Diversified Crops Report 21

from Experiment Station, HARC

February 2003

Index Words: Stevia, herbicide, weed control

Herbicide Screening in Stevia for Crop Phytotoxicity at Gay & Robinson, Inc.

L. T. Santo

SUMMARY

Twenty-four herbicides were broadcast over mature stevia plants to determine their effect on stevia after 30 days. Stevia was tolerant of treatments of Pentagon, Solicam, Authority and Fusilade, all of which can provide adequate weed control.

INTRODUCTION

Weeds limit stevia production at G&R. Left uncontrolled, weeds are expected to reduce yields and make stevia production unprofitable. The only herbicide currently registered for use in stevia is Roundup Ultra (glyphosate), but it can kill the crop unless carefully directed and shielded from the stevia leaves. Weeds next to the stevia plants growing through the plastic mulch can only be controlled by hand-weeding at a very high cost. Herbicides that can be safely applied over stevia are desirable for cost-effective weed control. Stevia's tolerance to 24 herbicides broadcast over mature plants is described in this report.

MATERIALS AND METHODS

The trial site was located about one mile northwest of the Kaumakani U.S. Post Office on Makaweli silty clay loam soil. The drip irrigation system was removed one week prior to the herbicide treatment application in a field that was abandoned because of weeds. The weeds were cut prior to the herbicide application. An untreated control with three replicates was included for comparison to the treated plants. Some of the untreated weeds surrounding the treated plots grew more than 12 inches tall during the trial. The herbicide treatments are described in Table 1. Rainfall was adequate before treatment and during the 30-day trial period.

The plots were of varying lengths (5 to 20 ft long) and arranged in a randomized block design with two replicates per treatment. The treatments were applied in a 15-inch swath directly centered over the stevia rows. The herbicides were mixed with water and 0.25% nonionic surfactant. The application was made with a carbon dioxide sprayer, a single nozzle boom and flatfan (Delavan 11003 Raindrop) nozzle at 20 psi and 30 gpa. The treatments were applied on 5 December 2001 at 10:15 a.m. and completed by 12:10 p.m. The spray conditions were as

follows: wind speed of 5 to 15 mph (average of 7 mph) from the NE, cloud cover of less than 10% at 12:10 p.m., relative humidity of 55%, soil temperature at two-inch depth of 80°F, air temperature of 85°F, dry foliage and moist soil.

The measurements consisted of number of plants per plot, average plant height and visual phytotoxicity rating at 0, 19 and 30 days after treatment (DAT). No plant height measurements were made on 19 DAT. The experiment was completed following the 30 DAT evaluation. The phytotoxicity rating was an estimate of the percentage of foliage showing adverse effects. A rating of 0% indicates no adverse effect relative to the untreated control, whereas 100% signifies dead plants. The number of plants was the ratio of the number of plants at 30 DAT to that at 0 DAT. The height gain was the 30 DAT height subtracted by the 0 DAT height and that quantity divided by the 0 DAT height. The 19 DAT data are not shown because the phytotoxicity and plant number trends were similar to the 30 DAT results.

Table 1. Herbicide Treatments. Untreated control was coded as CK.

Tradename	Common name	Code	Rate a.i. (lb/ac.)
Goal 2XL	oxyfluorfen	G	2.00
Pursuit	imazethapyr	Pu	0.09
Visor 2E	thiazopyr	Vi	1.00
Fusilade DX	fluazifop-P-butyl	F	0.37
Plateau	imazapic	Pl	0.19
Basagran	bentazon	B	1.50
Stinger	clopyralid	St	0.25
Command 3ME	clomazone	C	1.25
Poast	sethoxydim	Po	0.47
Milestone	azanfenidin	M	0.62
Karmex DF	diuron	K	2.40
Sinbar	terbacil	Si	1.60
Lorox	linuron	L	1.50
Pentagon	pendimethalin	Pe	1.60
Valor	flumioxazin	Va	0.10
Sencor	metribuzin	Se	0.80
Broadstrike	flumetsulam	Br	1.50
Stam 80EDF	propanil	Sta	1.13
Barricade	prodiamine	Ba	1.50
Solicam DF	norflurazon	So	3.93
Aim	carfentrazone-ethyl	Ai	0.02
Permit	halosulfuron-methyl	Per	0.06
Authority	sulfentrazone	Au	0.25
Bueno	MSMA	Bu	2.50

RESULTS AND DISCUSSION

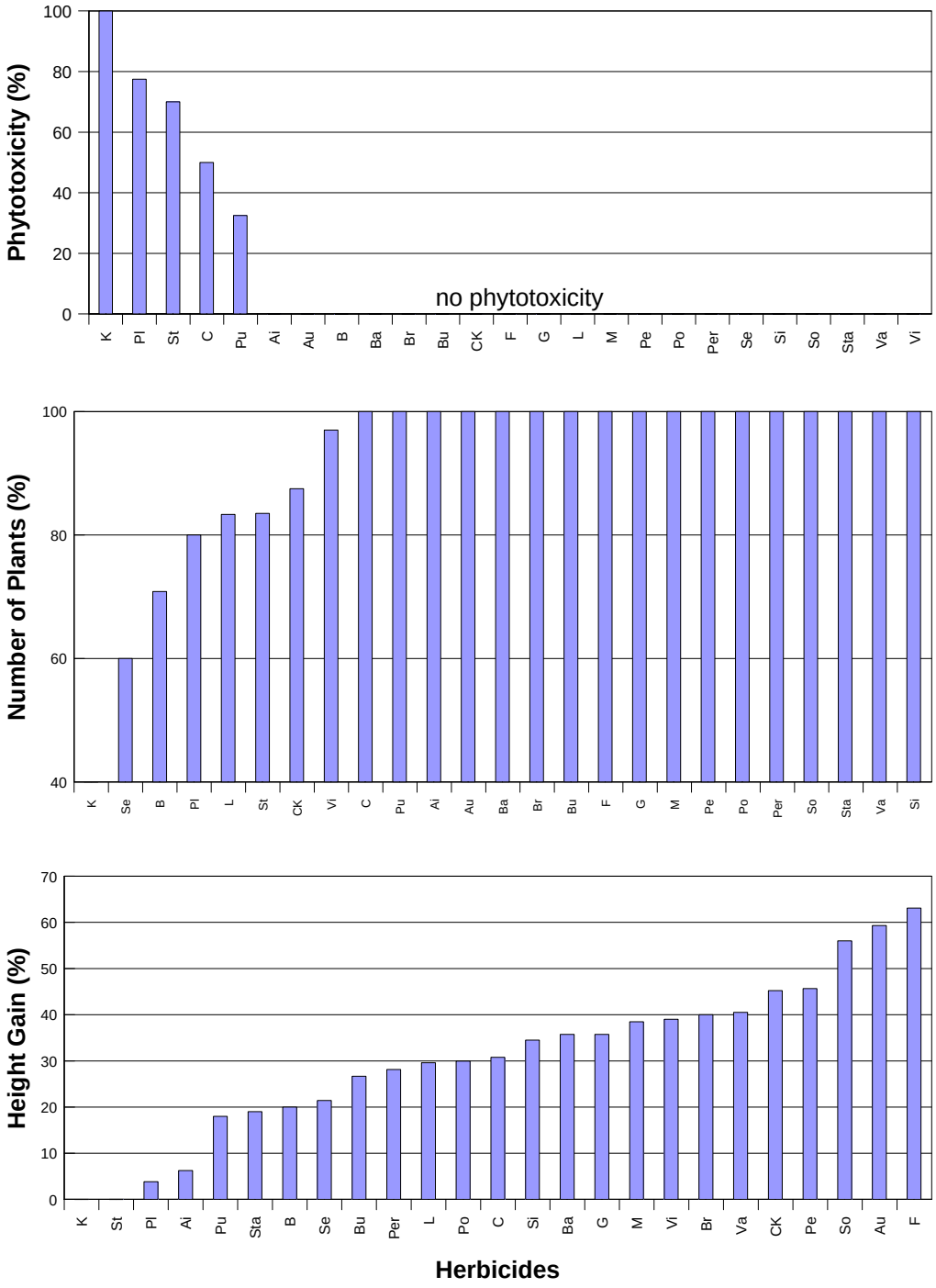
The results of the 30 DAT measurements relative to the untreated control or the initial measurements prior to herbicide application are shown in three bar graphs for phytotoxicity rating, number of plants and height gain (all expressed as percentage). Phytotoxicity or crop damage was significant for Karmex, Plateau, Stinger and Command. Only Karmex resulted in dead plants as early as 19 DAT. Phytotoxicity symptoms increased from 19 DAT to 30 DAT for Plateau, Stinger and Command. One replicate of Pursuit had about 65% phytotoxicity at 30 DAT, but another replicate had no visible damage. Stevia in all the other treatments had a similar appearance to the untreated control. Karmex, Plateau, Command and Pursuit were unacceptable as postemergents but should be further tested as a preplant or pre-transplant treatment. Stinger should be dropped because it is only effective as a postemergent and did not provide sufficient selectivity to stevia.

The plant number data show that Karmex, Sencor, Basagran, Plateau, Lorox and Stinger had more dead plants than the untreated control. All of the Karmex-treated plants were killed, whereas 60, 71, 80, 83 and 84%, respectively, of the plants treated with the above herbicides survived. The untreated control had 88% of the original plants. All the other treatments had more than 97% of the original plants. Some of the plants lost in the untreated control may be due to excessive competition from the weeds. These results suggest that Sencor, Basagran and Lorox may have some adverse effect without showing visible symptoms. Sencor and Lorox should be further tested as preplant or pre-transplant treatments. Additional testing of the postemergent Basagran at different growth stages may be warranted.

The most important result was the effect on plant growth as measured by the gain in plant height after treatment. The following herbicide plots had better growth than the untreated control: Pentagon, Solicam, Authority and Fusilade. Karmex, Stinger, Plateau and Aim adversely affected growth, hence, should definitely not be applied over stevia. The following group was estimated to be moderately phytotoxic to stevia: Pursuit, Stam, Basagran, Sencor, Bueno, Permit, Lorox, Poast and Command. Poast should be retested to confirm this result, because it was expected to provide similar tolerance to stevia as Fusilade. Other herbicides that should also be retested are Sinbar, Barricade, Goal, Milestone, Visor, Broadstrike and Valor which were nearly equal to the untreated control. This latter group may provide sufficient tolerance for over-the-crop applications, but the soil residual effect on stevia growth is not known.

CONCLUSIONS

Pentagon, Solicam, Authority and Fusilade are recommended herbicides for over-the-crop broadcast application. Additional trials should be conducted with herbicide application soon after transplanting or harvesting and for yield data to support their registration in stevia. Pentagon, Solicam and Authority are excellent preemergents, but are weak as postemergents. Fusilade is an excellent grass postemergent. What is still missing is a broadleaf postemergent herbicide. The use of Basagran and Bueno as broadleaf postemergents needs to be further tested on immature stevia. No phytotoxicity was visible on mature stevia, but nonsignificant growth reductions were measured.



Figures: Phytotoxicity, plant number and plant height at 30 DAT relative to measurements taken at 0 DAT. No phytotoxicity for Aim (Ai) through Visor (Vi); no plants for Karmex (K), and no height gains for K and Stinger (St).