

NORTRON® AND OUTLOOK® RESIDUAL ACTIVITY ON WEEDS COMPARED TO ROUNDUP® ALONE IN ROUNDUP READY® SUGAR BEETS

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Introduction

Production of Roundup Ready® (RR) sugar beets was launched in eastern Oregon and Idaho in 2008. The introduction of RR sugar beets presented an opportunity for growers to spray Roundup herbicide directly over the plants starting as early as two-leaf stage without concern for sugar beet plant injury. Growers have traditionally used preplant or pre-emergence (PRE) herbicides with soil-residual herbicides to control weeds, especially at the early growth stage when beet plants are small and less vigorous. Use of soil-residual herbicides also provides weed control for weeds that emerge later after crop emergence until canopy cover. If sugar beet root yield is to be maximized, the total glyphosate POST weed management program will require diligent monitoring of weed cohorts that emerge in succession. The proponents of inclusion of soil-residual herbicides into glyphosate sprays argue that it is a sound way to minimize selection of herbicide-resistant weed biotypes and a viable practice to provide sustainable weed control. The objective of this study was to evaluate weed control when soil-residual herbicides such as Nortron and Outlook are included in tank-mixes compared to spraying Roundup alone.

Materials and Methods

The study was established in 2008 at the Malheur Experiment Station, Ontario, Oregon in a well-drained furrow-irrigated field that was previously planted to wheat. The predominant soil was an Owyhee silt loam with 1.9 percent organic matter, a pH of 7.2 and a cation exchange capacity of 11 meq/g of soil. The soil was moldboard plowed and disked to create a seedbed suitable for sugar beet production. The study was laid out in a randomized complete block design with four replications. Individual plots were 7.33 ft wide (4 rows) by 25 ft long. Roundup Ready sugar beet variety 'BTSCT02RR08' was planted on April 10, 2008 using tractor-mounted flexi-planter units with double-disc furrow openers and cone seeders fed from a spinner divider that uniformly distributed the seeds within the row. Sugar beet seeds were dropped at the rate of 8 seeds/ft of row and thinned to 8-inch spacing between plants within the row on May 28, 2008. Counter® 15G (7.4 lb/acre) was applied on April 11 and Temik® 15G (10 lb/acre) on June 3, 2008. Sugar beets were fertilized on June 13 using a special blend fertilizer to supply 180 lb nitrogen, 20 lb potassium, and 3 Lbs zinc. The study was irrigated using a calendar schedule to maintain moisture in the top 12 inches of the soil profile. All herbicide treatments were applied using a CO₂-pressurized backpack sprayer fitted with a boom equipped with four 8002EVS Teejet nozzles calibrated to deliver 12 gal/acre. Early POST treatments were applied on May 17, while POST treatments were on June

8, 2008. Plants within each plot were visually evaluated for crop injury and weed control at 7, 23, 39, and 77 days after the last POST herbicide application using 0 percent (no crop injury or no weed control) to 100 percent (complete crop kill or complete weed control) scale. Sugar beets were harvested from 25 ft of the two center rows on October 16 using a beet harvester. Sugar beet weight from each plot was multiplied by a factor of 0.90 to correct for tare. Sugar content and other sugar yield variables were determined in a laboratory at the Amalgamated Sugar Factory in Nampa, Idaho. Sugar concentrations were determined by multiplying measured sucrose by 0.98 to estimate the sugar that would have been lost to respiration if the beets had been stored in a pile. The percent sugar extraction was calculated using the formula:

$$Ext = \frac{250 + [(1,255.2 * Cond) - (15,000 * Sug) - 6,185]}{Sug * (98.66 - 7.845 * Cond)}$$

Where *Ext* is percent sugar extraction, *Cond* is the electrical conductivity in mmho, and *Sug* is the percent sucrose concentration.

The data were subjected to analysis of variance and means compared using the least significant difference (LSD, $P = 0.05$).

Results and Discussion

Visual evaluations at 7, 23, 39, and 77 days after treatment (DAT) indicated reduced sugar beet growth in the untreated control and plots that received a single POST application of Roundup® Powermax at 32 fl oz/acre plus Outlook at 16 fl oz/acre plus ammonium sulfate plus non-ionic surfactant (NIS) at 2 percent V/V at 49 days after planting (Tables 1 to 4). The injury in these plots was characterized by reduced sugar beet growth, which could be directly associated with weed competition when early postemergence application of herbicides was not used. In fact, sugar beets growing in plots treated with a single application of Roundup Powermax at 32 fl oz/acre plus Outlook at 16 fl oz/acre plus ammonium sulfate plus NIS at 2 percent V/V at 49 days after planting had the lowest weed control throughout the season when compared to other herbicide treatments. Evaluations at 7 DAT indicate control for kochia, common lambsquarters, pigweed species, barnyardgrass, and hairy nightshade at 99 percent across herbicide treatments (Table 1). Weed control at 23 DAT ranged from 96 to 99 percent for kochia, 91 to 99 percent for common lambsquarters, 96 to 99 percent for pigweed species, 95 to 99 percent for barnyardgrass, and 99 percent for hairy nightshade (Table 2). Weed control was equally high at 39 DAT, ranging from 95 to 99 percent across herbicide treatments (Table 3). Late-season weed control was 99 percent for kochia, 94 to 99 percent for common lambsquarters, 85 to 99 percent for pigweed species, 95 to 99 percent for barnyardgrass, and 99 percent for hairy nightshade (Table 4). The use of Roundup Powermax supplemented with Nortron and Outlook seems to have provided a season-long control for the two most problematic weeds in sugar beet production (kochia and hairy nightshade). There were differences among treatments for root yield and estimated recoverable sucrose (lb/acre) (Table 5). However, there was no difference among treatments in percent sugar content and estimated recoverable sugar (lb/ton). Use of soil-residual herbicides, especially at the layby application, should provide better late-season weed control.

Table 1. Weed control ratings at 7 days (5/24/08) after POST herbicide application on Roundup Ready® sugar beets at Malheur Experiment Station, Oregon State University, Ontario, OR, 2008.

Treatment	Rate unit	Timing [‡]	Crop injury %	Weed control [†]				
				Kochia	Lambs- quarters	Pigweed spp.	Barnyard- grass	Hairy nightshade
1 Untreated			11 a	0 c	0 c	0 c	0 c	0 c
2 Roundup PowerMax	22 fl oz/acre	EPOST	0 b	99 a	99 a	99 a	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
3 Roundup PowerMax	22 fl oz/acre	EPOST	0 b	99 a	99 a	99 a	99 a	99 a
Nortron	12 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
4 Roundup PowerMax	22 fl oz/acre	EPOST	0 b	99 a	99 a	99 a	99 a	99 a
Nortron	6 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	6 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
5 Roundup PowerMax	22 fl oz/acre	EPOST	0 b	99 a	99 a	99 a	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	12 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
6 Roundup PowerMax	22 fl oz/acre	EPOST	0 b	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
7 Roundup PowerMax	22 fl oz/acre	EPOST	0 b	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Outlook	16 fl oz/acre	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
8 Roundup PowerMax	22 fl oz/acre	EPOST	0 b	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
9 Roundup PowerMax	22 fl oz/acre	POST	0 b	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
10 Roundup PowerMax	32 fl oz/acre	POST	9 a	93 b	88 b	90 b	95 b	95 b
NIS	0.24 pt/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						

[‡] EPOST = Early postemergence on 5/17/2008; POST = postemergence on 6/8/2008.

[†] Means within a column followed by the same letter are not significantly different (LSD, $P = 0.05$).

Table 2. Weed control ratings at 23 days after POST herbicide application on Roundup Ready® sugar beets at Malheur Experiment Station, Oregon State University, Ontario, Oregon, 2008.

Treatment	Rate unit	Timing [‡]	Crop injury %	Weed control [†]				
				Kochia	Lambs- quarters	Pigweed spp.	Barnyard- grass	Hairy nightshade
1 Untreated			45 a	0 c	0 c	0 c	0 c	0 b
2 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	99 a	99 a	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
3 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	99 a	99 a	99 a	99 a
Nortron	12 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
4 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	99 a	99 a	99 a	99 a
Nortron	6 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	6 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
5 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	94 b	91 b	99 a	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	12 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
6 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	97 ab	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
7 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	99.0 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Outlook	16 fl oz/acre	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
8 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	99.0 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
9 Roundup PowerMax	22 fl oz/acre	POST	0 a	99 a	97 ab	99 a	99 a	99 a
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
10 Roundup PowerMax	32 fl oz/acre	POST	19 a	96 ab	94 ab	96 b	95 b	99 a
NIS	0.24 pt/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						

[‡] EPOST = Early postemergence on 5/17/2008; POST = postemergence on 6/8/2008.

[†] Means within a column followed by the same letter are not significantly different (LSD, $P = 0.05$).

Table 3. Weed control ratings at 39 days after POST herbicide application on Roundup Ready® sugar beets at Malheur Experiment Station, Oregon State University, Ontario, Oregon, 2008.

Treatment	Rate unit	Timing‡	Crop injury %	Weed control†				
				Kochia	Lambs- quarters	Pigweed spp.	Barnyard- grass	Hairy nightshade
1 Untreated			71 a	0 b	0 d	0 c	0 c	0 b
2 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	97 ab	99 a	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
3 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	97 abc	99 a	99 a	99 a
Nortron	12 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
4 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	98 ab	99 a	99 a	99 a
Nortron	6 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	6 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
5 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	98 ab	99 a	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	12 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
6 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	96 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
7 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Outlook	16 fl oz/acre	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
8 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
9 Roundup PowerMax	22 fl oz/acre	POST	0 c	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
10 Roundup PowerMax	32 fl oz/acre	POST	17 b	99 a	95 bc	95 b	95 b	96 a
NIS	0.24 pt/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						

‡ EPOST = Early postemergence on 5/17/2008; POST = postemergence on 6/8/2008.

† Means within a column followed by the same letter are not significantly different (LSD, $P = 0.05$).

Table 4. Weed control ratings at 77 days after POST herbicide application on Roundup Ready® sugar beets at Malheur Experiment Station, Oregon State University, Ontario, Oregon, 2008.

Treatment	Rate unit	Timing [‡]	Crop injury %	Weed control [†]				
				Kochia	Lambs- quarters	Pigweed spp.	Barnyard- grass	Hairy nightshade
1 Untreated			94 a	0 c	0 d	0 c	0 c	0 b
2 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	98 a	98 ab	99 a	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
3 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	96 bc	99 a	98 a	99 a
Nortron	12 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
4 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	99 a	99 a	99 a	99 a
Nortron	6 fl oz/acre	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	6 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
5 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	98 a	99 ab	99 a	99 a
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
Nortron	12 fl oz/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
6 Roundup PowerMax	22 fl oz/acre	EPOST	0 c	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
7 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Outlook	16 fl oz/acre	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
8 Roundup PowerMax	22 fl oz/acre	EPOST	0 a	99 a	99 a	99 a	99 a	99 a
NIS	0.25 %V/V	EPOST						
Ammonium Sulfate	5 gal/100 gal	EPOST						
Roundup PowerMax	22 fl oz/acre	POST						
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
9 Roundup PowerMax	22 fl oz/acre	POST	0 a	99 a	94 c	98 a	99 a	99 a
NIS	0.25 %V/V	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						
10 Roundup PowerMax	32 fl oz/acre	POST	3.8 b	99 a	94 c	85 b	95 b	99 a
NIS	0.24 pt/acre	POST						
Ammonium Sulfate	5 gal/100 gal	POST						
Outlook	16 fl oz/acre	POST						

[‡] EPOST = Early postemergence on 5/17/2008; POST = postemergence on 6/8/2008.

[†] Means within a column followed by the same letter are not significantly different (LSD, $P = 0.05$).

Table 5. Root sugar content (percent), root yield, and recoverable sucrose estimates at Malheur Experiment Station, Oregon State University, Ontario, Oregon, 2008.

Treatment	Rate unit	Timing [‡]	Sugar beet yield [†]				
			Sugar content %	Root yield ton/acre	Extractable sugar %	Estimated recoverable sugar lb/acre	Estimated recoverable sugar lb/ton
1 Untreated			14.3 a	2.0 f	81.5 a	647 c	232.8 a
2 Roundup PowerMax	22 fl oz/acre	EPOST	15.2 a	43.8 cd	82.2 a	10,909 ab	249.1 a
Ammonium Sulfate	5 gal/100 gal	EPOST					
Roundup PowerMax	22 fl oz/acre	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
3 Roundup PowerMax	22 fl oz/acre	EPOST	15.1 a	47.2 ab	82.5 a	11,729 a	248.8 a
Nortron	12 fl oz/acre	EPOST					
Ammonium Sulfate	5 gal/100 gal	EPOST					
Roundup PowerMax	22 fl oz/acre	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
4 Roundup PowerMax	22 fl oz/acre	EPOST	15.0 a	48.1 a	83.1 a	11,958 a	248.7 a
Nortron	6 fl oz/acre	EPOST					
Ammonium Sulfate	5 gal/100 gal	EPOST					
Roundup PowerMax	22 fl oz/acre	POST					
Nortron	6 fl oz/acre	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
5 Roundup PowerMax	22 fl oz/acre	EPOST	15.3 a	45.1 abc	82.8 a	11,484 a	254.2 a
Ammonium Sulfate	5 gal/100 gal	EPOST					
Roundup PowerMax	22 fl oz/acre	POST					
Nortron	12 fl oz/acre	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
6 Roundup PowerMax	22 fl oz/acre	EPOST	15.8 a	47.2 ab	81.1 a	12,110 a	256.6 a
NIS	0.25 %V/V	EPOST					
Ammonium Sulfate	5 gal/100 gal	EPOST					
Roundup PowerMax	22 fl oz/acre	POST					
NIS	0.25 %V/V	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
7 Roundup PowerMax	22 fl oz/acre	EPOST	15.2 a	44.3 bcd	81.8 a	11,042 ab	248.3 a
NIS	0.25 %V/V	EPOST					
Ammonium Sulfate	5 gal/100 gal	EPOST					
Outlook	16 fl oz/acre	EPOST					
Roundup PowerMax	22 fl oz/acre	POST					
NIS	0.25 %V/V	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
8 Roundup PowerMax	22 fl oz/acre	EPOST	15.8 a	45.9 abc	83.0 a	12,044 a	262.6 a
NIS	0.25 %V/V	EPOST					
Ammonium Sulfate	5 gal/100 gal	EPOST					
Roundup PowerMax	22 fl oz/acre	POST					
NIS	0.25 %V/V	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
Outlook	16 fl oz/acre	POST					
9 Roundup PowerMax	22 fl oz/acre	POST	14.9 a	41.6 de	82.0 a	10,160 b	244.3 a
NIS	0.25 %V/V	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
Outlook	16 fl oz/acre	POST					
10 Roundup PowerMax	32 fl oz/acre	POST	15.6 a	39.3 e	82.4 a	10,076 b	256.4 a
NIS	0.24 pt/acre	POST					
Ammonium Sulfate	5 gal/100 gal	POST					
Outlook	16 fl oz/acre	POST					

[‡] EPOST = Early postemergence on 5/17/2008; POST = postemergence on 6/8/2008.

[†] Means within a column followed by the same letter are not significantly different (LSD, $P = 0.05$).