Management of Volunteer Potato in Dry Bulb Onions and Carrots

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Carrots and onions are often rotated with potatoes and tubers that survive winter can sprout in the spring and severely reduce carrot and onion growth and yield. Growers can spend in excess of $200 per acre hand weeding potatoes out of carrot and onion crops.

Studies have shown that spring or fall fumigation with metham sodium (Vapam, Busan, and others) and 1, 3, -dichloropropene (Telone II) can reduce the number of volunteer potatoes in the subsequent crop (Boydston, unpublished data). Lower rates of fumigants are less effective in killing tubers. Most tubers left after harvest are located at shallow depths of 0 to 4 inches, and in many winters these shallow tubers are killed by low temperatures. Tubers that are deeper than 4 inches are often likely to over winter due to warmer soil temperatures at the deeper depths. Tubers at these lower depths should be targeted with fumigants in normal winters while tubers at the shallower depths should be targeted with fumigants in mild winters. The method of application and placement of fumigant will affect the amount of fumigant in contact with tubers at various depths and the level of tuber kill. Follow labels for proper rates, soil temperatures, soil moisture, and time required between fumigation and planting of subsequent crop.

Carrots and onions often emerge slowly, so potato shoots that emerge before the crop can be killed with nonselective herbicides such as, paraquat (Gramoxone) or glyphosate (Roundup). However, tubers will normally send up new shoots within two weeks after herbicide application or tillage. Delayed planting of carrots or onions will maximize the number of potatoes that emerge prior to planting and allow for tillage or herbicide application to kill emerged shoots.

Onions

Preemergence (PRE) or early postemergence (POST) herbicides labeled in onions such as, bensulide (Prefar), DCPA (Dacthal), pendimethalin (Prowl), metolachlor (Dual), and trifluralin (Treflan), do not suppress volunteer potatoes. The POST applied grass herbicides sethoxydim (Poast), fluazifop (Fusilade), and clethodim (Select) also do not control volunteer potatoes.

Bromoxynil (Buctril) and oxyfluorfen (Goal) are labeled for control of emerged broadleaf weeds when onions have at least two true leaves. Weed control is best when weeds are small (1-3 leaf stage). Crop injury can result from POST application of herbicides. Cool cloudy weather before herbicide application can delay the development of the onion leaf cuticle and result in increased onion injury from oxyfluorfen and bromoxynil.

Trials were conducted in 1996 and 2000 at Prosser, WA to evaluate herbicide and cultivation treatments for volunteer potato control in sprinkler-irrigated onions.

Seventeen herbicide treatments were tested in 1996 and thirteen treatments in 2000. Earlier studies indicated a cultivation about 7-10 days after POST applied herbicides greatly reduced the number of daughter tubers produced on volunteer potato plants, so plots were cultivated 7-10 days after each POST herbicide application in both years of this study.

1996 Trial. In 1996, ethofumesate (Nortron) applied PRE at 1 or 2 lb. ai/acre followed by two applications of ethofumesate plus bromoxynil applied POST reduced potato tuber weight and number of tubers, but excessively injured onions and reduced onion yield by 87% compared to hand weeded checks (Table 1). Bentazon (Basagran) and bromoxynil applied POST two or three times caused yellow chlorotic potato foliage for several weeks after application, but plants eventually recovered. Pyridate (Tough) applied twice POST failed to control potatoes when applied at the 1.1 kg/ha rate, but controlled potatoes well at the 2.2 kg/ha rate. Onion yield was reduced in bentazon, bromoxynil, and pyridate treated plots due to either crop injury from herbicides or lack of potato control.

Two POST applications of fluroxypyr or clopyralid with bromoxynil at the 2- and 3-lf stage of onions caused epinastic growth of potato foliage, which lasted most of the season. Clopyralid (Stinger) plus bromoxynil and carfentrazone (Aim) applied POST at the 2- and 3-leaf stage of onions severely injured onions and reduced onion yield by 86% and 61%, respectively. Fluroxypyr (Starane) plus bromoxynil applied postemergence at the 2- and 3-leaf stage injured onions and reduced onion yield by 66%. Bromoxynil was safe on onions, but did not control volunteer potatoes as well as oxyfluorfen.

Oxyfluorfen applied POST three times alone or with bromoxynil at the 2, 3, and 4-5 leaf stages of onions followed by cultivation reduced volunteer potato tuber weight and number of tubers equal to or more than all other treatments (Table 1). When oxyfluorfen was applied POST three times alone or with bromoxynil onion yield was equal to that of hand weeded checks.

2000 Trial. In 2000, all herbicide treatments followed by cultivation significantly reduced the number and weight of potato daughter tubers produced compared to nontreated, cultivated checks. The low rate of ethofumesate at 0.5 lb. ai/acre applied PRE followed by two applications of ethofumesate plus bromoxynil applied POST controlled volunteer potatoes well and did not reduce onion yield compared to hand weeded checks (Table 2).

Two applications of fluroxypyr applied POST at the 2- and 3-leaf onion stage reduced potato tuber weight and number the greatest, but reduced onion yield by 28% compared to hand weeded checks. Applying bromoxynil or oxyfluorfen with fluroxypyr controlled potatoes similar to fluroxypyr applied alone. However, applying bromoxynil with fluroxypyr tended to increase onion injury and decrease onion yield (Table 2).

Two applications of clopyralid plus bromoxynil applied POST severely reduced onion yield by 88% compared to hand weeded checks. Bromoxynil did not appear to control potatoes well, but reduced final weight and number of daughter tubers in 2000. However, remaining potatoes in bromoxynil treated plots reduced onion yield by 19% compared to hand weeded checks.

Oxyfluorfen applied POST three times alone or tank mixed with bromoxynil reduced potato tuber number and weight compared to nontreated checks and onion yield was equal to hand weeded checks (Table 2).

Table 1. Onion and volunteer potato yield with herbicide and cultivation treatments.

Potatoes planted March 29, 1996; onions planted April 5, 1996.
Dacthal applied preemergence April 8, 1996 except to treatments 16 & 17, which received Nortron preemergence at 1 and 2-lb. ai/a, respectively.

	Application Timing to Onions			
Early Post (2-lf)	Post (3-lf)	Late Post (4-5 lf)	Onion	Potato
---------------------- (lbs ai or ae/a)	----------------------		------(T/a)------	
1. Goal 0.2	Goal 0.2		20	2.9
2. Goal 0.2	Goal 0.15	Goal 0.15	23	0.7
3. Buctril 0.2/Goal 0.15	Buctril 0.2/Goal 0.15		11	4.9
4. Buctril 0.2/Goal 0.15	Buctril 0.2/Goal 0.15	Buctril 0.2/Goal .15	21	0.4
5. Buctril 0.3	Buctril 0.25		8	5.9
6. Buctril 0.3	Buctril 0.25	Buctril 0.25	8	3.3
7. Aim 0.025	Aim 0.025		9	6.3
8. Starane 0.25/Buc 0.2	Starane 0.25/Buctril 0.2		8	0.8
9. Scythe 5%	Scythe 5%		7	7.6
10. Scythe 10%	Scythe 10%		5	6.8
11. Tough 0.9	Tough 0.9		7	5.1
12. Tough 1.8	Tough 1.8		1	0.4
13. Basagran 1.0	Basagran 1.0		4	10.7
14. Basagran 2.0	Basagran 2.0		1	6.9
15. Stinger 0.19/Buc 0.2	Stinger 0.19/Buctril 0.2		3	2.1
16. Nortron 0.5/Buc 0.2	Nortron 0.5/Buctril 0.2		3	4.9
17. Nortron 1.0/Buc 0.2	Nortron 1.0/Buctril 0.2		1	1.7
18. Dacthal pre and cultivation			6	9.5
19. Dacthal pre and cultivation and hand weeded			23	0
LSD (0.05)			4.2	2.28

Table 2. Onion and volunteer potato yield with herbicide and cultivation treatments.

Potatoes planted March 30, 2000; onions planted April 12, 2000.
Dachal applied preemergence April 14, 2000, except to treatments 10, 11, & 12, which received Nortron preemergence at 0.5, 1, and 2 lb ai/a, respectively.

	Application Timing to Onions				
	Early Post (2-lf)	Post (3-lf)	Late Post (4-5 lf)	Onion	Potato
	---------------------- (lbs ai or ae/a)	------------------------		----(T/a)----	
1.	Buctril 0.2/Goal 0.15	Buctril 0.2/Goal 0.15		38	0.8
2.	Buctril 0.2/Goal 0.15	Buctril 0.2/Goal 0.15	Buctril 0.2/Goal .15	36	0.5
3.	Goal 0.2	Goal 0.2		33	1.6
4.	Goal 0.2	Goal 0.15	Goal 0.15	37	1.5
5.	Buctril 0.3	Buctril 0.25		30	0.6
6.	Buctril 0.3	Buctril 0.25	Buctril 0.25	32	0.5
7.	Starane 0.25	Starane 0.25		28	0.1
8.	Starane 0.25/Buc 0.2	Starane 0.25/Buc 0.2		25	0.2
9.	Starane 0.25/Goal 0.15	Starane 0.25/Goal 0.15		30	0.3
10.	Nortron 0.25/Buc 0.2	Nortron 0.25/Buc 0.2		35	0.5
11.	Nortron 0.5/Buc 0.2	Nortron 0.5/Buctril 0.2		21	0.5
12.	Nortron 1.0/Buc 0.2	Nortron 1.0/Buctril 0.2		9	0.3
13.	Stinger 0.19/Buc 0.2	Stinger 0.19/Buc 0.2		5	0.5
14.	DCPA pre			5	12.5
15.	DCPA pre and cultivation			20	4.6
16.	DCPA pre and cultivation and hand weeded			39	0
	LSD (0.05)			7.3	1.67

When potatoes were not suppressed with herbicides or cultivation early in the season, onion stand and yield was severely reduced. Colorado potato beetles severely infested all plots in both 1996 and 2000 during late June and July and defoliated remaining potato plants. It was observed in 2000 that Colorado potato beetles infested herbicide injured potatoes to a greater degree than nontreated check plots and defoliated potato plants sooner in herbicide injured plots.

Onion Tolerance Trial to Starane Herbicide 2000. A field trial was conducted in 2000 at Prosser, WA to determine the tolerance and yield response of onions to fluroxypyr (Starane). Seven herbicide treatments were tested in a randomized complete block design with four replications. All plots were kept weed free with a PRE application of DCPA (Dacthal) and a POST application of oxyfluorfen (Goal) at the 2-leaf stage and hand weeding. Onions, variety AsgrowEX15120, were planted April 17, 2000 in 22-inch rows on a Warden silt loam soil. POST herbicides were applied on May 31 and June 14, 2000 when onions were in the 2-leaf and 4-leaf stage, respectively. Herbicides were applied in a spray volume of 50 gpa.

Table 3. Onion tolerance to Starane herbicide applied at the 2- and 4-leaf stage.

Treatment		Rate	Onion Stage	6-7-00 Onion injury	6-19-00 Onion injury	7-26-00 Onion injury	Onion Yield
		(lb ai or ae/a)		%	%	%	(T/A)
1	Dacthal	8	Pre	7.5 b	0.0 c	0.0 a	27.0 ab
	Goal	0.125	2 lf				
2	Dacthal	8	Pre	11.3 b	3.3 c	0.0 a	28.4 ab
	Starane	0.125	2 lf				
3	Dacthal	8	Pre	22.5 a	7.3 c	0.0 a	28.3 ab
	Starane	0.25	2 lf				
4	Dacthal	8	Pre	18.3 a	1.3 c	1.3 a	31.3 ab
	Goal	0.125	2 lf				
	Starane	0.125	2 lf				
5	Dacthal	8	Pre	20.0 a	2.5 c	0.0 a	28.4 ab
	Goal	0.125	2 lf				
	Starane	0.25	2 lf				
6	Dacthal	8	Pre	10.8 b	33.8 b	2.5 a	24.6 b
	Goal	.0125	2 lf				
	Starane	0.125	4 lf				
7	Dacthal	8	Pre	11.5 b	45.0 a	2.5 a	25.9 b
	Goal	0.125	2 lf				
	Starane	0.25	4 lf				
8	Hand Weeded Check			0.0 c	0.0 c	0.0 a	33.8 a

Means followed by same letter do not significantly differ according to LSD (P=.05).

Fluroxypyr visually injured onions for about 10 days after each application. Onion injury was greater when fluroxypyr was applied at 0.25 lb ae/a compared to 0.125 lb ae/a. Tank mixing Starane with Goal increased onion injury only at the lower rate of Starane (0.125 lb ae/a) compared to Starane applied alone at the same rate. Onion yield was not reduced by Starane applied at 0.125 or 0.25 lb ae/a at the 2-leaf stage compared to hand weeded checks or Dacthal plus Goal standard treatment. However, Starane at 0.125 or 0.25 lb ae/a applied at the 4-leaf stage of onion reduced onion yield from 23 to 27% compared to the hand weeded check. Reduced onion yields were mainly due to fewer onions in the >4 in. diameter category.

Previous studies have indicated a minimum of 0.19 lb ae/acre fluroxypyr is required for good suppression of volunteer potatoes (Boydston, unpublished data). Thus, the margin of selectivity of fluroxypyr for volunteer potato control in onions is narrow. A section 18 label for fluroxypyr use in onions in Colorado is currently being pursued.

In a separate study, 25% and 50% solutions of fluroxypyr or glyphosate (Roundup) in water applied to volunteer potatoes with a wiper application almost totally eliminated potatoes in onions, without much injury to onion plants. This application method would significantly increase application costs to growers, but could reduce onion injury with fluroxypyr.

Carrots

None of the herbicides currently labeled in carrots suppress volunteer potatoes other than Roundup applied prior to carrot emergence. Fumigation prior to carrot planting, cultivation, and hand weeding are the main methods use to control volunteer potatoes in carrots.

Carrot Tolerance to Fluroxypyr (Starane) Herbicide. Fluroxypyr has been used to control volunteer potatoes in corn and wheat crops so a field trial was conducted in 2000 at Mercer Ranches near Paterson, WA to determine the tolerance and yield response of carrots to fluroxypyr (Starane). Eight herbicide treatments were tested in a randomized complete block design with four replications. Plots were infested with volunteer potatoes that had over wintered from the previous season. Other weeds were controlled by the grower with trifluralin (Treflan), linuron (Lorox) and cultivation. Carrots, variety Apache, were planted March 27, 2000 in an arrangement of 6-rows/ bed with beds placed on 40-inch centers. The soil was a Sagehill fine sandy loam. Herbicides were applied POST on May 12 and May 23, 2000 when carrots were in the 3-leaf (2 in. tall) and 4 to 5-leaf (4 in. tall) stages, respectively. Herbicides were applied in a spray volume of 20 gpa.

Table 4. Carrot tolerance and potato control with fluroxypyr (Starane) applied at two stages of carrot growth.

Treatment		Rate	Carrot height	May 31 Carrot injury	May 31 Potato control	June 14 Carrot injury	June 14 Potato control	Carrot yield
		(lb ae/a)	(in.)	%	%	%	%	(T/a)
1	Starane	0.125	2	15	11	14	11	22
2	Starane + LI700	0.125	2	15	26	18	23	23
3	Starane	0.25	2	38	49	49	45	13
4	Starane + LI700	0.25	2	30	54	48	50	17
5	Starane	0.125	4	36	41	18	45	22
6	Starane + LI700	0.125	4	31	40	13	59	22
7	Starane	0.25	4	50	65	40	69	14
8	Starane + LI700	0.25	4	46	60	25	63	18
9	Untreated Check			0	0	0	0	24
LSD (P=0.05)				12.4	14.6	12.7	10.7	7.7

Carrots were injured by fluroxypyr applied at both stages of growth and injury was greater with the 0.25 lb ae/a rate. Carrots leaves exposed at the time of herbicide application were twisted downward and carrot roots had more hairs and callus-like bumps on the surface several weeks after application. Herbicide symptoms on carrots lessened later in the season and final carrot yield was not significantly reduced with the 0.125 lb ae/a rate of fluroxypyr. Carrot yield was reduced by fluroxypyr applied at the 0.25 lb ae/a rate without any surfactant added. Potato control was less than 70% with all the fluroxypyr treatments. Potato tubers that were produced on volunteer plants were collected and their ability to sprout is currently being determined.

Given the level of early season carrot injury, carrot yield reduction, and narrow margin of selectivity of fluroxypyr on carrots, it is not likely fluroxypyr will be developed for use in carrots.