EFFICACY OF POLADO, ARSENAL AND FUSILADE AS CHEMICAL SUGARCANE RIPENERS FOR LOUISIANA

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SUMMARY

The chemical ripeners, Polado and Arsenal, at the rates tested, significantly increased the yield of theoretical recoverable sugar per acre (TRS/A) when compared to control at 49 days after treatment (DAT). Polado and Arsenal, as well as Fusilade, increased the yield of theoretical recoverable sugar per ton of cane (TRS/TC) at 35 and 42 DAT. There was a significant increase in TRS/TC for Polado and Arsenal treatments at 49 DAT but not for either rate of Fusilade. Polado had the greatest deleterious effect on the yield of tons cane per acre (TC/A) at 49 DAT although there was no difference in TC/A at 49 DAT amongst the Polado treatment, the high rate of Arsenal, and the two rates of Fusilade. In most cases, there was an improvement in juice purity for all treatments at the three harvest dates when compared to control. There was little or no effect of the three ripeners on mean stalk weight at 35 and 42 DAT; however, there was a significant reduction in stalk weight at 49 DAT for the Polado treatment, the high rate of Arsenal, and the two Fusilade treatments. There was also a deleterious effect of most of the ripener treatments on mean stalk height at all sampling dates. Based on shoot counts taken on December 3, all treatments with the exception of Polado and the high rate of Fusilade had a similar number of shoots per acre when treated with a ripener than when left untreated. Polado-treated plots had a significantly lower shoot count while the high rate of Fusilade had a significantly higher shoot count when compared to control.

INTRODUCTION

In Louisiana, a sugarcane crop cycle usually consists of a fall-planted crop (plant-cane), which grows very little during winter and is harvested about one year after planting, and two or more stubble (ratoon) crops. The region has a 7- to 9-month growing season that extends from early spring to late November or until harvest during the period from late September to mid-January. Consequently, sugarcane is relatively immature at the beginning of harvest and sucrose levels are usually low, generally increasing as the harvest season advances, depending upon the variety. Sucrose levels in juice and sugar yield are affected greatly by variety and by the growing season before and during harvest. A combination of high incident light, low night temperatures and drying soil prior to and during the harvest period retards vegetative growth and promotes sucrose accumulation (natural ripening) (Legendre 1975).

Artificial ripening of sugarcane has been made possible by the development of plant growth regulators as chemical ripeners that hasten sugarcane maturation and increase sugar yield

(Nickell 1984). Glyphosate [isopropylamine salt of N-(phosphonomethyl)glycine], one of the most effective chemical ripeners used on a world-wide basis, apparently influences the way dry matter is partitioned, increasing the ratio of sucrose to fiber (Osgood et al. 1981). However, glyphosate treatment usually means a decreased cane yield in the crop being treated by slowing cane growth immediately after treatment, thus reducing stalk weight. In Louisiana, the effectiveness of glyphosate (Polado) (manufactured by Monsanto) for ripening sugarcane is strongly dependent upon variety, treatment-harvest interval, and growing season (Legendre and Finger 1987). The Polado label for sucrose enhancement in Louisiana, Florida, and Texas stipulates use only in stubble crops, a rate range of 4 to 14 ounces per acre of the formulated product and a treatment-harvest interval of 35 – 49 days. Polado is not labeled for plant-cane crops in these states because of possible phytotoxicity to crown, buds which could adversely affect regrowth (stubbling), thus reducing stands and yields in the stubble crop. Slow stand development in spring is commonly observed in Polado-treated sugarcane in Louisiana, but major reductions in regrowth, stalk population, and yield have not been reported except at high rates (normally more than 8 oz of the formulated product) and treatment-harvest intervals exceeding 49 days.

Currently, Polado is used on approximately 385,000 acres in Louisiana, netting the state's sugarcane growers, processors, and landlords an estimated $42,000,000 in increased gross revenues each year. However, since Polado is not labeled for plant-cane use, typically causes a loss of cane yield in the crop being treated, and has the potential for causing yield reduction in the subsequent stubble crop, additional research is needed to find alternative ripeners that can be used on the plant-cane crop, can be used at reduced treatment-harvest intervals, have little or no impact on cane yield and will not affect the subsequent stubble crop. Further, there is the possibility that a glyphosate-tolerant sugarcane variety will be developed in the near future that would effectively eliminate the use of glyphosate as a ripener. From 1983 to 1986, Legendre (unpublished data), while employed by the USDA-ARS, SRRC, Sugarcane Research Unit at Houma, showed that two products, Fusilade (manufactured by Syngenta) and Arsenal (manufactured by BASF), had the potential to ripen sugarcane under Louisiana conditions; however, the testing of both products was discontinued by their respective companies for company reasons.

PROCEDURES

The experiment was conducted in the first-stubble crop of the sugarcane variety LCP 85-384. Sugarcane was cultivated and fertilized according to recommended practices; insecticides were applied as required. The chemical treatments were applied on August 23, 2001, in water at a broadcast rate of 8 gal/A with a CO_2 sprayer and hand-held boom. A nonionic surfactant (0.25% v/v) was added to all spray solutions. The experiment consisted of six treatments: Polado at 0.2 lb a.e. /A (6 oz/A); Arsenal at 0.143 and 0.214 lb/A; Fusilade at 0.0625 and 0.0875 lb/A; and an untreated check serving as control. A 48-inch band was sprayed over sugarcane foliage so that most of the leaves were wet by the spray. Plots were one-row by 100-feet long with a 5-foot alley and with buffer rows on either side of treated row, arranged in a randomized complete block design with five replications.

Fifteen-stalk samples, taken at random along the row, were removed from each plot at 35 (September 27), 42 (October 4), and 49 (October 11) days after treatment (DAT). All stalks were stripped of all leaves and topped approximately 4-6 inches below the apical meristem (bud). Data collected and/or calculated included mean stalk weight and height, brix, by

refractometer, sucrose by polarimetry, purity as the ratio of sucrose to brix and the yield of theoretical recoverable sugar per ton of cane (TRS/TC). On October 11 (49 DAT), each plot was harvested by a cane combine (Cameco Model 2500) operating at approximately 3.5 mph and an extractor fan speed of 950 rpm. All cane from each plot was weighed in the wagon by use of load cells and the weights recorded. From these data, the yield of tons cane per acre (TC/A) was calculated and with the data for TRS/TC, the yield of theoretical recoverable sugar per acre (TRS/A) was calculated for each plot. To study the possible effect of the chemical ripeners on regrowth potential, stand counts were taken on December 3.

RESULTS AND DISCUSSION

Table 1 show the effect of the three chemical ripeners on mean stalk weight at 35, 42, and 49 days after treatment (DAT). There was little or no effect of the three ripeners on mean stalk weight at 35 and 42 DAT; however, there was a significant reduction in stalk weight at 49 DAT for the Polado treatment, the high rate of Arsenal, and the two Fusilade treatments. Table 2 shows the effect of the three chemical ripeners on mean stalk height at the three harvest dates. There was also a deleterious effect of most of the ripener treatments on mean stalk height at all sampling dates. Table 3 shows the effect of the three chemical ripeners on the yield of theoretical recoverable sugar per ton of cane (TRS/TC) for the three harvest dates. Polado and Arsenal, as well as Fusilade, increased the yield of TRS/TC at 35 and 42 DAT. There was a significant increase in TRS/TC for Polado and Arsenal treatments at 49 DAT but not for either rate of Fusilade. Table 4 shows the effect of the three chemical ripeners on juice purity at the three sampling dates. In most cases, there was an improvement in juice purity for all treatments at the three harvest dates when compared to control. Table 5 shows the effect of the three chemical ripeners on the yield of tons cane per acre (TC/A), TRS/TC, and TRS/A at 49 DAT. The chemical ripeners, Polado and Arsenal, at the rates tested, significantly increased the yield TRS/A when compared to control at 49 days after treatment (DAT). Polado had the greatest deleterious effect on TC/A at 49 DAT although there was no difference in TC/A at 49 DAT amongst the Polado treatment, the high rate of Arsenal, and the two rates of Fusilade. Table 6 shows the effect of the three chemical ripeners on regrowth potential. Based on shoot counts taken on December 3, all treatments with the exception of Polado and the high rate of Fusilade had a similar number of shoots per acre when treated with a ripener than when left untreated. Polado-treated plots had a significantly lower shoot count while the high rate of Fusilade had a significantly higher shoot count when compared to control.

These data show that Polado and Arsenal at the rates tested are effective in increasing both TRS/TC and TRS/A for the sugarcane variety LCP 85-384 while Arsenal at the low rate has minimal impact on TC/A. The stand count data show that Polado can reduce the stand counts taken shortly after harvest while Arsenal has apparently little or no effect at the rates tested.

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Table 1. Effect of the chemical ripeners Polado, Arsenal, and Fusilade on mean talk weight (STK WT) of the sugarcane variety LCP 85-384 in the first-stubble crop when harvested at 35, 42, and 49 days after treatment (DAT)[1,2].

		STK WT (lb)	
		DAT	
Treatment	35	42	49
Control	1.91 A	1.91 A	1.99 A
Polado (0.2 lb/A)	1.83 A	1.92 A	1.78 BC
Arsenal (0.143 lb/A)	2.00 A	1.94 A	2.20 A
Arsenal (0.214 lb/A)	1.90 A	1.85 AB	1.84 BC
Fusilade (0.0625 lb/A)	1.84 A	1.70 B	1.94 C
Fusilade (0.0875 lb/A)	1.91 A	1.84 AB	1.76 C

[1] Treatment date: August 23, 2001. Harvest dates: September 27 (35 DAT); October 4 (42 DAT); and October 11 (49 DAT)
[2] Means in a column followed by the same letter are non-significant at the 0.05P

Table 2. Effect of the chemical ripeners Polado, Arsenal, and Fusilade on mean stalk height (STK HT) of the sugarcane variety LCP 85-384 in the first-stubble crop when harvested at 35, 42, and 49 days after treatment (DAT)[12].

		STK HT (in)	
		DAT	
Treatment	35	42	49
Control	95.28 A	94.88 A	95.67 A
Polado (0.2 lb/A)	85.83 C	88.19 BC	89.76 AB
Arsenal (0.143 lb/A)	90.55 ABC	90.55 B	94.88 A
Arsenal (0.214 lb/A)	91.73 AB	87.80 BC	85.83 B
Fusilade (0.0625 lb/A)	87.40 BC	86.22 C	84.65 B
Fusilade (0.0875 lb/A)	86.22 C	86.22 C	86.22 B

[1] Treatment date: August 23, 2001. Harvest dates: September 27 (35 DAT); October 4 (42 DAT); and October 11 (49 DAT)
[2] Means in a column followed by the same letter are non-significant at the 0.05P

Table 3. Effect of the chemical ripeners Polado, Arsenal, and Fusilade on the yield of theoretical recoverable sugar per ton of cane (TRS/TC) of the sugarcane variety LCP 85-384 in the first-stubble crop when harvested at 35, 42, and 49 days after treatment (DAT)[12].

		TRS/TC (lb)	
		DAT	
Treatment	35	42	49
Control	145 C	165 E	176 D
Polado (0.2 lb/A)	208 A	214 A	226 ABC
Arsenal (0.143 lb/A)	185 B	196 BC	209 BC
Arsenal (0.214 lb/A)	185 B	207 AB	220 AB
Fusilade (0.0625 lb/A)	178 B	182 D	197 BCD
Fusilade (0.0875 lb/A)	176 B	191 CD	200 CD

[1] Treatment date: August 23, 2001. Harvest dates: September 27 (35 DAT); October 4 (42 DAT); and October 11 (49 DAT)
[2] Means in a column followed by the same letter are non-significant at the 0.05P

Table 4. Effect of the chemical ripeners Polado, Arsenal, and Fusilade on the juice purity of the sugarcane variety LCP 85-384 in the first-stubble crop when harvested at 35, 42, and 49 days after treatment (DAT) [12].

		PURITY (%)	
		DAT	
Treatment	35	42	49
Control	74.5 C	77.3 C	78.9 C
Polado (0.2 lb/A)	81.3 A	81.0 A	83.2 A
Arsenal (0.143 lb/A)	78.7 B	79.7 AB	82.3 AB
Arsenal (0.214 lb/A)	79.0 B	81.6 A	83.3 A
Fusilade (0.0625 lb/A)	77.9 B	78.0 BC	82.1 B
Fusilade (0.0875 lb/A)	77.4 B	79.6 AB	81.3 AB

[1] Treatment date: August 23, 2001. Harvest dates: September 27 (35 DAT); October 4 (42 DAT); and October 11 (49 DAT)
[2] Means in a column followed by the same letter are non-significant at the 0.05P

Table 5. Effect of the chemical ripeners Polado, Arsenal, and Fusilade on yield of tons cane per acre (TC/A), yield of theoretical recoverable sugar per ton of cane (TRS/TC) and yield of theoretical recoverable sugar per acre (TRS/A) of the sugarcane variety LCP 85-384 in the first-stubble crop when harvested 49 days after treatment (DAT) [12].

	TC/A	TRS/TC	TRS/A
Treatment	(tons)	(lb)	(lb)
Control	46.0 AB	176 D	8,106 D
Polado (0.2 lb/A)	41.2 C	226 ABC	9,287 ABC
Arsenal (0.143 lb/A)	47.8 A	209 BC	9,964 A
Arsenal (0.214 lb/A)	44.1 ABC	220 AB	9,705 AB
Fusilade (0.0625 lb/A)	44.5 ABC	197 BCD	8,783 BCD
Fusilade (0.0875 lb/A)	43.4 BC	200 CD	8,619 CD

[1] Treatment date, August 23, 2001; Harvest date, October 11, 2001
[2] Means in a column followed by the same letter are non-significant at the 0.05P

Table 6. Fall shoot counts following the application of the chemical ripeners Polado, Arsenal, and Fusilade to the sugarcane variety LCP 85-384 in the first-stubble crop [12].

	FALL SHOOT CT
Treatment	(Number/A)
Control	65,703 BC
Polado (0.2 lb/A)	26,267 D
Arsenal (0.143 lb/A)	64,788 BC
Arsenal (0.214 lb/A)	58,777 C
Fusilade (0.0625 lb/A)	71,801 AB
Fusilade (0.0875 lb/A)	76,608 A

[1] Treatment date, August 23, 2001; fall shoot count, December 3, 2001
[2] Means in a column followed by the same letter are non-significant at the 0.05P

EFFICACY OF GIBBERILLIC ACID IN INCREASING SUGAR YIELD IN LOUISIANA

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SUMMARY

Application of gibberellic acid failed to increase yield of tons cane per acre (TC/A), yield of theoretical recoverable sugar per ton of cane (TRS/TC), or yield of theoretical recoverable sugar per acre (TRS/A) when applied as a split application on two occasions at 1.0 qt/A on June 25, 2001, and 2.0 qt/A on July 27, 2001, to the fourth-stubble crop of LCP 85-384 and compared to control fields receiving no gibberellic acid. Glyphosate at 6 oz/A (0.2 lb/A) was applied to all fields, both treated and not treated with gibberellic acid, on October 22, 2001. Cane was harvested on December 10-11, 2001.

INTRODUCTION

Preliminary data from Florida and Louisiana had indicated that gibberellic acid when applied to actively growing sugarcane increased the yield of TC/A, TRS/TC, and/or TRS/A. The manufacturer of PRO-15 PLUS stated that its product activates the enzyme and hormone systems in plants which are essential for normal plant growth and reproduction. PRO-15 PLUS is formulated with 15% sulfur derived from liquid ammonium thiosulfate, which is said to provide nutrients for healthier roots, stronger stems and longer stalks, better fruit, and improved plant performance. This study was initiated to determine if the use of gibberellic acid with sulfur would improve cane and/or sugar yield when used in conjunction with Polado on Louisiana sugarcane.

PROCEDURES

Gibberellic acid (PRO-15 PLUS manufactured by Frit Industries, Ozark, AL) was applied twice to the fourth-stubble crop of the sugarcane variety LCP 85-384 at Alma Plantation, Lakeland, La., at 1 qt/A (0.01 oz. of gibberellic acid per qt) on June 25, 2001, by highboy sprayer in 15 gal spray mixture per acre and 2 qt/A on July 27, 2001, by airplane in 5 gal spray mixture per acre. A surfactant and no-drift product were included with each application to ensure proper coverage.

The experiment was comprised of only two treatments: a split application of the gibberellic acid and an untreated check serving as control. The field was arranged in a randomized complete block design with three replications. Each plot consisted of 30 rows wide

(180 ft) and three blocks deep or approximately 8.0 ac. Sugarcane was cultivated and fertilized according to recommended practices; insecticides were applied as required. Glyphosate (Polado-L) was applied by airplane at 6 oz (0.2 lb/A) on October 22, 2001, to the total area in 5-gal spray mixture per acre. The interior 16–18 rows of each plot or approximately 6.0 ac were harvested by a cane combine (Austoff Model 7700) operating at 3.5 mph and an extractor fan speed of 950 rpm. All cane from each plot was weighed by the Alma Factory's truck scale and the weights recorded. Each of the approximately 10-12 trucks of cane harvested from each plot was sampled by the core/press method of analyses to determine the yield of theoretical recoverable sugar per ton of cane (TRS/TC). From these data, the yield of tons cane per acre (TC/A) and yield of theoretical recoverable sugar per acre (TRS/A) were calculated.

RESULTS AND DISCUSSION

Yield data for the fourth-stubble crop of the sugarcane variety LCP 85-384 treated with gibberellic acid are shown in Table 1. Application of gibberellic acid failed to increase yield of tons cane per acre (TC/A), yield of theoretical recoverable sugar per ton of cane (TRS/TC), or yield of theoretical recoverable sugar per acre (TRS/A).

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Table 1. Effect of gibberellic acid treatment on yield of tons cane per acre (TC/A), yield of theoretical recoverable sugar per ton of cane (TRS/TC) and yield of theoretical recoverable sugar per acre (TRS/A) [1].

Treatment	TC/A	TRS/TC	TRS/A
	(tons)	(lb)	(lb)
Control	40.24	227.7	9,164
Gibberellic acid	39.24	225.0	8,828
LSD (0.05)	NS	NS	NS

[1] 1.0 qt/A gibberellic acid applied June 25, 2001, in 15 gal spray mixture by highboy
2.0 qt/A gibberellic acid applied July 27, 2001, in 5 gal spray mixture by airplane
6.0 oz/A glyphosate (0.2 lb/A) applied to all treatments October 22, 2001
Plots harvested by cane combine on December 10-11, 2001