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Weed Control in No-Till Pumpkins

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Introduction

No-till production systems for pumpkins are of interest to Midwest producers, but achieving acceptable weed control without cultivation can be difficult. Research was conducted in Wanatah, Indiana in 2007 to evaluate postemergence weed control options for pumpkins no-till planted into a fall-seeded, spring-killed winter wheat cover crop.

Materials and Methods

The trial was conducted at the Pinney-Purdue Agricultural Center on a Tracy sandy loam with 2.4% organic matter and 57 ppm phosphorus (P), 139 ppm potassium (K), 180 ppm magnesium (Mg), 750 ppm calcium (Ca), and pH 6.7. Winter wheat was planted in fall 2006 following a soybean crop. In spring 2007 six treatments were established in a randomized complete block design with four replications (Table 1).

Table 1. *Tillage and weed control treatments for pumpkins in Wanatah, IN 2007.*

Treatment	Tillage	Weed Control	Date of Treatment
1. ST	No-till	glyphosate 0.75 lb. ae/A Strategy® 4 pt./A	May 21, June 8 June 11
2. SAN	No-till	glyphosate 0.75 lb. ae/A Strategy® 4 pt./A Sandea® 0.5 oz./A	May 21, June 8 June 11 July 13
3. GLY	No-till	glyphosate 0.75 lb. ae/A Strategy® 4 pt./A glyphosate 0.75 lb. ae/A, row-middles with hooded sprayer	May 21, June 8 June 11 July 13
4. WDY	No-till	glyphosate 0.75 lb. ae/A	May 21, June 8
5. HW	No-till	glyphosate 0.75 lb. ae/A Strategy® 4 pt./A Hand weed	May 21, June 8 June 11 July 13-August 3
6. CT	Conventional	Strategy® 4 pt./A Cultivation	June 11 July 13

Individual plots were 36 feet long by 27 feet wide with two pumpkin rows spaced 9 feet apart. Wheat in CT plots was treated on May 9 with glyphosate at 0.75 lb. ae/A and incorporated on May 22. A total of 80 lbs./A N was applied; half from urea broadcast on June 7 and the remainder from UAN injected in early July. 'Magic Lantern' pumpkins were seeded on June 11 with a modified John Deere Maximerge 7000 planter. After Strategy® application, overhead

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sprinklers were used to apply 0.33 inch of water. Subsequently pumpkins were irrigated as needed. Pumpkins emerged unevenly, so seedlings were transplanted from plots with high numbers to plots with low numbers and thinned as needed to achieve the desired stand of 24 plants per plot (1,075 plants per acre). The insecticide Arctic® 3.2 EC (permethrin) was applied at 4 oz./A on July 3 for squash vine borer and on August 27 for squash bug. Fungicides were applied as follows to manage powdery mildew, downy mildew, plectosporium, and other diseases: July 21 Topsin M® 0.5 lb./A and Bravo Ultrex® 1.6 lbs./A.; July 27 Ranman® 2.5 oz./A and Bravo Ultrex®; August 3 Bravo Ultrex® and Tanos® 8 oz./A; August 11 Bravo Ultrex® and Previcur Flex® 1.2 pt./A; August 13 Quadris® 13 oz./A; August 16 Bravo Ultrex® and Ranman®; August 27 Bravo Ultrex®, Topsin M®, Previcur Flex®. Weed control, crop vigor, and crop injury were evaluated on July 2, 21, and August 15. On the 9-point rating scale, 9=no weeds present, most vigorous crop, or extreme crop injury; 1=solid stand of weeds, extremely low crop vigor, or no crop injury. Pumpkins were harvested September 6-7, and September 28 . Harvested fruit were graded into marketable orange (at least one half orange), marketable green (full size and starting to turn but less than one half orange), and cull. The number and weight of pumpkins in each group were recorded and used to calculate average fruit size and percent of total yield in each category. Analyses of variance (AOV) were performed and means separated using Fisher's protected LSD. When the variance for a treatment was zero for a particular response, an AOV was performed without that treatment.

Results and Discussion

Stand Establishment and Crop Vigor

Emergence ranged from a quarter to more than double the desired stand for individual plots, but there was no effect of tillage or weed control treatment, and after thinning and transplanting to achieve desired stand, differences in emergence did not influence plot yield (data not shown). Observations suggested that low emergence was more likely when the planting slot was on top of a wheat row instead of between two wheat rows.

Significant differences in crop vigor were not recorded until August 15 (Table 2). At that time, pumpkins were most vigorous in CT and GLY plots, followed by HW plots, which did not differ significantly. ST plots were intermediate in vigor between HW and SAN plots. WDY plots were least vigorous. Pumpkins in SAN plots showed some leaf chlorosis recorded as crop injury on July 21 and the injury was still visible on August 15 (Table 2). Pumpkins in GLY plots showed slight leaf chlorosis and distortion recorded as crop injury on both dates.

Weed Control

Early season weed control (July 2) was poor with no preemergence herbicide (WDY) and fair to good in other treatments (Table 2). Common lambsquarters and carpetweed were the most prevalent weeds. Some of the common lambsquarters had survived the burndown treatments applied to the winter wheat before planting pumpkins. On July 21, 8 days after postemergence herbicide application or cultivation, overall weed control was best for GLY and CT, but those treatments did not differ significantly from SAN or HW. ST plots had significantly worse control than GLY or CT, but did not differ from SAN or HW. WDY plots had greater weed pressure than any other treatment. Control of common lambsquarters was best in CT, but not significantly different from GLY. Treatments with SAN, HW, and ST didn't differ significantly for control of common lambsquarters. Control of carpetweed was fair to poor, did not differ among herbicide

treated plots, and was worst in WDY. Control of giant ragweed was better in SAN and HW than ST or CT; GLY and WDY treatments were intermediate between SAN and ST. All treatments with preemergence herbicide controlled fall panicum equally well (data not shown). On July 21 control of pigweeds, ivyleaf morningglory, and eastern black nightshade did not differ among treatments (data not shown). By August 15, overall weed control was best in HW, but not significantly different from GLY. CT plots received a lower rating than, but were not significantly less than, GLY, and were also similar to SAN. ST plots were worse than any of the post-treated plots, but better than WDY. Control of common lambsquarters was best in CT, but did not differ significantly from GLY or HW. Those two treatments in turn did not differ from the ST or SAN treatments. The WDY plot had the worst control of common lambsquarters. Control of carpetweed was rated better in GLY than HW or CT, but the difference wasn't significant. SAN plots were rated lower, but not significantly different from HW and CT. ST and WDY treatments showed similar poor control of carpetweed. Giant ragweed control was similar in all NT plots, and a little worse in CT plots. Pigweed control was best in SAN, but not significantly better than HW or CT. Those two were not significantly better than the GLY or WDY. The ST treatment showed the worst control of pigweeds, but not significantly different from GLY or WDY.

Yield and Fruit Size

The number of orange pumpkins was greater in HW and GLY plots than SAN and WDY; CT and ST were intermediate (Table 3). Yield of orange pumpkins in tons per acre followed a similar pattern, but only HW was significantly greater than SAN, and all except SAN were significantly greater than WDY. Average size of an orange pumpkin followed a similar pattern: HW produced the largest pumpkins, but not significantly different from GLY or CT; SAN and WDY had the smallest pumpkins; ST were intermediate in size.

The yield and number of all marketable pumpkins (both orange and green) were greatest in GLY and HW; CT was lower but not significantly different. ST and SAN treatments were intermediate between CT and the lowest-yielding WDY plots. Average fruit size followed a similar pattern.

For WDY plots, more than two-thirds of the total harvest was made up of marketable orange pumpkins picked on September 6-7. This was not significantly different from ST plots at 57%, but was more than any of the other plots, which had between 40% and 45% picked on the first harvest. The percent of all harvested pumpkins that were still green at the second harvest was about a quarter to a third (24% to 31%) for treatments with a postemergence weed control measure; and around 10% for those without (ST and WDY). Cull percentages varied between 7% and 17%, but did not differ among weed control treatments.

Summary

Weeds in no-till pumpkins were controlled reasonably well with a preemergence herbicide (Strategy®) followed by a hooded sprayer, row-middle application of a nonselective, nonresidual herbicide (glyphosate). Weed control, yield, and fruit size with this treatment were comparable to conventional tillage with a preemergence herbicide (Strategy®) and one cultivation. Hand weeding could be substituted for the nonselective herbicide with similar results. Other treatments for weed control in no-till pumpkins did not work as well. Use of the preemergence herbicide followed by a selective postemergence herbicide (Sandea®) did not control weeds as well as hand

weeding and resulted in crop injury, reduced yield, and smaller fruit. Use of the preemergence herbicide alone resulted in poor weed control and a trend towards reduced yield and fruit size. Even the best weed control treatment in this trial had large weeds present at season's end. Additional weed control measures would be required to prevent weed seed production and shed. Future trials could include additional herbicides labeled for preemergence or row-middle use, different cover crop management practices, and treatments designed specifically to minimize weed seed additions to the soil.

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Table 2. *Crop vigor, crop injury, and weed control ratings for 'Magic Lantern' pumpkins under conventional tillage with preemergence herbicide and cultivation or no-till production with various weed control programs, Wanatah, Indiana, 2007*[z].

Trt.[y]	Crop Vigor			Crop Injury		Weed Control[x]									
						Overall			LQ		CW		GR		PW
	7/2	7/21	8/15	7/21	8/15	7/2	7/21	8/15	7/21	8/15	7/21	8/15	7/21	8/15	8/15
ST	5.2	7.0	5.8 bc	1.0	1.0	7.2 ab	5.8 b	3.5 d	6.0 cd	4.8 b	6.2 a	2.8 c	7.8 bc	7.5 a	6.2 c
SAN	5.0	5.8	4.5 c	3.5	3.0	7.5 ab	7.0 ab	5.2 c	6.2 bc	5.0 b	6.8 a	5.0 b	8.8 a	8.2 a	8.8 a
GLY	6.0	7.0	7.2 a	1.8	1.8	8.2 a	8.0	7.0 ab	7.5 ab	7.0 a	7.8 a	7.0 a	8.5 ab	8.5 a	7.2 bc
WDY	6.8	7.0	2.8 d	1.0	1.0	5.0 c	3.8 c	1.8 e	4.8 d	2.0 c	4.5 b	1.5 c	8.2 ab	8.0	7.0 bc
HW	6.5	7.2	7.0 ab	1.0	1.0	8.0	6.8 ab	7.2 a	7.0 bc	6.8 a	7.0 a	6.2 ab	8.8 a	9.0	8.2 ab
CT	6.5	7.8	7.8 a	1.0	1.0	6.5 b	7.2 a	6.0 bc	8.8 a	8.0	7.5 a	6.0	7.0 c	6.2 b	8.0 ab

[z]1 to 9 rating scales. Crop vigor: 9=extremely vigorous, 5=average vigor, 1=extremely low vigor
Crop injury: 9=crop death, 1=no injury
Weed control: 9=nearly complete control, 1=solid weed cover
Means within a column followed by the same letters do not differ significantly at $P \leq .05$ based on Fisher's protected LSD.

[y]ST=No-till seeded on June 11 into glyphosate-killed winter wheat cover crop, Strategy® 4 pt./A after seeding; SAN=ST+Sandea® 0.5 oz./A on July 13; GLY=ST+glyphosate 0.75 lb. ae/A to row-middles on July 13; WDY=ST without Strategy®; HW=ST + hand weeding July 13-August 3; CT=conventional tillage, seeded July 11, Strategy® 4 pt./A after seeding, cultivation on July 13.

[x]Weed species: LQ=common lambsquarters, CW=carpetweed, GR=giant ragweed, PW=pigweeds.

Table 3. *Yield and fruit size of 'Magic Lantern' pumpkins under conventional tillage with preemergence herbicide and cultivation or no-till production with various weed control programs, Wanatah, Indiana, 2007.*

Treatment[z]	Mkt. Orange Fruit			Total Mkt. Fruit			Mkt. Orange 9/6	Mkt. Orange 9/28	Mkt. Green	Cull
	no./A	*ton/A*	*lb./fruit*	*no./A*	*ton/A*	*lb/fruit*	*percent of total no.*			
ST	1,154 ab	7.0 bcd	12.0 b	1,344 bc	7.9 bc	11.5 a	57 ab	19 a	13 b	12
SAN	919 b	4.7 cd	9.9 c	1,344 bc	6.7 c	9.5 b	41 b	17 ab	26 a	16
GLY	1,434 a	9.6 ab	13.5 ab	2,174 a	14.4 a	13.2 a	45 b	17 ab	31 a	7
WDY	829 b	3.9 d	9.4 c	941 c	4.4 c	9.1 b	72 a	6 c	9 b	13
HW	1,591 a	11.0 a	13.9 a	2,129 a	14.0 a	13.1 a	44 b	24 a	24 a	8
CT	1,165 ab	7.9 abc	13.3 ab	1,826 ab	11.8 ab	12.7 a	44 b	10 bc	28 a	17

[z]ST=No-till seeded on June 11 into glyphosate-killed winter wheat cover crop, Strategy® 4 pt./A after seeding; SAN=ST+Sandea® 0.5 oz./A on 7/13; GLY=ST+glyphosate 0.75 lb. ae/A to row-middles on July 13; WDY=ST without Strategy®; HW=ST + hand weeding July 13-August 3; CT=conventional tillage, seeded June 11, Strategy® 4 pt./A after seeding, cultivation on July 13.