

Project No: 13C-3419-8228

Title: Weed Control in Strawberries

Reporting Period: 2002-2003

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Accomplishments:

1. Three studies were completed in calendar year 2001-02: an established strawberry trial, a newly-planted strawberry trial, and a renovation trial. Fourteen herbicides were tested for crop safety and weed control and a total of fifty-nine treatments were applied.
2. Valor herbicide (Valent) was entered into IR-4 testing labeled for pre- and post-transplant use in newly-planted strawberry.
3. Spartan herbicide (FMC) was granted a Section 18 exemption by EPA for use in newly-planted and established strawberry.

Results: ‘Hood’ was used for the established strawberry and renovation trials and ‘Totem’ and ‘Redcrest’ were used in the newly-planted trial.

Newly-planted strawberry: Herbicides were applied immediately POSTR and again approx. 30 dat. All plots were weeded prior to the mid-season application. The highest leaf areas in August were found on hand weeded strawberries or those treated with Prowl or Milestone (Table 1). Using leaf area ratings, the top 5 treatment combinations were hand weeded + Milestone, Milestone + Outlook, Milestone + Spartan, hand weeded + Spartan, and Spartan + Spartan. The only mid-season applications to result in >10% leaf burn were Cobra and Valor, followed by Milestone (9%). The “softest” mid-season product as based on final leaf area was Spartan, followed by Milestone, Outlook, and Valor (Table 2).

Established strawberry: Crop injury from the herbicides ranged from 0 to 68% at 47 dat (days after treatment), but all were below 10% by 110 dat (Table 3). Visor with Prowl or Visor caused the most burning of treated leaves at 47 dat (68 and 64%, respectively), followed by Milestone mixes (41 and 34%, respectively) and Goal mixes (13% for both). Further evidence as to the transitory nature of the strawberry leaf injury was provided by the lack of significant differences between treatments for weed control, yield, or fruit size.

Renovation: Valor, Cobra, Visor, Prowl, and Milestone caused >30% injury at 10 dat (Table 4). Strawberries had recovered by 45 dat (all <10%), but Valor injury had increased to 24% by the February evaluation while injury from Sinbar was at 10%. Only strawberries treated with Valor were still showing >10% by the end of April, although it was not statistically significant. Following the dormant season application, only Valor-treated strawberries showed significantly more injury than non-treated plants in February (38%), although Milestone injury was moderate (13%). Injury from Valor was still 19% at the end of April, while Cobra injury was 14% (neither statistically significant). Only Stinger at 2/3 pt/a was providing higher weed control than non-treated strawberries (98 and 90%, respectively). Most renovation only treatments did not significantly affect strawberry yield; only Milestone yielded higher than non-treated strawberries. In the twice-treated strawberries, all yielded statistically similarly to non-treated strawberries. Fruit size did not differ between any treatments.

Appendix. Data tables.

Table 1. Crop injury, weed control, and leaf area after split applications of several herbicides in newly-planted strawberry.

Treatment ^a		Stand ^b	Weed control 1 ^b	Weeding time ^c	Crop injury ^d	Weed control 2 ^d	Leaf area ^d
Trans.	Mid-season	no./plot	%	hrs/a	%	%	cm ²
Visor (1.5 pt)		12.3	99	6.2	—	—	—
	Visor (1 pt)	—	—	—	9	96	746
	Prowl (4.8 pt)	—	—	—	6	89	671
	Spartan (4.3 oz)	—	—	—	6	97	767
	Milestone (2 oz)	—	—	—	10	98	758
	Cobra (1 pt)	—	—	—	11	99	614
	Valor (1.6 oz)	—	—	—	14	97	837
	Dual Magnum (0.8 pt)	—	—	—	5	92	886
	Outlook (0.8 pt)	—	—	—	1	90	957
	Devrinol (4 lb)	—	—	—	5	91	748
	Simazine (3.2 oz)	—	—	—	1	87	882
	Untreated	—	—	—	0	86	635
Prowl (4.8 pt)		12.4	98	8.2	—	—	—
	Visor (1 pt)	—	—	—	9	98	767
	Prowl (4.8 pt)	—	—	—	8	96	708
	Spartan (4.3 oz)	—	—	—	5	96	1117
	Milestone (2 oz)	—	—	—	8	99	975
	Cobra (1 pt)	—	—	—	10	99	813
	Valor (1.6 oz)	—	—	—	14	98	844
	Dual Magnum (0.8 pt)	—	—	—	5	96	1023
	Outlook (0.8 pt)	—	—	—	3	97	1078
	Devrinol (4 lb)	—	—	—	5	96	690
	Simazine (3.2 oz)	—	—	—	3	95	1008
	Untreated	—	—	—	3	95	1059

Treatment ^a		Stand ^b no./plot	Weed control 1 ^b %	Weeding time ^c hrs/a	Crop injury ^d %	Weed control 2 ^d %	Leaf area ^d cm ²
Trans.	Mid-season						
Spartan (5.3 oz)		12.5	66	17.3	—	—	—
	Visor (1 pt)	—	—	—	6	73	602
	Prowl (4.8 pt)	—	—	—	6	74	738
	Spartan (4.3 oz)	—	—	—	6	89	1204
	Milestone (2 oz)	—	—	—	9	88	936
	Cobra (1 pt)	—	—	—	11	86	671
	Valor (1.6 oz)	—	—	—	10	85	957
	Dual Magnum (0.8 pt)	—	—	—	4	63	600
	Outlook (0.8 pt)	—	—	—	0	60	767
	Devrinol (4 lb)	—	—	—	3	60	517
	Simazine (3.2 oz)	—	—	—	3	73	738
	Untreated	—	—	—	0	66	756
Milestone (3 oz)		12.0	85	11.1	—	—	—
	Visor (1 pt)	—	—	—	8	85	811
	Prowl (4.8 pt)	—	—	—	5	87	906
	Spartan (4.3 oz)	—	—	—	4	93	1318
	Milestone (2 oz)	—	—	—	9	92	1188
	Cobra (1 pt)	—	—	—	13	93	684
	Valor (1.6 oz)	—	—	—	14	95	1050
	Dual Magnum (0.8 pt)	—	—	—	1	73	638
	Outlook (0.8 pt)	—	—	—	1	85	1347
	Devrinol (4 lb)	—	—	—	4	84	1179
	Simazine (3.2 oz)	—	—	—	3	84	937
	Untreated	—	—	—	1	74	745
Cobra (1.5 pt)		11.6	90	6.4	—	—	—
	Visor (1 pt)	—	—	—	8	86	504
	Prowl (4.8 pt)	—	—	—	6	86	817
	Spartan (4.3 oz)	—	—	—	5	93	978
	Milestone (2 oz)	—	—	—	10	97	954
	Cobra (1 pt)	—	—	—	11	91	672
	Valor (1.6 oz)	—	—	—	13	98	797
	Dual Magnum (0.8 pt)	—	—	—	3	71	744
	Outlook (0.8 pt)	—	—	—	1	81	727
	Devrinol (4 lb)	—	—	—	3	78	629
	Simazine (3.2 oz)	—	—	—	5	69	788
	Untreated	—	—	—	3	68	618
Valor (2.2 oz)		12.2	85	6.8	—	—	—
	Visor (1 pt)	—	—	—	6	85	873
	Prowl (4.8 pt)	—	—	—	8	86	838
	Spartan (4.3 oz)	—	—	—	4	94	1247
	Milestone (2 oz)	—	—	—	10	95	942
	Cobra (1 pt)	—	—	—	10	90	782
	Valor (1.6 oz)	—	—	—	13	94	905
	Dual Magnum (0.8 pt)	—	—	—	4	78	1087
	Outlook (0.8 pt)	—	—	—	3	85	1001
	Devrinol (4 lb)	—	—	—	4	89	749
	Simazine (3.2 oz)	—	—	—	3	79	937
	Untreated	—	—	—	3	78	880

Treatment ^a		Stand ^b no./plot	Weed control 1 ^b %	Weeding time ^c hrs/a	Crop injury ^d %	Weed control 2 ^d %	Leaf area ^d cm ²
Trans.	Mid-season						
Dual Magnum (0.8 pt)	11.6	43	17.1	—	—	—	—
Visor (1 pt)		—	—	—	4	48	613
Prowl (4.8 pt)		—	—	—	5	66	697
Spartan (4.3 oz)		—	—	—	6	86	1157
Milestone (2 oz)		—	—	—	8	80	1011
Cobra (1 pt)		—	—	—	9	73	664
Valor (1.6 oz)		—	—	—	13	79	836
Dual Magnum (0.8 pt)		—	—	—	4	44	655
Outlook (0.8 pt)		—	—	—	1	48	669
Devrinol (4 lb)		—	—	—	1	51	606
Simazine (3.2 oz)		—	—	—	0	46	683
Untreated		—	—	—	0	50	638
Outlook (0.8 pt)		11.5	35	20.2	—	—	—
Visor (1 pt)		—	—	—	5	45	452
Prowl (4.8 pt)		—	—	—	5	66	606
Spartan (4.3 oz)		—	—	—	4	85	983
Milestone (2 oz)		—	—	—	6	80	928
Cobra (1 pt)		—	—	—	11	68	587
Valor (1.6 oz)		—	—	—	10	81	649
Dual Magnum (0.8 pt)		—	—	—	0	38	472
Outlook (0.8 pt)		—	—	—	0	41	681
Devrinol (4 lb)		—	—	—	0	39	587
Simazine (3.2 oz)		—	—	—	0	49	425
Untreated		—	—	—	0	23	471
Devrinol (8 lbs)		11.9	20	35.9	—	—	—
Visor (1 pt)		—	—	—	6	41	364
Prowl (4.8 pt)		—	—	—	5	56	592
Spartan (4.3 oz)		—	—	—	4	79	1036
Milestone (2 oz)		—	—	—	9	73	805
Cobra (1 pt)		—	—	—	9	58	609
Valor (1.6 oz)		—	—	—	11	78	718
Dual Magnum (0.8 pt)		—	—	—	1	36	404
Outlook (0.8 pt)		—	—	—	0	35	574
Devrinol (4 lb)		—	—	—	1	38	492
Simazine (3.2 oz)		—	—	—	0	55	502
Untreated		—	—	—	0	30	411
Handweeded		12.0	100	15.7	—	—	—
Visor (1 pt)		—	—	—	6	76	755
Prowl (4.8 pt)		—	—	—	8	81	847
Spartan (4.3 oz)		—	—	—	4	90	1316
Milestone (2 oz)		—	—	—	8	94	1414
Cobra (1 pt)		—	—	—	11	89	781
Valor (1.6 oz)		—	—	—	11	90	1098
Dual Magnum (0.8 pt)		—	—	—	3	73	871
Outlook (0.8 pt)		—	—	—	1	59	925
Devrinol (4 lb)		—	—	—	0	68	1022
Simazine (3.2 oz)		—	—	—	1	66	1024
Untreated		—	—	—	0	59	761

^a‘Totem’ and ‘Redcrest’ strawberries transplanted May 16 and 17 and sprayed May 27 and June 27, 2002.

^bStand and weed control evaluated June 18, 2002.

^cWeeding time in hours per acre for one person.

^dCrop injury and weed control evaluated July 13, 2002.

^eThree strawberry plants of each variety harvested August 9 and 10, 2002.

Table 2. Crop injury, weed control, and strawberry growth after mid-season applications of several herbicides in newly-planted strawberry (averaged across post-transplant treatments).

Treatment ^a	Crop injury ^b	Weed control ^b	Leaf area	Leaf	Leaf area/leaf	Runners	Daughters
	%	%	cm ²	no./plant	cm ² /leaf	no./plant	no./plant
Visor (1 pt)	7	73	649	12.5	64	2.2	1.8
Prowl (4.8 pt)	6	79	742	14.0	56	2.8	2.3
Spartan (4.3 oz)	5	90	1112	21.1	63	4.0	4.3
Milestone (2 oz)	9	89	991	17.9	64	3.4	3.1
Cobra (1 pt)	11	84	688	12.1	58	2.5	1.6
Valor (1.6 oz)	12	89	869	15.6	67	3.1	2.4
Dual Magnum (0.8 pt)	3	66	738	14.0	56	2.6	2.4
Outlook (0.8 pt)	1	68	873	16.0	73	2.7	2.9
Devrinol (4 lb)	3	69	722	14.2	63	2.3	2.4
Simazine (3.2 oz)	2	70	792	15.2	57	2.6	2.6
Untreated	1	63	697	13.2	59	2.1	2.2
LSD _{0.05}	1	5	118	1.6	10	0.4	0.5

^a‘Totem’ and ‘Redcrest’ strawberries transplanted May 16 and 17 and sprayed May 27 and June 27, 2002.

^bCrop injury and weed control evaluated July 13, 2002.

Table 3. Crop injury, weed control, and yield of strawberries treated with various herbicides at dormancy.

Treatment ^a	Rate	Crop injury		Weed control		Yield	Berry size
		2/25	4/29	2/25	4/29		
	product/a	-----	% -----	-----	% -----	lbs/a	g/fruit
1. Prowl + Milestone	3.6 pt + 3 oz	41	5	97	95	11565	16
2. Prowl + Valor	3.6 pt + 2.2 oz	68	6	96	90	10448	17
3. Prowl + Goal	3.6 pt + 0.8 pt	13	3	98	91	9902	15
4. Prowl + Stinger	3.6 pt + 0.67 pt	0	0	96	91	13431	16
5. Prowl + Spartan	3.6 pt + 5.3 oz	0	0	98	94	10216	13
6. Visor + Milestone	1.5 pt + 3 oz	34	1	98	94	11651	14
7. Visor + Valor	1.5 pt + 2.2 oz	64	8	98	94	10784	15
8. Visor + Goal	1.5 pt + 0.8 pt	13	0	98	92	11308	15
9. Visor + Stinger	1.5 pt + 0.67 pt	0	1	97	95	11369	12
10. Visor + Spartan	1.5 pt + 5.3 oz	0	1	95	91	9931	14
11. Hand weeded	—	0	0	100	100	12861	14
12. Untreated	—	0	0	96	88	11310	15
LSD _{0.05}	—	12	4	ns	ns	ns	ns

^aEstablished ‘Hood’ strawberries treated January 9, 2002.

Table 4. Crop injury to strawberries treated at renovation (post-harvest, after mowing) and/or at dormancy.

Treatment ^{a,b}	Rate product/a	Crop injury				Weed control		Yield lbs/a	Berry size g/fruit
		8/6	9/20	2/25	4/29	2/25	4/29		
		----- % -----				----- % -----			
<u>Renovation Only</u>									
1. Simazine	2 pt	1	1	0	6	87	82	9171	13
2. Sinbar	4 oz	1	0	10	8	84	80	8134	12
3. Devrinol	8 lb	1	0	0	3	92	86	7384	13
4. Valor	2.2 oz	55	8	24	13	88	78	7541	15
5. Visor	2 pt	36	0	0	0	91	83	9165	12
6. Prowl	4.8 pt	33	1	0	0	90	85	10688	12
7. Stinger	0.33 pt	5	0	0	0	94	95	11647	15
8. Stinger	0.67 pt	6	0	0	0	99	93	10245	14
9. Spartan	5.3 oz	11	1	1	1	86	83	5953	12
10. Cobra	1.5 pt	48	4	0	1	96	88	7184	13
11. Milestone	3 oz	31	3	1	4	88	84	13030	12
12. Untreated	—	0	0	1	4	90	86	8045	12
LSD _{0.05}	—	9	3	12	ns	8	ns	4958	ns
<u>Renovation + Dormant</u>									
13. Simazine + Simazine	2 pt + 2 pt	—	—	0	1	91	86	9279	13
14. Sinbar + Sinbar	4 oz + 4 oz	—	—	0	1	85	79	9254	13
15. Devrinol + Devrinol	8 lb + 8 lb	—	—	0	3	96	93	10916	14
16. Valor + Valor	2.2 oz + 2.2 oz	—	—	38	19	95	94	12090	12
17. Visor + Visor	2 pt + 2 pt	—	—	1	0	95	86	9459	14
18. Prowl + Prowl	4.8 pt + 4.8 pt	—	—	6	0	88	84	10211	14
19. Stinger + Stinger	0.33 pt + 0.33 pt	—	—	0	0	99	96	10594	14
20. Stinger + Stinger	0.67 pt + 0.67 pt	—	—	0	0	98	98	11576	23
21. Spartan + Spartan	5.3 oz + 5.3 oz	—	—	6	8	90	86	6914	16
22. Cobra + Cobra	1.5 pt + 1.5 pt	—	—	8	14	91	85	9821	15
23. Milestone + Milestone	3 oz + 3 oz	—	—	13	3	91	89	10537	14
24. Untreated	—	—	—	1	1	90	91	9010	15
LSD _{0.05}	—	—	—	13	ns	ns	ns	3428	ns

^aEstablished 'Hood' strawberries mown July 19 and sprayed July 27, 2001 (3 to 4" growth at time of spraying).

^bEstablished 'Hood' strawberries treated January 9, 2002.

Note: Valor was inadvertently applied at 10x rate at renovation.