

Weed control in vegetable seed.

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Five vegetable seed studies were conducted in 2000: two studies each in table beet seed and spinach seed, and one in cabbage seed.

Materials and Methods.

Table beets: Herbicide trial and New herbicide trial. Table beet seedlings were transplanted at WSU Mount Vernon April 21. Preplant incorporated, preemergence, and postemergence treatments were applied April 21, May 1, and June 1, respectively. Weed control and crop injury were estimated July 9 and August 2 at WSU Mount Vernon. On October 4, plants in each plot were counted and three representative plants were cut. These were dried in the greenhouse and the seed threshed November 6. Both trials were randomized complete blocks with four replicates.

Spinach: Herbicide trial and New herbicide trial. Spinach was seeded at WSU Mount Vernon May 8. Preplant incorporated, preemergence, and postemergence herbicides were applied May 8, May 13, and June 16, respectively. Weed control and spinach injury were estimated July 9 and August 2. Female plants in the herbicide trial were counted August 20, and five representative female plants were cut, dried in the greenhouse, and seed threshed October 3. Due to low stand counts in the new herbicide trial, no spinach plants were harvested. Both trials were randomized complete blocks with four replicates.

Cabbage herbicide trial. Cabbage seedlings (2- to 3-leaf) were transplanted at WSU Mount Vernon August 21, 1999 and at-transplant treatments applied August 27. Initial weed control and crop injury were estimated September 7. A split-plot application of Tough was applied to all plots September 10, and crop injury/weed control were again estimated October 13. Stand counts were made March 20, 2000 and general weed control again estimated March 30. Two cabbage plants were cut August 14 and plants allowed to dry in the field. Biomass of these dried plants was recorded August 28. The trial was a split-plot, randomized complete block with four replicates.

Results.

Table Beets. No treatment in the herbicide trial caused visible foliar injury (data not shown). Seven treatments were still providing >85% weed control by August 2 (Table 1): Nortron (PRE) followed by Pyramin (POST), Dual Magnum (PRE) followed by Betamix, Betamix Progress, or Pyramin (POST), Frontier (PRE) followed by Pyramin (POST), or Pyramin at 3.7 lbs/a (POST) followed by Betamix Progress or Frontier (POST).

In the new herbicide trial, most herbicides caused severe injury to developing foliage, with the exception of Visor and Spartan applied PRE (Table 2). These treatments initially resulted in excellent weed control, but control had dropped to 75 and 69% by August 2. Additional testing of these products at lower rates in tank mixtures with other products is warranted based on these data.

No treatment in either trial significantly reduced stand counts or seed yield from handweeded table beets (data not shown).

Spinach. Six treatments in the herbicide trial were still providing >80% weed control by August 2 (Table 3): Ro-Neet (PPI) followed by Pyramin or Spin Aid (POST), Dual Magnum (PRE) followed by Pyramin (POST), Pyramin + Frontier (PRE), or Pyramin (PRE) followed by Frontier or Spin Aid (POST). None of these treatments caused more than slight crop injury by June 9 (Table 3) or significantly reduced crop stands (Table 4). Treatments causing moderate crop injury were Dual Magnum + Nortron, Nortron + Frontier, Ro-Neet + Frontier, and Ro-Neet + Nortron, but only Dual Magnum + Nortron and Pyramin + Staple significantly reduced spinach stand count.

All treatments in the herbicide trial except Pyramin + Staple produced statistically as much seed as the handweeded check (Table 4).

In the new herbicide trial, all PRE herbicide treatments caused excessive injury to spinach, killing most to all spinach plants (Table 5). POST treatments also caused foliar injury (data not shown), but, with the exception of Spartan, did not kill the plants. Based on these data, none of these herbicides are likely candidates for further testing.

Cabbage. Prowl stunted cabbage transplants, eventually causing 41% growth reduction at 46 DAT (Table 6). Tough initially caused moderate injury, but plants had recovered by 13 DAT (data not shown). Most Tough combinations were providing > 85% weed control by September 23, with Spartan + Tough at 94%. By March, however, none of the treatments were adequately controlling weeds without crop injury. Stand counts and biomass of cabbage plants in 2000 were not statistically different.

Table 1. Weed control from several herbicide combinations used in table beet seed.

Treatment	Timing ^a	Rate	Weed control	
			6/9	8/2
		product/a	-----	% -----
Ro-Neet + Frontier	PPI + PRE	2.6 pt + 1.3 pt	88	60
Ro-Neet + Stinger + UpBeet	PPI + POST + POST	4 pt + 0.25 pt + 0.5 oz	53	36
Ro-Neet + Pyramin	PPI + POST	4 pt + 2.2 lb	68	76
Dual Magnum + Nortron	PRE	1 pt + 1.9 pt	93	79
Dual Magnum + Frontier	PRE	1 pt + 1.3 pt	91	81
Nortron + Frontier	PRE	1.9 pt + 1.3 pt	96	72
Nortron + UpBeet	PRE + POST	2.9 pt + 0.5 oz	81	56
Nortron + Stinger + UpBeet	PRE + POST + POST	2.9 pt + 0.25 pt + 0.5 oz	85	80
Nortron + Pyramin	PRE + POST	2.9 pt + 2.2 lb	85	90
Dual Magnum + Betamix	PRE + POST	1.6 pt + 3.1 pt	94	85
Dual Mag. + Betamix Prog.	PRE + POST	1.6 pt + 2.2 pt	96	93
Dual Magnum + Pyramin	PRE + POST	1.6 pt + 2.2 lb	86	88
Frontier + Pyramin	PRE + POST	1.3 pt + 2.2 lb	91	90
Pyramin + Betamix	PRE + POST	3.7 lb + 3.1 pt	92	79
Pyramin + Betamix Prg.	PRE + POST	3.7 lb + 2.2 pt	97	90
Pyramin + Frontier	PRE + POST	3.7 lb + 1.3 pt	91	90
Pyramin + Frontier	PRE + POST	2.2 lb + 1.3 pt	55	44
Betamix + Frontier	POST	3.1 pt + 1.3 pt	0	71
Betamix Prog. + Frontier	POST	2.2 pt + 1.3 pt	0	51
Pyramin + UpBeet	POST	2.2 lb + 0.5 oz	0	68
Frontier + Pyramin	POST	1.3 pt + 2.2 lb	0	68
Handweeded check	C	C	100	100
Weedy check	C	C	0	0
LSD _{0.05}	C	C	8	25

^aPPI = preplant incorporated; PRE = preemergence; POST = postemergence.

Table 2. Weed control from several new herbicides used in table beet seed.

Treatment	Timing ^a	Rate	Crop injury	Weed control		Crop density
				6/9	8/2	
		product/a	%	----- % -----		pl./plot
Milestone	PRE	8 oz	43	96	93	9
Visor	PRE	2 pt	18	99	75	8
Spartan	PRE	0.3 lb	13	79	69	9
Balance	PRE	2 oz	80	99	78	7
First Rate	PRE	0.6 oz	53	98	94	4
Broadstrike	PRE	1.1 oz	44	98	97	6
Visor	POST	2 pt	20	8	18	8
Spartan	POST	0.3 lb	93	92	74	6
Resource	POST	0.38 pt	68	26	13	7
Reflex	POST	1.5 pt	58	33	71	7
Weedy check	C	C	0	0	13	8
LSD _{0.05}	C	C	25	13	27	ns

^aPRE = preemergence; POST = postemergence.

Table 3. Weed control from several herbicide combinations used in spinach seed.

Treatment	Timing ^a	Rate	Crop injury ^b	Weed control		
				6/9	8/2	
		product/a	%	-----	%	-----
Ro-Neet + Dual Magnum	PPI + PRE	1.3 pt + 0.5 pt	6	90	78	
Ro-Neet + Pyramin	PPI + POST	1.3 pt + 1.5 lb	1	78	83	
Ro-Neet + Nortron	PPI + PRE	1 pt + 0.5 pt	10	91	75	
Ro-Neet + Frontier	PPI + PRE	1.3 pt + 1 pt	14	96	78	
Nortron + Pyramin	PRE + POST	0.5 pt + 1.1 lb	4	70	66	
Nortron + Frontier	PRE	0.5 pt + 1 pt	19	96	66	
Dual Magnum + Pyramin	PRE + POST	0.5 pt + 1.5 lb	3	85	87	
Dual Magnum + Nortron	PRE	0.5 pt + 1.4 pt	23	96	74	
Dual Magnum + Frontier	PRE	0.5 pt + 1 pt	8	91	66	
Pyramin + Frontier	PRE	1.5 lb + 1 pt	8	97	91	
Ro-Neet + Frontier	PPI + POST	1.3 pt + 0.67 pt	1	73	66	
Ro-Neet + Spin Aid	PPI + POST	1.3 pt + 3.1 pt	1	76	84	
Ro-Neet + Pyramin	PPI + POST	1.3 pt + 1.5 lb	0	81	75	
Nortron + Frontier	PRE + POST	0.5 pt + 0.67 pt	1	75	79	
Nortron + Betamix	PRE + POST	0.5 pt + 3.1 pt	3	55	46	
Nortron + Pyramin	PRE + POST	0.5 pt + 0.7 lb	0	74	68	
Pyramin + Frontier	PRE + POST	1.5 lb + 0.67 pt	0	83	86	
Pyramin + Spin Aid	PRE + POST	1.5 lb + 3.1 pt	0	81	95	
Dual Magnum + Frontier	PRE + POST	0.5 pt + 0.67 pt	0	71	58	
Dual Magnum + Spin Aid	PRE + POST	0.5 pt + 3.1 pt	0	74	73	
Dual Magnum + Pyramin	PRE + POST	0.5 pt + 0.7 lb	1	79	68	
Spin Aid + Frontier	POST	3.1 pt + 0.67 pt	B	0	75	
Spin Aid + Pyramin	POST	3.1 pt + 0.7 lb	B	0	8	
Pyramin + Staple	POST	0.7 lb + 1.2 oz	B	0	51	
Handweeded check	C	C	0	100	100	
LSD _{0.05}	C	C	5	10	24	

^aPPI = preplant incorporated; PRE = preemergence; POST = postemergence.

^bOn this date (6/9), POST treatments had not yet been applied.

Table 4. Crop density and seed yield of spinach after treatment with several herbicide combinations.

Treatment	Timing ^a	Rate	Crop density	Seed yield
		product/A	no./plot lbs/A	
Ro-Neet + Dual Magnum	PPI + PRE	1.3 pt + 0.5 pt	44	1912
Ro-Neet + Pyramin	PPI + POST	1.3 pt + 1.5 lb	56	1918
Ro-Neet + Nortron	PPI + PRE	1 pt + 0.5 pt	56	1742
Ro-Neet + Frontier	PPI + PRE	1.3 pt + 1 pt	48	1381
Nortron + Pyramin	PRE + POST	0.5 pt + 1.1 lb	46	1257
Nortron + Frontier	PRE	0.5 pt + 1 pt	50	1475
Dual Magnum + Pyramin	PRE + POST	0.5 pt + 1.5 lb	50	2137
Dual Magnum + Nortron	PRE	0.5 pt + 1.4 pt	42	904
Dual Magnum + Frontier	PRE	0.5 pt + 1 pt	49	1999
Pyramin + Frontier	PRE	1.5 lb + 1 pt	52	2128
Ro-Neet + Frontier	PPI + POST	1.3 pt + 0.67 pt	49	943
Ro-Neet + Spin Aid	PPI + POST	1.3 pt + 3.1 pt	60	2424
Ro-Neet + Pyramin	PPI + POST	1.3 pt + 1.5 lb	56	2229
Nortron + Frontier	PRE + POST	0.5 pt + 0.67 pt	56	1721
Nortron + Betamix	PRE + POST	0.5 pt + 3.1 pt	46	1091
Nortron + Pyramin	PRE + POST	0.5 pt + 0.7 lb	55	1973
Pyramin + Frontier	PRE + POST	1.5 lb + 0.67 pt	57	1975
Pyramin + Spin Aid	PRE + POST	1.5 lb + 3.1 pt	50	2281
Dual Magnum + Frontier	PRE + POST	0.5 pt + 0.67 pt	52	1024
Dual Magnum + Spin Aid	PRE + POST	0.5 pt + 3.1 pt	53	2194
Dual Magnum + Pyramin	PRE + POST	0.5 pt + 0.7 lb	50	1507
Spin Aid + Frontier	POST	3.1 pt + 0.67 pt	51	1789
Spin Aid + Pyramin	POST	3.1 pt + 0.7 lb	45	1782
Pyramin + Staple	POST	0.7 lb + 1.2 oz	12	0
Handweeded check	C	C	53	1633
LSD _{0.05}	C	C	11	1100

^aPPI = preplant incorporated; PRE = preemergence; POST = postemergence.

Table 5. Weed control from several new herbicides used in spinach seed.

Treatment	Timing ^a	Rate product/a	Crop injury ^b %	Weed control		Crop density pl./plot
				6/9 %	8/2 %	
Milestone	PRE	8 oz	100	99	99	0
Visor	PRE	2 pt	89	99	97	2
Spartan	PRE	0.3 lb	100	94	83	0
Balance	PRE	2 oz	100	99	76	0
First Rate	PRE	0.6 oz	78	96	84	6
Broadstrike	PRE	1.1 oz	83	98	88	1
Visor	POST	2 pt	B	0	28	36
Spartan	POST	0.3 lb	B	0	25	2
Resource	POST	0.38 pt	B	0	13	36
Reflex	POST	1.5 pt	B	0	25	33
Weedy check	C	C	0	0	0	22
LSD _{0.05}	C	C	4	2	10	9

^aPRE = preemergence; POST = postemergence.

^bOn this date (6/9), POST treatments had not yet been applied.

Table 6. Weed control from several herbicides and herbicide combinations used in cabbage seed.

Treatment	Timing ^a	Rate product/A	Weed control		
			9/7 ^b	10/23	3/30
			----- % -----		
Dual Magnum	POTR	1 pt	51	43	33
Dual Magnum + Tough	POTR + POST	1 pt + 1 pt	B	84	66
Spartan	POTR	5.25 oz	98	81	45
Spartan + Tough	POTR + POST	5.25 oz + 1 pt	B	94	54
Frontier	POTR	0.33 pt	51	28	30
Frontier + Tough	POTR + POST	0.33 pt + 1 pt	B	85	55
Milestone	POTR	0.5 oz	91	58	18
Milestone + Tough	POTR + POST	0.5 oz + 1 pt	B	85	35
Resource	POTR	0.33 pt	79	35	23
Resource + Tough	POTR + POST	0.33 pt + 1 pt	B	73	33
Prowl	POTR	3.6 pt	97	95	85
Prowl + Tough	POTR + POST	3.6 pt + 1 pt	B	96	84
Paramount	POTR	10 oz	66	30	23
Paramount + Tough	POTR + POST	10 oz + 1 pt	B	78	34
Simazine	POTR	14 oz	64	70	58
Simazine + Tough	POTR + POST	14 oz + 1 pt	B	88	71
LSD _{0.05}	C	C	19	11	7

^aPOTR = post-transplant, prior to weed emergence; POST = postemergence to weeds.

^bOn this date, the Tough treatment had not yet been applied.

Table 7. Crop injury from several herbicides and herbicide combinations in cabbage seed.

Treatment	Timing ^a	Rate product/A	Crop Injury	
			9/7 ^b	10/23
			----- % -----	
Dual Magnum	POTR	1 pt	0	0
Dual Magnum + Tough	POTR + POST	1 pt + 1 pt	B	0
Spartan	POTR	5.25 oz	0	0
Spartan + Tough	POTR + POST	5.25 oz + 1 pt	B	0
Frontier	POTR	0.33 pt	0	0
Frontier + Tough	POTR + POST	0.33 pt + 1 pt	B	0
Milestone	POTR	0.5 oz	0	0
Milestone + Tough	POTR + POST	0.5 oz + 1 pt	B	0
Resource	POTR	0.33 pt	0	0
Resource + Tough	POTR + POST	0.33 pt + 1 pt	B	0
Prowl	POTR	3.6 pt	9	41
Prowl + Tough	POTR + POST	3.6 pt + 1 pt	B	41
Paramount	POTR	10 oz	0	0
Paramount + Tough	POTR + POST	10 oz + 1 pt	B	0
Simazine	POTR	14 oz	0	0
Simazine + Tough	POTR + POST	14 oz + 1 pt	B	0
LSD _{0.05}	C	C	2	11

^aPOTR = post-transplant, prior to weed emergence; POST = postemergence to weeds.

^bOn this date, the Tough treatment had not yet been applied.