

Evaluation of Preemergence Herbicides for Onion Weed Control

K. Umeda, G. Gal, and B. Strickland

Abstract

At three test sites, ethofumesate (Nortron®) at 1.0 and 2.0 lb AI/A was safe on onions. Nortron appeared to provide marginal control of light to moderate weed infestations of London rocket (Sisymbrium irio) at two sites. Pendimethalin (Prowl®) at 0.50 and 0.75 lb AI/A was safe on onions at two sites with furrow irrigation. At three sites with sprinkler irrigation, Prowl treatments caused as high as 62 to 88% stand reduction when sprinklers were used to incorporate the herbicide. Bensulide (Prefar®) injured onions at early rating dates and height measurements indicated that the plants were shortened relative to the untreated check. End of the season visual observations showed that onions had grown out of the initial injury and the crop did not appear to be damaged. Prefar combined with Prowl or Nortron was more injurious to onions with sprinkler irrigation than with furrow irrigated incorporation. Prefar gave marginal weed control in the tests under conditions with low weed infestations. Lactofen (Cobra®) was injurious to onions at all five test sites and caused significant crop stand reduction. Combination treatments of Prowl with DCPA (Dacthal®) or Prefar were damaging to onions under sprinklers but injury was minimal with furrow irrigations. Metolachlor (Dual®) and dimethenamid (Frontier®) caused minimal injury and no stand reduction of onions under sprinklers but with furrow irrigation, the stand was reduced and height reduction was substantial. The series of field tests demonstrated that herbicide performance was significantly influenced by irrigation practices. Prowl herbicide was extremely injurious and caused substantial crop stand reduction with sprinkler irrigation. Dual and Frontier exhibited less injury on onions under sprinklers than with furrow irrigation. Cobra at 0.25 lb AI/A was damaging to onions regardless of irrigation practice.

Introduction

The impending loss of Dacthal herbicide from the marketplace places a significant burden on weed control practices in dry bulb onions production. Dacthal has provided good weed control of most weeds when onion crops are being established. Onions are extremely slow growing and weeds germinate and compete vigorously with the crop before alternative postemergence herbicides can be used safely. Alternative weed control practices will be necessary and the use of safe and effective preemergence (PREE) herbicides will compliment mechanical cultivations and hand-hoeing. These field tests were conducted to evaluate potential herbicides for weed control efficacy and onion crop safety.

Materials and Methods

Five small plot field tests were conducted within commercial onion fields in the Tolleson, Glendale, and Waddell areas west of Phoenix. All of the tests were established on conventionally planted onions on 40-inch beds with six, eight, or nine seedlines per bed during late October and early November 1997. The treatment plots consisted of two beds measuring 25 ft in length and arranged in a randomized complete block design with three replicates. All herbicide applications were made with a CO₂ backpack sprayer with a hand-held boom equipped with four flat fan 8002 nozzle tips. The herbicide treatments were broadcast applied in 22 gpa water that was pressurized to 40 psi. All test sites were irrigated within one to three days after PREE herbicide applications were made. After crops were established, sprinklers were removed at three sites and then furrow irrigated for the remainder of the growing season. The test site at Tolleson "B" was inadvertently oversprayed with Dacthal at 9.0 lb AI/A. At intervals after applications, onion injury and stand reduction was evaluated by visual observations and plant height and count measurements. Weed control efficacy was evaluated visually but several sites had minimal weed infestations.

Location	Onion Cultivar	Irrigation	Application date	Soil temperature	Air temperature
Waddell "A"	Ultra	furrow	10 Nov	68 F, dry	78 F, cloudy
Waddell "B"	Sweet Magnolia	furrow	04 Nov	78 F, dry	82 F, cloudy
Tolleson "A"	Granex 33	sprinkler	05 Nov	70 F, dry	80 F, clear
Tolleson "B"	Granex 33	sprinkler	03 Nov	68 F, dry	84 F, clear
Glendale	n/a (white)	sprinkler	31 Oct	70 F, dry	80 F, clear

Results and Discussion

In three tests, Prowl, Prefar, Nortron, and combinations of the herbicides were evaluated in comparison to Dacthal. At all three test sites, Nortron at both rates tested was safe on onions (Table 1). Crop stand and height was not affected relative to the untreated onions. With light to moderate weed infestations at Glendale and Tolleson "B" Nortron appeared to provide marginal control of London rocket (Table 2). Sowthistle (*Sonchus oleraceus*), cheeseweed (*Malva parviflora*), sweetclover (*Melilotus officinalis*), and shepherd's purse (*Capsella bursa-pastoris*) were not present in Nortron treated plots compared to the few that were observed in the untreated check. Prowl at both rates tested was safe on onions at Waddell "B" with furrow irrigation. At Glendale and Tolleson "B" with sprinkler irrigation, all Prowl treatments, alone or in combinations, significantly injured and reduced the onion stand. Prowl treatments caused as high as 62 to 88% stand reduction when sprinklers were used to incorporate the herbicide. Prefar injured onions at the early rating date and height measurements indicated that the plants were shortened relative to the untreated check. End of the season visual observations showed that onions had grown out of the initial injury and the crop did not appear to be reduced. Prefar combined with Prowl or Nortron was more injurious to onions with sprinkler irrigation than with furrow irrigated incorporation. Prefar gave marginal weed control in the tests under conditions with low weed infestations. Cobra was injurious to onions at all five test sites and caused significant crop stand reduction (Tables 1, 2, & 3).

At two test sites, Prowl, Prefar, Dual, Frontier, and combination treatments were evaluated. Prowl at 0.50 lb AI/A caused significant damage to onions under sprinkler irrigation at the Tolleson "A" field (Table 3). Slight height reduction was measured at Waddell "A" but visual injury was not evident with furrow irrigation. Prefar at 4.0 lb AI/A reduced the height of onions at both Waddell "A" and Tolleson "A" but again, the end of season ratings indicated that Prefar treated onions showed minimal injury. Combination treatments of Prowl with Dacthal or Prefar were damaging to onions under sprinklers but injury was minimal with furrow irrigations. Prefar plus Dacthal significantly injured onions under sprinklers and caused height reduction with furrow irrigation. Dual and Frontier caused minimal injury and no stand reduction of onions under sprinklers but with furrow irrigation, the stand was reduced and height reduction was substantial.

The weed infestation was negligible at the Waddell "A" site. At the Tolleson "A" site, Prowl, Dacthal, and Prowl combination treatments controlled nettleleaf goosefoot (*Chenopodium murale*), London rocket, and limited infestations of cheeseweed, shepherd's purse and sweetclover (Table 3). Prefar treatments, Dual, and Frontier marginally controlled goosefoot but did not adequately control London rocket.

The series of field tests demonstrated that herbicide performance was significantly influenced by irrigation practices. Prowl herbicide was extremely injurious and caused substantial crop stand reduction with sprinkler irrigation. Dual and Frontier exhibited less injury on onions under sprinklers than with furrow irrigation. Cobra at 0.25 lb AI/A was damaging to onions regardless of irrigation practice. Generally, Prowl treatments provided good weed control resulting in few weeds surviving in the treated plots. The addition of Dacthal, Prefar, or Nortron combined to only slightly improve weed control. Prefar at 4.0 or 6.0 lb AI/A gave marginal weed control of weeds present in the tests and crop injury was evident early in the season but onions proceeded to grow and height reduction was negligible by visual observations at the end of the season.

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Table 1. Evaluation of Preemergence Herbicides for Onion Weed Control. (Umeda, Gal. and Strickland)

Treatment	Rate (lb AI/A)	Onion																	
		Glendale				Tolleson "B"				Waddell "B"									
		CSR 05 Jan	CSR 06 Jan	Injury 05 Jan	Injury 06 Jan	CSR 05 Jan	CSR 06 Jan	Injury 05 Jan	Injury 06 Jan	CSR 06 Jan	CSR 06 Jan	Injury 06 Jan	Injury 16 Feb						
Untreated check		0	6	0	0	4.2	10.7	0	7.3	0	0	3.4	9.9	0	6.1	0	0	3.6	7.5
Dacthal	9.0	0	4.9	15	0	2.9	9.0	0	7.0	12	0	3.4	10.6	0	4.7	0	0	2.9	8.0
Nortron	1.0	0	6.6	0	0	3.6	10.3	0	8.6	0	0	3.9	10.4	0	6.3	0	0	3.1	7.5
Nortron	2.0	0	5.9	5	0	3.5	10.2	0	7.8	3	0	3.1	9.5	0	6.0	0	2	3.3	7.5
Prowl	0.5	25	4.3	10	28	3.3	9.2	53	2.7	43	35	2.9	8.1	0	5.8	0	0	3.3	7.5
Prowl	0.75	88	0.4	47	87	1.6	7.2	67	2.5	43	57	2.4	7.7	0	6.0	3	0	3.0	7.0
Prefar	4.0	20	4.3	25	0	2.9	7.9	0	6.5	10	0	2.9	8.6	0	5.8	7	0	2.9	7.4
Prefar	6.0	7	5.4	23	0	3.3	8.3	7	5.2	28	0	2.7	8.5	10	4.7	20	3	3.0	7.4
Cobra	0.25	62	1.8	33	70	2.6	7.8	42	3.7	33	27	3.1	9.0	22	3.3	30	7	2.7	6.9
Prowl + Prefar	0.5 + 4.0	62	1.7	38	57	2.4	7.2	83	1.8	47	53	1.7	6.4	0	4.7	18	0	3.1	7.4
Prefar + Nortron	4.0 + 1.0	17	5.4	20	13	3.4	9.2	12	5.4	20	0	2.9	8.4	0	4.6	10	0	2.9	7.2
Nortron + Prowl	1.0 + 0.5	65	3.2	30	63	3.0	8.1	62	3.6	40	25	2.6	8.8	0	5.7	3	3	3.1	7.3
LSD (p=0.05)		33	2.5	17.5	30.3	0.74	1.84	17.6	2.2	16.2	17.1	0.83	1.3	6.4	1.2	9.5	7.3	0.56	1.04

Glendale treated 31 October 1997, Tolleson "B" treated 05 November 1997., Waddell "B" treated on 04 November 1997.

CSR = crop stand reduction, no./plot measured average number of plants per 3 ft of row per each seedline

Injury measured average height of 10 plants per plot

Table 2. Evaluation of Preemergence Herbicides for Onion Weed Control. (Umeda, Gal, and Strickland)

Treatment	Rate (lb AI/A)	Weed Control									
		Glendale					Tolleson "B"				
		SSYR	MALPA	SONOL	MEUOF	%	SSYR	MALPA	SONOL	MEUOF	CAPBP
Untreated check		0	0	0	0	91	82	93	0	86	
Dacthal	9.0	85	99	99	99	99	93	93	0	93	
Nortron	1.0	78	75	96	33	93	92	96	0	96	
Nortron	2.0	73	99	99	99	88	92	99	33	98	
Prowl	0.5	90	99	99	99	98	98	69	66	99	
Prowl	0.75	99	99	99	99	99	99	99	33	99	
Prefar	4.0	82	99	99	99	89	88	69	0	88	
Prefar	6.0	75	96	96	99	93	99	94	0	90	
Cobra	0.25	96	99	99	99	99	82	99	0	99	
Prowl + Prefar	0.5 + 4.0	88	99	99	99	99	99	99	0	99	
Prefar + Nortron	4.0 + 1.0	77	88	93	99	98	88	99	0	86	
Nortron + Prowl	1.0 + 0.5	86	99	94	99	99	99	99	66	99	
LSD (p=0.05)		16.6	12.2	7.8	27.9	11.3	7.2	38.3	56.5	12.4	

Glendale treated 31 October 1997, Tolleson "B" treated 05 November 1997.
 SSYR = *Sisymbrium irio* (London rocket), MALPA = *Malva parviflora* (cheeseweed), SONOL = *Sonchus oleraceus* (sowthistle)
 CAPBP = *Capsella bursa-pastoris* (shepherd's purse), MEUOF = *Meililotis officinalis* (yellow sweetclover)

Table 3. Evaluation of Preemergence Herbicides for Onion Weed Control. (Umeda, Gal. and Strickland)

Treatment	Rate (lb AI/A)	Onion						Weed Control								
		Waddell "A"			Tolleson "A"			SSYIR		MALPA		CAPBP		MEUOF		
		Injury	CSR	Injury	Injury	CSR	CSR	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan
		12 Jan	16 Feb	06 May	12 Jan	05 Jan	23 Feb	05 Jan	06 May	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan	05 Jan
		height (inches)	%	no./plot	height (inches)	%	no./plot	%	no./plot	%	no./plot	%	no./plot	%	no./plot	%
Untreated check		3.1	7.8	0	5.4	4.3	11.5	0	0	0	8.6	0	0	0	0	0
Prowl	0.5	2.5	7.1	0	4.5	3.0	9.1	28	17	37	5.4	98	91	99	99	43
Prefar	4.0	2.2	6.6	7	3.0	3.1	9.8	18	0	7	6.3	99	17	30	99	33
Dacthal	6.0	3.1	7.7	0	4.7	3.2	10.9	5	0	0	8.1	99	87	93	93	33
Dacthal + Prowl	6.0 + 0.5	2.9	7.1	0	4.6	3.2	8.4	28	28	47	3.4	99	99	99	99	99
Prowl + Prefar	0.5 + 4.0	2.0	5.8	10	3.0	1.4	6.3	47	50	87	0.6	99	93	99	99	99
Prefar + Dacthal	4.0 + 6.0	2.2	5.7	0	3.7	2.9	7.5	33	0	33	3.9	99	57	90	99	66
Dual	1.0	2.1	6.6	65	0.9	3.2	10.5	0	0	0	8.3	82	52	88	96	0
Dual	2.0	1.4	4.6	88	0.8	3.4	10.5	10	0	0	8.1	83	57	58	99	33
Frontier	0.5	2.2	7.3	33	1.5	3.6	10.7	7	0	0	7.9	93	30	66	94	66
Frontier	1.0	1.7	6.4	52	1.5	3.3	10.0	3	0	0	7.6	85	58	99	99	0
Cobra	0.25	2.3	6.9	60	0.8	3.1	8.6	27	27	0	3.0	99	99	94	99	99
LSD (p=0.05)		0.64	1.38	13.9	0.8	0.57	1.57	12.7	17.7	14.3	2.1	4.4	58.9	44.6	6.5	70.8

Waddell "A" treated on 10 November 1997, Tolleson "A" treated on 03 November 1997.

CSR = crop stand reduction, no./plot measured average number of plants per 3 ft of row per each seedline
Injury measured average height of 10 plants per plot

CHEMU = *Chenopodium murale* (nettleleaf goosefoot), SSYIR = *Sisymbrium irio* (London rocket), MALPA = *Malva parviflora* (cheeseweed), CAPBP = *Capsella bursa-pastoris* (shepherd's purse), MEUOF = *Melilotis officinalis* (yellow sweetclover)