RESPONSES OF SOME SUGARCANE VARIETIES TO STANDARD AND COMBINATION RIPENER TREATMENTS

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Abstract

The effects on sucrose yield of varying the time interval between Ethrel and Fusilade Super applications in a combination treatment were tested on variety NCo376. Results suggested that Ethrel applied 12 weeks, and Fusilade Super applied eight weeks before harvesting were the most beneficial. Other varieties which responded to a combination treatment were N19, N12 and N22. Varieties N14, N19, N17, N12, N22 and NCo376 grown under irrigation all responded to one of the ripener treatments, and their responses to Ethrel and Fusilade Super are discussed. There were no significant gains in sucrose yield of CP66/1043 in response to the ripeners although sucrose content was increased.

Introduction

The first records of two ripeners being applied in sequence to the same cane in southern Africa are of experiments conducted at the South African Sugar Association Experiment Station during 1977 (Anon., 1978). An experiment in which Mon 8000 (Polado) was applied to cane which previously had been sprayed with ethephon (Ethrel) or Embark, gave encouraging results. Following the registration of fluazifop (Fusilade Super) as a ripener in South Africa, Rostron (1985) tested this concept with Ethrel followed by Fusilade Super. Comparing commercially ripened fields in Swaziland, Sweet et al. (1987) reported excellent results from combining Ethrel and Fusilade, stating that the individual benefits are 'additive' when the chemicals are applied in sequence. The combination treatment soon became commercial practice on NCo376 in Swaziland, and Leibbrandt (1989) verified that responses to the combination treatment were additive on NCo376, but not on N14. The poor responses of N14 to the combination treatment were attributed to the lack of response of this variety to Ethrel. In a comparison of ripeners conducted in Cuba on six varieties, Cutino et al. (1992) found that Fusilade Super and glyphosate (Roundup) applied individually were economically more favourable than the combination of Ethrel + Fusilade Super.

Three of the experiments reported here were conducted on NCo376 to assess the effects of varying the interval between applying Ethrel and Fusilade Super. A combination treatment and lone applications of Ethrel and Fusilade Super were tested in two experiments on N19, N12, CP66/1043 and N22. Responses of NCo376, N14, N17 and N19 to standard Ethrel and Fusilade Super treatments were also tested in two experiments.

Treatments and Methods

Three combination treatments, in which the time of applying Fusilade Super was varied following Ethrel application, were compared with Ethrel alone (experiment I) or Ethrel and Fusilade Super alone (experiments II and III). In experiments IV and V Ethrel and Fusilade Super were applied about twelve and eight weeks respectively before har-

Table 1

Details of treatments

Experiment number	Crop cycle and age at harvest (months)	Variety	Chemicals applied*	Purity at spraying
I	6/6/90 - 6/6/91 (12)	NCo376	Eth, Eth + FusS	Ethrel - 66%
II	6/6/91 - 1/7/92 (12,8)	NCo376	Eth, FusS Eth + FusS	Ethrel - 60%
III	1/7/92 - 3/6/93 (11,1)	NCo376	Eth, FusS Eth + FusS	Ethrel - 59%
IV	3/4/91 - 30/4/92 (12,9)	N19, N12, N22, CP66/1043	Eth, FusS, Eth + FusS	Ethrel - < 70%
V	30/4/92 - 18/5/93 (12,7)	N19, N12, N22, CP66/1043	Eth, FusS, Eth + FusS	Ethrel - < 65%
VI	18/6/91 - 16/6/92 (12)	N14, N17, N19, NCo376	Eth, FusS	75%
VII	16/6/92 - 16/6/93 (12)	N14, N17, N19, NCo376	Eth, FusS	70%

* Ethrel applied at 1,5 l/ha and Fusilade Super at 300 to 345 ml/ha.

Note: In experiments IV and V purity of CP66/1043 was 81% and 79%, respectively, at the time of spraying Ethrel.

vesting, as single and combination treatments. Single treatments of Ethrel and Fusilade Super were applied eight weeks before harvesting in experiments VI and VII. The experiments were sited on a deep Hutton soil form and were irrigated regularly. Further details of the experiments are shown in Table I. In experiments I, II, III and V the chemicals were applied with a knapsack, pressurised with CO^2 at 175 kPa, which delivered about 60 l/ha via two TK 1,0 floodjets mounted on an overhead boom. In experiments IV, VI and VII, a tractor-mounted boom linked to a PTO driven pump was used to apply the treatments. At 900 rpm a pressure of 175 kPa was developed so that each TK 1,0 floodjet delivered 7 ml per second. A ground speed of one metre per second was maintained by the tractor.

In experiments I, II and III, net plots consisted of two rows 1,4 m apart and 14 m long. In all the other experiments there were four 10 m long net rows in each plot. Treatments were replicated six times in a randomised block design in experiments I, II and III. A split plot design with treatments replicated four times was used in all the remaining trials. Sixteen stalks were taken from each plot at various times and analysed for sucrose content. Plots were harvested and weighed at the termination of each experiment to assess the effects of treatments on cane and sucrose yields. The data were subjected to analysis of variance. Only the effects of treatments at harvesting are presented.

Results and Discussion

Combination treatment

NCo376

When responses to Ethrel were substantial (experiment I) there was no additional improvement in sucrose yield from the combination treatments (Table 2). However, there is good evidence from experiment III that the combination treatment increased the sucrose content more than the individual responses from Ethrel and Fusilade Super (hereafter referred to as an 'additive' response). In this experiment the application of ripeners severely reduced cane yield and only the sucrose yields from the combination of Ethrel (12w) + FusS (8w) were significantly higher than those of the untreated cane (P=0,05).

Table 2

Yields and responses of NCo376 to various intervals between applications within the combination treatment (Eth + FS) and to Ethrel (Eth) and Fusilade Super (FS).

	Experiment Number								
	I			II			III		
Treatment	Cane t/ha	Ers %c	Ers t/ha	Cane t/ha	Ers %c	Ers t/ha	Cane t/ha	Ers %c	Ers t/ha
Control Eth	104	9,6	10,0	112	11,9	13,3	109	9,0	9,8
(12wk)	108	11,9	12,8	110	12,8	14,0	99	10,1	10,2
Eth(12wk) + FS(8wk)	100	12,3	12,3	107	13,2	14,2	93	12,6	11,7
Eth(12wk) + FS(6wk)	96	11,7	11,2	98	12,2	11,9	88	11,9	10,5
Eth(12wk) + FS(4wk)	107	11,7	12,5	104	12,4	12,9	87	11,4	9,9
FS (6wk)	-	-	-	108	12,5	13,9	108	10,0	10,8
MEAN	103	11,4	11,8	106	12,5	13,3	97	10,8	10,5
CV% LSD	9,3	7,9	13,3	8,7	10,5	14,4	8,8	8,1	11,7
0.05	11,5	1,0	1,8	10,9	4,8	2,3	10,2	1,0	1,4

The poor responses to ripeners applied in experiment II and the greater variability of sucrose content were probably due to severe lodging. The reduction of cane yield following Ethrel applications (experiment III) is not common and this is only the second known documented occurrence in southern Africa (*Donaldson and Leibbrandt, unpublished data). The reason for this may be that in experiment III the chemical was applied to young, vigorously growing cane. During the final three months before harvesting in experiment I, the stalks accumulated 30% and 50% of their final wet and dry mass respectively, whereas in experiment III the stalks accumulated 40% and 60% of their final wet and dry mass during this period (Figure 1). Another effect from applying Ethrel to young cane is profuse tillering (Kingston, 1988).

The better response to Ethrel in experiment I than in experiment III was somewhat unexpected, since the purities of experiment I (66%) were higher than those of experiment III (59%) at the time of spraying (Clowes, 1978; Rostron, 1975). The relatively low yields and rapid growth at the time

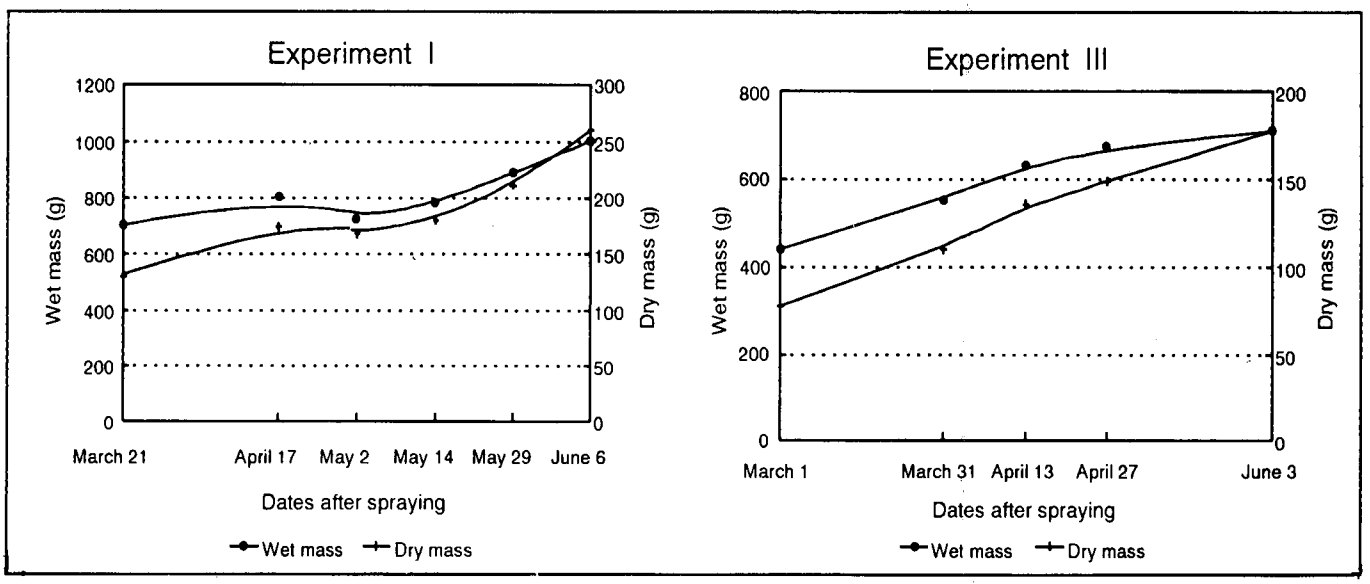

FIGURE 1 Wet and dry mass of unsprayed stalks during the final three months before harvesting experiments I and III.

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of spraying may not have been conducive to good responses to ripener treatments.

Other varieties

The response of N19 to the combination treatment exceeded the individual responses (Table 3). The responses of N12 and N22 to Ethrel alone were poor in experiments IV and V and, despite this, the combination treatment gave additive responses in experiment IV but not in experiment V. The sucrose content of CP66/1043 after the combination treatment was no better than after Fusilade Super applied on its own (P=0,05) which, due to negative effects on cane mass, did not translate into significant gains in sucrose yields.

Table 3

Yields and sucrose content of four varieties in response to Ethrel (Eth) (12w), Fusilade Super (FusS) (8w) and combination treatments (Eth(12w)+FusS(8w))

	Experiment Number					
	IV			V		
Treatment	Cane t/ha	Ers % c	Ers t/ha	Cane t/ha	Ers % c	Ers t/ha
N19						
Control	146	10,6	15,5	130	11,5	15,0
Ethrel	140	10,3	14,4	131	11,6	15,2
FusS	137	10,5	14,4	132	12,9	17,0
Eth+FusS	140	11,6	16,2	130	13,8	17,9
N12						
Control	143	8,6	12,3	144	9,8	14,1
Ethrel	142	7,3	10,4	151	9,7	14,6
FusS	152	9,3	14,1	146	11,4	16,6
Eth+FusS	143	10,2	14,6	146	11,1	16,2
CP66/1043						
Control	107	13,8	14,8	108	13,6	14,7
Ethrel	110	13,2	14,5	104	13,8	14,4
FusS	101	15,4	15,6	100	15,8	15,8
Eth+FusS	102	15,6	15,9	101	15,9	16,1
N22						
Control	137	10,1	13,8	137	11,4	15,6
Ethrel	128	10,9	14,0	127	12,0	15,2
FusS	127	11,4	14,5	125	13,8	17,3
Eth+FusS	124	12,3	15,3	123	14,0	17,2
MEAN	130	11,3	14,7	127	12,6	15,8
CV %	5,6	5,0	6,0	6,3	3,5	7,7
LSD 0,05	9,4	1,4	1,9	11,5	1,0	1,7

Ethrel, Fusilade Super and varieties

The poor responses to ripeners in experiment VII (Table 4) is further evidence of the effect of lodging on the benefits from ripeners. The only significant response to Fusilade Super was in N14, and this is probably a reflection of the less severe lodging of this variety. Responses from Fusilade Super were clearly better than those from Ethrel in experiment VII and responses to Ethrel were better than those from Fusilade Super in experiment VI (except for N14).

The good response of N19 to Fusilade Super in experiment V (Table 3) suggests that this variety may respond well to Fusilade Super. The nearly significant response of N14 to Ethrel in experiment VI was the result of slightly higher cane yields and an increase in sucrose content (nearly significant at P=0,05). The responses of N14 to Fusilade Super were

Table 4

Effects of Ethrel and Fusilade Super on sucrose content and yields of four varieties

	Experiment Number					
	VI			VII		
Treatments	Cane t/ha	Ers % c	Ers t/ha	Cane t/ha	Ers % c	Ers t/ha
NCo376						
Control	150	11,3	17,0	146	10,0	14,6
Ethrel	160	12,6	20,2	142	9,8	13,9
FusiladeS	156	12,2	19,0	143	10,9	15,6
N14						
Control	139	11,1	15,4	130	9,9	12,9
Ethrel	145	11,9	17,3	129	11,2	14,4
FusiladeS	144	12,9	18,6	133	11,3	15,0
N17						
Control	135	11,8	15,9	117	10,9	12,7
Ethrel	137	13,0	17,8	122	10,3	12,6
FusiladeS	134	12,4	16,6	126	11,3	14,2
N19						
Control	131	12,1	15,9	128	10,8	13,8
Ethrel	137	13,5	18,5	128	11,0	14,1
FusiladeS	124	13,1	16,2	128	11,9	15,2
MEAN	141	12,3	17,4	131	10,8	14,1
CV%	2,6	5,8	2,9	5,4	6,7	8,9
LSD 0,05	12,3	1,0	2,0	14,0	1,5	2,0

clearly superior to those from Ethrel. N12 responded well to Fusilade Super in experiment V and to the combination treatment in experiment IV. N22 responded well to Fusilade Super and not to Ethrel. This variety appeared to be sensitive to the treatments and it needs to be established whether the interval from spraying to harvesting should be shorter for such varieties. The data presented for N22 gave some indication of an additive response (not significant) to the combination treatment when responses to the individual ripeners were poor.

General

The experiments were conducted during the period 1991 to 1993 when rainfall was well below the long term average. Despite the good water holding characteristics of the soil on which the experiments were conducted and regular irrigation, evaporative demand depleted available moisture on occasions. The crops were subjected, therefore, to stress between irrigation. Under such conditions periods of slow growth are followed by rapid compensating growth (*Inman-Bamber, unpublished data). It has been demonstrated that the herbicidal efficacy of fluazifop is reduced by stress (Boydston, 1992; Dickson et al., 1990). As a ripener of sugarcane, fluazifop is also less effective when applied to cane that is stressed (Donaldson and van Staden, 1993). It is well known that varieties react differently to stress; this would affect their responses to ripeners and they are likely to respond differently under stress-free conditions.

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Conclusions

Whereas the combination treatment produced indications of additive responses on a range of varieties, the only significant benefit in terms of sucrose yield was on N19. With few exceptions the combination treatment produced the better response, albeit sometimes only slightly better than the best individual ripener. The most effective time of applying Fusilade Super appears to be eight weeks before harvesting and four weeks after the application of Ethrel. At least one of the ripener treatments increased the sucrose yield of each variety tested, with the exception of CP66/1043. The potential benefit of a ripener to the industry should be considered in the light of the range of stress conditions which may develop in the crop, particularly before and after the application of Fusilade Super.

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