SHORT, NON-REFEREED PAPER

EVALUATION OF MODDUS® AS A NEW CHEMICAL RIPENER FOR THE SOUTH AFRICAN SUGAR INDUSTRY: PRELIMINARY FINDINGS

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Abstract

Information from Brazil and Australia indicates that trinexapac-ethyl (Moddus®) is an excellent new sugarcane ripener. However, there is no information on the response of South African varieties to this chemical. The objective of this investigation was to establish the ripening potential of this chemical in local varieties and to compare responses with the current industry standards, Ethephon® and Fusilade Forte®. Evaluation was conducted in drip irrigated plant crops of N27 and N32 at Heatonville and Pongola respectively. Each trial was laid out in a complete randomised replicated design. Ripener treatments comprised (a) untreated control, (b) Ethephon® applied 84 days before harvest (DBH), (c) Fusilade Forte® applied 43 DBH, (d) Moddus® applied at two rates 70 DBH, (e) Ethephon® and Fusilade Forte® applied as a combination treatment, and (f) Moddus® (at two rates) and Fusilade Forte® applied as combination treatments. At Pongola the various treatments improved estimated recoverable crystal (ERC) yields in N32 by between 1.0-4.3 t/ha compared with the control. Best results were achieved in the combination treatments. However, the two Moddus®-Fusilade Forte® combination treatments outperformed the standard Ethephon®-Fusilade Forte® combination treatment by 1.0 t ERC/ha. At Heatonville ripener responses in N27 were smaller with improvements ranging between 0.5-1.0 t ERC/ha and without clear treatment differences. These preliminary results indicate that Moddus® is an effective ripener and that a Moddus®-Fusilade Forte® combination treatment could increase ERC yields considerably more than current industry standards. Results will be verified in the first ratoon crops at both locations.

Keywords: cane quality, cane yield, chemical ripening, Moddus®, sugarcane, sugar yield

Introduction

Trinexapac-ethyl (Moddus®) is a growth regulator used as an anti-lodging agent in cereals and as a growth regulator in turf grasses. However, at the correct dosage this chemical can potentially be used as a chemical ripener in sugarcane. Once absorbed through the leaves the active compound transiently (over a 4-6 week period) inhibits the conversion of an inactive precursor (GA_{20}) of the plant hormone giberellic acid (GA) into one of its main bioactive forms (GA_1). In the process GA_{20} accumulates, while the suppression of GA_1 levels leads to an inhibition of internode elongation (Resende *et al*., 2000; Rixon *et al*. 2007), which lowers sink demand with a concomitant acceleration of sucrose storage (ripening) within the stalk. Results from Brazil and Australia indicate that Moddus® is very effective in ripening sugarcane with juice purities of up to 85% at the time of application (Resende *et al*., 2000;

Kingston and Rixon, 2007). However, there is no information on the response of South African varieties to this chemical. The objectives of this investigation were therefore to establish the ripening potential of this chemical in local varieties and to compare responses with the current industry standards, Ethephon® and Fusilade Forte®.

Materials and Methods

Two drip irrigated field trials on a private farm in Heatonville and at the South African Sugarcane Research Institute's experiment farm in Pongola were planted to N27 and N32 during February to April 2010. The treatment plots consisted of 6 cane rows, each 16 m long and spaced 1.4 m apart (Pongola, N32) or 10 m long and spaced 1.3 m apart (Heatonville, N27). The experiment design in both trials was a randomised block with five replications per treatment.

In both trials treatments comprised an unsprayed (untreated) control and ripeners applied either as individual or combination treatments. For the individual treatments Ethephon® was applied 84 days before harvest (DBH) at 1.5 l/ha, while Fusilade Forte® was applied 43 DBH at 0.2 l/ha according to recommended practice. Moddus® was applied 70 DBH at 0.8 and 1.0 l/ha. The spray-to-harvest interval and application rates were based on previous research conducted at SASRI (unpublished results[1]). For the combination treatments Ethephon® was applied 84 DBH at 1.5 l/ha followed by Fusilade Forte® 43 DBH at 0.2 l/ha, while Moddus® was applied 70 DBH at 0.8 and 1 l/ha followed by Fusilade Forte® 43 DBH at 0.2 l/ha. Ripeners were applied by CO_2-pressurised spraying equipment with an overhead boom fitted with two TK-1 floodjet nozzles. The spray mixtures were delivered in water volumes of between 57 and 62 l/ha.

The trials were harvested on 19 April 2011 (Pongola) and 26 May 2011 (Heatonville), at which time stalk samples were collected for quality analysis and cane yields were determined in each plot.

Results and Discussion

At Pongola the various ripener treatments improved estimated recoverable crystal (ERC) content (%) by between 1.0-3.3 percentage units (Table 1). As reported previously (unpublished results[1]), Moddus® applied at 1.0 l/ha (M_1) improved ERC content much more (by 1.1 percentage units) than at 0.8 l/ha ($M_{0.8}$) and also outperformed the Ethephon® ($Eth_{1.5}$) and Fusilade Forte® ($FF_{0.2}$) individual treatments. In terms of ERC content, the three combination treatments (**$Eth_{1.5}$+$FF_{0.2}$**, $M_{0.8}$+$FF_{0.2}$ and M_1+$FF_{0.2}$) outperformed the individual treatments.

None of the treatments resulted in statistically significant reductions in cane yield (Table 1). Previous research has demonstrated statistically significant reductions in cane yield in N32 when Moddus® was applied 92 DBH (unpublished results[1]), which suggest that the shorter spray-to-harvest interval (70 DBH) employed in this study is more appropriate, and is also in good agreement with findings from Brazil (Resende *et al*., 2000).

[1]RA Donaldson, internal report, SASRI, Mount Edgecombe, South Africa

At Pongola the various ripener treatments improved ERC yields in N32 by between 1.0-4.3 t/ha compared with the control (Table 1). Best results were achieved in the three combination treatments. However, the two Moddus®-Fusilade Forte® combination treatments ($M_{0.8}$+$FF_{0.2}$ and M_1+$FF_{0.2}$) outperformed the standard Ethephon®-Fusilade Forte® combination treatment ($Eth_{1.5}$+$FF_{0.2}$) by 1.0 t ERC/ha.

Table 1. The effects of Ethephon® ($Eth_{1.5}$), Fusilade Forte® ($FF_{0.2}$) and Moddus® ($M_{0.8}$ and M_1) individual and combination ($Eth_{1.5}$+$FF_{0.2}$, $M_{0.8}$+$FF_{0.2}$ and M_1+$FF_{0.2}$) treatments on estimated recoverable crystal (ERC) content and yields (cane and ERC) in varieties N27 (Heatonville) and N32 (Pongola). Subscript values represent product application rates in l/ha. Values represent the mean of five replicates and LSD (P<0.05) values are indicated at the bottom of the table.

Treatment	ERC (%)	Cane yield (t/ha)	ERC yield (t/ha)	ERC (%)	Cane yield (t/ha)	ERC yield (t/ha)
	Pongola – N32			Heatonville – N27		
Control	9.5	120	11.3	10.6	117	12.4
$Eth_{1.5}$	10.7	119	12.9	11.1	115	13.0
$FF_{0.2}$	10.7	118	12.6	11.6	115	13.3
$M_{0.8}$	10.5	117	12.3	12.0	109	13.2
M_1	11.7	114	13.2	11.9	111	13.2
$Eth_{1.5}$ + FF	12.8	114	14.5	11.7	110	13.1
$M_{0.8}$ + $FF_{0.2}$	12.2	127	15.6	12.5	107	13.4
M_1 + $FF_{0.2}$	12.7	120	15.5	12.3	106	13.1
LSD	1.4	13.3	2.2	0.8	12.9	1.7

At Heatonville (N27) improvements in ERC content ranged between 0.5-1.9 percentage units but with the Moddus® individual and combination treatments achieving the best responses (Table 1). None of the treatments resulted in any statistical significant reduction in cane yield (Table 1). However the biggest effects on cane yield was observed in the two Moddus®-Fusilade Forte® combination treatments ($M_{0.8}$+$FF_{0.2}$ and M_1+$FF_{0.2}$) where cane yields were respectively 10 and 11 t/ha lower than in the control. At Heatonville ripener responses were smaller with improvements in ERC yields ranging between 0.5-1.0 t ERC/ha and without clear treatment differences (Table 1).

These preliminary results indicate that Moddus® is a very effective ripener under South African conditions and that a Moddus®-Fusilade Forte® combination treatment could possibly increase ERC yields considerably more than current industry standards. Results are being verified in the first ratoon crops at both locations. Besides yield performance, possible effects on ratoon regrowth are also assessed. These results contribute towards the possible future registration of Moddus® as a new sugarcane ripener for the South African sugar industry.

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