YELLOW NUTSEDGE CONTROL IN VARIOUS CROPS

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Ontario, OR, 2003

Introduction

Yellow nutsedge is an increasing weed problem in the Treasure Valley of eastern Oregon and southwestern Idaho. Yellow nutsedge is particularly detrimental in onion production due to the noncompetitive nature of the crop and the ability of yellow nutsedge to proliferate under the growing conditions that exist in onion production. Previous research conducted in the Treasure Valley evaluating yellow nutsedge control in onion has met with limited success, in part due to the lack of effective herbicide options and the weed's ability to germinate over long periods of time during the growing season. An integrated approach is needed to manage yellow nutsedge, including the use of effective herbicide treatments in each of the crops within a rotation. This research was conducted to evaluate the effects of crop species and herbicides on growth and development of yellow nutsedge in field corn, dry bean, potato, and sugar beet production.

Methods

Studies were conducted in a field heavily infested with yellow nutsedge located north of Ontario on the Oregon Slope. The soil was a Owyhee silt loam with pH 8.5 and 1.7 percent organic matter. The field was disked on April 14 and ground hogged on April 16. The field was harrowed and bedded for corn, dry bean, potato, and sugar beet on April 17 and 18. A trial with wheat was also established but was abandoned due to the late planting date. Plot size varied among trials, but plots were replicated four times in all trials. Pretreatment nutsedge tuber numbers were sampled April 21 through April 28. Sampling for yellow nutsedge tubers consisted of taking eight core samples measuring 4.25 inches in diameter and 7 inches deep from the center furrow within each individual plot. The samples were combined and the tubers were extracted from the soil by washing the soil through screens with 11/64-inch holes. To determine treatment effects on tuber numbers, core samples were taken again at the time the crops were harvested. Season-end sampling differed by crop and will be described within the individual crop methods. The extraction process for season-end yellow nutsedge tubers was the same as for the initial samples. In total, tuber sampling involved taking 2,800 core samples, washing tubers from approximately 8.6 tons of soil, and individually counting 70,000 nutsedge tubers. Herbicide applications were made with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 30 psi. Crop injury and visual evaluations of yellow nutsedge control were made throughout the growing season. Yields were taken for each crop and specific methods are described by crop.

Corn

Beds were harrowed on May 23 and preplant incorporated herbicide treatments were applied to plots and incorporated by making two passes with the bed harrow in opposite directions. Pioneer 'P-36N18 Roundup Ready' (103-day relative maturity) field corn was planted May 23 on a 7-inch seed spacing on 30-inch rows. Corn was sidedressed, prior to planting, on May 15 with 121 lb N, 48 lb P, 62 lb K, 22 lb sulfate, 30 lb S, 1 lb Zn, 2 lb Mn, and 1 lb B per acre. Dual II Magnum (s-metolachlor) was applied prelant incorporated (PPI) to some plots on May 22. Early postemergence treatments (EPOST) were applied June 5, mid-postemergence (MPOST) treatments were applied June 9, and late postemergence (LPOST) treatments were applied on June 17. Postemergence treatments included Basagran (bentazon), Permit (halosulfuron), and Roundup (glyphosate). Basagran and Roundup were applied either twice alone or twice following PPI Dual II Magnum. Permit was applied one time alone or one time alone following PPI Dual II Magnum. Basagran and Permit were applied in combination with a crop oil concentrate (COC) while ammonium sulfate (AMS) was added to Roundup applications. Yield was determined by harvesting ears from a 15-ft section of the center two rows of each plot on October 10. The ears were shelled, and grain moisture content and weights were recorded. Final yields were adjusted to 12 percent moisture content. Yellow nutsedge tuber numbers were determined by taking eight core samples from the tops of the center two beds in each plot.

Dry Bean

On May 20, beds were harrowed and PPI herbicide treatments were applied and incorporated by harrowing the beds two more times in opposite directions. After the PPI herbicides were incorporated, 'GTS-900' pinto beans were planted and Prowl (pendimethalin) was applied preemergence to help control weeds other than yellow nutsedge. Problems with the planter required replanting some plots, resulting in an erratic stand. PPI treatments included Dual Magnum (s-metolachlor), Eptam (EPTC), and a combination of Dual Magnum plus Eptam. Postemergence treatments were applied June 12 and included Sandea (halosulfuron) plus non-ionic surfactant (NIS) and Basagran plus COC. The plots treated with Basagran received a second application of Basagran on June 23. On August 28, plants were pulled from 10 ft of row where the bean stand was consistent to determine dry bean yield. After the bean plants had dried, the beans were threshed by hand. Final nutsedge tuber numbers were determined by taking four core samples from the same 10-ft section of row that the beans were harvested from.

Potato

'Russet Burbank' potatoes were planted May 1 with a 9-inch seed spacing on 36-inch rows. Potatoes were sidedressed on May 9 with 200 lb N, 250 lb P, 150 lb K, 95 lb S, 4 lb Mn, and 1 lb B per acre. On May 13, the potato beds were re-hilled with a lilliston cultivator, preemergence herbicides were applied and incorporated with another pass of the lilliston. All plots received preemergence Prowl for general weed control. Past research has shown that Prowl has no effect on yellow nutsedge. Herbicides applied for yellow nutsedge control included Dual Magnum, Outlook (dimethenamid-P), and Eptam applied preemergence and incorporated and postemergence applications of Matrix (rimsulfuron), and Permit. Postemergence treatments were applied June 5. On August 19, the vines were flailed. On September 9, potatoes were harvested from 10 ft of the center two rows. Potatoes were graded to size on September 12-17. To evaluate nutsedge tuber production, eight core samples were taken from the shoulder of the center two potato hills prior to potato harvest on August 21.

Sugar Beet
On April 28, Hilleshog variety 'WS PM-21' was planted at a 2-inch spacing to ensure a stand of sugar beets. Beets were planted on 22-inch rows. Counter 20 CR was applied for insect control on April 29. Asana was applied at 8 oz/acre on May 12 for cutworm control. Temik 15 G (14 lb/acre) was applied June 6 for sugar beet root maggot control. On June 17, the stand was hand thinned to one plant every 8 inches. Plots were 4 rows wide, 27 ft long, and arranged in a randomized complete block design. The trial was sidedressed on June 6 with 150 lb N, 122 lb P, 108 lb K, 3 lb sulfate, 102 lb S, 2 lb Zn, 3 lb Mn, and 1 lb B per acre. All plots were treated with a standard herbicide program of Progress (ethofumesate + desmedipham + phenmedipham), Upbeet (triflusulfuron), and Stinger (clopyralid) applied three times. The Progress rate increased with each application, while the Upbeet and Stinger rates were the same for all three applications. Dual Magnum or Outlook were applied for yellow nutsedge control at different timings and in various combinations. Treatments for yellow nutsedge were applied when sugar beets had two true leaves (May 21), or eight true leaves (June 6). One treatment included Eptam applied on June 30 just prior to the last cultivation. Sugar beet yields were taken by harvesting 10 ft of row containing healthy sugar beets on September 26. Harvesting only healthy sections of beets was necessitated by a severe rhizoctonia infestation. Nutsedge tuber numbers were sampled by taking 4 cores from the same 10-ft area that the sugar beets were harvested.

Results and Discussion

Spring bedding, difficult growing conditions, and late planting made the potato and sugar beet crops at this location less competitive than would be expected in commercial fields. Also, late planting gives the crop less time to grow before yellow nutsedge emerges and becomes competitive.

Corn
The corn rotation had some of the best yellow nutsedge control and appeared to suppress yellow nutsedge tuber numbers better than the other crops at this location. Corn was not injured by any of the herbicide treatments evaluated (Table 1). Yellow nutsedge control ranged from 57 to 93 percent. Dual II Magnum alone had among the least control. Basagran applied twice gave less control than treatments containing Permit or Roundup applied twice. All treatments reduced final tuber numbers compared to the untreated plot and the percent change in tubers ranged from a 17

percent gain in the untreated to a 50 percent reduction when Dual II Magnum was applied PPI and followed by two postemergence applications of Roundup. Corn yields did not differ significantly among treatments and ranged from 56 to 72 bu/acre. Low corn yields were attributed to heat stress during pollination as the ears did not completely fill.

Dry Bean
There appear to be effective options for yellow nutsedge control in dry beans. Treatments containing Sandea caused 21-28 percent dry bean injury (Table 2). Other treatments did not injure the beans. Eptam, Dual Magnum, and a combination of Eptam plus Dual Magnum provided among the least yellow nutsedge control of all the treatments. Inadequate incorporation may have lead to the poor control provided by these herbicides. Treatments with Sandea either alone or following PPI Eptam or Dual Magnum and Basagran applied twice following PPI Dual Magnum provided 73-84 percent yellow nutsedge control. Dry bean yields were correlated with yellow nutsedge control. Eptam and Sandea at the two higher rates had final tuber numbers that were not different from the untreated control. All other treatments had reduced tuber numbers compared to the untreated control. The average percent change of tubers ranged from an 81 percent increase to a 41 percent decrease. Eptam alone and the middle rate of Sandea had tuber increases similar to the untreated control. All other treatments had significant reductions in tuber numbers compared to the untreated control.

Potato
Herbicides applied in potatoes worked poorly, possibly because furrow irrigation was not effective for herbicide activation. Late planting, extreme heat, and potato vines dying early resulted in a less than desirable potato crop. The postemergence application of Permit was the only treatment to cause significant potato injury (Table 3). Yellow nutsedge control was among the highest with Dual Magnum, Permit, and Outlook. Treatments with Eptam PPI, or Matrix alone postemergence, or Eptam followed by Matrix had among the poorest yellow nutsedge control. Tuber numbers were variable and both final tuber numbers and the average percent change in tuber numbers were not affected by herbicide. Permit was the only treatment that resulted in a decrease (-105/ft^2) in tubers at harvest compared to the spring sampling. The untreated control had an increase of 104 tubers/ft^2 between spring and harvest sampling. Potato yields ranged from 56 to 79 cwt/acre.

Sugar Beet
Sugar beets were planted late and developed rhizoctonia during the season. Prolonged heat stress also impacted the crop. No differences in sugar beet injury were observed among herbicide treatments (Table 4). Yellow nutsedge control was variable and a statistical separation of differences among treatments was not possible. Control ranged from 31 to 61 percent. The average numbers of yellow nutsedge tubers and the percent change in tuber numbers were not different among herbicide treatments. Yellow nutsedge tubers increased by 109 to 300 percent. It was surprising that yellow nutsedge tuber numbers increased so much in a sugar beet crop with a healthy canopy

we would expect that yellow nutsedge tuber production would be suppressed. Sugar beet root yields were also not significant and ranged from 15 to 19 tons/acre.

These data suggest that corn suppressed yellow nutsedge growth better than the other crops, and that the herbicides available for use in corn caused additional reductions in tuber numbers. Both a competitive crop and effective herbicides must be used in order to control yellow nutsedge and reduce yellow nutsedge tuber numbers.

Table 1. Corn injury, corn yield, yellow nutsedge control, and yellow nutsedge tuber response to herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

			Crop injury		Nutsedge control	Average nutsedge tubers		
Treatment*	Rate	Timing†	6-24	Crop yield	7-25	Initial	Final	Change
	lb ai/acre	Leaf	---%---	bu/acre	---%---	----------no/ft²---------		---%---
Dual II Magnum	1.6	PPI	0	71	57	149	112	-34
Basagran + COC Basagran + COC	1.0 + 1.0% v/v 1.0 + 1.0% v/v	MPOST LPOST	0	67	62	138	66	-39
Permit + COC	0.031 + 1.0% v/v	MPOST	0	72	81	183	150	-31
Permit + COC	0.063 + 1.0% v/v	MPOST	0	70	90	138	90	-49
Roundup + AMS Roundup + AMS	0.75 + 2.5 0.75 + 2.5	EPOST LPOST	0	68	91	114	59	-47
Dual II Magnum + Roundup + AMS	1.6 + 0.75 + 2.5	MPOST	3	64	74	133	104	-1
Dual II Magnum Roundup + AMS Roundup + AMS	1.6 0.75 + 2.5 0.75 + 2.5	PPI MPOST LPOST	0	66	93	125	54	-52
Dual II Magnum Basagran + COC Basagran + COC	1.6 1.0 + 1.0% v/v 1.0 + 1.0% v/v	PPI MPOST LPOST	0	70	76	158	86	-51
Dual II Magnum Permit + COC	1.6 0.031 + 1.0% v/v	PPI MPOST	0	66	86	137	93	-36
Untreated control	--	--	-	56	-	204	238	17
LSD (0.05)	--	--	NS	NS	19	NS	76	40

*COC = crop oil concentrate, AMS = ammonium sulfate.

†Application timing abbreviations and dates: preplant incorporated (PPI) on May 22, early postemergence (EPOST) on June 5, mid-postemergence (MPOST) on June 9, and late postermergence (LPOST) on June 17.

Table 2. Dry bean injury, dry bean yield, yellow nutsedge control, and yellow nutsedge tuber response to herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment*	Rate	Timing†	Crop injury	Crop yield	Nutsedge control	Average nutsedge tubers		
			6-24		8-18	Initial	Final	Change
	lb ai/acre	Leaf	---%---	cwt/acre	---%---	----------no/ft²---------		---%---
Dual Magnum	1.6	PPI	0	26	51	210	217	0
Eptam	3.9	PPI	0	25	10	202	379	101
Sandea + NIS	0.031 + 0.25% v/v	POST	22	32	74	215	222	-7
Sandea + NIS	0.035 + 0.25% v/v	POST	28	33	73	251	425	61
Sandea + NIS	0.047 + 0.25% v/v	POST	23	29	79	199	279	20
Eptam Sandea + NIS	3.9 0.031 + 0.25% v/v	PPI POST	23	35	81	213	182	-16
Dual Magnum Sandea + NIS	1.6 0.031 + 0.25% v/v	PPI POST	21	30	84	222	126	-41
Dual Magnum Basagran + COC Basagran + COC	1.6 1.0 + 1.0% v/v 1.0 + 1.0% v/v	PPI POST LPOST	4	36	84	214	147	-27
Eptam + Dual Magnum	3.9 + 0.95	PPI	0	31	28	229	248	9
Untreated control	--	--	-	22	-	231	412	82
LSD (0.05)	--	--	7	5.7	13	NS	156	61

*The entire trial was treated with Prowl (1.0 lb ai/acre) preemergence for control of weeds other than yellow nutsedge. NIS = non-ionic surfactant, COC = crop oil concentrate.

†Application timing abbreviations and dates: preplant incorporated (PPI) on May 20, postemergence (POST) on June 12, and late postermergence (LPOST) on June 23.

Table 3. Potato injury, potato yield, yellow nutsedge control, and yellow nutsedge tuber response to herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment*	Rate	Timing†	Crop injury 6-24	Crop yield‡	Nutsedge control 8-18	Average nutsedge tubers Initial	Final	Change
	lb ai/acre	Leaf	---%---	cwt/acre	---%---	----------no/ft²---------		---%---
Dual Magnum	1.9	PREI	0	57	61	252	307	79
Outlook	0.84	PREI	0	67	58	215	224	100
Eptam	6.0	PREI	0	60	26	242	319	32
Eptam Matix + COC	6.0 0.023 + 1% v/v	PREI POST	0	64	40	278	306	118
Dual Magnum Matix + COC	1.9 0.023 + 1% v/v	PREI POST	0	79	66	271	265	0
Matix + COC	0.023 + 1% v/v	POST	0	61	29	298	448	101
Permit + COC	0.023 + 1% v/v	POST	20	72	50	297	192	-38
Untreated control	--	--	--	56	-	278	418	65
LSD (0.05)	--	--	2	NS	20	NS	NS	NS

*The entire trial was treated with Prowl (1.0 lb ai/acre) preemergence for control of weeds other than yellow nutsedge. COC = crop oil concentrate.

†Preemergence incorporated (PREI) treatments were applied on May 13 and postemergence (POST) treatments were applied on June 5.

‡Reported potato yield is total yield.

Table 4. Sugar beet injury, sugar beet yield, yellow nutsedge control, and yellow nutsedge tuber response to soil-active herbicides added to standard sugar beet treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment*	Rate	Timing†	Crop injury 6-24	Crop yield	Nutsedge control 7-28	Average nutsedge tubers Initial	Average nutsedge tubers Final	Average nutsedge tubers Change
	lb ai/acre	Leaf	---%---	ton/acre	---%---	--------no/ft²-------		---%---
Standard Program			-	15	-	188	482	202
Betamix+ Upbeet	0.25 + 0.016	cot						
Betamix+ Upbeet + Stinger	0.33 + 0.016 + 0.094	2-leaf						
Betamix+ Upbeet + Stinger	0.42 + 0.016 + 0.094	8-leaf						
Standard Program	same	cot, 2, 8-lf	9	18	41	175	357	109
Dual Magnum	1.6	2-leaf						
Standard Program	same	cot, 2, 8-lf	4	16	45	150	366	248
Outlook	0.84	2-leaf						
Standard Program	same	cot, 2, 8-lf	8	18	47	132	365	167
Outlook	0.66	2-leaf						
Standard Program	same	cot, 2, 8-lf	5	18	31	155	475	300
Dual Magnum	1.6	2-leaf						
Eptam	3.0	Layby						
Standard Program	same	cot, 2, 8-lf	4	18	61	177	396	121
Dual Magnum	1.6	2-leaf						
Outlook	0.84	8-leaf						
Standard Program	same	cot, 2, 8-lf	5	19	41	163	416	154
Dual Magnum	1.6	2-leaf						
Dual Magnum	0.9	8-leaf						
Standard Program	same	cot, 2, 8-lf	13	16	40	183	410	179
Dual Magnum + COC	1.6 + 1.0% v/v	2-leaf						
LSD (0.05)			NS	NS	NS	NS	NS	NS

*COC = crop oil concentrate.
†Applications were made when sugar beets were cotyledon (cot) on May 12, two-leaf (2-lf) on May 21, eight-leaf (8-lf) on June 6, and layby on June 30 just prior to the final cultivation.