Differential Tolerance of Fresh Market Sweet Corn Cultivars to the Herbicides Nicosulfuron and Primisulfuron

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Abstract. Field studies were conducted to determine the tolerance of 11 sweet corn (Zea mays L.) cultivars to the herbicides nicosulfuron and primisulfuron. The su cultivar ‘Merit’ was intolerant of nicosulfuron and primisulfuron, as indicated by significant differences from the untreated check for all measured variables. Most other su cultivars exhibited stunting, but injury was ≤19% (0% = no injury; 100% = dead) with nicosulfuron and primisulfuron in 1992. The se cultivars Alpine and Harris Moran Silverado exhibited variable stunting to nicosulfuron (25% and 23% injury, respectively) and primisulfuron (43% and 50%, respectively) in 1992. The sh2 cultivar Supersweet Jubilee was injured less by nicosulfuron (16%) than by primisulfuron (33%) in 1992. All cultivars except Merit recovered from early-season herbicide injury in 1992 and 1993. Significant differences among the se, su, and sh2 cultivars were recorded for the remaining variables (stalk height, marketable ear number and yield, ear length and diameter), but no patterns with respect to a specific sugary genetic background developed in 1992 or 1993. Nicosulfuron and primisulfuron were safely applied to the cultivars Alpine, Harris Moran Silverado, Royal Gold, Seneca Chief, Calumet, Jubilee, and Supersweet Jubilee without reductions in fresh ear yield. Chemical names used: [4,6-bis(difluoromethoxy)-2-(4,6-dimethoxy-2-pyrimidinyl)amino] carbonyl[N-ethyl]-2,2-dioxide and 2,4-diamine must be post-directed (PD) in fresh sweet corn. Currently, no herbicides are registered for POST grass control in fresh sweet corn.

Nicosulfuron and primisulfuron were first marketed for control of most annual and some perennial grasses, as well as certain broadleaf weeds, in field corn in 1991 and 1990, respectively (Ahrens, 1994). Currently, nicosulfuron has a supplemental label for use in the United States in Illinois, Iowa, Minnesota, New Jersey, New York, and Wisconsin on contract processing sweet corn only (E.I. duPont, 1999a). However, restrictions are imposed because of the susceptibility of some cultivars to injury from nicosulfuron (Morton and Harvey, 1992; O’Sullivan and Bouw, 1998). The variable tolerance among fresh sweet corn cultivars to the sulfonylurea herbicides has been noted (Mons et al., 1992; Robinson et al., 1994; Stall and Bewick, 1992) and attributed to a specific cultivar’s ability to metabolize the parent chemical in the herbicide (Burton et al., 1994). Herbicide safeners will enhance the level of metabolism in tolerant cultivars, but do not reduce injury in nontolerant ones (Burton et al., 1994). Herbicide-insecticide interaction can also increase sensitivity of certain cultivars of field and sweet corn to sulfonylurea herbicides (Morton et al., 1991; 1993; Robinson et al., 1996; Williams and Harvey, 1996).

The recessive sugary (su) allele is common in many sweet corn cultivars. Some of the su cultivars (e.g., Silver Queen) are tolerant (Stall and Bewick, 1992) to sulfonylurea herbicides, while other cultivars (e.g., Merit) are susceptible (Robinson et al., 1994). Through breeding, the independent, recessive, modifier mutant gene sugar enhanced (se1) can be bred into su lines, but to obtain the full effects of the high sugary trait in F1 hybrids, both su and se1 parents should be homozygous for the gene (Ferguson et al., 1978). Heterozygous se1 cultivars are phenotypically su1 and should respond to environmen-
nal conditions as do sul cultivars. Stall and Bewick (1992) found no correlation between sensitivity to nicosulfuron and the sh2 or se1 endosperms of a specific cultivar. However, some cultivars that were intolerant to nicosulfuron contained the sh2 and se1 gene. Thus, screening of cultivars is essential for potential future registration of the herbicide for use in fresh sweet corn production.

Currently PPI, PRE, and POST herbicide options are available for weed control in fresh sweet corn production. However, some compounds (e.g., cyanazine) may not be re-registered, and POST grass control options are limited. Registration of nicosulfuron or primisulfuron currently registered for weed control in field and processing sweet corn, for fresh sweet corn production would provide producers alternative herbicide options. Current registrations for processing sweet corn carry cultivar restrictions. If registration were granted for use of these herbicides, then information about specific cultivars would be required.

The objectives of this investigation were to determine the responses of several fresh sweet corn cultivars that have not undergone previous screening to nicosulfuron and primisulfuron, including: 1) tolerance; 2) ear number; 3) ear diameter; 4) plant height; 5) fodder yield; and 6) total fresh ear yield.

Results and Discussion

Plants were established each year by 50% overseeding (2.5 cm soil depth) with a plot planter equipped with seeding cones. After emergence, plots were thinned by hand to a final stand of 49,400 plants per ha. Planting dates were 4 Apr. 1992 and 21 Apr. 1993, following conventional tillage by moldboard plowing and smoothing using a rotary tiller. The experimental design was a split-plot with four replications (blocks). Each plot consisted of six rows (0.8 m wide × 5.5 m long) of a single cultivar. Two rows were used per treatment (i.e., nicosulfuron, primisulfuron, and untreated). Fertilizer was applied based on soil test recommendations for sweet corn production and insecticides were applied POST as needed to control insects.

Nicosulfuron (75% a.i.) and primisulfuron (75% a.i.) applied at 15 and 18 g·ha⁻¹, respectively (all concentrations expressed as a.i.). All treatments were applied with a tractor-mounted boom sprayer using compressed air calibrated to deliver 187 L·ha⁻¹ at 210 kPa. The POST treatments were applied on 1 May 1992 and 1 June 1993 to plants that were 15 and 40 cm tall, respectively. All plots were maintained weed-free by hand hoeing.

Total leaf necrosis and injury to the whorl, were visually estimated 8 weeks after POST treatment in 1992 using a scale of 0% (no injury) to 100% (dead). Each year, one row from each treatment was harvested at optimum roasting ear stage (R3) to determine marketable ear number and weight. Aver age stalk height for each year was determined for marketable ear number and weight across the treatment (i.e., nicosulfuron, primisulfuron, and check). Injury varied by cultivar (Table 2). Orthogonal contrasts indicated that cultivars were tolerant of either herbicide. 'Calumet', 'Deltapine Sweet G-90', 'Iochief', 'Jubilee', 'Merit', 'Royal Gold', 'Seneca Chief', and 'Silver Queen' (su1), and 'Supersweet Jubilee' (sh2) (Table 1). Tables 1 and 2 show fresh weight data were subjected to analysis of variance (ANOVA) and tested for year × treatment interactions. Treatment means were separated with appropriate Fisher's protected least significant difference test (LSD) at $P \leq 0.05$, and orthogonal contrasts were made between se1 vs. sul, sul vs. sh2, and sul vs. sh2 cultivars.

### Materials and Methods

Studies were conducted at the Georgia Experiment Station near Griffin, in 1992, on a Pacolet coarse sandy loam and in 1993 on a Cecil sandy clay loam; both soils were fine, kaolinitic, thermic Typic Kanhapludults. Each year, the treatment area received pendimethalin at 0.8 kg·ha⁻¹ a.i. PRE for dicot and annual grass control. Commercial sweet corn cultivars commonly grown in the southeastern United States at the time these studies were initiated were selected, based on consultation with extension and seed company representatives. Cultivars included 'Alpine' and 'Harris Moran Silverado' (both heterozygous se1), 'Calumet', 'Deltapine Sweet G-90', 'Iochief', 'Jubilee', 'Merit', 'Royal Gold', 'Seneca Chief', and 'Silver Queen' (su1), and 'Supersweet Jubilee' (sh2) (Table 1).

Table 1. Sweet corn cultivars evaluated for tolerance to nicosulfuron and primisulfuron in Georgia, 1992 and 1993.

| Cultivar               | Endosperm type | Kernel color |
|------------------------|----------------|--------------|
| Alpine                 | se1            | White        |
| Harris Moran Silverado | se1            | White        |
| Royal Gold             | sul            | Yellow       |
| Seneca Chief           | su1            | Yellow       |
| Calumet                | sul            | Yellow       |
| Deltapine Sweet G-90   | su1            | Yellow       |
| Iochief                | su1            | Yellow       |
| Jubilee                | sul            | Yellow       |
| Merit                  | sul            | Yellow       |
| Silver Queen           | sul            | White        |
| Supersweet Jubilee     | sh2            | Yellow       |

| Cultivar               | Treatment: Nicosulfuron<sup>1</sup> | Primisulfuron<sup>1</sup> | Check | LSD<sub>0.05</sub> |
|------------------------|-------------------------------------|--------------------------|-------|-------------------|
| Alpine                 | 25                                  | 43                       | 0     | 8                 |
| Harris Moran Silverado | 23                                  | 50                       | 0     | 13                |
| Royal Gold             | 1                                   | 1                        | 0     | NS                |
| Seneca Chief           | 11                                  | 16                       | 0     | 10                |
| Calumet                | 6                                    | 19                       | 0     | 8                 |
| Deltapine Sweet G-90   | 6                                    | 19                       | 0     | 11                |
| Iochief                | 13                                  | 19                       | 0     | 1                 |
| Jubilee                | 14                                  | 39                       | 0     | 15                |
| Merit                  | 99                                  | 99                       | 0     | 1                 |
| Silver Queen           | 5                                    | 6                        | 0     | NS                |
| Supersweet Jubilee     | 16                                  | 33                       | 0     | 15                |

<sup>1</sup>Applied at 15 g·ha⁻¹ a.i.
<sup>2</sup>Applied at 18 g·ha⁻¹ a.i.

Table 2. Injury means and orthogonal contrasts for sweet corn cultivars evaluated for tolerance to nicosulfuron and primisulfuron in Georgia, 1992.

Orthogonal contrast:

- se1 vs. sul
- se1 vs. sh2
- sul vs. sh2
- su1 vs. sul
- su2 vs. sh2
- se1 vs. su1
- se1 vs. sul
- su1 vs. sul

| Orthogonal contrast | LSD<sub>0.05</sub> |
|---------------------|---------------------|
| se1 vs. su1         | NS                  |
| se1 vs. sh2         | NS                  |
| sul vs. sh2         | NS                  |
| su1 vs. sul         | NS                  |
| su2 vs. sh2         | NS                  |
| se1 vs. su1         | NS                  |
| se1 vs. sul         | NS                  |
| su1 vs. sul         | NS                  |

Abbreviations: se1 = sugary enhancer; sul = sugary; sh2 = shrunken-2.

<sup>1</sup>Applied at 15 g·ha⁻¹ a.i.
<sup>2</sup>Applied at 18 g·ha⁻¹ a.i.

Orthogonal contrast for se1 cultivars: Alpine and Harris Moran Silverado. su cultivars: 'Calumet', 'Deltapine Sweet G-90', 'Iochief', 'Jubilee', 'Silver Queen', 'Royal Gold', and 'Seneca Chief' ('Merit' was not included). sh2 cultivar: 'Supersweet Jubilee'.

n.s. ***Nonsignificant or significant at $P \leq 0.05$, 0.01, and 0.001 levels, respectively, for Fisher’s protected LSD test.
were not significantly injured by nicosulfuron, but ‘Alpine’ and ‘Silverado’ were. O’Sullivan and Bouw (1998) reported cultivar differences in tolerance to nicosulfuron/rimsulfuron mixtures for sel cultivars of sweet corn and for the sh2 cultivar Supersweet Jubilee, which was significantly injured (16%) in our study.

Primsulfuron was more injurious than nicosulfuron in all cultivars. The sel cultivars Alpine and Silverado were significantly injured (43% and 50%, respectively). ‘Royal Gold’ had the greatest tolerance (1% injury) of any of the sul cultivars and ‘Calumet’ was not significantly injured by primisulfuron, but injury to ‘Deltapine Sweet G-90’, ‘Iochief’, ‘Jubilee’, and ‘Supersweet Jubilee’ was 19%, 19%, 39%, and 33%, respectively. Greater injury from primisulfuron than from nicosulfuron has been previously reported for several sweet corn cultivars (Monks et al., 1992).

Fodder weight and stalk height. Neither herbicide affected fodder weight in 1992 except in ‘Merit’ (data not presented). Height of ‘Royal Gold’, ‘Deltapine Sweet G-90’, ‘SilverQueen’, and ‘Supersweet Jubilee’ was not significantly reduced in 1992 or 1993 (Table 3). Orthogonal contrasts indicated that herbicide-treated sul cultivars were significantly taller than sel or sh2 cultivars in 1992 and 1993. In 1992, orthogonal contrasts indicated no differences among cultivars in nontreated plants, but in 1993, all three contrasts were significant. Morton and Harvey (1992) noted differences in injury to ‘Jubilee’ with nicosulfuron in Wisconsin.

Height of ‘Alpine’, ‘Harris Moran Silverado’, ‘Iochief’, and ‘Jubilee’ was reduced by nicosulfuron in 1992, but reductions were significant only in ‘Alpine’ and ‘Calumet’ in 1993. This variation could be attributed to the timing of herbicide application (at 15 cm in 1992 and 40 cm in 1993). Morton and Harvey (1992) noted vigor, but not plant height, of ‘Jubilee’ and other hybrids declined with increasing nicosulfuron rate. Robinson et al. (1994) observed reduced tolerance of ‘Zenith’ as nicosulfuron was applied at increasing heights up the stalk. O’Sullivan and Bouw (1998) reduced the height of processing sweet corn cultivars by increasing the application rate of a nicosulfuron/rimsulfuron mixture from 25 to 50 g·ha⁻¹.

Primsulfuron reduced the height of ‘Alpine’, ‘Harris Moran Silverado’, ‘Seneca Chief’, ‘Iochief’, and ‘Jubilee’ in 1992; however, ‘Iochief’ was the only cultivar with a significant height reduction in 1993. Again, this trend could be attributed to exposure when plants were taller in 1993 than in 1992.

Ear length and diameter. Ear length and diameter were affected in ‘Alpine’, ‘Harris Moran Silverado’, ‘Royal Gold’, ‘Seneca Chief’, ‘Calumet’, ‘Deltapine Sweet G-90’, and ‘Jubilee’. Ear length of ‘Iochief’ and ‘Supersweet Jubilee’ was significantly reduced by primisulfuron (2 cm/ear reduction) and nicosulfuron (4 cm/ear reduction) (data not presented).

### Table 3. Stalk height (cm) means and orthogonal contrasts for sweet corn cultivars evaluated for tolerance to nicosulfuron and primisulfuron in Georgia.

| Cultivar              | Treatment: Nicosulfuron² | Primisulfuron² | Check | LSD₀.₀₅     |
|-----------------------|--------------------------|----------------|-------|-------------|
| Alpine                | 136                      | 131            | 154   | 16          |
| Harris Moran Silverado| 130                      | 120            | 146   | 9           |
| Royal Gold            | 171                      | 170            | 175   | NS          |
| Seneca Chief          | 144                      | 130            | 148   | 7           |
| Calumet               | 155                      | 155            | 161   | NS          |
| Deltapine Sweet G-90  | 164                      | 153            | 160   | NS          |
| Iochief               | 151                      | 146            | 163   | 7           |
| Jubilee               | 154                      | 134            | 164   | 8           |
| Silver Queen          | 158                      | 149            | 158   | NS          |
| Supersweet Jubilee    | 138                      | 130            | 145   | NS          |

**Orthogonal contrast**

| sel vs. sul          | sul > sel"        | sul > sel'"     | NS    | sul > sel'"  |
| sel vs. sh2         | NS               | NS             | NS    | NS          |
| sul vs. sh2         | sul > sh2"       | sul > sh2'"    | NS    | sul > sh2'"  |

*²Applied at 15 g·ha⁻¹ a.i.
*³Applied at 18 g·ha⁻¹ a.i.
*⁴Orthogonal contrast for sel cultivars: ‘Alpine’ and ‘Harris Moran Silverado’. sul cultivars: ‘Calumet’, ‘Deltapine Sweet G-90’, ‘Iochief’, ‘Jubilee’, ‘Silver Queen’, ‘Royal Gold’, and ‘Seneca Chief’ (‘Merit’ was not included). sh2 cultivar: ‘Supersweet Jubilee’.

*", **, ***Nonsignificant or significant at P ≤ 0.05, 0.01, and 0.001 levels, respectively, for Fisher’s protected LSD test.

### Table 4. Number of marketable ears/ha (in 1000’s) and orthogonal contrasts for sweet corn cultivars evaluated for tolerance to nicosulfuron and primisulfuron in Georgia.

| Cultivar             | Treatment: Nicosulfuron² | Primisulfuron² | Check | LSD₀.₀₅     |
|----------------------|--------------------------|----------------|-------|-------------|
| Alpine               | 33                       | 24             | 29    | NS          |
| Harris Moran Silverado| 26                       | 23             | 30    | NS          |
| Royal Gold           | 24                       | 21             | 23    | NS          |
| Seneca Chief         | 12                       | 24             | 21    | NS          |
| Calumet              | 14                       | 14             | 16    | NS          |
| Deltapine Sweet G-9017| 12                       | 18             | 17    | NS          |
| Iochief              | 23                       | 17             | 27    | NS          |
| Jubilee              | 25                       | 24             | 29    | NS          |
| Silver Queen         | 18                       | 13             | 18    | NS          |
| Supersweet Jubilee   | 19                       | 12             | 21    | 6           |

**Orthogonal contrast**

| sel vs. sul          | sel > sul"        | sel > sul'"     | NS    | NS          |
| sel vs. sh2         | sel > sh2"       | sel > sh2'"    | NS    | NS          |
| sul vs. sh2         | NS               | NS             | NS    | NS          |

*²Applied at 15 g·ha⁻¹ a.i.
*³Applied at 18 g·ha⁻¹ a.i.
*⁴Orthogonal contrast for sel cultivars: ‘Alpine’ and ‘Harris Moran Silverado’. sul cultivars: ‘Calumet’, ‘Deltapine Sweet G-90’, ‘Iochief’, ‘Jubilee’, ‘Silver Queen’, ‘Royal Gold’, and ‘Seneca Chief’ (‘Merit’ was not included). sh2 cultivar: ‘Supersweet Jubilee’.

*", **, ***Nonsignificant or significant at P ≤ 0.05, 0.01, and 0.001 levels, respectively, for Fisher’s protected LSD test.
not presented) and ‘Silver Queen’ ear diameter was significantly reduced by nicosulfuron (4 mm/ear reduction), but ear length was unaffected. Overall, there was no consistent effect of either herbicide on ear length or diameter.

**Marketable ear number.** Orthogonal contrasts in 1992 indicated that marketable ear number was greater in sel cultivars than in sul or sh2 cultivars treated with nicosulfuron or primisulfuron, but this was not true in 1993. While there was significant injury to the sel cultivars in 1993, it did not affect marketable ear number.

Marketable ear number was increased for nicosulfuron-treated cultivars Alpine, Royal Gold, and Silver Queen in 1992 and for ‘Harris Moran Silverado’, ‘Calumet’, ‘Seneca Chief’, ‘Iochief’, ‘Jubilee’, ‘Silver Queen’, ‘Royal Gold’, and ‘Seneca Chief’ (‘Merit’ was not included). sh2 cultivar: ‘Supersweet Jubilee’.

### Conclusion

These data indicate that POST application of nicosulfuron or primisulfuron to fresh sweet corn cultivars caused injury, and reduced fodder weight, stalk height, and ear yield, but response was cultivar-specific. However, marketable qualities, such as ear length and ear diameter, were not adversely affected except in ‘Merit’ in which plants were killed.

Overall, these data suggest that cultivar response to these herbicides is predictable, given proper screening, and that nicosulfuron and primisulfuron can be used safely on the cultivars examined. However, several new cultivars of sweet corn have been introduced in the southeastern United States and their responses should be evaluated.

### Literature Cited

Abelson, P.H. 1997. Uncertainties about crop protection. Weed Technol. 11:629–632.
Ahrens, W.H. (ed.). 1994. Herbicide handbook. Seventh ed. Weed Sci. Soc. Amer. Champaign, Ill.
Burton, J.D., E.P. Maness, D.W. Monks, and D.K. Robinson. 1994. Sulfonylurea selectivity and safener activity in ‘Landmark’ and ‘Merit’ sweet corn. Pesticide Biochem. Phys. 48:163–172.
E.I. dupont 1999a. Accent supplemental labeling. Accent herbicide for weed control in sweet corn for processing in the states of Minnesota, Wisconsin, Illinois, and Iowa. E.I. du Pont de Nemours. Agr. Prod., Wilmington, Del.
Ferguson, J.E., A.M. Rhodes, and D.B. Dickinson. 1978. The genetics of sugary enhancer (se), an independent modifier of sweet corn (su). J. of Hered. 69:377–380.
Fritz, V.A., J.B. Hebel, and A.M. Borowiski. 1991. Sweet corn genotypes vs. ethoproph in relation to yield components. Agron. J. 83:991–995.
Georgia Agricultural Statistics Service. 1997. Georgia agricultural facts, 1993–1997. Georgia Agr. Stat. Serv., Athens.
Mizelle, W.O. 1999. Georgia vegetable acreage estimates (AGECON 93–027). Coop. Ext. Service. U.S. Dept. of Agr, The Univ. of Georgia College of Agri. and Environ. Sci., Athens, Ga.
Monks, D.W., C.A. Mullins, and K.E. Johnson. 1992. Response of sweet corn to nicosulfuron and primisulfuron. Weed Technol. 6:280–282.
Morton, C.A., and R.G. Harvey. 1992. Sweet corn hybrid tolerance to nicosulfuron. Weed Technol. 6:91–96.
Morton, C.A., R.G. Harvey, J.J. Kells, D.A. Landis, W.E. Lueschen, and V.A. Fritz. 1993. In-furrow terbufos reduces field and sweet corn tolerance to nicosulfuron. Weed Tech. 7:934–939.
Morton, C.A., R.G. Harvey, J.J. Kells, W.E. Lueschen, and V.A. Fritz. 1991. Effect of DPX-V9360 and terbufos on field and sweet corn under three environments. Weed Technol 5:130–136.
National Agricultural Statistics Service. 2000. National Agricultural Statistics Service U.S. Dept. of Agr. 1999 Annu. summary. NASS–USDA, Washington, D.C.
O’Sullivan, J. and W.J. Bouw. 1998. Sensitivity of processing sweet corn cultivars to nicosulfuron/rimisulfuron. Can. J. Plant Sci. 78:151–154.
Robinson, D.K., D.W. Monks, and J.D. Burton. 1996. Safening influence of LAB 145 138 on nicosulfuron, terbufos, and bentazon interactions in sweet corn. Weed Sci. 44:339–344.
Robinson, D.K., D.W. Monks, and J.R. Schultheis. 1994. Effect of nicosulfuron applied post-emergence and post-directed on sweet corn tolerance. Weed Technol 8:630–634.
Stall, M.W. and T.A. Bewick. 1992. Sweet corn cultivars respond differentially to the herbicide nicosulfuron. HortScience 27:131–133.
Williams, B.J. and R.G. Harvey. 1996. Nicosulfuron tolerance in sweet corn as affected by hybrid, rootworm insecticide, and nicosulfuron treatment. Weed Technol. 10:488–494.

### Table 5. Yield of marketable ears (kg·ha⁻¹) for sweet corn cultivars evaluated for tolerance to nicosulfuron and primisulfuron in Georgia.

| Cultivar               | Treatment | Nicosulfuron | Primisulfuron | Check | LSD<sub>0.05</sub> | Nicosulfuron | Primisulfuron | Check | LSD<sub>0.05</sub> |
|------------------------|-----------|--------------|---------------|-------|-------------------|--------------|---------------|-------|-------------------|
| Alpine                 | 6070      | 5340         | 6750          | NS    | 3100              | 3770         | 3560          | NS    |                   |
| Harris Moran Silverado | 5300      | 4850         | 7090          | NS    | 4630              | 3780         | 4780          | NS    |                   |
| Royal Gold             | 5690      | 4830         | 5530          | NS    | 4190              | 4840         | 4650          | NS    |                   |
| Seneca Chief           | 2470      | 4460         | 4320          | 1080  | 3970              | 3070         | 3920          | NS    |                   |
| Calumet                | 3120      | 3360         | 3770          | NS    | 3790              | 3240         | 3560          | NS    |                   |
| Deltapine Sweet G-90   | 3820      | 2810         | 4470          | 5900  | 3560              | 4720         | 4350          | NS    |                   |
| Iochief                | 4150      | 5580         | 5500          | NS    | 4110              | 2260         | 5080          | NS    |                   |
| Jubilee                | 3640      | 3500         | 6970          | NS    | 3920              | 4190         | 3990          | NS    |                   |
| Silver Queen           | 3660      | 2940         | 3940          | NS    | 2890              | 4170         | 4170          | NS    |                   |
| Supersweet Jubilee     | 4500      | 2810         | 5230          | 1910  | 3130              | 2870         | 4580          | NS    |                   |

* Applied at 15 g·ha⁻¹ a.i.
* Applied at 18 g·ha⁻¹ a.i.

Orthogonal contrast for sel cultivars: ‘Alpine’ and ‘Harris Moran Silverado’. sul cultivars: ‘Calumet’, ‘Deltapine Sweet G-90’, ‘Iochief’, ‘Jubilee’, ‘Silver Queen’, ‘Royal Gold’, and ‘Seneca Chief’ (‘Merit’ was not included). sh2 cultivar: ‘Supersweet Jubilee’.

**su1** NS NS NS NS NS NS

**sh2** NS NS NS NS NS NS

**P** ≤ 0.05, 0.01, and 0.001 levels, respectively for Fisher’s protected LSD test.