.0 | 33.3 | 30.3 | 18.6 | 18.1 | 19.2 |
| Devrinol + Pendulum Aquacap | 8 lb + 4 pt | 16.3 | 32.8 | 27.8 | 17.9 | 17.8 | 18.2 |
| Surflan + Pennant Magnum | 1.5 pt + 2 pt | 20.0 | 36.3 | 26.5 | 18.1 | 18.7 | 17.8 |
| Roundup (check) | 2 pt | 17.5 | 36.3 | 29.8 | 18.7 | 18.9 | 18.5 |

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 11), tulip (April 26), and iris (May 7, 2011).

Table 3. Tulip bulb number and weights after treatment with various herbicides (2010-11).

| Treatment | Rate product/a | Total bulb number no./plot | Total bulb weight g/plot | Average bulb weight g/bulb |
|------------------------------|-------------------|-------------------------------------|-----------------------------------|-------------------------------------|
| Callisto | 8 floz | 90.5 | 1430 | 15.9 |
| Callisto | 12 floz | 98.3 | 1420 | 14.5 |
| Devrinol | 8 lb | 90.3 | 1360 | 15.1 |
| Surflan | 2 pt | 89.8 | 1385 | 15.5 |
| Pennant Magnum | 2 pt | 86.3 | 1426 | 16.5 |
| Pendulum Aquacap | 6 pt | 97.0 | 1351 | 13.9 |
| Dimension | 2 pt | 91.3 | 1295 | 14.3 |
| Dimension + Devrinol | 2 pt + 8 lb | 89.5 | 1394 | 15.8 |
| Dimension + Surflan | 2 pt + 1.5 pt | 89.5 | 1460 | 16.3 |
| Dimension + Pennant Magnum | 2 pt + 2 pt | 85.0 | 1395 | 16.6 |
| Dimension + Pendulum Aquacap | 2 pt + 4 pt | 85.3 | 1332 | 15.6 |
| Callisto + Devrinol | 8 fl.oz + 4 lb | 86.8 | 1342 | 15.5 |
| Callisto + Surflan | 8 fl.oz + 1.5 pt | 93.8 | 1431 | 15.3 |
| Callisto + Pennant Magnum | 8 fl.oz + 2 pt | 89.8 | 1349 | 15.0 |
| Callisto + Pendulum Aquacap | 5 fl.oz + 4 pt | 89.3 | 1396 | 15.7 |
| Devrinol + Surflan | 8 lb + 1.5 pt | 93.0 | 1358 | 14.7 |
| Devrinol + Pennant Magnum | 8 lb + 2 pt | 91.8 | 1372 | 15.1 |
| Devrinol + Pendulum Aquacap | 8 lb + 4 pt | 90.0 | 1339 | 15.3 |
| Surflan + Pennant Magnum | 1.5 pt + 2 pt | 88.0 | 1421 | 16.2 |
| Roundup (check) | 2 pt | 91.0 | 1337 | 14.7 |

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 June 28, 2011.

Table 4. Daffodil bulb number and weights after treatment with various herbicides (2010-11).

| Treatment | Rate | Total bulb number | Total bulb weight | Average bulb weight |
|------------------------------|------------------|-------------------------|-------------------------|---------------------------|
| | product/a | no./plot | g/plot | g/bulb |
| Callisto | 8 floz | 22.3 | 1956 | 88.6 |
| Callisto | 12 floz | 18.5 | 2032 | 109.5 |
| Devrinol | 8 lb | 21.0 | 2217 | 105.3 |
| Surflan | 2 pt | 20.5 | 2279 | 114.2 |
| Pennant Magnum | 2 pt | 20.5 | 1991 | 100.8 |
| Pendulum Aquacap | 6 pt | 22.5 | 2253 | 100.8 |
| Dimension | 2 pt | 20.3 | 1869 | 92.3 |
| Dimension + Devrinol | 2 pt + 8 lb | 21.5 | 2001 | 94.3 |
| Dimension + Surflan | 2 pt + 1.5 pt | 20.0 | 1744 | 88.2 |
| Dimension + Pennant Magnum | 2 pt + 2 pt | 19.8 | 2121 | 108.4 |
| Dimension + Pendulum Aquacap | 2 pt + 4 pt | 20.5 | 2221 | 109.7 |
| Callisto + Devrinol | 8 fl.oz + 4 lb | 22.3 | 2109 | 95.7 |
| Callisto + Surflan | 8 fl.oz + 1.5 pt | 17.5 | 2006 | 115.5 |
| Callisto + Pennant Magnum | 8 fl.oz + 2 pt | 21.0 | 1990 | 96.4 |
| Callisto + Pendulum Aquacap | 5 fl.oz + 4 pt | 18.5 | 2014 | 110.2 |
| Devrinol + Surflan | 8 lb + 1.5 pt | 19.5 | 1875 | 97.1 |
| Devrinol + Pennant Magnum | 8 lb + 2 pt | 17.0 | 1871 | 110.8 |
| Devrinol + Pendulum Aquacap | 8 lb + 4 pt | 20.5 | 1872 | 91.9 |
| Surflan + Pennant Magnum | 1.5 pt + 2 pt | 18.8 | 1893 | 101.9 |
| Roundup (check) | 2 pt | 17.5 | 1806 | 103.6 |

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 22, 2011.

Table 5. Iris bulb number and weights after treatment with various herbicides (2010-11).

| Treatment | Rate | Total bulb number | Total bulb weight | Average bulb weight |
|------------------------------|------------------|-------------------------|-------------------------|---------------------------|
| | product/a | no./plot | g/plot | g/bulb |
| Callisto | 8 floz | 169.3 | 794 | 4.7 |
| Callisto | 12 floz | 155.0 | 656 | 4.2 |
| Devrinol | 8 lb | 153.8 | 683 | 4.5 |
| Surflan | 2 pt | 163.5 | 806 | 4.9 |
| Pennant Magnum | 2 pt | 167.8 | 880 | 5.2 |
| Pendulum Aquacap | 6 pt | 161.5 | 786 | 4.9 |
| Dimension | 2 pt | 166.5 | 768 | 4.6 |
| Dimension + Devrinol | 2 pt + 8 lb | 142.3 | 664 | 4.7 |
| Dimension + Surflan | 2 pt + 1.5 pt | 155.0 | 729 | 4.7 |
| Dimension + Pennant Magnum | 2 pt + 2 pt | 155.8 | 787 | 5.1 |
| Dimension + Pendulum Aquacap | 2 pt + 4 pt | 167.5 | 729 | 4.3 |
| Callisto + Devrinol | 8 fl.oz + 4 lb | 154.3 | 757 | 4.9 |
| Callisto + Surflan | 8 fl.oz + 1.5 pt | 161.5 | 761 | 4.7 |
| Callisto + Pennant Magnum | 8 fl.oz + 2 pt | 155.7 | 681 | 4.3 |
| Callisto + Pendulum Aquacap | 5 fl.oz + 4 pt | 155.0 | 665 | 4.3 |
| Devrinol + Surflan | 8 lb + 1.5 pt | 151.8 | 715 | 4.7 |
| Devrinol + Pennant Magnum | 8 lb + 2 pt | 169.0 | 795 | 4.7 |
| Devrinol + Pendulum Aquacap | 8 lb + 4 pt | 150.3 | 685 | 4.6 |
| Surflan + Pennant Magnum | 1.5 pt + 2 pt | 158.0 | 796 | 5.0 |
| Roundup (check) | 2 pt | 155.3 | 711 | 4.5 |

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 22, 2011.