DEVELOPING EFFECTIVE CROP ROTATION SYSTEMS TO MANAGE YELLOW NUTSEDGE EXPANSION

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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. The gravity of this problem is especially noticeable when the land is planted to onions. Thus, development of effective yellow nutsedge strategies is viewed by many as priority number one for researchers. 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 years. Research results at the Malheur Experiment Station indicate that millions of tubers are produced per acre each season in heavily infested fields (Shock et al. 2006). Successful control of yellow nutsedge will partly require development of elaborate crop rotation schemes that include multiple tactics including tillage, fumigation, and herbicides to destroy those pesky tubers. It has been reported that farming activities play a significant role in yellow nutsedge distribution in infested fields (Schippers et al. 1993). This study is a first step in developing crop rotation schemes that will demonstrate the effect of tillage and rotation on yellow nutsedge control.

Materials and Methods

A multi-year study was initiated during summer 2007 in a field heavily infested with yellow nutsedge along Hwy 201 near the Malheur Experiment Station, Ontario, Oregon. The study was laid out in a split-split-plot design with tillage (reduced and conventional tillage) forming the main plots, rotational crops as the first subplot, and herbicides as the sub-subplots. The terminal crop in each of the planned rotations will be onion. Rotations are: 1) corn/corn/sugar beet/dry beans/onions; 2) corn/sugar beet/dry bean/wheat/onions; and 3) corn/dry bean/potato/sugar beet/onions. Conventionally tilled plots were moldboard plowed and disked twice before beds were formed to facilitate furrow irrigation. Reduced tillage plots were disked only twice to avoid deep tillage that dilutes tubers within the soil profile. Following soil analysis, a compound fertilizer to provide 120 lbs nitrogen (N), 30 lbs phosphorus (P), 13 lbs sulfate (SO_4), 2 lbs zinc (Zn), and 1 lb boron (B) per acre was applied on May 4, 2007. The entire study was planted to Dekalb Roundup Ready® corn hybrid 6668751 at 26,000 plants/acre in the first year as a measure to drive down the tubers before introducing other crops in year two.

Herbicide treatments used on corn included: 1) untreated; 2) Dual Magnum® 1.67 pt/acre Pre-emergence (PRE); 3) Dual Magnum 1.67 pt/acre PRE followed by 1.67 pt/acre Post-emergence (POST); 4) Dual Magnum 2.5 pt/acre plus Basagran® 1.5

pt/acre PRE; and 5) Dual Magnum 3 pt/acre plus Basagran 2 pt/acre PRE. Treatments 2-5 were also treated with two sequential applications of POST application of Roundup OriginalMax® at 32 fl oz/acre plus ammonium sulfate (AMS).

Soil sampling for initial tuber quantification was done in spring after bed formation and irrigation by taking 5 cores each measuring 4.25 inches in diameter and 12 inches deep from each plot. The soil cores were processed to recover tubers using the washing and sieving procedure. Fall soil sampling was done on October 4 and processed to recover tubers on October 17, 2007. The tubers from each plot were placed in a ziplock plastic bag and stored in a dark cooler at 40°F until they were counted and weighed. The study was furrow irrigated as needed to maintain moisture in the top 12 inches of the soil profile. The corn was harvested for yield from 20 ft of the 2 center rows in each plot.

Results and Discussion

The study area had a relatively uniform distribution of yellow nutsedge tubers/ft^2 at the initiation of the study (Table 1). There was no difference in corn yield between treatments except for the untreated control that had very low yield due to excessive weed competition (Table 1). There was no difference between tillage for corn yield, which averaged 5 and 5.7 tons/acre for conventional and reduced tillage, respectively. This is not a surprise because it takes about 4 years for tillage effects to manifest themselves. However, when averaged across tillage, there was a significant difference between treatments, mainly with the untreated control producing the lowest yield.

Soil samples taken during the fall indicated significant reduction in the number of tubers in response to herbicide treatments used during summer 2007. There was no difference in the number of yellow nutsedge tubers between conventional and reduced till plots, which was expected because tillage effects do not manifest themselves until the fourth year of the practice. Soil sampling during fall indicated a trend for reduced tuber numbers in plots treated with sequential Dual Magnum at 1.67 pt/acre followed by Roundup OriginalMax at 32 fl oz/acre. Plots treated with Dual Magnum 1.67 pt/acre followed by a combination of Roundup plus Basagran at 1.5 pt/acre did not improve yellow nutsedge control. Weed control in each crop grown in a rotation will include herbicides known to control yellow nutsedge. We hope that in the final year of the rotation, yellow nutsedge tubers will have been degraded significantly to enable a successful onion crop.

References

Schippers, P., S.J. Ter Borg, J.M. Van Groenendael, and B. Habekotte. 1993. What makes *Cyperus esculentus* (yellow nutsedge) an invasive species? A spatial model approach. Proceedings Brighton Crop Protection Conference 495–504.

Shock, C.C., J. Ishida, and E. Feibert. 2006. Yellow nutsedge nutlet production in response to nutlet planting depth. Oregon State University Agricultural Experiment Station Special Report 1075:160-162.

Table 1. Yellow nutsedge tuber production and corn yield in response to tillage and herbicide treatments in Roundup Ready® field corn, Malheur Experiment Station, Oregon State University, Ontario, OR, summer 2007.

Treatments	Rate unit	Conventional tillage					Reduced tillage				
		May 29, 2007		November 4, 2007		Corn yield	May 29, 2007		November 4, 2007		Corn yield
		Tubers/ft^2	Weight (g)	Tubers/ft^2	Weight (g)	Tons/acre	Tubers/ft^2	Weight (g)	Tubers/ft^2	Weight (g)	Tons/acre
1. Control		729.1	62.4	1088.0	96.7	1.2	614.0	52.5	1146.9	88.5	1.6
2. Dual II Magnum	1.67 pt/a	628.3	56.5	270.1	23.6	5.4	526.0	53.6	222.7	22.7	6.3
Roundup OMax	32.0 oz/a										
Ammonium Sulfate	2 % V/V										
3. Dual II Magnum	1.67 pt/a	640.5	65.3	214.6	21.8	5.5	657.7	62.0	359.5	33.6	6.1
Dual II Magnum	1.67 pt/a										
Roundup OMax	32.0 oz/a										
Ammonium Sulfate	2% V/V										
4. Dual II Magnum	2.5 pt/a	649.3	59.9	428.5	36.6	6.3	631.0	60.6	284.3	25.4	5.4
Basagran	1.5 pt/a										
Roundup OMax	32.0 oz/a										
Ammonium Sulfate	2 % V/V										
5. Dual II Magnum	3.0 pt/a	528.7	47.4	223.4	20.3	6.6	429.9	42.6	260.0	24.9	6.5
Basagran	2.0 pt/a										
Roundup OMax	32.0 oz/a										
Ammonium Sulfate	2 % V/V										
LSD (0.05)		345.9	28.8	422.9	39.5	1.5	345.9	28.8	422.9	39.5	1.5