

WEED CONTROL IN LIBERTY-RESISTANT SUGAR BEETS

Corey J. Guza, Corey V. Ransom, and Joey Ishida
Malheur Experiment Station
Oregon State University
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Introduction

Sugar beet varieties with resistance to the herbicide Liberty (glufosinate) provide new options for weed control in sugar beets. Research is needed to determine application timings for Liberty and to determine if Nortron can be used effectively in Liberty-resistant sugar beet weed control systems.

Materials and Methods

Two trials were established to evaluate Liberty for weed control in Liberty-resistant sugar beets. One trial evaluated application timings for Liberty, and the other evaluated Nortron applied before or in combination with Liberty. Sugar beets were planted using a tool-bar planter with a 22-in row spacing. Seeds were planted to a 2-in spacing and subsequently thinned to an 8-in spacing. Trials were randomized complete block designs with three replications. A Liberty-resistant sugar beet variety, Betaseed 8757 LL, was planted on April 16. Counter 20 CR was applied over the row at a rate of 6 oz/1000 ft, one day after planting. On June 5, sugar beets were side-dressed with 210 lb N/acre as urea. Herbicide applications were made with a CO₂-pressurized backpack sprayer delivering 20 gpa at 30 psi. Weed control was evaluated June 29 and September 14. Sugar beet yields were determined by harvesting the two center rows of each plot on October 15. Herbicide applications were timed to growth stages of the weeds.

Liberty Application Timing

The first trial evaluated sequential Liberty applications started at two different times. One application sequence began at 0.5-in weeds and the other at 2-in weeds. The initial applications of Liberty were followed with 2 sequential applications approximately 1 and 2 wk after the initial application. Two rates of Liberty, 0.26 or 0.35 lb ai/acre, were evaluated with and without the addition of ammonium sulfate (AMS) at 3 lb/acre. Liberty treatments in this trial were compared to a standard herbicide program of Progress (0.33 lb ai/acre) applied to cotyledon sugar beets and then applied again one and two weeks after the initial application.

Nortron Combinations with Liberty

The second trial evaluated Nortron applications at different timings for weed control in Liberty-resistant sugar beets. Nortron was applied PPI (1.0 to 2.0 lb ai/acre) and followed with two sequential applications of Liberty at 0.26 lb ai/acre or 0.35 lb ai/acre. Liberty applications were begun at 0.5-in or 2-in weeds. Other treatments were one application of Liberty (0.26 or 0.35 lb ai/acre) to 0.5- or 2-in weeds followed by a

treatment of Liberty tank-mixed with Nortron (1.0 lb ai/acre) as a layby treatment. Treatments with Nortron were compared to sequential applications of Liberty alone and a standard herbicide program. The standard herbicide program was Nortron (1.0 lb ai/acre) applied PPI, Progress (0.25 lb ai/acre) applied to cotyledon sugar beets, followed by Progress (0.33 lb ai/acre) plus Upbeet (0.0156 lb ai/acre), and Progress (0.33 lb ai/acre) plus Upbeet (0.0156 lb ai/acre) and Poast (0.3 lb ai/acre) applied one and two weeks after the initial postemergence application.

Results

Liberty Application Timing

Most Liberty treatments provided weed control (88-95 percent) equal to the standard treatment of Progress for all weed species on June 29 (Table 1). Liberty (0.26 lb ai/acre) without AMS, provided less control of common lambsquarters (85 percent) than the standard (Table 1). On September 14, Liberty treatments provided common lambsquarters and hairy nightshade control equal to standard (94-98 percent). All Liberty treatments provided greater control of barnyardgrass (78-93 percent) compared to the standard (33 percent) on September 14. Redroot pigweed control with Liberty was equal to the standard for all treatments except for sequential applications of Liberty (0.35 lb ai/acre) which were initiated at 2-in weeds with and without the addition of AMS. These treatments provided redroot pigweed control greater than the standard (97 percent). The same Liberty treatment (0.35 lb ai/acre) initially applied to 0.5-inch weeds provided less control of redroot pigweed (78 percent) compared to the standard (83 percent). The reason for this is unclear. Sugar beet yields in the Liberty timing study were greater with Liberty treatments 40 to 42 tons/acre compared to the standard 39 tons/acre. All treatments increased yields in comparison to the untreated check (12 tons/acre).

Nortron Combinations with Liberty

Treatments with Nortron applied PPI with sequential applications of Liberty provided weed control at levels equal to the standard treatment of Nortron, Progress, Progress plus Upbeet, and Progress plus Upbeet and Poast for many of the weed species (Table 2). However, redroot pigweed control was slightly lower with Nortron (1.0 lb ai/acre) applied PPI and two sequential applications of Liberty (0.26 or 0.35 lb ai/acre) on September 14. Sequential applications of Liberty at 0.26 lb ai/acre provided less control of redroot pigweed (82-87 percent) and common lambsquarters (85-87 percent) than the standard on September 14 (98 percent). Treatments with Nortron applied in combination with Liberty (0.26 lb ai/acre) as a lay-by showed lower weed control (50-77 percent) than the standard on June 29 (95 percent). However on September 14, only redroot pigweed control was lower than the standard for Nortron layby treatments with Liberty (0.26 and 0.35 lb ai/acre) initially applied to 2-in weeds. Sugar beet yields in this study ranged from 34 to 44 ton/acre. Most Liberty treatments resulted in sugar beet yields equal to the standard treatment (44 tons/acre). However, treatments with Liberty and Nortron layby treatments had among the lowest sugar beet yields (34-39 ton/acre). The untreated check yielded only 11 tons/acre.

Table 1. Weed control and sugar beet yields in response to Liberty application timings in Liberty-resistant sugar beets, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

| Treatment | Rate | Timing† | Weed control | | | | | | | Sugar beet yield | | | | | |
|---------------|------------|------------------|-----------------|----------|---------------|----------|------------------|----------|----------------|------------------|---------------|-------------|-----------------------------|--------|---------|
| | | | Redroot pigweed | | Lambsquarters | | Hairy nightshade | | Barnyard grass | Root yield | Sugar content | Gross sugar | Estimated recoverable sugar | | |
| | | | June 29 | Sept. 14 | June 29 | Sept. 14 | June 29 | Sept. 14 | Sept. 14 | | | | ton/acre | % | lb/acre |
| Liberty | 0.26 | | 92 | 88 | 85 | 94 | 92 | 95 | 88 | 42.1 | 16.37 | 13,783 | 90.20 | 12,432 | 295 |
| Liberty | 0.35 | EP + MP | 95 | 85 | 95 | 97 | 95 | 97 | 85 | 42.4 | 16.32 | 13,852 | 90.11 | 12,482 | 294 |
| Liberty + AMS | 0.26+ 3.0 | + LP | 95 | 83 | 88 | 97 | 95 | 98 | 78 | 41.2 | 16.64 | 13,712 | 90.36 | 12,390 | 301 |
| Liberty + AMS | 0.35 + 3.0 | | 95 | 78 | 92 | 97 | 95 | 97 | 78 | 41.2 | 16.42 | 13,528 | 90.18 | 12,200 | 296 |
| Liberty | 0.26 | | 92 | 95 | 92 | 98 | 92 | 98 | 92 | 41.5 | 16.26 | 13,484 | 90.23 | 12,168 | 294 |
| Liberty | 0.35 | MP + LP | 95 | 97 | 92 | 97 | 92 | 97 | 89 | 40.8 | 16.13 | 13,164 | 90.25 | 11,881 | 291 |
| Liberty + AMS | 0.26 + 3.0 | + LLP | 95 | 94 | 92 | 98 | 95 | 98 | 88 | 41.9 | 16.31 | 13,659 | 90.15 | 12,314 | 294 |
| Liberty + AMS | 0.35 + 3.0 | | 95 | 97 | 95 | 97 | 95 | 97 | 93 | 40.6 | 16.54 | 13,438 | 90.40 | 12,150 | 299 |
| Progress | 0.33 | COT + EP + MP | 95 | 83 | 95 | 94 | 95 | 95 | 33 | 39.0 | 16.28 | 12,700 | 90.15 | 11,450 | 294 |
| Untreated | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.6 | 16.20 | 3,766 | 91.55 | 3,450 | 297 |
| LSD (0.05) | | | 4 | 11 | 6 | 5 | 5 | 4 | 26 | 1.8 | 0.45 | 597 | 0.55 | 561 | 9 |

†EP= early postemergence applications were applied at 0.5-in weeds with MP and LP applications approximately 1 and 2 weeks after the initial application. MP = mid-postemergence applications were applied to 1 to 2 in weeds and LP and LLP applications were made approximately 1 and 2 weeks after the initial application.

Table 2. Weed control and sugar beet yields with Liberty and Nortron applications in Liberty-resistant sugar beets, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

| Treatment | Rate | Timing | Weed control | | | | | | | Sugar beet yield | | | | | |
|-------------------|---------------|---------------|-----------------|----------|---------------|----------|------------------|----------|----------------|------------------|---------------|-------------|------------|-----------------------------|-------|
| | | | Redroot pigweed | | Lambsquarters | | Hairy nightshade | | Barnyard-grass | Root yield | Sugar content | Gross sugar | Extraction | Estimated recoverable sugar | |
| | | | June 29 | Sept. 14 | June 29 | Sept. 14 | June 29 | Sept. 14 | Sept. 14 | | | | | ton/acre | % |
| lb ai/acre | -----%----- | | | | | | | | | | | | | | |
| Nortron | 1.0 | PPI + | | | | | | | | | | | | | |
| Liberty | 0.26 | EP + MP | 92 | 88 | 90 | 93 | 90 | 97 | 95 | 42.6 | 16.28 | 13,880 | 90.22 | 12,513 | 293.7 |
| Nortron | 1.5 | PPI + | | | | | | | | | | | | | |
| Liberty | 0.26 | EP + MP | 95 | 96 | 92 | 94 | 92 | 97 | 96 | 41.2 | 16.31 | 13,440 | 90.20 | 12,120 | 294.1 |
| Nortron | 2.0 | PPI + | | | | | | | | | | | | | |
| Liberty | 0.26 | EP + MP | 95 | 98 | 85 | 92 | 88 | 96 | 97 | 40.8 | 16.53 | 13,480 | 90.16 | 12,153 | 298.0 |
| Nortron | 1.0 | PPI + | | | | | | | | | | | | | |
| Liberty | 0.35 | EP + MP | 95 | 85 | 86 | 90 | 83 | 98 | 92 | 40.5 | 16.12 | 13,140 | 90.31 | 11,862 | 292.7 |
| Nortron | 1.0 | PPI + | | | | | | | | | | | | | |
| Liberty | 0.26 | MP + LP | 95 | 93 | 87 | 96 | 73 | 97 | 86 | 40.6 | 16.18 | 13,120 | 89.99 | 11,806 | 291.2 |
| Nortron | 1.0 | PPI + | | | | | | | | | | | | | |
| Liberty | 0.35 | MP + LP | 95 | 97 | 92 | 97 | 88 | 98 | 93 | 41.8 | 16.16 | 13,520 | 90.08 | 12,173 | 291.3 |
| Liberty | 0.26 | EP + LP + LP | 88 | 87 | 82 | 85 | 87 | 92 | 79 | 40.5 | 16.45 | 13,320 | 90.45 | 12,046 | 297.5 |
| Liberty | 0.35 | EP + MP + LP | 95 | 89 | 92 | 96 | 92 | 97 | 91 | 41.5 | 16.28 | 13,520 | 90.12 | 12,186 | 293.4 |
| Liberty | 0.26 | MP + LP + LLP | 95 | 82 | 77 | 87 | 73 | 98 | 88 | 39.4 | 16.24 | 12,880 | 90.41 | 11,580 | 293.9 |
| Liberty | 0.35 | MP + LP + LLP | 92 | 95 | 92 | 96 | 92 | 98 | 94 | 41.9 | 16.06 | 13,440 | 90.00 | 12,100 | 289.0 |
| Liberty | 0.26 | EP + | | | | | | | | | | | | | |
| Liberty + Nortron | 0.26 + 1.0 | MP | 50 | 89 | 50 | 88 | 30 | 94 | 68 | 33.9 | 16.17 | 10,960 | 90.53 | 9,926 | 292.6 |
| Liberty | 0.35 | EP + | | | | | | | | | | | | | |
| Liberty + Nortron | 0.35 + 1.0 | MP | 92 | 93 | 88 | 93 | 75 | 95 | 75 | 39.1 | 16.08 | 12,560 | 90.40 | 11,360 | 290.7 |
| Liberty | 0.26 | MP + | | | | | | | | | | | | | |
| Liberty + Nortron | 0.26 + 1.0 | LP | 77 | 87 | 73 | 89 | 37 | 94 | 58 | 35.3 | 16.56 | 11,700 | 90.73 | 10,613 | 300.5 |
| Liberty | 0.35 | MP + | | | | | | | | | | | | | |
| Liberty + Nortron | 0.35 + 1.0 | LP | 87 | 85 | 80 | 91 | 62 | 94 | 83 | 38.6 | 16.03 | 12,380 | 90.13 | 11,160 | 288.9 |
| Nortron | 1.0 | PPI + | | | | | | | | | | | | | |
| Progress | 0.25 | COT + | | | | | | | | | | | | | |
| Progress+ Upbeet | 0.33 + 0.0156 | EP + | 95 | 98 | 95 | 98 | 95 | 98 | 95 | 43.5 | 16.09 | 14,000 | 89.80 | 12,573 | 288.9 |
| Progress+ | 0.33 + | MP | | | | | | | | | | | | | |
| Upbeet + Poast | 0.0156 + 0.3 | | | | | | | | | | | | | | |
| Untreated | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.1 | 15.95 | 3,540 | 91.15 | 3,226 | 290.4 |
| LSD(0.05) | | | 10 | 9 | 11 | 10 | 12 | 6 | 20 | 3.7 | 0.38 | 1,248 | 0.71 | 1,150 | 8.5 |