CONTROL OF YELLOW NUTSEDGE AND ANNUAL WEEDS IN ONIONS

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Introduction

Effective weed control is essential for the production of marketable onions. Yellow nutsedge and annual weeds reduce yields in commercial onion production. Trials were conducted to identify herbicides and weed control programs that provide effective weed control in onions. Yellow nutsedge tuber production and distribution in the soil also was determined.

Methods

Trials were conducted at the Malheur Experiment Station and on cooperators' fields evaluating experimental and registered herbicides for weed control and onion tolerance. Herbicides were evaluated for control of annual weeds and yellow nutsedge. Trials were conducted to evaluate onion tolerance to postemergence herbicide treatments under furrow irrigation. All herbicide treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 30 psi.

Data were analyzed using analysis of variance and means were separated using a protected least significant difference (LSD) at the 5 or 10 percent level, (0.05, 0.10).

Trials on the Station

General Procedures
On April 4, onions (cv. 'Vision', Petoseed, Payette, ID) were planted at a 3.7-inch spacing in double rows on 22-inch beds. Plots were four rows wide and 27 ft long and arranged in a randomized complete block design with three or four replications. Lorsban was applied in a 6-inch band over each row at 3.7 oz/1,000 ft of row. Onions were sidedressed with 100 lb N/acre as urea on May 23 and with another 100 lb N/acre on June 13. Conventional insecticides and fungicides were applied for thrips and downy mildew control. Weed control and onion injury were evaluated throughout the season. Onions were harvested September 20 and 21 and graded by size on October 5 and 6.

Application Timing of Soil-Active Herbicides
Preemergence applications of Roundup (0.75 lb ae/acre) in combination with Prowl

(1.5 lb ai/acre), Nortron (2.0 lb ai/acre), Dual Magnum (1.3 lb ai/acre), and Outlook (0.64 lb ai/acre) followed by sequential postemergence herbicide treatments were compared to treatments where Prowl, Nortron, Dual Magnum, and Outlook were applied in combination with the postemergence treatments. The sequential postemergence herbicide program consisted of an initial application of Buctril (0.125 lb ai/acre) followed by two applications of Buctril (0.125 lb ai/acre), Goal (0.05 lb ai/acre), and Poast (0.1 lb ai/acre). Preemergence applications of Prowl were compared to postemergence applications and a split application, where half of the Prowl was applied preemergence and the rest was applied with the third postemergence application. Prowl also was compared to other herbicides for residual weed control. Preemergence applications were made on April 14 and postemergence applications on May 3 (one-leaf), May 12 (two-leaf), and May 22 (three-leaf).

Onion Tolerance to Postemergence Frontier, Outlook, Dual Magnum, and Prowl
Onion tolerance to postemergence applications of Frontier, Outlook, Dual Magnum, and Prowl was examined. Outlook was applied at the typical use rate (0.64 lb ai/acre) and at twice the standard rate (1.29 lb ai/acre). Frontier, Dual Magnum, and Prowl were all evaluated at twice the standard use rate. Plots were maintained weed-free with applications of Buctril, Goal, and Select and by hand weeding. Treatments were applied on May 12 when onions had two true leaves.

Onion Tolerance to Postemergence Basagran, Starane, and V-53482
In this trial, postemergence herbicide treatments were evaluated for onion tolerance. Plots were maintained weed free to isolate possible yield loss effects of herbicide injury from yield losses due to weed competition. Weeds were removed with postemergence herbicide applications and with hand weeding. Treatments included Basagran at 1.0 and 2.0 lb ai/acre alone and in combination with crop oil concentrate (COC) at 1 percent volume per volume (v/v). Starane was applied alone at 0.063, 0.125, 0.25, and 0.5 lb ai/acre. V-53482 was applied at 0.047, 0.063, and 0.094 lb ai/acre with the addition of non-ionic surfactant (NIS) at 0.25 percent v/v. Treatments for evaluation were applied May 18 when onions had three true leaves.

Weed Control in Onions with Buctril and Connect
A trial was conducted to compare Buctril with a new bromoxynil formulation marketed under the trade name Connect. Connect is formulated as a wettable powder (WSP), whereas Buctril is formulated as an emulsifiable concentrate (EC). Treatments included Buctril, Connect, and Connect plus COC (1 percent v/v) at 0.125 lb ai/acre, applied three times. Other treatments were 0.125 lb ai/acre of Buctril or Connect plus COC applied to one-leaf onions, followed by 0.25 lb ai/acre of Buctril or Connect plus COC in combination with Goal (0.12 lb ai/acre), or Goal and Prowl (1.0 lb ai/acre). Postemergence applications were made May 3 to one-leaf onions, May 12 to two-leaf onions, and May 22 to three-leaf onions.

Trials in Growers' Fields

Yellow Nutsedge Control

Two trials were established in a field heavily infested with yellow nutsedge. One trial evaluated Vapam applied in the spring followed by postemergence applications of Dual II Magnum, Outlook, and Basagran. Vapam did not provide observable yellow nutsedge control and results from that trial are not included in this report. The other trial evaluated postemergence herbicide treatments for yellow nutsedge control. Onions were planted on a 3.7-inch spacing in double rows on 22-inch beds on April 25. Plots were four rows wide and 30 ft long and arranged in a randomized complete block design with four replications. Onions were sidedressed with 60 lb N/acre as urea on June 5.

Postemergence treatments were applied on June 2 and June 13. At the first application, onions and nutsedge were 4 inches tall. Buctril (0.125 lb ai/acre) and Select (0.05 lb ai/acre) were applied to control annual weeds not controlled by the herbicides applied for nutsedge control. Broadleaf weeds were removed by hand on July 12. Nutsedge control was evaluated throughout the season. On August 1 and 2, two soil cores with a 4.25-inch diameter and a 10-inch depth were taken from each plot. The samples were washed through a 5/64-inch mesh screen and the yellow nutsedge tubers were collected. Tubers were dried, counted, and weighed. Only viable tubers (tubers not easily crushed between the fingers) were included in the results. Tuber measurements were used to calculate nutsedge tuber numbers and yields on a per acre basis. Because of poor onion establishment and heavy competition from the yellow nutsedge, onion yields were not taken from this trial.

Yellow Nutsedge Tuber Yield and Soil Distribution in Untreated Onions

Soil core samples were taken on July 3, 17, 24, and August 9 randomly from a 600-ft^2 area in a field with an extremely high yellow nutsedge population to determine the number, yield, soil distribution, and production of tubers. The soil core probe had a 4.25-inch diameter and was 10 inches long. Soil cores were replicated four times within each sample date. Soil from the core samples was separated into 2-inch increments. Soil was washed from the samples, and nutsedge tubers were collected and dried. Nonviable tubers (those that could be crushed easily between the fingers) were removed and the remaining tubers were counted and weighed.

Results and Discussion

Onion stands and weed populations were variable in the trials conducted at the experiment station.

Trials on the Station

Application Timing of Soil-Active Herbicides
Preemergence soil-active herbicide treatments did not increase onion injury compared to the plot treated only with Roundup preemergence (Table 1). All treated plots exhibited injury (10 to 13 percent) on May 31, but this injury was apparently from the uniform postemergence applications of Buctril plus Goal. On June 20, little onion injury was observed. Weed populations were variable and few benefits from using a soil-active herbicide were evident. Prowl applied as a split application and at the one-leaf timing provided greater lambsquarters control than no soil residual treatment. Prowl and Outlook preemergence and Outlook applied at the two-leaf timing provided greater hairy nightshade control than Prowl applied at the one- or two-leaf application timing. Onion density did not differ among treatments and onion yields were improved by all treatments compared to the untreated check (Table 2). Outlook applied preemergence had increased jumbo onion yields compared to no soil-active herbicide, Prowl preemergence, the split application of Prowl, and the two-leaf application of Dual Magnum. Prowl plus Nortron preemergence increased colossal onion yields compared to Nortron and Dual applied preemergence and Dual Magnum and Outlook applied to two-leaf onions. At the 90 percent confidence level, total onion yields were greater with preemergence Outlook compared to no soil-active herbicide, Prowl preemergence, and Outlook applied at the two-leaf timing.

Onion Tolerance to Postemergence Frontier, Outlook, Dual Magnum, and Prowl
None of the herbicides tested caused significant onion injury even though they were applied at double the standard use rate (Table 3). Differences in onion stand and onion yield also were not apparent. Variability in the plot area resulted in large fluctuations in yield among plots.

Onion Tolerance to Postemergence Basagran, Starane, and V-53482
One day after treatment (May 19), onion injury was among the greatest with Starane and V-53482 (Table 4). Injury with Basagran became more apparent with time and Basagran with COC was among the highest on June 20 along with the high rate of V-53482 (0.094 lb ai/acre). V-53482 (0.094 lb ai/acre) was the only treatment that reduced onion stand compared to the control, but Basagran (2.0 lb ai/acre) with COC did have slightly reduced stands compared to some of the Starane treatments. Probably because of the reduced stand, V-53482 at the highest rate had reduced jumbo and total onion yields. Other yield differences among treatments may have been apparent if the research site had been more uniform. Another year of data will be necessary to make reliable conclusions to onion tolerance to these herbicides.

Weed Control in Onions with Buctril and Connect
Onion injury was not different between Buctril and Connect (Table 5). The greatest onion injury on May 19 and May 31 was from treatments containing Goal (0.12 lb ai/acre). The population of redroot pigweed was variable and treatment differences were not apparent. Three applications of Buctril or Connect alone at 0.125 lb ai/acre

provided lower common lambsquarters control than all other treatments including three applications of Connect plus COC. Only small differences in hairy nightshade control were apparent and all treatments provided greater than 87 percent control. The addition of COC to Connect may potentially improve common lambsquarters control, while apparently not increasing onion injury.

Trials in Growers' Fields

Yellow Nutsedge Control Trials

Poor onion emergence and growth delayed herbicide applications. The herbicide timing was later than it should have been to effectively control yellow nutsedge. On July 5, treatments containing Basagran plus COC applied at the three-leaf stage significantly injured onions (Table 6). On June 24, those same treatments were providing some of the highest yellow nutsedge control (73 to 89 percent). By July 5 and July 28, treatments that included an application of Basagran and COC on June 13 were still among the most effective in controlling yellow nutsedge. On July 5, Outlook followed by Basagran a week later provided greater yellow nutsedge control than Outlook and Basagran applied in a tank mixture. At the 90 percent confidence level (*P = 0.10*), Dual II Magnum and Outlook alone or followed by Basagran plus COC, and Basagran plus COC applied twice, reduced yellow nutsedge tuber numbers compared to the untreated check. All treatments reduced nutsedge tuber weight compared to the untreated check with few differences among treatments. The untreated check had over 36 million nutsedge tubers per acre, equivalent to more than 3.2 tons of tubers per acre of soil 10 inches deep. This level of yellow nutsedge infestation would be difficult to manage. Beginning herbicide applications earlier may provide increased yellow nutsedge control with soil-active herbicide treatments.

Yellow Nutsedge Tuber Yield and Soil Distribution in Untreated Onions

Soil cores taken from various soil depths and over time revealed that on July 3 yellow nutsedge tubers were most abundant 2- to 4-inch deep in the soil (Table 7). Between July 3 and July 17 yellow nutsedge tuber numbers and weight increased in the 0- to 2-, 2- to 4-, and 4- to 6-inch depths, but not at depths below 6 inches. On August 9, tuber biomass had increased at all depths compared to the first sampling date and tuber numbers had increased at all depths but the 8- to 10-inch depth. In only 37 days, tuber numbers and weight increased approximately three fold when averaged across all of the soil depths. Surprisingly, one of the largest increases occurred between July 3 and July 17, and not later in the season.

Table 1. Onion injury and weed control in response to application timing of soil-active herbicides, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

			Injury		Weed control†		
Treatment*	Rate	Timing	5-31	6-20	Redroot pigweed	Common lambsquarters	Hairy nightshade
	lb ai/acre				%		
No soil active			13	0	98	90	96
Prowl	1.5	PRE	11	0	98	93	98
Prowl + Prowl	0.75 + 0.75	PRE + 2-leaf	11	0	95	98	97
Nortron	2	PRE	10	3	96	93	94
Dual Magnum	1.3	PRE	10	4	90	79	94
Outlook	0.64	PRE	13	0	97	97	98
Prowl + Nortron	0.75 + 2.0	PRE	11	5	95	93	94
Prowl	1.5	1-leaf	10	0	93	98	92
Prowl	1.5	2-leaf	13	0	97	97	91
Dual Magnum	1.3	2-leaf	11	3	96	88	95
Outlook	0.64	2-leaf	11	3	90	92	97
Untreated			0	0	0	0	0
LSD (0.05)			4	NS	7	7	5

*All plots except the untreated received Roundup preemergence on April 14 (PRE), Buctril plus Poast on May 3 (1-leaf), Buctril, Goal, and Poast on May 12 (2-leaf), and Buctril plus Goal on May 22 (3-leaf).
†Weed control ratings were taken June 20.

Table 2. Onion density and yield in response to application timing of soil-active herbicides, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Treatment*	Rate	Timing	Onion density†	Onion yield‡				
				Small	Medium	Jumbo	Colossal	Total
	lb ai/acre		No/m	cwt/acre				
No soil active			10.9	5.4	29	495	262	821
Prowl	1.5	PRE	10.9	1.9	25	465	272	787
Prowl + Prowl	0.75 + 0.75	PRE + 2-leaf	11.5	2.3	15	504	412	971
Nortron	2	PRE	14.4	7.0	32	696	229	1001
Dual Magnum	1.3	PRE	13.1	4.5	34	620	204	897
Outlook	0.64	PRE	15.3	9.3	38	790	267	1145
Prowl + Nortron	0.75 + 2.0	PRE	12.8	4.9	23	570	419	1058
Prowl	1.5	1-leaf	13.7	8.1	37	592	352	1020
Prowl	1.5	2-leaf	14.4	3.2	36	697	350	1127
Dual Magnum	1.3	2-leaf	10.7	4.2	45	494	257	839
Outlook	0.64	2-leaf	13.5	5.2	41	564	162	797
Untreated			15.0	8.3	7	3	0	19
LSD (0.05)			NS	NS	22	269	159	374
LSD (0.10)								310

†All plots except the untreated received Roundup preemergence on April 14 (PRE), Buctril plus Poast on May 3 (1-Leaf), Buctril, Goal, and Poast on May 12 (2-Leaf), and Buctril plus Goal on May 22 (3-Leaf).
‡Onion density counts were taken on June 20.
§Onions were harvested September 20 and 21.

Table 3. Onion injury, density, yield, and grade in response to postemergence applications of Frontier, Outlook, Dual Magnum, and Prowl, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

		Onion injury			Onion yield‡				
Treatment*	Rate	5-19	6-20	Onion density†	Small	Medium	Jumbo	Colossal	Total
	lb ai/acre	---------%---------		----No/m---	----------cwt/acre----------				
Frontier	2.34	0	3	12.8	2.7	17	464	362	889
Outlook	0.64	0	3	11.5	2.3	21	478	346	882
Outlook	1.29	0	4	12.8	4.8	30	596	361	1,028
Dual Magnum	2.6	1	1	12.7	4.5	25	573	328	964
Prowl	2.96	0	1	13.8	5.5	37	574	436	1,085
Untreated		0	0	14.0	5.9	31	683	275	1,034
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS	NS

*Treatments were applied to two-leaf onions on May 12. Plots were maintained weed free with applications of Buctril, Goal, Select, and hand weeding.
†Onion density was counted on June 20.
‡Onions were harvested September 20 and 21.

Table 4. Onion injury, density, yield, and grade in response to postemergence applications of Basagran, Starane, and V-53482, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Treatment*	Rate	Onion injury		Onion density †	Onion yield ‡				
		5-19	6-20		Small	Medium	Jumbo	Colossal	Total
	lb ai/acre	---%---		---No/m---	---cwt/acre---				
Basagran	1.0	10	11	12.0	2.1	24.0	443	281	773
Basagran	2.0	13	14	11.0	3.1	22.0	425	310	783
Basagran + COC	1.0	21	16	11.8	3.6	19.0	513	339	909
Basagran + COC	2.0	9	24	10.3	4.6	25.0	453	316	828
Starane	0.063	33	5	12.7	10.1	18.0	523	354	943
Starane	0.125	40	0	14.4	4.6	29.0	596	329	987
Starane	0.25	45	6	11.8	3.9	16.0	398	302	743
Starane	0.5	38	14	14.3	6.0	20.0	561	304	918
V-53482 + NIS	0.047	28	6	14.5	6.8	28.0	664	319	1,041
V-53482 + NIS	0.063	25	8	12.1	1.7	17.0	558	341	952
V-53482 + NIS	0.094	28	21	6.6	0.7	5.0	147	331	513
Untreated		1	1	12.3	7.0	23.0	502	347	905
LSD (0.05)		16	7	3.8	NS	NS	231	NS	247

*Treatments were applied to three-leaf onions on May 18. COC was applied at 1 percent v/v and NIS was applied at 0.25percent v/v. Plots were maintained weed free with applications of Buctril, Goal, Select, and hand weeding.
†Onion density was counted on June 20.
‡Onions were harvested September 20 and 21.

Table 5. Weed control in onions with Buctril and Connect, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

			Injury		Weed control‡		
Treatment*	Rate	Timing†	5-19	6-20	Redroot pigweed	Common lambsquarters	Hairy nightshade
	lb ai/acre	Leaf	----------	----------	----------	%----------	----------
Buctril	0.125	1, 2, 3-leaf	7	0	68	72	97
Connect	0.125	1, 2, 3-leaf	8	0	87	78	93
Connect + COC	0.125 + 1% v/v	1, 2, 3-leaf	5	0	85	90	96
Buctril Buctril + Goal	0.125 0.25 + 0.12	1-leaf 2-leaf	40	0	84	91	95
Connect + COC Connect + Goal + COC	0.125 + 1% v/v 0.25 + 0.12 + 1% v/v	1-leaf 2-leaf	38	3	82	88	90
Buctril Buctril + Goal + Prowl	0.125 0.25 + 0.12 + 1.0	1-leaf 2-leaf	37	2	84	91	92
Connect + COC Connect + Goal + Prowl + COC	0.125 + 1% v/v 0.25 + 0.12 + 1.0+ 1% v/v	1-leaf 2-leaf	41	0	76	94	87
Untreated			0	0	0	0	0
LSD (0.05)			8	NS	20	8	8

*COC was applied at 1 percent v/v. All plots except the untreated received Roundup preemergence on April 14 (PRE).
†Applications were made to 1-leaf onions May 3, 2-leaf onions on May 12, and 3-leaf onions on May 22.
‡Weed control ratings were taken June 20.

Table 6. Yellow nutsedge control and tuber production in response to postemergence herbicide applications in onions, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

			Injury		Yellow nutsedge control			Yellow nutsedge tuber	
Treatment	Rate	Timing*	6-24	7-5	6-24	7-5	7-28	Number	Weight
	lb ai/acre		----------	----------	----------	%----------	----------	1,000/acre	ton/acre
Dual II Magnum	1.25	2-leaf	3	5	59	59	49	14,424	1.07
Outlook	0.64	2-Leaf	0	0	64	48	46	16,968	0.95
Basagran + COC	1.0 + 1% v/v	2-leaf	0	0	65	53	9	18,405	1.21
Dual II Magnum + Outlook	1.25 + 0.64	2-leaf	1	4	66	66	48	18,516	1.20
Dual II Magnum + Basagran	1.25 + 1.0	2-leaf	8	4	68	72	46	22,661	1.08
Outlook + Basagran	0.64 + 1.0	2-leaf	5	1	66	68	31	20,505	1.14
Dual II Magnum Basagran + COC	1.25 1.0 + 1% v/v	2-leaf 3-leaf	4	15	86	88	66	12,546	0.56
Outlook Basagran + COC	0.64 1.5 + 1% v/v	2-leaf 3-leaf	1	9	87	91	64	12,823	0.59
Basagran + COC Basagran + COC	1.0 + 1% v/v 1.0 + 1% v/v	2-leaf 3-leaf	11	13	89	88	65	7,296	0.25
Outlook + Basagran + COC	0.64 + 1.0 + 1% v/v	2-leaf	11	10	73	67	25	22,882	1.06
Dual II Magnum + Basagran + COC	1.25 + 1.5 + 1% v/v	2-leaf	10	15	79	75	31	35,428	1.65
Untreated			0	0	0	0	0	36,589	3.23
LSD (0.05)			8	7	17	14	18	NS	1.14
LSD (0.10)								15,205	

*Treatments were applied to 2-leaf onions on June 2 and to 3-leaf onions on June 13.

Table 7. Yellow nutsedge tuber number and weight at various soil depths over time, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

	Tuber number				Tuber weight			
Soil depth*	7-3	7-17	7-24	8-9	7-3	7-17	7-24	8-9
inch	1,000/acre				ton/acre			
0-2	1,879	9,064	8,401	8,622	0.14	0.53	0.47	0.27
2-4	4,864	12,491	11,828	16,028	0.24	1.24	1.17	0.87
4-6	1,769	5,969	6,301	9,396	0.09	0.66	0.91	0.80
6-8	995	553	1,548	2,985	0.07	0.08	0.53	0.32
8-10	774	995	663	1,548	0.02	0.10	0.04	0.23
LSD (0.05)	1,822				0.17			
Total	10,280	29,072	28,741	38,579	0.56	2.61	3.13	2.48

*Samples were taken with a 4.25-inch-diameter soil probe 10 inches long.