SHORT NON-REFEREED PAPER

# EARLY SEASON RESPONSE OF COASTAL RAINFED SUGARCANE VARIETIES TO CHEMICAL RIPENERS

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## Abstract

Chemical ripener research often focuses on the response of sugarcane varieties to ripeners under high potential irrigated conditions. However, good responses can also be achieved under favourable coastal growing conditions. This study quantified the effects of Ethephon (Eth), Fusilade Forte (FF) and the combination treatment (Eth+FF) on recoverable value (RV%) and RV yield of three coastal rainfed varieties (N42, N47 and N51). A field trial was established along the coast (Mount Edgecombe, KwaZulu-Natal, South Africa) as a complete randomised design with each variety x treatment combination replicated five times. Ripeners were applied at standard spray-to-harvest intervals and at rates of 1.5 L/ha (Eth) and 0.2 L/ha (FF). Cane quality and yield were determined at harvest in each treatment plot. Post-harvest measurements, including stalk population and stalk height, were also conducted to test for any residual ripener effects. Statistically significant increases in RV% were observed in seven out of nine variety x ripener treatment combinations. Only variety N47 showed significant increases in RV% in response to Eth. The FF treatment significantly increased cane quality in the three varieties by between 1.1 and 1.3 RV% units. Varieties N42 and N51 responded well to the Eth+FF treatment with increases of up to 2.0 RV% units. There were no significant reductions in cane yield in any of the treatments, thus leading to large increases in RV yield. The residual action of some of the ripener treatments caused a temporary increase in growth of the succeeding ratoon crop at a young age, which disappeared towards harvest.

*Keywords:* cane quality, chemical ripeners, coastal varieties, Ethephon, Fusilade Forte

## Introduction

Sugarcane ripening (increase in stalk sucrose mass over time) is a natural phenomenon that is driven by environmental factors such as low temperature and reduced water supply (Bakker, 1999). Ripening can also be enhanced by withholding irrigation (drying-off) a few weeks before the planned harvest date (Robertson and Donaldson, 1998). However, favourable conditions for natural ripening may not always be achieved in wetter years thereby resulting in immature crops at harvest. In such instances, the use of chemical ripeners becomes valuable to increase sucrose yields (Donaldson, 2001; van Heerden *et al*., 2013).

Chemical ripener research often focuses on the response of sugarcane varieties to ripeners under high potential irrigated conditions. However, good responses can also be achieved under favourable coastal growing conditions. This study quantified the effects of Ethephon (Eth),

Fusilade Forte (FF) and the combination treatment (Eth+FF) on recoverable value (RV%) and RV yield of three coastal rainfed varieties (N42, N47 and N51). The residual action of these ripener treatments on the following ratoon crops were also investigated.

## Materials and methods

*Field trial*

A field trial was established in October 2010 along the KwaZulu-Natal coast at Mount Edgecombe, South Africa. 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 (iv) Ethephon + Fusilade Forte combination (Eth+FF). Three varieties released for the coastal rainfed region (N42, N47 and N51) were evaluated with each variety x treatment combination replicated five times. The treatment plots consisted of five cane rows, each 8 m long and spaced 1.2 m apart. Supplementary irrigation was applied by surface drip to maintain soil moisture content in the top 60 cm of the soil profile between 75-95% of field capacity and avoid water stress. Soil moisture content was monitored using a 503DR Neutron probe. The trial was harvested on a 12 month cycle. The plant crop was cut back in May 2011 to introduce an early season cutting cycle. The first, second and third ratoon crops were harvested in May of the subsequent years (2012 to 2014).

*Chemical ripener application*

Chemical ripeners were applied at spray-to-harvest intervals (STHIs) according to the South African Sugarcane Research Institute (SASRI) recommendations with Eth and FF applied 12 and 6 weeks before harvest, respectively. The same STHIs were used for the combination treatment where both chemicals were applied to the same treatment plots. Juice purities at the time of ripener applications were below 75% and 85% for Eth and FF, respectively. Ripeners 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 1.2 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 67 L/ha as per the registered recommendations.

*Measurements and yield determination*

Samples of 12 stalks were taken for cane quality (recoverable value, RV%) analysis in rows 2 and 5 of each plot at five different time intervals between ripener application and harvest. At the same time intervals, stalk population and stalk height were also measured in rows 3 and 4 of each plot. At harvest, rows 3 and 4 were cut manually in each plot and weighed using a mechanical grab to determine cane yield (t/ha, TCH). RV yield (t/ha) was then calculated as the product of TCH and RV%.

Post-harvest measurements, including stalk population and stalk height, were conducted in rows 3 and 4 of each plot at three month intervals to test for any residual ripener effects.

Data was statistically analysed by the biometry services at SASRI using the Genstat® software package.

## Results and Discussion

Since there was no significant ($F>0.05$) year x treatment interactions, data obtained over the three ratoon crops were combined to allow determination of overall treatment effects. Significant increases in RV% were observed in seven out of nine variety x ripener treatment combinations. The FF treatment significantly increased cane quality in all three varieties by

between 1.1 and 1.3 RV% units (Figure 1). Only variety N47 showed a significant increase in RV% (1.0 RV% units) in response to Eth. Variety N42 responded particularly well to the combination treatment with an increase of 2.0 RV% units, significantly outperforming both the Eth and FF individual treatments. Variety N51 also responded favourably to the Eth+FF treatment with an increase of 1.9 RV% units, significantly outperforming the Eth but not the FF individual treatment.

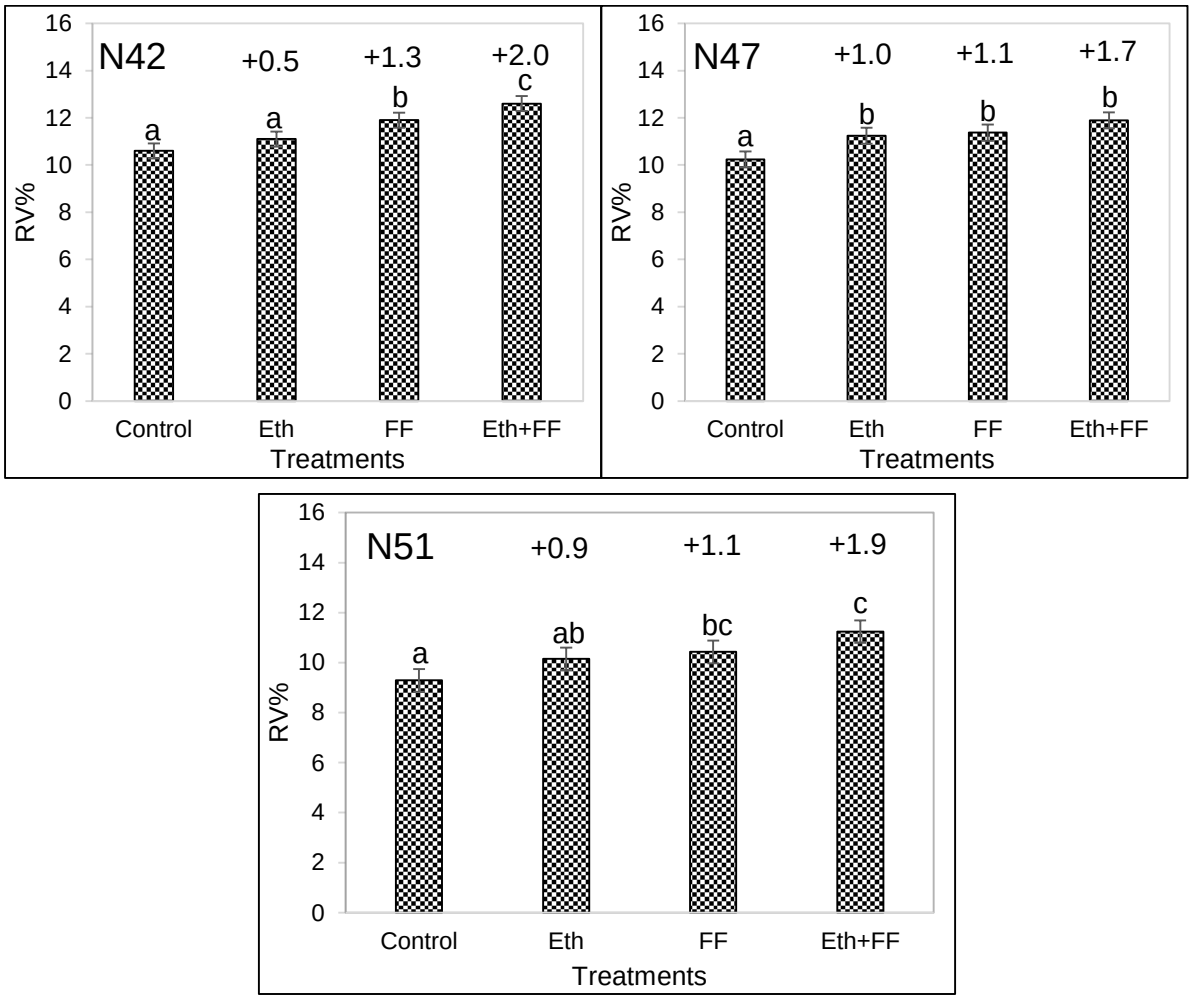


**Figure 1. Effects of Ethephon (Eth), Fusilade Forte (FF) and the combination treatment (Eth+FF) on cane quality (RV%) in varieties N42, N47 and N51 averaged across three ratoon crops. Vertical bars indicate least significance difference (LSD). Different letters above each vertical bar indicate significant differences (P=0.05) between the control and ripener treatments. The actual increase in RV% units over the control is indicated for each treatment.**

To reap the greatest economic benefit from chemical ripeners, not only increases in cane quality (RV%), but also increases in RV yield (t/ha), must be achieved. As mentioned above, most of the ripener treatments increased RV% significantly, but their mode of action, namely suppression of stalk and/or leaf growth, could have also reduced cane yield at harvest. The results revealed that none of the ripener treatments resulted in a significant decrease in cane yield (results not shown). Gains in RV yield observed were often not statistically significant except for three out of nine variety x ripener treatment combinations (results not shown). RV yield averaged across the three varieties, ripener treatments and ratoons increased by between 0.4-3.1 t/ha over the controls.

The residual action of the FF treatment resulted in a temporary increase in stalk population and stalk length of the succeeding N42 and N51 crops but with no effect on N47 (data not shown). There were no residual effects in response to the Eth treatment in any of the three varieties.

## Conclusion

In conclusion, the three coastal rainfed varieties responded differently to ripener treatments in terms of gains in RV% and RV yield. None of the ripener treatments resulted in a significant reduction in cane yield or any negative residual effects on the following ratoons. Based on the results obtained over three ratoon crops, the following ripener recommendations can be made (based on RV% responses):

Variety N42: Application of Fusilade Forte, but in particular the combination treatment, is recommended.

Variety N47: Application of either Ethephon or Fusilade Forte, but not the combination treatment, is recommended.

Variety N51: Application of either Fusilade Forte or the combination treatment (marginal response) is recommended. It should be noted that this variety might be susceptible to seasonal variability in the magnitude by which ripeners increase RV%.

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