

MICRO-RATE HERBICIDE APPLICATIONS AND BAS 656 07 H FOR WEED CONTROL IN SUGAR BEETS

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Introduction

Sugar beet producers long have applied sequential applications of Progress, Upbeet, and Stinger at reduced rates, in a timely manner to improve weed control and reduce sugar beet injury. Recently, research has shown that sugar beet herbicides can be applied as a broadcast treatment at the band application rate if a methylated seed oil (MSO) surfactant is added. These extremely low-rate treatments have been called "micro-rates". A trial was initiated to examine micro-rate herbicide treatments for weed control efficacy and sugar beet tolerance.

Techniques have been developed that allow chemical manufacturers to separate active and inactive components of herbicides during the production process. This can result in a product that is active at lower total use rates. These new herbicides are being developed for use in sugar beets and will provide additional herbicide options for weed control in the near future. These new products may be incorporated into existing weed control programs to make their use most effective. Trials were established at the Malheur Experiment Station to evaluate BAS 656 07 H for sugar beet tolerance and weed control efficacy.

Procedures

Hilleshog 'WS PM-21' sugar beets were planted on April 7 in 22-in rows. Plots were sidedressed on June 15 with 210 lb N/acre as urea. Herbicide treatments were applied with a CO₂-pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi. Plots four rows wide and 30 ft long were arranged in a randomized complete block design. Sugar beet injury and weed control were evaluated throughout the season. Sugar beet yields were determined by harvesting the center two rows of each plot on October 6. Sixteen sugar beets from each plot were sent to Hilleshog Mono-Hy Research Station in Nyssa, Oregon, to determine beet pulp sugar content and purity.

Micro-rate Herbicides

Band herbicide application rates were applied as a broadcast treatment with the addition of a methylated seed oil adjuvant. Broadcast treatments were applied with 8002 flat fan nozzles while band applications were applied with 8001 even flat fan nozzles. Banded treatments were applied in an 11-in band over the row. Initial

herbicide applications were made to cotyledon sugar beets and then sequentially at 7- to 10-day intervals. Redroot pigweed, hairy nightshade, and annual sowthistle were less than 0.25 in tall, and common lambsquarters, barnyardgrass, and kochia were less than 0.5 in tall at the time of the first herbicide application. A total of four herbicide applications were made during the season. Applications were made on April 24, May 1, May 10, and May 18. An error on the third application resulted in banded treatments receiving 33 percent more herbicide than desired, and the broadcast treatments receiving only half of the herbicide rate planned. A mathematical error also resulted in Assure II being applied at greater than registered rates. Cultivation did not remove all of the weeds outside of the herbicide band, resulting in less control in banded than in broadcast treatments.

BAS 656 07 H Tolerance and Weed Control

For the tolerance trial, all plots were maintained weed free with applications of Betamix and by hand labor. Sugar beet injury and yield was evaluated in response to postemergence applications of BAS 656 07 H at a typical use rate (0.64 lb ai/acre) and at rates 2 (1.28 lb ai/acre) and 4 (2.56 lb ai/acre) times the typical use rate. Combinations of BAS 656 07 H at 0.64 lb ai/acre with Betamix or Betamix plus Upbeet also were evaluated. Treatments were applied to 6-leaf sugar beets on May 18.

The weed control treatments consisted of BAS 656 07 H (0.64 lb ai/acre), Betamix (0.25 lb ai/acre), and Betamix plus Upbeet (0.0156 lb ai/acre) alone and in combinations applied to 2-leaf sugar beets on May 10. Poast also was applied in one treatment to 8-leaf sugar beets on May 26. All plots except the untreated received Betamix (0.25 lb ai/acre) when sugar beets were in the cotyledon stage.

Results and Discussion

Micro-rate Herbicides

All broadcast herbicide treatments provided greater than 93 percent control of redroot pigweed, common lambsquarters, hairy nightshade, and annual sowthistle (Table 1). Broadcast treatments had higher sugar beet injury than banded treatments 4 days after the initial application (data not shown), but injury was not different among treatments at any other evaluation. Banded treatments were generally less effective than broadcast treatments, because cultivation did not remove weeds surviving at the edge of the herbicide treated band. Using Progress or Betamix in the micro-rate treatment provided similar weed control; however, kochia was not present in significant numbers in this trial. Barnyardgrass control was increased by the addition of Assure II to the micro-rate treatment. Root yields and estimated recoverable sugar were improved by all treatments compared to the untreated check, but were not different among the herbicide treatments. Using the micro-rates program requires more frequent herbicide applications, but allows producers to broadcast-apply their herbicides and may reduce the number of cultivations that need to be made during the season.

BAS 656 07 H Tolerance and Weed Control

In the tolerance trial, no significant injury was observed at any evaluation, and sugar beet yield and quality were not different for any of the treatments (Table 2).

For the weed control trial, the addition of BAS 656 07 H to Betamix or Betamix plus UpBeet treatments did not increase broadleaf weed control (Table 3). Broadleaf control was generally poorer when Frontier or BAS 656 07 H was applied alone. The addition of BAS 656 07 H to Betamix or Betamix plus UpBeet increased sugar beet injury 10 days after application, but injury was not apparent at later evaluations. The addition of BAS 656 07 H to Betamix or Betamix plus UpBeet increased late season grass control. BAS 656 07 H alone following the cotyledon application of Betamix provided greater barnyardgrass control than two applications of Betamix. Sugar beet yields were among the highest with BAS 656 07 H combinations. Sugar content and extraction were not different among treatments (data not shown). BAS 656 07 H combinations were also among the highest for estimated recoverable sugar, with the addition of BAS 656 07 H to Betamix plus UpBeet significantly increasing recoverable sugar. This increase is probably related to the increased late season barnyardgrass control with the BAS 656 07 H combination. The use of BAS 656 07 H for weed control in sugar beets may help to provide late season grass control.

Table 1. Sugar beet injury, weed control, and sugar beet yield with micro-rate herbicide applications, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| Treatment [†] | Rate oz ai/acre | Application | Injury | Weed Control [‡] | | | | Root yield [§] ton/acre | ERS lb/acre |
|---|--|-------------|--------|---------------------------|-------------------------|---------------------|--------------------|--|----------------|
| | | | | Redroot pigweed | Common lambsquarters | Hairy nightshade | Barnyard- grass | | |
| | | | | % | | | | | |
| Progress + Upbeet + Stinger + MSO | 1.3 + 0.083 + 0.5 + 1.5% v/v | Broadcast | 2 | 95 | 100 | 94 | 73 | 41.6 | 13,591 |
| Progress + Upbeet + Stinger + MSO | 1.3 + 0.083 + 0.5 + 1.5% v/v | Band | 0 | 78 | 95 | 68 | 70 | 39.1 | 12,567 |
| Progress + Upbeet + Stinger + MSO + Assure II | 1.3 + 0.083 + 0.5 + 1.5% v/v + 0.44 | Broadcast | 3 | 93 | 100 | 96 | 98 | 40.9 | 13,310 |
| Progress + Upbeet + Stinger + MSO + Assure II | 1.3 + 0.083 + 0.5 + 1.5% v/v + 0.44 | Band | 0 | 80 | 92 | 67 | 83 | 39.3 | 12,880 |
| Progress + Upbeet + Stinger | 4.0 + 0.25 + 1.5 | Band | 5 | 82 | 93 | 70 | 78 | 39.1 | 12,647 |
| Betamix + Upbeet + Stinger + MSO | 1.3 + 0.083 + 0.5 + 1.5% v/v | Broadcast | 0 | 100 | 100 | 94 | 90 | 39.5 | 12,757 |
| Progress + Upbeet + Stinger + MSO | 2.0 + 0.25 + 0.75 + 1.5 % v/v | Broadcast | 2 | 100 | 100 | 96 | 89 | 41.9 | 13,513 |
| Untreated | | | 0 | 0 | 0 | 0 | 0 | 11.0 | 3,561 |
| LSD (0.05) | | | NS | 13 | 8 | 15 | 12 | 4.7 | 1,629 |

[†]Treatments were applied on April 24, May 1, May 10, and May 18.

[‡]Weed control and sugar beet injury evaluations were taken on June 15.

[§]Sugar beets were harvested on October 6.

Table 2. Sugar beet injury, yield, and quality in response to applications of Frontier and BAS 656 07 H under weed free conditions, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| Treatment [†] | Rate lb ai/acre | Crop injury | | | | Root yield [‡] tons/acre | Sugar | Extraction | Estimated recoverable lb/acre |
|------------------------------------|-------------------------|-------------|-----|------|------|--------------------------------------|-------|------------|----------------------------------|
| | | 5-29 | 6-2 | 6-15 | 7-12 | | | | |
| Handweeded | | 0 | 0 | 6 | 0 | 40.3 | 17.8 | 93.5 | 13,389 |
| Frontier | 1.17 | 3 | 6 | 4 | 0 | 42.2 | 17.7 | 93.6 | 14,017 |
| BAS 656 07 H | 0.64 | 1 | 6 | 8 | 0 | 40.6 | 17.7 | 93.3 | 13,412 |
| BAS 656 07 H | 1.28 | 4 | 4 | 5 | 0 | 43.3 | 17.7 | 93.5 | 14,309 |
| BAS 656 07 H | 2.56 | 2 | 4 | 6 | 0 | 41.8 | 17.5 | 93.3 | 13,621 |
| BAS 656 07 H + Betamix | 0.64 + 0.33 | 5 | 5 | 6 | 0 | 41.6 | 18.0 | 93.6 | 14,003 |
| BAS 656 07 H + Betamix + Upbeet | 0.64 + 0.33 + 0.0156 | 6 | 6 | 9 | 0 | 41.7 | 17.8 | 93.6 | 13,864 |
| LSD (0.05) | | NS | NS | NS | NS | NS | NS | NS | NS |

[†]All plots received Betamix (0.25 lb ai/acre) on April 24 and May 1. Treatments were applied to 6 leaf sugar beets on May 18.

[‡]Sugar beets were harvested on October 6.

Table 3. Sugar beet injury, weed control, and sugar beet root yield in response to applications of Frontier and BAS 656 07 H, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

| Treatment [†] | Rate lb ai/acre | Timing | Crop injury | | Weed control [‡] | | | Sugar beet root yield [§] tons/acre | |
|------------------------------------|-------------------------|--------|-------------|------|---------------------------|----------------|------------------|---|----------------|
| | | | 5-20 | 6-21 | Redroot pigweed | Lambs-quarters | Hairy nightshade | | Barnyard-grass |
| Untreated | | | 0 | 0 | 0 | 0 | 0 | 0 | 14.6 |
| Frontier | 1.17 | 2-Leaf | 0 | 0 | 63 | 83 | 68 | 65 | 30.6 |
| BAS 656 07 H | 0.64 | 2-Leaf | 0 | 0 | 65 | 96 | 55 | 78 | 27.6 |
| BAS 656 07 H + Betamix | 0.64 + 0.25 | 2-Leaf | 7 | 0 | 75 | 96 | 83 | 75 | 36.0 |
| Betamix | 0.25 | 2-Leaf | 0 | 0 | 69 | 92 | 76 | 43 | 32.2 |
| BAS 656 07 H + Betamix + Upbeet | 0.64 + 0.25 + 0.0156 | 2-Leaf | 28 | 0 | 78 | 90 | 82 | 85 | 37.5 |
| Betamix + Upbeet | 0.25 + 0.0156 | 2-Leaf | 18 | 0 | 75 | 95 | 82 | 0 | 33.5 |
| Betamix | 0.25 | 2-Leaf | 10 | 0 | 74 | 95 | 78 | 98 | 37.8 |
| LSD (0.05) | | | 4 | NS | 6 | 9 | 14 | 27 | 4.7 |

[†]All plots except the untreated received Betamix (0.25 lb ai/acre) at cotyledon sugar beets on April 24. The listed treatments were applied to 2-leaf sugar beets on May 10 or 8-leaf sugar beets on May 26.

[‡]Weed control was evaluated on June 21, except barnyardgrass which was evaluated on July 27.

[§]Sugar beets were harvested on October 6.