

Weed control in ornamental bulbs (2001-2002).

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Two studies were conducted in ornamental bulbs during 2001-2002: a nonselective, postemergence herbicide timing trial and a new herbicide trial. Plant materials for all these studies were kindly donated by Washington Bulb Co. and Hulbert Farms.

Materials and Methods.

Herbicide timing study. The second year of weed control studies were conducted on >Merry Widow= tulip, >Dutch Master= daffodil, and >Blue Diamond= iris at WSU Mount Vernon beginning in the fall of 2001. Visor, Prowl, diuron, Gallery, and Surflan was applied in combination with Roundup or Finale. Application timings were (1) all in the fall, (2) all in the spring (preemergence), (3) all in the spring (early postemergence), (4) half in the fall/half in the spring (preemergence), or (5) half in the fall/half in the spring (early postemergence). The spectrum and efficacy of weed control and crop safety was evaluated.

Initial Afall@ treatments were made on November 18, preemergence (PRE) to all bulbs. The Aspring@ PRE treatments were made February 4, when iris averaged 7 inches tall, daffodil averaged 3 inches, and tulip averaged just under an inch. The Aspring@ postemergence (POST) treatments with Roundup were made February 26, when average iris, daffodil, and tulip heights were 9, 8, and 2 inches, respectively.

Weed control was estimated February 25 (PRE only), March 22, April 23, and June 18. Injury to bulb foliage was estimated March 22 and April 23. Flowers were counted in each plot and height of five typical flowers was measured April 1 (daffodil), April 23 (tulip), and May 28 (iris). Bulbs were dug at maturity, then cleaned, sorted, counted, and weighed.

New herbicide trial. Several new herbicides were tested PRE and early POST in >Gander=s Rhapsody= tulip and >Blue Diamond= iris at WSU Mount Vernon. Products tested were Balance (isoxaflutole), Valor (flumioxazin), Dual Magnum (s-metolachlor), Outlook (dimethenamid-p), Milestone (azafenidin), Spartan (sulfentrazone), First Rate (chloransulam), Broadstrike (flumetsulam), Resource (flumiclorac), and Factor (prodiamine). Treatments were made December 21 (PRE) and February 4 (POST). Average iris height at the POST timing was 7 inches, while tulips were 3 inches.

Weed control and foliar injury was estimated February 20 (PRE only), March 7, March 26, and June 6. Flowers were counted in each plot and height of five typical flowers was measured April 24 (tulip), and May 28 (iris). In plots where weed control was good and crop damage was limited, bulbs were dug at maturity, then cleaned, sorted, counted, and weighed.

Statistics. The statistical design for all field studies was a randomized complete block design with four replicates. Means were separated using Fisher=s Protected LSD (P = 0.05).

Results.

Herbicide timing study.

Weed control was generally excellent for all Visor and Diuron treatments (Table 1). Many Gallery, Surflan, and Prowl tank mixtures did not provide adequate weed control by June 18, in particular when applied all in the fall. Split applications (fall and spring) with Gallery did not perform as well as other residual tank mixtures at that timing.

Foliar Injury. There was a pattern to foliar injury depending upon timing of the applications and which residual product was used.

Tulip (Table 2):

- A. When applied all in the fall, only Visor + Roundup caused above average injury by April 23.
- B. All POST applications resulted in severe tulip injury by April 23, from 61 to 79% with Roundup and from 41 to 60% with Finale.
- C. When split between fall and spring, all POST applications resulted in severe tulip injury by April 23, from 56 to 74% with Roundup and from 35 to 51% with Finale.

Daffodil (Table 3):

- A. When applied all in the fall, products were safe for daffodil.
- B. When applied all in the spring, mixtures with Finale were far more damaging than with Roundup.
- C. When split between fall and spring, mixtures of all residual products (except diuron) with Finale caused slight damage (.

Iris (Table 4):

- A. When applied all in the fall, products were safe for iris.
- B. When applied all in the spring, all POST combinations with Finale caused 15 to 20% injury by April 23.
- C. When split between fall and spring, all POST combinations with Finale caused 16 to 23% injury by April 23.

Flower number and flower height (Tables 2-4) in tulip were reduced by mixing residual products with Roundup and applying all in the spring. Gallery + Finale all in the spring also reduced tulip flower number and height. When split applied fall and spring, mixes with Gallery, Prowl, and Surflan significantly reduced tulip number but not height. Iris flowers were reduced by nearly all treatments except when applied all in the fall. Daffodil flowers were mostly unaffected by herbicide treatment.

Yield. Based on average bulb data, there were some clear trends in the 2002 yield data.

Tulip (Table 5): Visor-treated bulbs generally were smaller and fewer than when treated by other residual herbicide, regardless of timing. POST treatments with any residual herbicide, either all in the spring or split between fall and spring, usually resulted in lower bulb weight and number.

Daffodil (Table 6): Diuron generally reduced bulb yield and size, as did most spring applications of Visor, Gallery + Finale, Prowl, Surflan + Roundup. Bulb number was unaffected by herbicide applications.

Iris (Table 7): Bulb weight was reduced by all treatments compared to fall-treated iris. As with tulip, POST treatments in particular troublesome, resulting in poorer yield for nearly all herbicide combinations and timings. Bulb number was unaffected by herbicide applications.

New herbicide trial.

Weed Control. Several treatments provided good to excellent weed control (Table 8). Nearly all applications were still controlling > 83% of the weeds by April 23. By June 18, however, only spring applications of Valor, Milestone, FirstRate, and Spartan were still controlling > 84% of weeds.

Foliar and Floral Injury (Tables 9-10). Fall-applied FirstRate and spring-applied Valor, Milestone, and FirstRate caused severe foliar injury to tulip, and Spartan in spring caused slight damage. These treatments also generally reduced flower height and number. Balance and Outlook also reduced flower number. FirstRate in the fall and all spring applications except Factor and Broadstrike caused moderate to severe foliar burn on iris. These same treatments also reduced flower number and height.

Yield (Tables 9-10). Tulip were sensitive to spring-applied Milestone and either fall- or spring-applied FirstRate, as yield and bulb weight were reduced. Iris bulb yield and bulb size were reduced by spring-applied Valor, Milestone, Spartan, and FirstRate.

Table 1. Weed control in ornamental bulbs treated with various herbicide combinations and timings.

Residual herbicide	Nonselective herbicide ^a	Timing ^b	Weed control			
			2/25/02	3/22/02	4/23/02	6/18/02
			----- % -----			
Visor (3 pts/a)	Roundup	Fall	100	100	99	97
	Roundup	Spring, PRE	97	100	99	99
	Roundup	Spring, POST	73	95	99	97
	Finale	Spring, POST	79	97	99	98
	Roundup	Fall + Spring, PRE	100	100	99	99
	Roundup	Fall + Spring, POST	100	100	99	97
	Finale	Fall + Spring, POST	100	100	99	99
Diuron (4 lbs/a)	Roundup	Fall	100	100	98	90
	Roundup	Spring, PRE	90	100	98	89
	Roundup	Spring, POST	78	94	98	97
	Finale	Spring, POST	75	95	99	94
	Roundup	Fall + Spring, PRE	100	100	98	92
	Roundup	Fall + Spring, POST	100	100	99	96
	Finale	Fall + Spring, POST	100	100	99	96
Gallery (10.7 oz/a)	Roundup	Fall	100	100	94	53
	Roundup	Spring, PRE	99	99	97	82
	Roundup	Spring, POST	75	96	97	73
	Finale	Spring, POST	75	94	91	89
	Roundup	Fall + Spring, PRE	100	100	98	45
	Roundup	Fall + Spring, POST	99	100	97	48
	Finale	Fall + Spring, POST	99	100	96	43
Prowl (7.3 pts/a)	Roundup	Fall	100	100	93	48
	Roundup	Spring, PRE	96	100	95	75
	Roundup	Spring, POST	75	96	96	88
	Finale	Spring, POST	78	96	97	90
	Roundup	Fall + Spring, PRE	100	100	95	68
	Roundup	Fall + Spring, POST	100	100	98	83
	Finale	Fall + Spring, POST	100	100	96	83
Surflan (3 pts/a)	Roundup	Fall	100	100	98	78
	Roundup	Spring, PRE	97	100	98	81
	Roundup	Spring, POST	78	96	95	85
	Finale	Spring, POST	76	94	95	83
	Roundup	Fall + Spring, PRE	100	100	99	85
	Roundup	Fall + Spring, POST	100	100	99	78
	Finale	Fall + Spring, POST	100	100	99	86
LSD _{0.05}			4	2	3	11

^aRoundup applied at 1.5 pts/a; Finale applied at 6 pts/a.

^bFall = all residual applied in fall; Spring = all residual applied in spring;

Fall + Spring = half residual applied in fall, half applied in spring;

PRE = preemergence; POST = postemergence.

Table 2. >Merry Widow= tulip injury after treatment with various herbicide combinations and timings.

Residual herbicide	Nonselective herbicide ^a	Timing ^b	Foliar injury	Foliar injury	Flower number	Flower height
			3/22/02	4/23/02	4/23/02	4/23/02
			%	%	per plot	inches
Visor (3 pts/a)	Roundup	Fall	1	18	28	11
	Roundup	Spring, PRE	0	3	37	13
	Roundup	Spring, POST	15	70	11	6
	Finale	Spring, POST	19	44	28	9
	Roundup	Fall + Spring, PRE	1	8	35	11
	Roundup	Fall + Spring, POST	9	73	8	5
	Finale	Fall + Spring, POST	19	38	29	9
Diuron (4 lbs/a)	Roundup	Fall	0	4	33	13
	Roundup	Spring, PRE	6	4	33	13
	Roundup	Spring, POST	5	61	19	5
	Finale	Spring, POST	9	41	32	10
	Roundup	Fall + Spring, PRE	1	15	34	11
	Roundup	Fall + Spring, POST	3	56	18	8
	Finale	Fall + Spring, POST	6	35	31	10
Gallery (10.7 oz/a)	Roundup	Fall	1	3	31	13
	Roundup	Spring, PRE	10	14	32	12
	Roundup	Spring, POST	21	70	10	5
	Finale	Spring, POST	18	60	25	7
	Roundup	Fall + Spring, PRE	8	10	29	11
	Roundup	Fall + Spring, POST	24	73	11	5
	Finale	Fall + Spring, POST	18	38	26	9
Prowl (7.3 pts/a)	Roundup	Fall	1	10	31	12
	Roundup	Spring, PRE	5	10	33	12
	Roundup	Spring, POST	13	71	8	7
	Finale	Spring, POST	21	45	27	8
	Roundup	Fall + Spring, PRE	0	6	35	13
	Roundup	Fall + Spring, POST	6	75	7	6
	Finale	Fall + Spring, POST	20	44	24	9
Surflan (3 pts/a)	Roundup	Fall	0	3	31	13
	Roundup	Spring, PRE	3	5	30	12
	Roundup	Spring, POST	15	79	10	4
	Finale	Spring, POST	23	51	27	8
	Roundup	Fall + Spring, PRE	5	11	36	13
	Roundup	Fall + Spring, POST	10	74	9	4
	Finale	Fall + Spring, POST	19	51	23	8
LSD _{0.05}			7	13	6	5

^aRoundup applied at 1.5 pts/a; Finale applied at 6 pts/a.

^bFall = all residual applied in fall; Spring = all residual applied in spring;
 Fall + Spring = half residual applied in fall, half applied in spring;
 PRE = preemergence; POST = postemergence.

Table 3. >Dutch Master= daffodil injury after treatment with various herbicide combinations and timings.

Residual herbicide	Nonselective herbicide ^a	Timing ^b	Foliar injury	Foliar injury	Flower number	Flower height
			3/22/02	4/23/02	4/01/02	4/01/02
			%	%	per plot	inches
Visor (3 pts/a)	Roundup	Fall	0	0	16	15
	Roundup	Spring, PRE	0	0	16	14
	Roundup	Spring, POST	1	1	18	13
	Finale	Spring, POST	14	8	15	13
	Roundup	Fall + Spring, PRE	1	1	15	14
	Roundup	Fall + Spring, POST	0	3	20	13
	Finale	Fall + Spring, POST	18	8	17	12
Diuron (4 lbs/a)	Roundup	Fall	0	0	18	14
	Roundup	Spring, PRE	0	0	18	16
	Roundup	Spring, POST	0	0	14	15
	Finale	Spring, POST	1	1	18	16
	Roundup	Fall + Spring, PRE	0	1	18	16
	Roundup	Fall + Spring, POST	0	0	15	16
	Finale	Fall + Spring, POST	0	3	16	16
Gallery (10.7 oz/a)	Roundup	Fall	0	0	16	15
	Roundup	Spring, PRE	0	1	18	15
	Roundup	Spring, POST	1	1	17	14
	Finale	Spring, POST	20	10	17	15
	Roundup	Fall + Spring, PRE	0	3	16	15
	Roundup	Fall + Spring, POST	0	0	16	14
	Finale	Fall + Spring, POST	14	8	18	14
Prowl (7.3 pts/a)	Roundup	Fall	0	0	17	16
	Roundup	Spring, PRE	0	1	16	15
	Roundup	Spring, POST	0	1	17	13
	Finale	Spring, POST	15	5	18	13
	Roundup	Fall + Spring, PRE	0	0	16	15
	Roundup	Fall + Spring, POST	0	3	17	13
	Finale	Fall + Spring, POST	15	4	16	14
Surflan (3 pts/a)	Roundup	Fall	0	0	16	15
	Roundup	Spring, PRE	0	0	16	15
	Roundup	Spring, POST	0	1	18	14
	Finale	Spring, POST	20	8	15	15
	Roundup	Fall + Spring, PRE	0	0	14	14
	Roundup	Fall + Spring, POST	0	0	16	14
	Finale	Fall + Spring, POST	15	8	14	15
LSD _{0.05}			4	4	ns	3

^aRoundup applied at 1.5 pts/a; Finale applied at 6 pts/a.

^bFall = all residual applied in fall; Spring = all residual applied in spring;

Fall + Spring = half residual applied in fall, half applied in spring;

PRE = preemergence; POST = postemergence.

Table 4. >Blue Diamond= iris injury after treatment with various herbicide combinations and timings.

Residual herbicide	Nonselective herbicide ^a	Timing ^b	Foliar injury	Foliar injury	Flower number	Flower height
			3/22/02	4/23/02	5/28/02	5/28/02
			%	%	per plot	inches
Visor (3 pts/a)	Roundup	Fall	1	6	20	12
	Roundup	Spring, PRE	3	8	7	10
	Roundup	Spring, POST	5	5	5	13
	Finale	Spring, POST	40	15	15	15
	Roundup	Fall + Spring, PRE	4	9	5	10
	Roundup	Fall + Spring, POST	0	8	3	12
	Finale	Fall + Spring, POST	40	16	13	14
Diuron (4 lbs/a)	Roundup	Fall	1	0	26	19
	Roundup	Spring, PRE	15	8	18	14
	Roundup	Spring, POST	5	3	11	13
	Finale	Spring, POST	26	20	7	12
	Roundup	Fall + Spring, PRE	10	3	22	14
	Roundup	Fall + Spring, POST	8	8	9	12
	Finale	Fall + Spring, POST	21	18	6	13
Gallery (10.7 oz/a)	Roundup	Fall	0	0	27	16
	Roundup	Spring, PRE	1	0	19	15
	Roundup	Spring, POST	1	6	4	12
	Finale	Spring, POST	50	19	12	14
	Roundup	Fall + Spring, PRE	5	8	14	14
	Roundup	Fall + Spring, POST	3	8	5	9
	Finale	Fall + Spring, POST	44	23	12	13
Prowl (7.3 pts/a)	Roundup	Fall	3	0	30	18
	Roundup	Spring, PRE	4	11	7	13
	Roundup	Spring, POST	4	10	0	0
	Finale	Spring, POST	40	18	13	14
	Roundup	Fall + Spring, PRE	0	6	7	13
	Roundup	Fall + Spring, POST	0	11	3	12
	Finale	Fall + Spring, POST	38	18	13	14
Surflan (3 pts/a)	Roundup	Fall	1	3	24	17
	Roundup	Spring, PRE	4	6	7	12
	Roundup	Spring, POST	5	9	5	12
	Finale	Spring, POST	44	19	12	14
	Roundup	Fall + Spring, PRE	3	5	9	13
	Roundup	Fall + Spring, POST	3	11	4	12
	Finale	Fall + Spring, POST	44	20	13	14
LSD _{0.05}			6	7	7	10

^aRoundup applied at 1.5 pts/a; Finale applied at 6 pts/a.

^bFall = all residual applied in fall; Spring = all residual applied in spring;

Fall + Spring = half residual applied in fall, half applied in spring;

PRE = preemergence; POST = postemergence.

Table 5. >Merry Widow= tulip bulb yield after treatment with various herbicide combinations and timings.

Residual herbicide	Nonselective herbicide ^a	Timing ^b	Total bulb number	Total bulb weight	Average bulb weight
			no./plot	g/plot	g/bulb
Visor (3 pts/a)	Roundup	Fall	126	681	5.4
	Roundup	Spring, PRE	127	723	5.7
	Roundup	Spring, POST	98	357	3.6
	Finale	Spring, POST	105	443	4.2
	Roundup	Fall + Spring, PRE	120	704	5.9
	Roundup	Fall + Spring, POST	97	313	3.3
	Finale	Fall + Spring, POST	100	431	4.4
Diuron (4 lbs/a)	Roundup	Fall	133	870	6.6
	Roundup	Spring, PRE	123	829	6.8
	Roundup	Spring, POST	97	359	3.7
	Finale	Spring, POST	98	511	5.2
	Roundup	Fall + Spring, PRE	136	756	5.6
	Roundup	Fall + Spring, POST	87	393	4.6
	Finale	Fall + Spring, POST	98	517	5.2
Gallery (10.7 oz/a)	Roundup	Fall	120	830	7.1
	Roundup	Spring, PRE	134	743	5.5
	Roundup	Spring, POST	91	308	3.4
	Finale	Spring, POST	101	375	3.7
	Roundup	Fall + Spring, PRE	130	797	6.2
	Roundup	Fall + Spring, POST	95	345	3.7
	Finale	Fall + Spring, POST	110	529	4.9
Prowl (7.3 pts/a)	Roundup	Fall	137	881	6.5
	Roundup	Spring, PRE	141	878	6.2
	Roundup	Spring, POST	90	297	3.3
	Finale	Spring, POST	112	497	4.5
	Roundup	Fall + Spring, PRE	164	902	5.5
	Roundup	Fall + Spring, POST	85	285	3.4
	Finale	Fall + Spring, POST	112	525	4.7
Surflan (3 pts/a)	Roundup	Fall	149	924	6.4
	Roundup	Spring, PRE	155	895	5.8
	Roundup	Spring, POST	108	330	3.1
	Finale	Spring, POST	128	565	4.4
	Roundup	Fall + Spring, PRE	132	899	7.0
	Roundup	Fall + Spring, POST	99	257	2.7
	Finale	Fall + Spring, POST	96	417	4.4
LSD _{0.05}			26	128	0.8

^aRoundup applied at 1.5 pts/a; Finale applied at 6 pts/a.

^bFall = all residual applied in fall; Spring = all residual applied in spring;

Fall + Spring = half residual applied in fall, half applied in spring;

PRE = preemergence; POST = postemergence.

Table 6. >Dutch Master= daffodil bulb yield after treatment with various herbicide combinations and timings.

Residual herbicide	Nonselective herbicide ^a	Timing ^b	Total bulb number	Total bulb weight	Average bulb weight
			no./plot	g/plot	g/bulb
Visor (3 pts/a)	Roundup	Fall	24	2550	107.6
	Roundup	Spring, PRE	25	2214	91.7
	Roundup	Spring, POST	26	2157	83.1
	Finale	Spring, POST	22	1978	92.2
	Roundup	Fall + Spring, PRE	26	2058	80.4
	Roundup	Fall + Spring, POST	26	2276	87.6
	Finale	Fall + Spring, POST	23	1926	84.9
Diuron (4 lbs/a)	Roundup	Fall	24	2169	88.9
	Roundup	Spring, PRE	26	1950	78.5
	Roundup	Spring, POST	23	1559	67.0
	Finale	Spring, POST	23	1217	54.2
	Roundup	Fall + Spring, PRE	24	2157	89.4
	Roundup	Fall + Spring, POST	26	1523	59.8
	Finale	Fall + Spring, POST	25	1667	66.8
Gallery (10.7 oz/a)	Roundup	Fall	25	2413	96.1
	Roundup	Spring, PRE	27	2444	93.7
	Roundup	Spring, POST	24	2271	94.8
	Finale	Spring, POST	24	1987	83.9
	Roundup	Fall + Spring, PRE	23	2184	95.9
	Roundup	Fall + Spring, POST	24	2175	90.7
	Finale	Fall + Spring, POST	25	2130	86.5
Prowl (7.3 pts/a)	Roundup	Fall	23	2368	104.2
	Roundup	Spring, PRE	25	2349	93.3
	Roundup	Spring, POST	26	2222	87.7
	Finale	Spring, POST	25	2284	93.8
	Roundup	Fall + Spring, PRE	24	2470	105.7
	Roundup	Fall + Spring, POST	24	2005	84.0
	Finale	Fall + Spring, POST	24	2080	87.3
Surflan (3 pts/a)	Roundup	Fall	25	2250	88.9
	Roundup	Spring, PRE	24	2466	102.0
	Roundup	Spring, POST	27	2372	89.8
	Finale	Spring, POST	25	2243	91.8
	Roundup	Fall + Spring, PRE	23	2162	96.1
	Roundup	Fall + Spring, POST	24	2096	86.3
	Finale	Fall + Spring, POST	23	2036	91.1
LSD _{0.05}			ns	400	17.7

^aRoundup applied at 1.5 pts/a; Finale applied at 6 pts/a.

^bFall = all residual applied in fall; Spring = all residual applied in spring;
 Fall + Spring = half residual applied in fall, half applied in spring;
 PRE = preemergence; POST = postemergence.

Table 7. >Blue Diamond= iris bulb yield after treatment with various herbicide combinations and timings.

Residual herbicide	Nonselective herbicide ^a	Timing ^b	Total bulb number	Total bulb weight	Average bulb weight
			no./plot	g/plot	g/bulb
Visor (3 pts/a)	Roundup	Fall	114	611	4.6
	Roundup	Spring, PRE	99	383	3.5
	Roundup	Spring, POST	133	418	3.1
	Finale	Spring, POST	124	419	3.4
	Roundup	Fall + Spring, PRE	110	365	3.2
	Roundup	Fall + Spring, POST	127	417	3.3
	Finale	Fall + Spring, POST	114	402	3.6
Diuron (4 lbs/a)	Roundup	Fall	127	842	7.1
	Roundup	Spring, PRE	124	582	4.7
	Roundup	Spring, POST	132	456	3.4
	Finale	Spring, POST	99	262	2.5
	Roundup	Fall + Spring, PRE	136	670	4.9
	Roundup	Fall + Spring, POST	114	444	3.8
	Finale	Fall + Spring, POST	113	320	2.8
Gallery (10.7 oz/a)	Roundup	Fall	147	764	5.2
	Roundup	Spring, PRE	136	616	4.5
	Roundup	Spring, POST	107	418	4.6
	Finale	Spring, POST	126	327	2.6
	Roundup	Fall + Spring, PRE	126	468	3.7
	Roundup	Fall + Spring, POST	104	366	3.5
	Finale	Fall + Spring, POST	121	374	3.1
Prowl (7.3 pts/a)	Roundup	Fall	159	783	4.9
	Roundup	Spring, PRE	108	334	3.1
	Roundup	Spring, POST	99	244	2.4
	Finale	Spring, POST	123	430	3.5
	Roundup	Fall + Spring, PRE	124	424	3.5
	Roundup	Fall + Spring, POST	125	389	3.1
	Finale	Fall + Spring, POST	130	404	3.1
Surflan (3 pts/a)	Roundup	Fall	132	659	5.0
	Roundup	Spring, PRE	110	369	3.3
	Roundup	Spring, POST	118	590	4.6
	Finale	Spring, POST	111	359	3.2
	Roundup	Fall + Spring, PRE	122	454	3.8
	Roundup	Fall + Spring, POST	108	336	3.1
	Finale	Fall + Spring, POST	132	430	3.2
LSD _{0.05}			ns	216	1.4

^aRoundup applied at 1.5 pts/a; Finale applied at 6 pts/a.

^bFall = all residual applied in fall; Spring = all residual applied in spring;

Fall + Spring = half residual applied in fall, half applied in spring;

PRE = preemergence; POST = postemergence.

Table 8. Weed control in ornamental bulbs after treatment with various herbicides.

Treatment	Rate	Timing	Weed control			
			2/25/02	3/22/02	4/23/02	6/18/02
			----- % -----			
Balance	2.6 oz	Fall	100	100	84	24
Valor	2.2 oz	Fall	100	100	99	81
Dual Magnum	2.6 pt	Fall	100	100	97	74
Outlook	3.3 pt	Fall	100	100	96	81
FirstRate	0.61 oz	Fall	100	100	93	67
Broadstrike	1.1 oz	Fall	99	100	83	38
Factor	2.31 lbs	Fall	100	100	93	71
Factor	2.31 lbs	Spring, POST	97	100	93	59
Valor	2.2 oz	Spring, POST	100	100	99	84
Milestone	10 oz	Spring, POST	100	100	99	97
Spartan	5.3 oz	Spring, POST	100	100	99	87
FirstRate	0.61 oz	Spring, POST	96	100	97	85
Broadstrike	1.1 oz	Spring, POST	97	100	90	58
Resource	6 fl.oz	Spring, POST	98	100	89	46
Untreated	C	C	0	0	0	0
LSD _{0.05}	C	C	2	1	4	13

Table 9. >Gander=s Rhapsody=tulip injury and bulb yield after treatment with various herbicides.

Treatment	Rate	Timing	Foliar injury			Flower number	Flower height	Total bulb number	Total bulb weight	Average bulb weight
			2/25/02	3/22/02	4/23/02					
	Product/a		----- % -----			no./plot	inches	no./plot	g/plot	g/bulb
Balance	2.6 oz	Fall	3	3	1	28	13.5	173	889	5.3
Valor	2.2 oz	Fall	24	15	9	34	12.1	150	715	4.8
Dual Magnum	2.6 pt	Fall	16	8	11	32	12.2	130	842	6.8
Outlook	3.3 pt	Fall	3	4	8	27	13.1	159	873	5.5
FirstRate	0.61 oz	Fall	10	11	31	32	7.6	149	483	3.2
Broadstrike	1.1 oz	Fall	0	1	1	34	13.4	169	979	5.8
Factor	2.31 lbs	Fall	0	1	4	32	12.7	145	843	5.8
Factor	2.31 lbs	Spring, POST	9	3	9	33	11.3	163	870	5.4
Valor	2.2 oz	Spring, POST	36	33	34	26	9.4	127	630	4.9
Milestone	10 oz	Spring, POST	53	43	68	27	6.6	107	331	3.1
Spartan	5.3 oz	Spring, POST	36	31	14	30	10.5	138	698	5.1
FirstRate	0.61 oz	Spring, POST	8	15	53	24	4.6	86	263	3.1
Broadstrike	1.1 oz	Spring, POST	0	4	9	33	10.6	170	890	5.3
Resource	6 fl.oz	Spring, POST	29	11	6	36	14.2	174	936	5.5
Untreated	C	C	0	0	0	37	14.3	156	826	5.3
LSD _{0.05}	C	C	12	10	13	6	6.1	33	136	1.1

Table 10. >Blue Diamond= iris injury and bulb yield after treatment with various herbicide combinations and timings.

Treatment	Rate	Timing	Foliar injury			Flower number	Flower height	Total bulb number	Total bulb weight	Average bulb weight
			2/25/02	3/22/02	4/23/02					
	Product/a		----- % -----			no./plot	inches	no./plot	g/plot	g/bulb
Balance	2.6 oz	Fall	0	3	1	29	18.1	150	713	4.7
Valor	2.2 oz	Fall	23	21	10	24	16.4	143	575	4.0
Dual Magnum	2.6 pt	Fall	9	9	6	26	16.4	170	728	4.2
Outlook	3.3 pt	Fall	0	1	4	27	16.6	148	717	4.9
FirstRate	0.61 oz	Fall	0	4	20	20	11.4	137	401	2.9
Broadstrike	1.1 oz	Fall	0	0	1	26	17.7	150	735	4.9
Factor	2.31 lbs	Fall	0	3	1	26	17.6	162	768	4.7
Factor	2.31 lbs	Spring, POST	0	3	4	19	15.3	153	631	4.1
Valor	2.2 oz	Spring, POST	51	53	54	7	12.9	88	179	2.0
Milestone	10 oz	Spring, POST	63	71	71	8	12.1	100	197	2.0
Spartan	5.3 oz	Spring, POST	64	65	50	11	11.7	99	221	2.2
FirstRate	0.61 oz	Spring, POST	11	15	26	12	7.8	140	312	2.2
Broadstrike	1.1 oz	Spring, POST	1	4	16	10	13.2	142	512	3.6
Resource	6 fl.oz	Spring, POST	28	39	40	9	13.4	130	391	3.0
Untreated	C	C	0	0	0	30	18.5	163	543	3.3
LSD _{0.05}	C	C	13	16	14	7	2.0	32	178	0.8