

**Project Number:** 13K 3419 7228

**Title:** Weed control in vegetable seed crops.

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**Reporting Period:** 2011-12

**Accomplishments:** Five weed control trials in vegetable seed were conducted in 2012: one study in cabbage seed, one study in table beet seed, and three studies in spinach seed.

### **Results:**

*Cabbage seed herbicide screen.* Eleven cabbage seed lines were transplanted at WSU Mount Vernon NWREC September 15, 2011. All plots received simazine treatment November 10, 2011 and Envoy (clethodim) April 4, 2012 for general weed control in addition to the spring applications of interest. Postemergence (POST) applications of Goal (oxyfluorfen, 2 lb/gal), GoalTender (oxyfluorfen, 4 lb/gal), Callisto (mesotrione), and Spartan (sulfentrazone) were made over-the-top of cabbage plants February 10, 2012. Crop injury and weed control were estimated May 2, 2012. All plants were pulled from the soil from April 18 to May 7, 2012 when specific lines were budding and plant population and fresh weight from each plot were recorded. The trial was a split-block, randomized complete block with three replicates.

Broadleaf weed control was moderate from all spring treatments, with best control ranging from 62 to 78% from Callisto, Goal, GoalTender, and the high rate of Spartan (Table 1). The primary weed species in these plots were shepherd's-purse (*Capsella bursa-pastoris*) and common chickweed (*Stellaria media*).

The only herbicide to cause lasting visual crop damage was Callisto (35% at 8 weeks after treatment; Table 1). All tested lines were sensitive to Callisto. Fresh weight of cabbage plants treated with Callisto was also lower than nontreated cabbage, although not significantly less than Spartan at 6.4 fl.oz/a. Herbicide treatment did not reduce cabbage stand in April or May.

#### *Spinach seed.*

Herbicide trial. Spinach was seeded May 12, 2012 at WSU Mount Vernon NWREC. Preplant-incorporated (PPI) treatments were applied May 11, preemergence (PRE) treatments May 14, and postemergence (POST) June 12, 2012. Weed control and crop injury were estimated June 4 and July 6. Spinach plants were pulled from the soil September 13, 2012 and plants placed in the greenhouse to dry. Plants were then threshed and seed cleaned and weighed. The trial was a randomized complete block with four replicates.

Despite rather high spinach foliar injury estimates (injury from 22 of 25 treatments numerically exceeded that of nontreated spinach and all numerically exceeded the standard Ro-Neet (cycloate) fb Asulox (asulam) treatment at the July rating), spinach injury did not statistically differ by treatment (data not shown). Variable emergence and growth was likely to blame, as the least significant difference between treatments was 40 percentage points in July. Treatments with Nortron (ethofumesate) and Command (clomazone) must therefore be considered potentially injurious.

Weed control differed among treatments by July, with the best control achieved with standard Ro-Neet fb Asulox and Command + Dual Magnum (s-metolachlor; 94 and 90%, respectively; Table 2). Command applied PRE also provided >86% weed control in July.

Seed yield ranged from 130 to 1300 g/plot (Table 2). Several treatments were statistically equal to the handweeded check, including currently registered combinations of Ro-Neet, Dual Magnum, Nortron, and Asulox; new combinations with these products with Command or Define were also among top yielders. Germination percentage has not yet been determined.

Micro-rate trial. Spinach was seeded as in the herbicide trial. Herbicides were also applied the same days as in the herbicide trial. Two POST treatments were used in this trial, however, so the first, P7, was applied 7 days after spinach emergence (June 12, 2012) and the second, P14, was applied 14 days after spinach emergence (June 20, 2012). Crop injury and weed control estimates and plant harvest was conducted as in the herbicide trial. The trial was a randomized complete block with four replicates.

Weed control and crop injury did not differ by treatment in the June or July evaluation, however July data are provided for comparison in Table 3. Injury from Spin Aid + Asulox was light in all cases, reaching a maximum of 15% in July following two micro-rate applications. Corresponding weed control ranged from 64 to 86% for the same treatments.

Seed yield did not differ between these treatments (Table 3), indicating that observed slight spinach injury did not persist through the season. Seed germination percentage has not yet been determined.

Charcoal seeding study. Spinach was seeded as in the herbicide trial. Activated charcoal slurry (300 lbs/acre applied in 800 gallons/acre) was applied May 16, 2012 and preemergence (PRE) herbicides applied May 17, 2012 and postemergence (POST) herbicides June 12, 2012. Crop injury and weed control estimates were made as in the herbicide trial. Spinach plants were harvested on September 13, 2012, placed in a drying oven, and weighed. The trial was a split-plot, randomized complete block with four replicates. Herbicide was the main plot, charcoal was the split-plot.

Charcoal application did not affect foliar injury to spinach at either date (Table 4). Charcoal gave little protection from these herbicides, as injury ranged from 53 to 100% by June and from 36 to 100% in July among treatments. Weed control was uniformly excellent in June and still good by July, and charcoal did not modify weed control appreciably at either date. This indicates that either the application was faulty, or that charcoal was not mobile enough to protect spinach roots from herbicide uptake in 2012. With the exception of Karmex (1 lb) fb Asulox, most treatments did not outperform standard herbicides in absence of charcoal.

*Table beet herbicide screen.* Red beet stecklings were transplanted May 24, 2012 at WSU Mount Vernon NWREC. PPI treatments were applied May 18, PRE treatments were applied May 25 and POST treatments were applied June 6 and 27 and July 4. Crop injury, stand counts, and weed control were estimated June 13, July 9, and August 8. Beets were pulled from the plots September 25, dried in the greenhouse, and seed threshed and cleaned.

Injury to beet stecklings was greatest (>50%) following application of Callisto, Command PRE at 6.4 fl.oz/a, Goal, or Kerb (pronamide) PRE at about two weeks after PPI/PRE treatments (Table 5). Other products causing severe damage at that evaluation date was Chateau (flumioxazin) and Command PRE at 3.4 fl.oz/a. Beets treated with Callisto were still showing 63% injury at 2.5 months after treatment. Asulox caused slight, but inconsistent, foliar injury (up to 15%).

Early season weed control was poor to excellent, with micro-rate applications generally achieving the best weed control in August (Table 6). Ro-Neet, Nortron, or Dual Magnum followed by two or three micro-rate applications ranged from 81 to 97% control. In addition, Lorox (linuron) and Chateau provided a similar level of weed control as did these micro-rates.

Table beet stand was severely reduced by Callisto and Kerb (Table 7). Seed yield from these treatments has not yet been analyzed, and germination percentage has not yet been determined.

Table 1. Crop injury and weed control from spring herbicide application to eleven overwintered cabbage seed lines (2011-12).

Treatment <sup>a</sup>	Rate	Crop injury	Weed control	Fresh weight <sup>b</sup>	Cabbage stand <sup>b</sup>
		May 2	May 2		
	product/a	%	%	lb/plant	plants/plot
Simazine	1 pt	0 a	43 c	2.78 b	12.2 b
Goal XL	2 pt	0 a	73 ab	2.80 ab	12.2 b
GoalTender	1 pt	0 a	67 abc	2.96 a	12.9 a
Callisto	3 fl.oz	35 b	78 a	2.60 c	12.4 ab
Spartan	3.2 fl.oz	0 a	52 bc	2.82 ab	12.4 ab
Spartan	6.4 fl.oz	0 a	62 abc	2.75 bc	11.9 b
Non-treated check	---	0 a	0 d	2.86 ab	12.5 ab

Means within a column followed by the same letter, or without letters, are not statistically different ( $P < 0.05$ ). Cabbage was transplanted September 15, 2011.

<sup>a</sup>Simazine was applied to all plots November 10, 2011; treatment herbicides were applied February 10, 2012; Envoy was applied to all plots April 4, 2012; the active ingredient in both Goal and GoalTender is oxyfluorfen.

<sup>b</sup>Cabbage fresh weight and stand count were determined when plants began to bud, from mid-April to early May, 2012, depending on seed line.

Table 2. Crop injury and weed control in spinach seed after treatment with several herbicides (2012).

Treatment	Rate	Timing <sup>a</sup>	Weed control		Seed yield <sup>b</sup>
			June 4	July 6	
	product/a		%	%	g
Ro-Neet + Command	1.3 pt + 6.4 fl.oz	PPI + PPI	86	33 hij	353 efg
Ro-Neet + Command	1.3 pt + 10.7 fl.oz	PPI + PPI	95	70 a-f	641 b-g
Ro-Neet fb Dual Magnum	1.3 pt + 8.4 fl.oz	PPI + PRE	91	54 c-i	600 b-g
Ro-Neet fb Define	1.3 pt + 1 pt	PPI + PRE	96	76 a-d	1305 a
Ro-Neet fb Command	1.3 pt + 3.4 fl.oz	PPI + POST	85	64 a-h	889 a-e
Ro-Neet fb Command	1.3 pt + 6.4 fl.oz	PPI + POST	83	64 a-h	723 a-f
Ro-Neet fb Asulox	1.3 pt fb 3 pt	PPI + POST	86	94 a	1128 ab
Command fb Nortron	6.4 fl.oz + 4.6 fl.oz	PPI + PRE	86	41 f-i	489 d-g
Command fb Nortron	10.7 fl.oz + 4.6 fl.oz	PPI + PRE	79	43 e-i	363 efg
Command + Nortron	3.4 fl.oz + 4.6 fl.oz	PRE + PRE	91	65 a-h	873 a-e
Command + Nortron	6.4 fl.oz + 4.6 fl.oz	PRE + PRE	84	79 a-d	687 b-g
Nortron + Dual Magnum	4.6 fl.oz + 5.9 fl.oz	PRE + PRE	79	20 j	130 g
Nortron + Define	4.6 fl.oz + 1 pt	PRE + PRE	92	69 a-f	567 b-g
Nortron fb Asulox	4.6 fl.oz + 3 pt	PRE + POST	84	74 a-f	969 a-d
Command fb Dual Magnum	6.4 fl.oz + 8.4 fl.oz	PPI + PRE	84	58 b-i	701 b-g
Command fb Dual Magnum	10.7 fl.oz + 8.4 fl.oz	PPI + PRE	81	51 d-j	318 efg
Command + Dual Magnum	3.4 fl.oz + 8.4 fl.oz	PRE + PRE	71	30 ij	199 fg
Command + Dual Magnum	6.4 fl.oz + 8.4 fl.oz	PRE + PRE	89	90 ab	860 a-e
Dual Magnum + Define	8.4 fl.oz + 1 pt	PRE + PRE	91	58 b-i	765 a-f
Dual Magnum fb Asulox	8.4 fl.oz + 3 pt	PRE + POST	88	75 a-e	1026 a-d
Command	6.4 fl.oz	PPI	76	43 f-j	538 c-g
Command	10.7 fl.oz	PPI	73	59 b-i	760 a-f
Command	3.4 fl.oz	PRE	75	36 g-j	577 b-g
Command	6.4 fl.oz	PRE	85	86 abc	766 a-f
Hand weeded	---	---	0	88 ab	1095 abc

Means within a column followed by the same letter, or not followed by a letter, are not statistically different ( $P < 0.05$ ). Spinach was seeded May 12, 2012.

<sup>a</sup>PPI = pre-plant incorporated (May 11, 2012); PRE = preemergence (May 14, 2012); POST = postemergence (June 12, 2012).

<sup>b</sup>Spinach plants harvested September 13, 2012; seed weights and germination still to be determined.

Table 3. Crop injury and weed control in spinach seed after treatment with several herbicides (2012).

Treatment <sup>a</sup>	Rate	Timing <sup>b</sup>	Crop injury <sup>c</sup>	Weed control <sup>c</sup>	Seed yield <sup>d</sup>
	product/a		%	%	g
Ro-Neet + (Spin Aid + Asulox + MSO)	1.3 pt + (2 fl.oz + 1.8 pt + 1.5%)	PPI + (P7)	3	85	1177
Ro-Neet + (Spin Aid + Asulox + MSO)	1.3 pt + 3 pt + (2 fl.oz + 1.8 pt + 1.5%)	PPI + (P7 + P14)	15	64	1490
Ro-Neet + (Stinger + Asulox + MSO)	1.3 pt + (2.7 fl.oz + 1.8 pt + 1.5%)	PPI + (P7)	0	84	1447
Ro-Neet + (Stinger + Asulox + MSO)	1.3 pt + (2.7 fl.oz + 1.8 pt + 1.5%)	PPI + (P7 + P14)	10	78	1402
Nortron + (Spin Aid + Asulox + MSO)	6.1 fl.oz + (2 fl.oz + 1.8 pt + 1.5%)	PRE + (P7)	3	81	1389
Nortron + (Spin Aid + Asulox + MSO)	6.1 fl.oz + (2 fl.oz + 1.8 pt + 1.5%)	PRE + (P7 + P14)	0	84	1163
Nortron + (Stinger + Asulox + MSO)	6.1 fl.oz + (2.7 fl.oz + 1.8 pt + 1.5%)	PRE + (P7)	0	78	1484
Nortron + (Stinger + Asulox + MSO)	6.1 fl.oz + (2.7 fl.oz + 1.8 pt + 1.5%)	PRE + (P7 + P14)	13	78	1453
Dual Magnum + (Spin Aid + Asulox + MSO)	10.8 fl.oz + (2 fl.oz + 1.8 pt + 1.5%)	PRE + (P7)	0	81	1245
Dual Magnum + (Spin Aid + Asulox + MSO)	10.8 fl.oz + (2 fl.oz + 1.8 pt + 1.5%)	PRE + (P7 + P14)	0	79	1087
Dual Magnum + (Stinger + Asulox + MSO)	10.8 fl.oz + (2.7 fl.oz + 1.8 pt + 1.5%)	PRE + (P7)	3	78	1445
Dual Magnum + (Stinger + Asulox + MSO)	10.8 fl.oz + (2.7 fl.oz + 1.8 pt + 1.5%)	PRE + (P7 + P14)	0	86	1440
Hand weeded	---	---	8	91	1491

Means within a column followed by the same letter, or not followed by a letter, are not statistically different ( $P < 0.05$ ). Spinach was seeded May 12, 2012.

<sup>a</sup>MSO = methylated seed oil.

<sup>b</sup>PPI = pre-plant incorporated (May 11, 2012); PRE = preemergence (May 14, 2012); P7 = postemergence (June 12, 2012), 7 days after spinach emergence; P14 = postemergence (June 20, 2012) 14 days after spinach emergence.

<sup>c</sup>Weed control and crop injury estimated July 6, 2012.

<sup>d</sup>Plants harvested September 13, 2012; seed weights and germination still to be determined.

Table 4. Spinach injury, weed control, with and without charcoal<sup>a</sup> prior to herbicide application (2012).

Herbicide treatment <sup>b</sup>	Rate	Spinach injury <sup>c</sup>		Weed control <sup>c</sup>		Spinach biomass		Weed biomass	
		June 4	July 6	June 4	July 6	With charcoal	Without charcoal	With charcoal	Without charcoal
	product/a	%	%	%	%	g/plot	g/plot	g/plot	g/plot
Karmex	1 lb	54 bc	53 c	95 abc	73 de	403	48	141	224
Karmex	2 lb	79 abc	84 ab	96 abc	76 cde	399	70	227	154
Ro-Neet fb Karmex	1.3 pt fb 1 lb	79 abc	61 bc	97 abc	80 b-e	370	86	254	64
Ro-Neet fb Karmex	1.3 pt fb 2 lb	85 a	86 ab	97 ab	86 abc	233	88	209	116
Nortron + Karmex	6.1 fl.oz + 1 lb	54 bc	44 c	92 d	69 e	410	26	92	324
Nortron + Karmex	6.1 fl.oz + 2 lb	73 abc	63 bc	94 bcd	83 a-d	389	156	72	39
Karmex fb Asulox	1 lb fb 1.8 pt	53 c	36 c	94 cd	81 a-d	608	56	86	60
Karmex fb Asulox	2 lb fb 1.8 pt	84 ab	88 ab	95 abc	86 abc	269	0	83	38
Chateau	2.2 oz	89 a	89 ab	97 abc	82 a-d	51	0	446	200
Chateau	4.4 oz	100 a	100 a	98 ab	91 ab	0	0	249	75
Ro-Neet fb Chateau	1.3 pt fb 2.2 oz	100 a	100 a	98 a	84 a-d	0	0	216	7
Ro-Neet fb Chateau	1.3 pt fb 4.4 oz	100 a	100 a	99 a	93 a	0	0	66	0
Nortron + Chateau	6.1 fl.oz + 2.2 oz	91 a	86 ab	97 abc	81 a-d	130	0	114	37
Nortron + Chateau	6.1 fl.oz + 4.4 oz	100 a	99 a	97 abc	88 abc	0	0	73	51
Chateau fb Asulox	2.2 oz fb 1.8 pt	100 a	99 a	97 abc	87 abc	67	0	96	70
Chateau fb Asulox	4.4 oz fb 1.8 pt	100 a	99 a	97 abc	89 ab	0	0	131	19
Handweeded check	---	2 d	4 d	79 e	92 ab	517	396	8	1
With activated charcoal	---	79	72	96 a	83	226 a		151 a	
Without activated charcoal	---	78	79	95 b	84	54 b		87 b	

Means within a column followed by the same letter, or not followed by a letter, are not statistically different ( $P < 0.05$ ). Spinach was seeded May 12, 2012.

<sup>a</sup>Activated charcoal slurry (300 lbs/acre applied in 800 gallons/acre) was applied May 16, 2012.

<sup>b</sup>PPI = pre-plant incorporated (May 11, 2012); PRE = preemergence (May 17, 2012); POST = postemergence (June 12, 2012).

<sup>c</sup>Weed control and crop injury estimated June 4 and July 6, 2012.

<sup>d</sup>Plants harvested September 13, 2012.

Table 5. Table beet injury after treatment with several herbicides (2012).

Treatment <sup>a</sup>	Rate product/a	Timing <sup>b</sup>	Crop injury		
			Jun 13 %	Jul 9 %	Aug 8 %
Hand weeded	---	---	0 d	0 d	0 b
Ro-Neet + Asulox	2.7 pt + 3 pt	PPI + P21	0 d	3 cd	15 b
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7)	0 d	0 d	0 b
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7, P14)	0 d	0 d	0 b
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7, P14, P21)	0 d	0 d	0 b
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7)	0 d	18 bcd	15 b
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14)	0 d	0 d	0 b
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14, P21)	0 d	0 d	0 b
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7)	0 d	5 bcd	10 b
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14)	7 d	33 b	10 b
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14, P21)	0 d	0 d	0 b
Command	6.4 fl.oz	PPI	6 d	15 bcd	0 b
Command	10.7 fl.oz	PPI	12 cd	13 bcd	15 b
Command	3.4 fl.oz	PRE	40 bc	0 d	0 b
Command	6.4 fl.oz	PRE	65 ab	0 d	0 b
EPTC	3.5 pt	PPI	0 d	3 cd	5 b
EPTC	3.5 pt	PRE	0	13 bcd	13 b
Callisto	3 fl.oz	PRE	77 a	70 a	63 a
Chateau	2 oz	PRE	40 bc	14 bcd	8 b
Prowl H2O	2.5 pt	PRE	15 cd	0 d	0 b
Goal	2 pt	PRE	62 ab	10 bcd	10 b
Lorox	1 lb	PRE	0 d	0 d	0 b
Diuron	1 lb	PRE	0 d	0 d	0 b
Kerb	2 lb	PRE	52 ab	30 bc	18 b
Kerb	2 lb	P7	0 d	10 bcd	0 b

Means within a column and followed by the same letter, or with no letters, are not statistically different ( $P < 0.05$ ).

Table beet stecklings were transplanted May 24, 2012.

<sup>a</sup>MSO = methylated seed oil.

<sup>b</sup>PPI = pre-plant incorporated (May 18, 2012); PRE = preemergence (May 25, 2012); P7 = postemergence (June 20, 2012), 7 days after beet leaf emergence; P14 = postemergence (June 27, 2012), 14 days after beet leaf emergence; P21 = postemergence (July 4, 2012), 21 days after beet leaf emergence.

Table 6. Weed control in table beet seed after treatment with several herbicides (2012).

Treatment <sup>a</sup>	Rate product/a	Timing <sup>b</sup>	Weed control		
			Jun 13 %	Jul 9 %	Aug 8 %
Hand weeded	---	---	60 h	38 de	24 hi
Ro-Neet + Asulox	2.7 pt + 3 pt	PPI + P21	85 a-f	16 fg	40 gh
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7)	80 efg	93 ab	75 b-e
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7, P14)	81 d-g	94 ab	89 abc
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7, P14, P21)	84 b-f	96 a	80 a-e
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7)	71 gh	88 abc	69 de
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14)	75 gh	90 abc	84 a-e
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14, P21)	79 fg	93 ab	97 a
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7)	74 gh	79 bc	48 fg
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14)	78 fg	93 ab	81 a-e
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14, P21)	74 gh	94 ab	94 ab
Command	6.4 fl.oz	PPI	83 c-g	28 ef	28 hi
Command	10.7 fl.oz	PPI	81 d-g	35 de	35 gh
Command	3.4 fl.oz	PRE	93 a-f	46 d	21 hi
Command	6.4 fl.oz	PRE	95 a-e	90 abc	68 e
EPTC	3.5 pt	PPI	86 a-g	8 g	34 hi
EPTC	3.5 pt	PRE	80 efg	4 g	26 hi
Callisto	3 fl.oz	PRE	91 a-f	26 ef	15 i
Chateau	2 oz	PRE	99 a	90 abc	80 a-e
Prowl H2O	2.5 pt	PRE	96 a-d	75 c	66 ef
Goal	2 pt	PRE	99 ab	81 abc	75 b-e
Lorox	1 lb	PRE	97 abc	95 ab	88 a-d
Diuron	1 lb	PRE	98 ab	80 abc	66 ef
Kerb	2 lb	PRE	98 ab	93 ab	71 cde
Kerb	2 lb	P7	60 h	15 fg	39 gh

Means within a column and followed by the same letter, or with no letters, are not statistically different ( $P < 0.05$ ).

Table beet stecklings were transplanted May 24, 2012.

<sup>a</sup>MSO = methylated seed oil.

<sup>b</sup>PPI = pre-plant incorporated (May 18, 2012); PRE = preemergence (May 25, 2012); P7 = postemergence (June 20, 2012), 7 days after beet leaf emergence; P14 = postemergence (June 27, 2012), 14 days after beet leaf emergence; P21 = postemergence (July 4, 2012), 21 days after beet leaf emergence.

Table 4. Table beet plant stand and seed yield after treatment with several herbicides (2012).

Treatment <sup>a</sup>	Rate product/a	Timing <sup>b</sup>	Beet stand <sup>c</sup> no./plot	Seed yield <sup>d</sup> g/plant
Hand weeded	---	---	6.5 a-d	
Ro-Neet + Asulox	2.7 pt + 3 pt	PPI + P21	6.0 a-d	
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7)	7.3 abc	
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7, P14)	7.0 abc	
Ro-Neet + (Asulox + UpBeet + Stinger + MSO)	2.7 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PPI + (P7, P14, P21)	7.0 abc	
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7)	5.0 cd	
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14)	7.3 abc	
Nortron + (Asulox + UpBeet + Stinger + MSO)	1.5 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14, P21)	8.0 a	
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7)	5.8 a-d	
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14)	5.5 bcd	
Dual Magnum + (Asulox + UpBeet + Stinger + MSO)	2 pt + (1.5 pt + 0.1 oz + 1.3 fl.oz + 1.5%)	PRE + (P7, P14, P21)	7.8 ab	
Command	6.4 fl.oz	PPI	7.3 abc	
Command	10.7 fl.oz	PPI	5.8 a-d	
Command	3.4 fl.oz	PRE	7.3 abc	
Command	6.4 fl.oz	PRE	7.3 abc	
EPTC	3.5 pt	PPI	6.3 a-d	
EPTC	3.5 pt	PRE	6.0 a-d	
Callisto	3 fl.oz	PRE	0.3 e	
Prowl H2O	2.5 pt	PRE	6.0 a-d	
Goal	2 pt	PRE	6.8 a-d	
Lorox	1 lb	PRE	6.3 a-d	
Diuron	1 lb	PRE	6.5 a-d	
Kerb	2 lb	PRE	6.5 a-d	
Kerb	2 lb	P7	4.5 d	
Chateau	2 oz	PRE	6.5 a-d	

Means within a column and followed by the same letter, or with no letters, are not statistically different ( $P < 0.05$ ). Table beet stecklings were transplanted May 24, 2012.

<sup>a</sup>MSO = methylated seed oil.

<sup>b</sup>PPI = pre-plant incorporated (May 18, 2012); PRE = preemergence (May 25, 2012); P7 = postemergence (June 20, 2012), 7 days after beet leaf emergence; P14 = postemergence (June 27, 2012), 14 days after beet leaf emergence; P21 = postemergence (July 4, 2012), 21 days after beet leaf emergence.

<sup>c</sup>Beet stand was estimated August 8, 2012.

<sup>d</sup>Beet plants were harvested September 25, 2012; seed weights and germination still to be determined.