

Project No: 13C-3419-8228

Title: Weed Control in Strawberries

Reporting Period: FY 2009-10

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Accomplishments: Two studies were completed in 2009-10: an established strawberry trial and a newly-planted strawberry trial. Thirteen herbicides were tested for crop safety and weed control and a total of 39 treatments were applied. In addition, Spartan (sulfentrazone, FMC) was again granted a Section 18 exemption by EPA for use in strawberry.

Results: 'Hood' was used for both strawberry trials. Plant material was generously donated by Sakuma Brothers Farms.

Newly-planted strawberry: Strawberries were transplanted July 2 at WSU Mount Vernon NWREC. Herbicides were applied to newly-planted strawberries after transplanting July 5 (PRE to weeds) and August 12 (POST to weeds). Due to the lateness of the planting and the dry summer, strawberry plants were irrigated twice during 2009. Crop injury and weed control were estimated July 27 and September 22. Living strawberry plants were counted and leaf area of three randomly-selected plants was determined on October 12. The experimental design was a randomized complete block with four replicates. Data are provided in Table 1.

No treatment caused more than 10% crop injury. Weed control initially was very good, given the lateness of the season and the dry summer during 2009. By the end of the season, however, only seven combination treatments were providing adequate weed control. These included Prowl H₂O + Chateau or Spartan, Spartan + Goal or Outlook, and Goal + Outlook (PRE) and Chateau + Prowl H₂O or Spartan (PRE + POST). Herbicide treatments did not significantly affect strawberry plant survival. Vegetative growth parameters showed that herbicide treatments were generally quite safe, although strawberry leaf area was reduced by nearly 50% for Prowl H₂O + Chateau (PRE) and Chateau + Prowl H₂O (PRE + POST). The three experimental treatments (V1, V2, and Granite) were apparently safe for strawberry, but weed control this season only ranged from 49 to 56% by September. So either higher rates or sequential applications or tank mixtures would be required for these products.

Established strawberry: Strawberries were transplanted July 2, 2008 and treated with Spartan + Prowl H₂O (5 fl.oz/a + 3.2 pt/a) July 15 for weed control during the establishment year. The strawberry block was rototilled several times from late summer until winter to maintain weed control between the rows. Split-blocks of these established strawberries were then treated with simazine at 1.1 lbs/a December 12, 2008 and then the main plots were treated with sequential herbicides February 13, 2009. Crop injury and weed control were estimated March 31 and April 24. Berries were picked four times (June 15, 22, and 29) and marketable berries were counted and weighed. The experimental design was a randomized complete block with four replicates. Crop injury and weed control data are provided in Table 2, and yield data in Table 3.

Although 29% of the treatments did not result in greater than 10% injury by March, 83% of the products resulted in greater than 10% injury when applied in sequence with simazine, and four of those resulted in greater than 20% injury (note that hand weeded check plots also rated 10% injury in March)(Table 2). Most injurious at that evaluation were Chateau at 1.5 or 1.9 oz/a or KSU 12800. By April, however, only simazine + Dual Magnum and KSU 12800 with or without simazine were still showing greater than 10% injury. Weed control was much enhanced by use of simazine prior to dormant treatment (Table 2). 71% in March, 54% in April (with) while only three or four treatments were providing adequate weed control without simazine in March and April (respectively). Of non-registered products, Gallery was particularly notable, with both rates alone or with simazine resulting in excellent weed control. Fruit yield did not significantly differ with herbicide treatment, and using simazine did not significantly improve total yield (Table 3). Average fruit weight was greater in plants treated with simazine (16.7 and 14.8g/fruit for plants with and without simazine, respectively).

Table 1. Number of strawberry plants, mean leaf area, and weed control after application of several herbicides in newly-planted strawberry (all plots in analysis).

Treatment ^a	Rate	Timing	Crop injury		Weed control		Number of plants ^b	Leaf area ^b
			Jul 27	Sep 22	Jul 27	Sep 22		
	product/a		%	%	%	%	plants/plot	cm ² /plant
Spartan	8 fl.oz	PRE	1	0	93	63	19	1397
Chateau	2.2 oz	PRE	1	0	93	69	14	1287
Prowl + Spartan	3.2 pt + 5 fl.oz	PRE + PRE	4	0	96	91	15	959
Prowl + Chateau	3.2 pt + 2.2 oz	PRE + PRE	8	0	98	94	14	1042
Spartan + Goal	8 fl.oz + 10 fl.oz	PRE + PRE	3	0	98	84	16	1387
Spartan + Outlook	8 fl.oz + 13 fl.oz	PRE + PRE	1	0	94	80	16	1376
Spartan + Dual Magnum	8 fl.oz + 13 fl.oz	PRE + PRE	1	0	98	79	14	1979
Spartan + Devrinol	8 fl.oz + 4 lbs	PRE + PRE	0	0	95	71	17	1717
Goal + Outlook	10 fl.oz + 13 fl.oz	PRE + PRE	1	0	96	81	17	1158
Goal + Dual Magnum	10 fl.oz + 13 fl.oz	PRE + PRE	4	0	95	78	17	1507
Spartan + Prowl	8 fl.oz + 2.1 pt	PRE + POST	1	0	93	75	15	1407
Spartan + Devrinol	8 fl.oz + 4 lbs	PRE + POST	3	0	91	64	19	1441
Chateau + Prowl	2.2 oz + 2.1 pt	PRE + POST	4	0	93	86	16	889
Chateau + Spartan	2.2 oz + 5 fl.oz	PRE + POST	4	3	95	91	15	1063
Chateau + Devrinol	2.2 oz + 4 lbs	PRE + POST	3	0	93	75	17	1145
V1	5.3 oz	PRE	8	0	89	56	15	1597
V2	2.1 oz	PRE	0	0	90	49	16	1453
Granite	2.6 fl.oz	PRE	1	0	91	51	16	1379
Hand weeded	---	---	0	0	88	78	16	1754
LSD _{0.05}	---	---	3	1	ns	11	ns	503

^aStrawberries transplanted July 2, 2009; PRE = immediately following transplanting, July 5, 2009; POST = one month after transplanting, August 12, 2009.

^bStrawberry stand and leaf area measured October 12, 2009.

Table 2. Crop injury and weed control after applications of various herbicides in established strawberry.

Treatment ^a	Rate	Crop injury ^b				Weed control ^b			
		with simazine		without simazine		with simazine		without simazine	
		Mar 31	Apr 24	Mar 31	Apr 24	Mar 31	Apr 24	Mar 31	Apr 24
	product/a	%						%	
Prowl	2.1 pt	10	0	5	0	87	80	60	53
Prowl	3.2 pt	12	0	3	5	87	85	55	50
Prowl	4.2 pt	15	2	5	2	87	83	48	48
Prowl	5.3 pt	10	2	5	0	83	82	37	53
Dual Magnum	1 pt	7	12	0	3	83	78	30	27
Dual Magnum	2.1 pt	15	0	7	0	87	78	67	67
Stinger	10.7 fl.oz	7	3	0	2	78	87	12	28
Stinger	1.3 pt	8	3	2	2	83	80	30	33
Outlook	1.3 pt	10	0	2	0	82	40	7	32
Outlook	2.7 pt	8	2	2	2	88	78	22	25
Spartan	4.8 fl.oz	15	2	8	0	93	92	70	68
Spartan	6.4 fl.oz	17	2	5	0	95	92	63	55
Spartan	8.0 fl.oz	15	0	2	0	95	90	65	65
Spartan	9.6 fl.oz	15	0	5	0	93	87	68	53
Chateau	0.8 oz	18	2	13	2	78	78	48	40
Chateau	1.1 oz	20	3	15	2	93	92	77	82
Chateau	1.5 oz	28	5	23	3	97	93	68	62
Chateau	1.9 oz	27	7	20	7	93	83	53	55
Devrinol	6.0 lbs	17	2	10	0	83	72	30	23
Devrinol	8.0 lbs	13	2	8	0	90	87	60	65
Gallery	10.7 oz	13	3	13	2	92	90	83	83
Gallery	1.3 lbs	13	2	5	2	93	93	85	87
V-2	5.9 oz	12	2	7	0	93	88	68	47
KSU 12800	3.6 fl.oz	28	10	27	10	98	97	93	88
Hand weed	---	10	0	5	0	82	100	35	100

^aFall simazine applied December 12, 2008; dormant-season herbicides applied February 13, 2009.

Table 3. Total fruit weight and average berry weight after applications of various herbicides in established strawberry.

Treatment ^a	Rate	Total fruit weight ^b		Average berry weight ^b	
		With simazine	Without simazine	With simazine	without simazine
	product/a	lbs/a	lbs/a	g/berry	g/berry
Prowl	2.1 pt	7479	9477	16.7	13.7
Prowl	3.2 pt	7021	4877	18.8	13.3
Prowl	4.2 pt	7166	8616	16.1	14.3
Prowl	5.3 pt	5009	6770	16.3	13.4
Dual Magnum	1 pt	8554	5857	16.8	12.9
Dual Magnum	2.1 pt	10986	11005	17.1	15.6
Stinger	10.7 fl.oz	7557	5165	14.3	12.0
Stinger	1.3 pt	7114	8258	13.3	13.7
Outlook	1.3 pt	11435	8111	17.0	14.0
Outlook	2.7 pt	8558	9753	18.9	13.8
Spartan	4.8 fl.oz	9816	10655	16.4	16.1
Spartan	6.4 fl.oz	8154	10850	17.5	16.6
Spartan	8.0 fl.oz	5809	9119	18.7	17.1
Spartan	9.6 fl.oz	9511	8530	18.2	15.3
Chateau	0.8 oz	10519	6605	16.8	13.5
Chateau	1.1 oz	8509	10009	13.7	14.5
Chateau	1.5 oz	7444	6362	16.6	13.4
Chateau	1.9 oz	6747	3526	13.7	13.1
Devrinol	6.0 lbs	7551	4967	17.3	15.0
Devrinol	8.0 lbs	8864	5132	19.0	14.9
Gallery	10.7 oz	8740	7530	15.9	16.7
Gallery	1.3 lbs	9138	7375	18.2	16.4
V-2	5.9 oz	9123	7723	17.3	17.8
KSU 12800	3.6 fl.oz	6340	6844	16.4	15.9
Hand weed	---	8393	9972	16.6	16.1

^aFall simazine applied December 12, 2008; dormant-season herbicides applied February 13, 2009.

^bStrawberries picked three times (June 15, 22, and 29, 2009).