CONTROL OF YELLOW NUTSEDGE WITH EFFECTIVE CROP ROTATIONS

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Introduction

Yellow nutsedge has become a major crop production threat in many agricultural fields in the Treasure Valley of eastern Oregon and southwestern Idaho. The severity and negative effects of yellow nutsedge are especially noticeable when fields are planted to direct-seeded onions. Field surveys have indicated an average of 42 percent in heavily infested fields. Control of yellow nutsedge presents a challenge because of its ability to reproduce by rhizomes and tubers that are able to survive in the soil for 3 to 4 years. Farming activities play a significant role in yellow nutsedge distribution in infested fields. Successful control of yellow nutsedge will therefore require integrated approaches including effective crop rotations and use of herbicides with proven efficacy. The objective of this study was to evaluate the effect of tillage, crop rotation, and herbicides on yellow nutsedge control.

Materials and Methods

The study was initiated in 2007 in a field heavily infested with yellow nutsedge near the Malheur Experiment Station, Ontario, Oregon. The study was a split-plot design with tillage (reduced and conventional) forming the main plots onto which three rotational crops and herbicide treatments were imposed as subplots. Each year the crops were planted on 22-inch beds. The rotations were designed so that the terminal crop will be onions in 2011. Rotations were: (1) corn/corn/sugar beet/wheat/onions; (2) corn/sugar beet/corn/wheat/onions; and (3) corn/corn (late planting)/pinto beans/wheat/onions.

Conventionally tilled plots were moldboard plowed each year and disked twice before forming beds to facilitate furrow irrigation. Reduced-tillage plots were disked only twice to avoid deep tillage, which is believed to redistribute tubers within the soil profile. Fertilizer was applied to provide nutrients as determined by soil tests in 2007-2010. In 2007, the entire study was planted to Dekalb Roundup Ready® (RR) corn hybrid 'DK-51-39' with seeds spaced 7 inches within the row. Rotational crops in 2008 were RR corn hybrid 'DK C52-59' planted on May 15 and RR sugar beet variety Beta 'CT 01RR07' planted on April 18. Rotational crops in 2009 were RR corn hybrid ‘DKC 52-59’, RR sugar beet ‘BTS 26RR14’, and ‘Othello’ pinto beans. Corn and sugar beets were mechanically planted in respective plots at 7 inches within the row and 8 seeds per ft of row, respectively. Pinto beans were seeded at 80 lb/acre. Counter® 15-G (terbufos) insecticide was banded over the sugar beet rows at 7.4 lb/acre immediately after planting. Sugar beet rows were sidedressed with Temik® 15G at 10 lb/acre (aldicarb 1.5 lb ai/acre) 53 days after planting. Sugar beets and pinto beans were sprayed with Quadris® at 4 oz/acre (azoxystrobin + chlorothalonil at 2.75 oz ai/acre) on May 22 and June 11. Sugar beets were thinned on May 28, 2008 to 8-inch spacing within the row.

Soil sampling to quantify initial yellow nutsedge tuber density was conducted during spring 2007 after beds were made and the field irrigated. The process was repeated at the end of each crop year to quantify changes in yellow nutsedge tubers in response to treatments. Five soil cores measuring 4.25 inches in diameter and 12 inches deep each were taken randomly from each plot. The soil was processed to recover yellow nutsedge tubers using the washing and sieving procedure. Tubers from each plot were placed in a ziplock plastic bag and stored in the dark at 40°F until they were counted and weighed. The study was furrow irrigated as needed on a calendar schedule to maintain moisture in the top 12 inches of the soil profile. Crops were harvested for yield at maturity from 20 ft of the 2 center rows of each plot.

Herbicides used on corn in 2007 and rotational crops in 2008-2010 are presented in Table 1. All herbicide treatments were applied using a tractor with a sprayer boom equipped with 8002EVS Teejet nozzles calibrated to deliver 20 gal of solution per acre. The data were subjected to analysis of variance and the means compared using Fisher's protected LSD at $P = 0.05$.

Results and Discussion

Yellow nutsedge tubers were uniformly distributed at the beginning of the study (Table 2). At the end of the 2007 growing season, yellow nutsedge tuber population density was reduced by herbicide treatments relative to the untreated control. Since there was no significant difference among tillage in 2007 for yellow nutsedge tuber population density, the average is presented in Table 1. The reduction in yellow nutsedge tubers was greater in conventionally tilled plots in 2008 through 2010 (Table 2). Yellow nutsedge population density dramatically increased in the untreated treatment in 2008 and 2009 relative to plots treated with herbicides. The conventionally tilled corn/corn/sugar beet/wheat rotation resulted in the fewest yellow nutsedge tubers. The entire study area will be planted to onions in 2011 to assess the tillage and herbicide treatment effects on yellow nutsedge during the last 4 years.

Table 1. List of yearly treatments used in the rotational study to control yellow nutsedge in different crops at Malheur Experiment Station, Ontario, OR 2007-2010.

2007[a]

Conventional and reduced till
Corn
1. Untreated
2. Dual II Magnum 1.67 pt/a (PRE)[b]; Roundup 32 fl oz/a (POST) +AMS 3.2 pt/a
3. Dual II Magnum 1.67 pt/a (PRE); Dual II Magnum 1.67 pt/a (POST) + Roundup 32 fl oz/a + AMS 3.2 pt/a
4. Dual II Magnum 2.5 pt/a (PRE); Basagran 1.5 pt/a (POST) + Roundup 32 fl oz/a +AMS 3.2 pt/a
5. Dual II Magnum 3 pt/a (PRE); Basagran 2 pt/a (POST) + Roundup 32 fl oz/a +AMS 3.2 pt/a

2008

Rotational crops in conventional and reduced till		
Corn	**Sugar beet**	**Corn (late)**
Untreated	Untreated	Untreated
Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a	Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a	Eptam 4.5 pt/a (PPI)[c] Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a
Outlook 14 oz/a (PPI) Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a	Nortron 12 oz/a (PPI) Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) + Eptam 3.5 pt/a (POST2) +AMS 3.2 pt/a	Outlook 14 oz/a (PPI) Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a
Eradicane 6 pt/a (PPI) Roundup 22 oz/a (POST1) + Basagran 1.5 pt/a +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a	Outlook 21 oz/a (PPI) Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +Nortron 12 oz/a (POST2) +AMS 3.2 pt/a	Dual II Mag 1.33 pt/a (PPI) Roundup 32 oz/a (POST1) + Basagran 1.5 pt/a +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a
Outlook 18 oz/a (PPI) Roundup 22 oz/a (POST1) + Basagran 2 pt/a +AMS 3.2 pt/a Roundup 22 oz/a (POST2) + Dual II Mag 1.33 pt/a +AMS 3.2 pt/a	Dual IIM 1.33pt/a (POST1) +Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Dual IIM 1.33pt/a (POST2) Roundup 22 oz/a (POS2) +AMS 3.2 pt/a	Dual II Mag 1.33 pt/a (PPI) Eptam 4.5 pt/a (PPI) Roundup 32 oz/a (POST1) + Basagran 1.5 pt/a +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a

[a] All plots were planted to corn in 2007. Conventional and reduced tillage plots were sprayed with the same herbicide rates as indicated for each year. The main plots were divided into three plots and the rotational crops planted as shown in 2008 and 2009.
[b]PRE = preemergence of crop; POST = postemergence.
[c]PPI = preplant incorporated.

Table 1. continued

2009		
Rotational crops in conventional and reduced till		
Sugar beet	**Corn**	**Pinto beans**
1. Untreated	Untreated	Untreated
2. Roundup 22 oz/a (POST1) +Outlook 21 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a	Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a	Outlook 21 oz/a (PPI) Raptor 4 oz/a (POST) +Basagran 0.75 pt/a +AMS 3.2 pt/a
3. Roundup 22 oz/a (POST1) +Outlook 10.5 oz/a (POST1) +AMS 3.2 pt/a	Outlook 21 oz/a (PPI) Roundup 22 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a	Outlook 14 oz/a (PPI) Outlook 7 oz/a (POST1) +Basagran 0.75 pt/a +AMS 3.2 pt/a Basagran 1.5 pt/a (POST2) +AMS 3.2 pt/a
4. Roundup 21 oz/a (POST1) +Outlook 21 oz/a +AMS 3.2 pt/a Roundup 21 oz/a (POST2) +Nortron 5 oz/a +AMS 3.2 pt/a Roundup 22 oz/a (POST3) +AMS 3.2 pt/a	Dual II Magnum 1.5 pt/a (PPI) Roundup 22 oz/a (POST1) +Basagran 2 pt/a +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +AMS 3.2 pt/a +AMS 3.2 pt/a	Dual Magnum 1.33 (PPI) Basagran 1 pt/a (POST1) +Raptor 4 oz/a +AMS 3.2 pt/a Basagran 1.5 pt/a (POST2) +AMS 3.2 pt/a
5. Roundup 22 oz/a (POST1) +Outlook 21 oz/a (POST1) +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +Dual Mag 1.33 pt/a (POST2) +AMS 3.2 pt/a Roundup 22 oz/a (POST3) +AMS 3.2 pt/a	Dual II Magnum 1.5 pt/a (PPI) Roundup 22 oz/a (POST1) +Basagran 2 pt/a +AMS 3.2 pt/a Roundup 22 oz/a (POST2) +Basagran 1.5 pt/a +AMS 3.2 pt/a	Dual Magnum 1.33 (PPI) +Treflan 1.5 pt/a Basagran 1 pt/a (POST1) +Outlook 18 oz/a +AMS 3.2 pt/a Basagran 2 pt/a +COC 2 pt/a

2010[d]		
Conventional and reduced till		
Wheat	**Wheat**	**Wheat**
1. Untreated	Untreated	Untreated
2. Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a
3. Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a
4. Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a
5. Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a	Bronate advanced 1.66 pt/a

[d] All wheat plots in 2010 were treated with Bronate Advanced at 1.66 pt/acre.

Table 2. Yellow nutsedge tuber (tubers/yd^2) changes in response to tillage and herbicide treatments at Malheur Experiment Station, Ontario, OR from 2007 to 2010.

	2007	
	Spring	Fall
Treatment[a]	Corn	
	------- tubers/yd^2 --------	
1	5,988 a	9,962 a
2	5,146 a	2,197 b
3	5,867 a	2,559 b
4	5,707 a	3,178 b
5	4,274 a	2,155 b

	2008					
	Conventional tillage			Reduced tillage		
Treatment	Corn	Sugar beet	Corn (late)	Corn	Sugar beet	Corn (late)
	---------- tubers/yd^2 ----------					
1	11,173 a	15,187 a	8,541 a	14,843 a	20,040 a	8,964 a
2	984 b	1,056 b	966 b	1,431 b	1,412 b	996 b
3	1,129 b	670 b	875 b	1,243 b	990 b	1,630 b
4	1,835 b	1,388 b	1,044 b	1,612 b	1,497 b	1,243 b
5	1,750 b	1,756 b	736 b	1,738 b	911 b	1,038 b

	2009					
	Conventional tillage			Reduced tillage		
Treatment	Sugar beet	Corn	Pinto bean	Sugar beet	Corn	Pinto bean
	---------- tubers/yd^2 ----------					
1	17,040 a	14,366 a	10,243 a	13,376 a	24,567 a	13,841 a
2	537 b	773 b	453 b	984 b	990 b	1,008 b
3	869 b	1,086 b	531 b	797 b	881 b	1,014 b
4	917 b	1,195 b	435 b	857 b	1,262 b	954 b
5	392 c	887 b	513 b	972 b	525 c	839 b

	2010					
	Conventional tillage			Reduced tillage		
Treatment	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
	---------- tubers/yd^2 ----------					
1	4,992 a	10,720 a	7,418 a	6,084 a	11,855 a	7,292 a
2	254 b	423 b	447 b	410 b	471 b	954 b
3	175 c	332 b	453 b	338 b	386 b	718 b
4	380 b	314 b	392 b	332 b	598 b	899 b
5	145 c	368 b	290 b	338 b	435 b	592 b

[a]Herbicides used in each treatment and year are listed in table 1.