SHORT NON-REFEREED PAPER

CHEMICAL RIPENER RESPONSES IN IRRIGATED SUGARCANE VARIETIES AT PONGOLA (SOUTH AFRICA)

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Abstract

Increases in stalk sucrose content through chemical ripening depend on the chemical used, the sugarcane variety, and the environmental conditions. The objective of this study was to quantify the effects of Ethephon (Eth), Fusilade Forte (FF) and the combination treatment (Eth+FF) on cane quality and recoverable value (RV) yield in different irrigated varieties (N36, N49 and N53) and pre-release irrigated variety (01F1920) at Pongola (South Africa). The trial was a complete randomised design with each variety x treatment combination replicated six times. Eth and FF were applied at standard spray-to-harvest intervals and at rates of 1.5 and 0.2 L/ha respectively. Cane quality, stalk heights and population numbers were determined on five occasions between spraying and harvesting. Cane and RV yields were determined at harvest. The various ripener treatments induced statistically significant increases in cane quality (RV%) in N36 and 01F1920 with near significant increases in N49 and N53. Increases in cane quality ranged from 0.3 to 5.3 RV% units. There were no significant reductions in cane yield in any of the variety x treatment combinations. RV yield was significantly increased in all the varieties except N53. Increases in RV yield ranged from 0.5 to 5.7 tRV/ha, with the largest responses induced by the FF and Eth+FF treatments. Results clearly demonstrated that the large increases in RV%, in the presence of only modest reductions in cane yield, would make the use of chemical ripeners in these varieties under Pongola growing conditions highly profitable.

Keywords: cane quality, cane yield, chemical ripeners, Ethephon, Fusilade Forte, recoverable value

Introduction

Chemical ripeners are used for ripening sugarcane crops when environmental conditions conducive to vigorous crop growth (sufficient water and optimum temperatures) have left the crop immature at harvesting (Alexander, 1973; Legendere, 1974). Currently, two chemicals are registered for use in the South African sugarcane industry for ripening purposes: Ethephon® (2-chloroethyl phosphoric acid) and Fusilade Forte® (fluazifop-p-butyl). These ripeners can be used as either a single treatment or combination (piggy-back or tandem) treatment.

Chemical ripeners are very effective in vigorously growing and high yielding crops that have been optimally fertilised and carefully managed from crop start to harvest (Dalley and Richard, 2010). Some factors that may interfere with chemical ripener efficacy include

drought stress, low temperatures, crop maturity and varietal differences. Mild or moderate drought stress, nutrient stress, low temperatures and shortening of day length induce natural ripening, which significantly reduces chemical ripener efficacy (Clowes, 1980; MacCatty, 1980; Rostron, 1985). It is also known from previous research conducted at the South African Sugarcane Research Institute (SASRI) that varieties respond differently to chemical ripeners. Therefore, the objectives of this study were to quantify the effects of Ethephon (Eth), Fusilade Forte (FF) and the combination treatment (Eth+FF) on cane quality (RV%), cane yield and recoverable value (RV) yield in three irrigated varieties (N36, N49 and N53) and the pre-release irrigated variety 01F1920 at Pongola.

Materials and Methods

Field trial

A field trial was established on April 2011 at the SASRI Pongola farm. Trial plots were irrigated, and were harvested at 12 months in April 2012. The trial was laid out as a complete randomised block design with four treatments per variety: (i) unsprayed control (C), (ii) Ethephon (Eth), (iii) Fusilade Forte (FF) and Ethephon + Fusilade Forte combination (Eth +FF). Three varieties released for the irrigated region (N36, N49 and N53) and one pre-release variety (01F1920) were planted, with six replicates for each variety x treatment combination. The treatment plots consisted of six cane rows, each 8 m long and spaced 1.4 m apart. The crop was initially irrigated with overhead sprinklers to bring the water in the soil profile to field capacity and to achieve uniform germination. Thereafter water was applied by surface drip irrigation to maintain soil moisture content in the top 60 cm of the soil profile between 75-95% of field capacity. Soil moisture content was monitored using 10HS Decagon soil moisture probes inserted in pairs into undisturbed soil at 15 and 45 cm depths in each of the five N49 control plots. In total, 547 mm of irrigation was applied in this trial.

Measurements

Samples of 12 stalks were taken for millroom analysis in rows 2 and 5 of each plot at five different time intervals between ripener application and harvest for standard cane quality analysis. Stalk heights, population counts, green leaf counts and lodge ratings were also recorded at the same time intervals in rows 3 and 4 of each plot.

Chemical ripener application

Chemical ripeners were applied at spray-to-harvest intervals (STHIs) according to SASRI recommendations with Eth and FF applied 12 and 6 weeks before harvest, respectively. Juice purities (averaged across varieties) at the time of ripener applications were 45% and 60% for Eth and FF, respectively. Eth and FF were applied to rows 2, 3, 4 and 5 in each plot with a hand-held spray boom fitted with two TK-1 stainless steel flood-jet nozzles spaced 1.4 m apart. A CO_2-pressurised knapsack was used to apply the products at a rate of 1.5 L/ha (Eth) and 0.2 L/ha (FF) at 175 kPa pressure and in a water volume of 57 L/ha.

Yield and quality

At harvest, rows 3 and 4 were cut manually and weighed using a mechanical grab to determine cane yield in tons per hectare (TCH). RV yields (t/ha) were then calculated as the product of TCH and RV%. Data was statistically analysed by the SASRI biometry department using the Genstat® software package.

Results and Discussion

The chemical ripener treatments increased cane quality (RV%) in all the varieties; however, these increases were not statistically significant in all cases (Figure 1). Varieties N36 and 01F1920 experienced statistically significant increases in RV%, whereas N49 and N53 experienced near statistically significant increases. Increases in RV% above unsprayed control values ranged from 0.3-5.3 RV% units. The largest increases in RV% were achieved in the FF and ETH+FF treatments for all varieties except N36, where FF was not applied due to severe lodging that occurred prior to the planned application date.

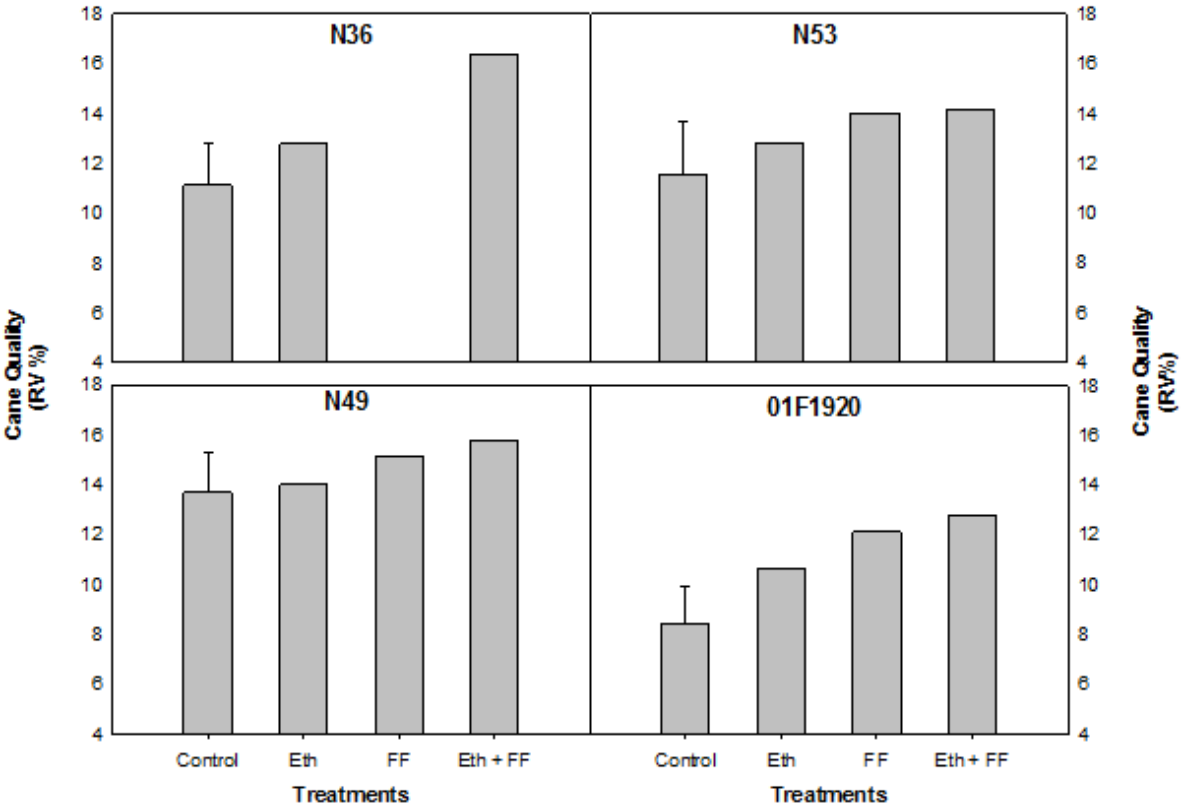

Figure 1: Effects of Ethephon (Eth), Fusilade Forte (FF) and the combination treatment (Eth+FF) on cane quality (RV%) in varieties N36, N49, N53 and 01F1920 at harvest.

There were no statistically significant reductions in cane yield as a result of chemical ripening in any of the varieties (results not shown). However, varieties N53 and 01F1920 experienced the largest reductions in cane yield in response to the Eth+FF treatment. In variety N49, cane yield was not reduced by any of the treatments. Because of the substantial RV% increases achieved by the various ripener treatments (Figure 1), the modest reductions in cane yield did not reduce (erode) the RV yield increases to any great extent. There were statistically significant increases in RV yield in all varieties and ripener treatments with the exception of N53, where the increases were not statistically significant (results not shown). Increases in RV yield ranged from 0.5-5.7 t RV/ha. The Eth+FF treatment achieved the best RV yield increase in N36, while the FF treatment achieved the best increases in N49 and N53. In pre-release variety 01F1920, both the FF and Eth+FF treatments achieved similar increases in RV yield.

Conclusions

In conclusion, all varieties responded positively to chemical ripeners in terms of RV% increases achieved. Reductions in cane yield were modest enough to ensure that RV% increases translated into direct economic benefit in the form of increased RV yields. On its own, increased RV% will also be of benefit to growers situated far away from the mill, and to the miller in terms of higher quality cane for sugar extraction. Results clearly demonstrated that the use of chemical ripeners in these varieties under Pongola growing conditions would be a highly profitable crop management practice.

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