EARLY AND LATE SEASON CHEMICAL RIPENING OF SUGARCANE

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Abstract

Mon 8000 and Roundup were evaluated as ripeners and compared with the registered ripeners Ethrel (0,75 kg ai/ha) and Embark (0,75 kg ai/ha). In seven small plot trials, using varieties NCo 376, NCo 293, N52/219 or N55/805, the treatments were applied either early or late in the milling season. Mon 8000 and Roundup were effective as early and late season ripeners on mature or immature sugarcane, ers % cane being significantly improved in all seven trials. Ethrel and Embark significantly improved ers % cane during the early part of the milling season only when applied to immature sugarcane (juice purity lower than 75%); however, on mature cane (juice purity higher than 80%) there was evidence of a growth rather than a ripening response, which tended to vary, depending on the variety. Growth stimulation was not apparent in NCo 376, whereas N52/219 responded to Ethrel and Embark, with N55/805 and NCo 293 responding only to Ethrel. The analysis of stalks partitioned from the base upwards showed that Ethrel and Embark only ripened immature internodes which had not been naturally ripened. Mon 8000 and Roundup produced a similar ripening effect to Ethrel and Embark, but in addition sucrose accumulation occurred, particularly in the lower portions of the stalk, irrespective of the degree of natural maturity. It is suggested that chemical ripeners maybe classified as either 'ripeners' or 'loaders', depending on how sugar accumulation occurs in the stalk. Measurements on regrowth after harvest showed that rates of Mon 8000 and Roundup below 0,6 kg ai/ha may not affect regrowth. Chlorosis may be apparent when rates of 0,6 kg ai or more per hectare are used, and stunting was only evident above a rate of 0,9 kg ai/ha. These effects tended to diminish with time. Ethrel and Embark did not appear to affect the regrowth.

Introduction

Ethrel, and more recently Embark, have been registered as sugarcane ripeners in South Africa. Responses to both these chemicals have been consistent in South Africa and Swaziland when applied early in the milling season to sugarcane which was immature (juice purity 75% or less) at the time of spraying [7,9].

Mon 8000, a coded compound, and Roundup (N – phosphonomethyl-glycine), have recently been evaluated as ripeners during the early (sucrose incline) and late (sucrose decline) periods of the milling season. Some of the results from these trials are presented in this paper.

Whole stalk samples were analysed for juice quality and fibre content at various intervals after spraying. Stalks were partitioned prior to analysis so that the effects of each chemical ripener on different parts of the stalk could be studied. Visual assessments and measurements of regrowth were made on the succeeding ratoon crop.

Materials and Methods

Details of the experiments are given in Table 1 and the chemical treatments applied are shown in Table 2. In Trial 2 at Shakaskraal 0,6 and 1,2 kg ai/ha of Mon 8000 were applied singly in April and also as double sprays in both April and six weeks later. As similar ripening effects were produced from all four Mon 8000 treatments, only the April application of 0,6 kg ai/ha is included in the results on ripening. However, results reported on regrowth include all four Mon 8000 treatments. All treatments were replicated.

The chemicals were applied to two rows of cane simultaneously, using an extended lance with a T-piece attached

TABLE 2

Chemical treatments applied in the various experiments

Chemical	Rate kg a.i./ha	Early Season					Late Season	
		1 Pongola	2 Shakaskraal	3 La Mercy	4 Midlands	5 Shakaskraal	6 Pongola	7 Natal Estates
Ethrel	0,75	●	●		●		●	●
Embark ...	0,75	●*	●*		●*		●	●
Mon 8000 ..	0,3	●		●	●			
	0,4							●●**
	0,6	●	●	●	●	●	●	●**
	1,2		●					
Roundup (41%)	0,6 ***	●		●			●	
Volume of water ℓ/ha		460	880	400	420	400	80	70

* Agral 90 added, 0,01% v/v
** Antidrift agent Nalcotrol (non-ionic) added, 0,04% v/v
*** Isopropylamine salt of glyphosate (41%)

TABLE 1

Details of the experiments

Experiment		Variety	Date treated	Crop	Milling season	Crop condition at spraying				Weeks from spraying to last sampling
No	Site					Age mths	Estimated tc/ha	Juice purity %	Comments	
1	Pongola	NCo 376	23rd March	2R	Early	10	92	62	Irrigated Flowered	19
2	Shakaskraal	NCo 376	28th April	3R	Early	8	71	70	Irrigated	18
3	La Mercy	NCo 376	18th March	Plant	Early	14	101	90	Rainfed; 10 green leaves; 50-60 cm immature top	9
4	Midlands	NCo 293	16th March	3R	Early	17	105	88	Rainfed	20
5	Shakaskraal	NCo 376	30th June	3R	Early/Mid	10	94	84	Irrigated (same crop as 2 above)	9
6	Pongola	NCo 376	13th Sept	1R	Late	8	62	81	Irrigated	6
		N52/219	13th Sept	1R	Late	8	84	83		
7	Natal Estates	N55/805	15th Oct	Plant	Late	11	95	91	Rainfed, grown on alluvium-derived soil in valley bottom	9

to a carbon dioxide pressurized sprayer. Two Spraying Systems TK 2,5 flood jets were positioned immediately above each cane row. In the latter experiments TK 1 nozzles were used instead of TK 2,5 nozzles to reduce the spray volume from 300 litres to 70 litres per hectare. Treatments were applied only during calm weather conditions and two unsprayed guard rows separated adjacent plots. The net plot size varied between 17 and 40 m^2.

Samples comprising 16 stalks per plot were taken from all the experiments at the time of spraying and at various intervals thereafter. The trashed stalks were topped by hand at the natural breaking point. Each bundle of 16 stalks was fed through a disintegrator and sub-samples were analysed for juice quality and fibre content. The amount of recoverable sugar (ers % cane) was estimated using the formula: ers % cane = S% – 0,485 (non-sucrose %) – 0,056 (fibre %).

Thirty stalks per treatment were prepared for partitioning by marking the following sections from the base upwards; the bottom 75 cm, the next 50 cm and thereafter 25 cm sections to the top of the stalk. Each stalk section in a bundle was milled separately and analysed. First the top sections were fed into a disintegrator, followed by successive sections of the stalk until the base was reached. The mass of each section was determined as milling progressed.

The effects of the ripener treatments on the regeneration of the following ratoon crops were assessed in most trials by measuring stalk height to the top visible dewlap. Twenty stalks were selected at random for measurement in each plot. The stalks in each plot were counted and visual assessments of regrowth were made at intervals.

Results

Visual symptoms

Mon 8000 and Roundup produced similar visual symptoms. The most marked effect was the inhibition of apical growth, which stimulated sideshoot development. These sideshoots, which generally occurred on the top 6 elongated nodes, were noticeable between 3 and 6 weeks from the time of spraying. Root primordia sometimes developed on these upper nodes. Reddening of the leaf sheaths and lower leaf blades was often apparent within the first few weeks after spraying.

The natural breaking point, normally close to the point of attachment of the sheath associated with the 4th to 6th leaf, changed about six weeks after treatment with Mon 8000 and Roundup when the top tended to break off in the region of the apical growing point. This apical region became hardened and discoloured, usually turning from brown to red or mauve, and rotting generally occurred in time. Signs of rotting were usually first evident in the spindle and spread downwards to the region of the growing point.

The leaf canopy of treated sugarcane sometimes acquired a browny-yellow tinge about three weeks after spraying. When sugarcane was growing rapidly early or late in the milling season inhibition of apical growth resulted in shorter stalks so that canopy was reduced between three and six weeks after spraying.

Mon 8000 caused splitting of the third or fourth internode 13 weeks after application on variety NCo 293 growing in the Natal Midlands (Trial 4). The affected internode was elongating at the time that the chemical was applied. Nineteen weeks after treatment marked deterioration of the affected internode had occurred. Splitting of lower internodes was apparent in untreated stalks.

Flower Development

Flower emergence in variety NCo 376 was inhibited by all four chemical ripeners in Trial 1 at Pongola. Flowers emerged from 64% of the stalks in the control plots whereas flowers emerged from less than three percent of the stalks in the treated plots, although initiation had occurred in many instances.

Early Season Trials

Results from the early season trials (Table 3) show that Mon 8000 and Roundup significantly improved juice quality (ers % c) even when the juice purity at the time of spraying was higher than 84% (Trials 3, 4 and 5). Little ripening response can be expected from Ethrel and Embark on sugarcane with a juice purity above 80%. Significant improvements in juice quality were normally apparent three weeks after the application of either Mon 8000 or Roundup, whereas with Ethrel and Embark increases were normally delayed a further three weeks.

Unlike Ethrel and Embark, both Mon 8000 and Roundup tended to reduce stalk mass, as these chemicals inhibited apical growth soon after spraying. There is evidence that the reduction in stalk mass tended to be greater during the early part of the milling season, particularly on younger cane in which apical growth tended to be faster. Mon 8000 had little effect on stalk mass of variety NCo 376 when applied in June in Trial 5. In Trial 1 in March stalk mass was reduced, and to a greater extent by the higher rate (0,6 kg ai/ha) than by the lower rate (0,3 kg ai/ha).

The significant improvement in juice quality (ers % cane) generally more than offset the effect of a concurrent reduction in stalk mass, at least between 3 and 9 weeks after spraying, and even later in Trials 1 and 2, when large responses were obtained from all the ripeners. The effects of treatments on ers % cane and stalk mass has been expressed in terms of the mass (g) of ers produced per stalk (see Table 3). All four chemicals tended to produce similar responses 6 and 9 weeks after application on immature sugarcane (Trials 1 and 2). Responses to Mon 8000 were apparent after three weeks, whilst responses to Ethrel and Embark tended to be delayed, but persisted for a longer period of time.

In relatively mature sugarcane (purity higher than 84% in Trials 3, 4 and 5) reasonable increases in mass of ers were obtained from treating with Mon 8000 and Roundup. The lack of response in variety NCo 376 at La Mercy (Trial 3) to the higher rate of Mon 8000 was probably due to an initially low stalk mass, as indicated by the samples taken at the time of spraying (week 0). Ethrel and Embark did not significantly improve the juice quality of the relatively mature (88% juice purity) NCo 293 grown in the Midlands, but Ethrel did unexpectedly increase stalk mass which resulted in an increase in the mass of ers produced per stalk.

Late season

Mon 8000 and Roundup improved the juice quality of sugarcane in both late season trials (Table 4) by approximately two percentage units. Stalk mass was noticeably reduced by these treatments about six weeks after spraying. It is uncertain whether Nalcotrol lessened the reduction in stalk mass or whether the apparent effect was due to differences which were present at the time of spraying. The reduction after 6 weeks in ers due to treatment with Roundup in variety N52/219 may have been a real effect due to a lower stalk mass, but it may also have been due to sampling error, as there was a positive response 3 weeks after spraying (Table 4). Least significant differences are not shown in Table 4 for trial 6 as the number of replicates varied for each treatment; however, responses which differed significantly ($P = 0,05$) from the control are in bold type.

Ethrel and Embark produced only a small increase in juice quality (ers % cane) of less than half a percentage unit. Stalk mass was not reduced, and there was evidence that Ethrel and Embark increased stalk mass in variety N52/219. Ethrel appeared to have a similar effect in Trial 7 on variety N55/805, where stimulation of new growth was observed.

Partitioning

Only the results from the Ethrel and Mon 8000 treatments are shown in Table 5 and Figure 1 for the partitioned stalks as

TABLE 3

Results from early season trials (1-5)

		Ers % cane					Mean stalk mass, g					Ers, g/ stalk				
Weeks after spraying		0	3	6	9	18	0	3	6	9	18	0	3	6	9	18
Trial	Treatment				10*	19*				10*	19*				10*	19*
1	Control	3,3	3,7	6,8	9,3	11,9	797	935	845	961	1 101	26,3	34,0	57,1	89,9	131,3
	Ethrel 0,75	3,3	4,5	**8,9**	**11,8**	**13,6**	747	843	878	910	1 058	24,9	38,4	**77,8**	**107,6**	143,9
	Embark 0,75	3,7	4,6	**8,8**	**11,4**	**14,3**	762	945	864	921	**994**	27,8	43,0	**76,4**	**104,6**	142,2
	Mon 0,3	4,1	**5,3**	**10,4**	**12,2**	**14,2**	795	888	772	881	**928**	32,2	**47,7**	**79,8**	**107,7**	132,0
	Mon 0,6	3,9	**5,5**	**11,0**	**13,6**	**15,2**	778	845	752	**814**	**863**	30,1	**46,5**	**83,0**	**110,9**	131,6
	Roundup 0,6**	–	4,8	10,2	13,4	14,7		903	831	889	922		43,8	84,8	119,2	135,7
	I SD (P=0,05)	1,28	1,30	0,96	1,06	0,79	–	96	121	96	104	–	12,0	12,8	15,8	17,0
2	Control	5,2	7,1	8,6	9,8	11,7	556	775	712	775	828	29,2	55,3	61,0	76,0	96,6
	Ethrel 0,75	5,0	–	**10,1**	**11,2**	**13,2**	604	–	733	685	798	30,6	–	**73,8**	76,8	105,7
	Embark 0,75	5,8	–	**9,3**	**10,9**	**13,9**	602	–	728	735	848	34,4	–	67,5	80,5	**117,7**
	Mon 0,6	5,6	–	**10,5**	**11,4**	**14,0**	556		674	687	767	30,9	–	**70,6**	78,6	106,7
	LSD (P=0,05)	–	–	0,76	1,47	0,86	–	–	73	90	112	–	–	9,0	14,5	17,5
3	Control	11,1	12,0	12,9	14,2		872	961	930	995		97,1	115,6	119,9	141,1	
	Mon 0,3	11,4	12,2	13,2	14,5		902	963	931	997		102,6	117,1	123,4	144,8	
	Mon 0,6	11,5	12,3	**13,8**	**14,9**		817	873	867	892		94,1	106,2	119,0	132,6	
	Roundup 0,6	11,7	**12,7**	**13,9**	**15,0**		848	850	894	979		99,1	108,0	124,1	146,4	
	LSD (P=0,05)	0,92	0,70	0,57	0,43		–	150	129	138			16,1	18,0	19,1	
					10*					10*					10*	
4	Control	10,7		11,2	12,8	12,7	1 009		960	1 072	1 054	108,3		107,3	136,6	134,1
	Ethrel 0,75	10,3		11,4	12,9	**13,5**	922		1 172	1 112	1 150	95,3		**133,8**	143,4	154,9
	Embark 0,75	11,0		11,7	12,6	**13,5**	864		964	1 092	1 109	94,5		112,1	137,5	149,7
	Mon 0,3	10,5		**12,8**	**14,3**	**14,1**	933		1 006	1 041	1 031	97,8		128,5	148,7	145,7
	Mon 0,6	10,1		**12,9**	**14,1**	**14,2**	917		1 028	1 005	997	92,0		**132,6**	141,9	141,4
	LSD (P=0,05)	0,93		0,56	0,64	0,46	–		216	156	157			25,4	22,8	22,9
5	Control	9,9	10,9	10,1	11,5		772	828	902	772		76,4	90,3	90,8	88,5	
	Mon 0,6	10,0	11,1	**11,2**	**12,6**		787	791	908	767		78,8	87,9	101,6	96,7	
	LSD (P=0,05)	1,46	0,66	0,80	0,62		–	142	115	240		–	18,5	11,6	30,2	

NB. All results significantly different from the Control (P=0,05) are in bold type

* Weeks after spraying

** A few plots adjacent to the trial were treated with Roundup; L.S.D's do not apply to this treatment.

Embark and Ethrel tended to produce similar effects and Roundup and Mon 8000 were also similar in their effects. The ripening effects of Ethrel and Embark were always associated with an increase in both pol % cane and juice purity (Table 5). Only stalks which had not been naturally ripened (low juice purity) responded to these chemicals (Fig 1). Mon 8000 and Roundup produced similar ripening effects as did Ethrel and Embark (Table 5) but the former two chemicals inhibited apical growth and were able to 'load' sugar into all sections of the stalk (see Table 5 and Fig 1). Sucrose loading was brought about by an increase in pol % cane without an increase in juice purity.

Regrowth

There was a particular need to measure the regrowth of cane as leaf chlorosis (Fig. 3) was observed in succeeding ratoons when rates of Mon 8000 or Roundup, usually more than 0,6 kg ai/ha, had been applied to the previous crop.

Additional data were collected from a trial conducted by a commercial company, in which Mon 8000 was applied at rates of 0,22; 0,45; 0,67 and 1,12 kg ai/ha. The sugarcane variety NCo 376 was immature (74% juice purity) at the time of spraying on the 9th March and the trial was harvested on the 30th May.

Leaf chlorosis in the succeeding ratoon crop (Fig 2) was apparent on a number of tillers in Trial 1 at Pongola where Roundup had previously been applied, but few tillers were affected by Mon 8000. In Trial 2 at Shakaskraal chlorosis was observed when double the normal rate of Mon 8000 had been applied (1,2 kg ai/ha) as well as when this rate was applied twice, in April and again in June. Stunting was evident only when 1,2 kg ai/ha was applied twice and in one of the three plots when half this rate was applied twice. No visual symptoms were apparent on variety NCo 293 in the Midlands (Trial 4), on NCo 376 at Shakaskraal (Trial 5) or on N55/805 at Natal Estates (Trial 7). No data were collected from Trial 3 at La Mercy, and Trial 6 at Pongola has yet to be harvested. In the trial conducted by a commercial company chlorosis was common in ratooning cane when Mon 8000 had been sprayed, at rates of 0,67 and 1,12 kg ai/ha, with only a few plots showing slight chlorosis following treatment at the lower rates of 0,45 and 0,22 kg ai/ha.

Leaf chlorosis and stunting have recently been noticed on NCo 376 and N52/219 on an unreported trial at Pongola when the previous crop received more than 0,9 kg ai of Mon 8000 and Roundup. These effects were apparent one and two months after harvesting.

Fig 3 shows some of the height and shoot count data obtained. Half of Trial 1 at Pongola was harvested on 25th August and the other half was harvested five weeks later on the 29th September. Fig 3 shows the regrowth data collected from this field on the 16th November. Data from Trial 2 at Shakaskraal were collected one, five and six months after harvest, which was on the 8th September. The trial conducted by a commercial company on Natal Estates was harvested on 30th May and regrowth data were collected from each of the six replicates at five and seven months after harvest. Stalk heights have been

measured in Trial 7 on Natal Estates, six weeks after harvesting on 29th December.

The data presented in Fig 3 suggest that even when the higher rates of Mon 8000 and Roundup produced chlorosis of the leaves and stunting, these effects were barely evident five months after harvesting. In an earlier trial with Roundup[1] there was strong evidence that stalk populations had been substantially increased. Ethrel and Embark did not appear to affect subsequent ratooning.

Discussion

The application of Ethrel, Embark, Mon 8000 and Roundup early in the milling season to relatively immature sugarcane (juice purity below 75%) of variety NCo 376 in Trials 1 and 2 significantly improved ers % cane (Table 3). Mon 8000 and Roundup were the only chemicals to improve ers % cane by more than a percentage unit when applied both early (Trials 3, 4 and 5) and late (Trials 6 and 7) in the milling season when relatively mature sugarcane (juice purity higher than 80%) was treated. The ripening activity of Roundup (Mon 0573) reported in Hawaii[3,4] is substantiated by these results.

Responses to Ethrel and Embark when applied to mature NCo 376 in Trial 3 and to N52/219 in Trial 6 were largely due to an increase in stalk mass (Tables 3 and 4), as the improvement in ers % cane was less than 0,5 of a percentage unit. These results confirm earlier work that immature sugarcane is ripened early in the season by Ethrel[8,9] and Embark[7], whereas growth stimulation may occur in mature sugarcane. There is evidence that growth stimulation may differ between varieties, and that Ethrel and Embark need not produce the same response. Stimulation of growth from treatment with Ethrel did not occur on variety NCo 376 in Trial 6 and the results of earlier trials[5] support this evidence. Growth stimulation may occur in varieties N55/805[5], N52/219 and NCo 293 (Tables 3 and 4). This phenomenon requires further investigation.

The optimum time to harvest sugarcane treated with either Mon 8000 or Roundup is likely to vary from 3 to 6 weeks after application due to the subsequent reduction in stalk mass. However, for Ethrel and Embark the optimum time to harvest is likely to be after 6 weeks. Increases in the mass of ers of 8 - 22% due to treatment with Ethrel and Embark were obtained 18 weeks after application in Trials 1, 2 and 4, and confirm Rostron's[6] data that responses may persist for a considerable period of time. This effect could be of significant practical value, particularly in the Natal Midlands and the coastal belt where sugarcane with low juice purities early in the season is also likely to have a low stalk mass.

The analysis of partitioned stalks (Table 5 and Fig 1) has shown that chemical ripeners can be grouped according to their mode of action as either 'ripeners' or 'loaders'. Ethrel and Em-

TABLE 4

Results from two late season trials (6 and 7)

			Ers % cane				Stalk mass, g				Ers g/stalk			
Weeks after spraying			0	3	6	9	0	3	6	9	0	3	6	9
Trial No.	Variety	Treatment												
6	NCo 376	Control	8,55	9,68	10,21		517	638	694		44,0	61,8	71,0	
		Ethrel	8,30	9,75	10,74		545	638	668		45,0	62,1	71,4	
		Embark	8,91	9,79	10,74		557	622	694		49,6	60,9	74,4	
		Mon 0,6	9,04	**11,38**	**13,38**		548	597	**583**		49,4	67,8	78,0	
		Roundup 0,6 ...	8,10	**10,99**	**13,50**		561	606	604		45,5	66,6	81,6	
	N52/219	Control	10,41	11,32	11,63		761	902	959		78,9	101,9	111,3	
		Ethrel	10,10	11,24	12,16		786	788	1 086		79,2	110,8	132,0	
		Embark	9,34	11,46	11,96		743	981	1 092		69,4	112,6	130,7	
		Mon 0,6	10,70	**13,08**	**14,08**		716	848	855		76,7	110,7	120,5	
		Roundup 0,6 ...	10,35	**12,89**	**13,40**		739	981	750		76,7	126,5	100,5	
			-1*		5*		-1*		5*		-1*		5*	
7	N55/805	Control	13,5		13,0	12,8	831		834	1 006	111,9		108,3	128,5
		Ethrel	13,5		11,7	12,0	875		**992**	1 127	118,4		116,2	135,5
		Embark	13,2		13,0	12,4	855		839	1 030	113,0		109,2	128,3
		Mon 0,4	13,1		**14,9**	**14,5**	830		855	889	109,0		127,5	129,5
		Mon 0,6 + N** .	13,4		**15,1**	**15,1**	873		909	1 033	116,9		**137,4**	**155,9**
		Mon 0,6 + N** .	12,9		**15,6**	**15,5**	902		947	941	115,8		**147,8**	145,2
		LSD (P=0,05) ..	0,65		0,55	0,92	–		136	140	–		20,2	20,0

NB. All results significantly different (P=0,05) from the control are in bold type

* Weeks after spraying

** N = Nalcotrol, an anti-drift additive

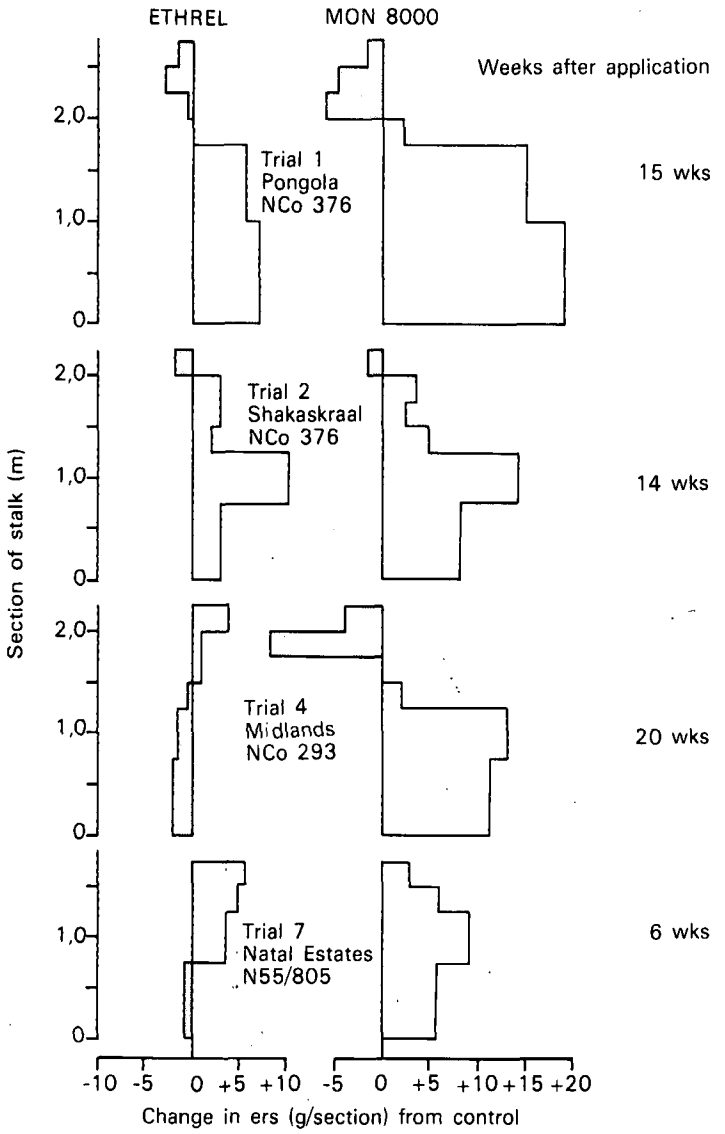

Figure 1: Partitioning data showing the change from control in ers per section following treatment with Ethrel and Mon 8000

TABLE 5

The analysis of partitioned stalk

a) Trial 2 NCo 376 14 weeks after treatment application

Section of stalk from base (cm)	Pol % cane			% juice purity			Ers g/section		
	Control	Ethrel	Mon	Control	Ethrel	Mon	Control	Ethrel	Mon
200+	5,8	–	–	58	–	–	1,6	–	–
175 - 200	8,3	9,8	11,9	70	77	85	4,0	6,8	7,2
150 - 175	10,6	13,3	12,7	79	89	84	7,3	10,4	9,5
125 - 150	12,0	14,5	15,1	85	92	91	8,7	11,1	13,1
75 - 125	13,1	15,2	16,8	91	94	94	18,1	27,9	32,3
0 - 75	13,7	15,4	16,6	93	94	94	49,2	51,7	57,3

b) Trial 7 N55/805 6 weeks after treatment application

Section of stalk from base (cm)	Pol % cane			% juice purity			Ers g/section		
	Control	Ethrel	Mon	Control	Ethrel	Mon	Control	Ethrel	Mon
150 - 175	6,6	8,2	9,7	56	66	68	4,0	9,1	13,3
125 - 150	11,2	14,0	14,6	80	90	87	11,5	16,3	20,3
75 - 125	14,9	15,6	18,4	90	93	94	32,1	35,7	42,6
0 - 75	16,1	15,6	17,8	94	94	94	58,7	58,0	67,3

bark belong to the 'ripener' group and these chemicals are only able to ripen immature stalk. This explains the lack of effect due to treatment with Ethrel and Embark early in the sucrose decline phase and emphasizes the need for maturity testing to decide whether or not treatment is warranted. Mon 8000 and Roundup are able to ripen immature stalk and, in addition, to 'load'[2] sucrose into ripened stalk. These chemicals are therefore also effective when applied to mature sugarcane both early and late in the milling season. The magnitude of the response is likely to be determined, at least to some extent, by the amount of photosynthate that can be produced and converted into sugar between the time of spray application and harvesting. Consequently responses are likely to be smallest during the peak sucrose period and great during the 'early' or 'late' periods of the milling season. Inhibition of apical growth may be associated with the physiological process involving sucrose loading, and this effect could possibly be used to screen chemicals which may operate as 'loaders'.

Chemicals which act as 'loaders' could be of great value to the sugar industry as they have a much larger potential usage than chemicals which only act as 'ripeners'.

The effects of Mon 8000 and Roundup on regrowth require further study. However, results obtained from these trials were encouraging as chlorosis (Fig 2), when it occurred, was only apparent during the first three months of growth. There are indications, particularly from an earlier trial[1] that plant populations may sometimes be increased. The evidence does suggest that rates between 0,3 and 0,6 kg ai/ha of Mon 8000 and Roundup produce good ripening responses without affecting subsequent ratooning.

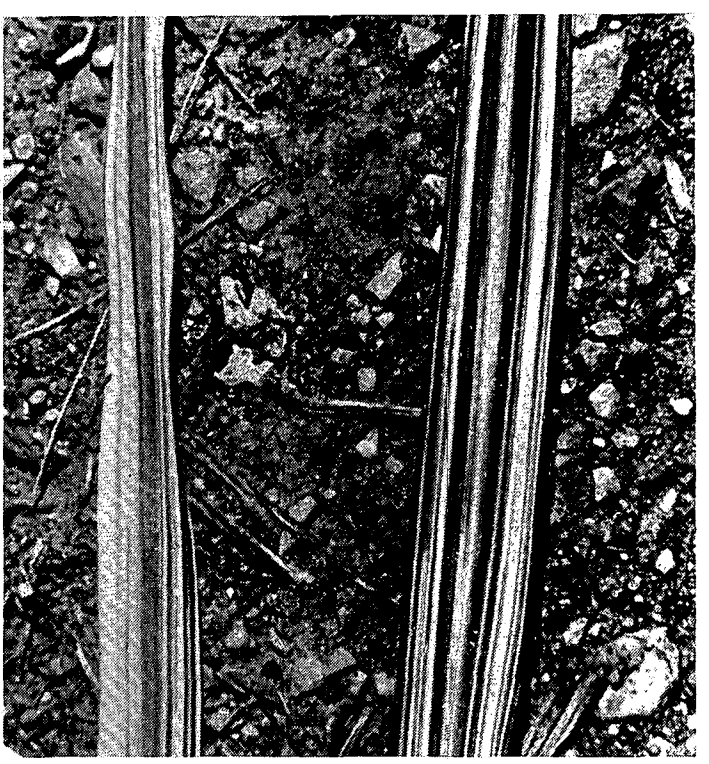

Figure 2: Characteristic symptoms of leaf chlorosis on the regrowth of sugarcane sprayed with Mon 8000 or Roundup.

Conclusions

1. Mon 8000 and Roundup may be useful as ripeners on relatively mature sugarcane, both during the early and late parts of the milling season.
2. The inhibition of apical dominance in the stalk by Mon 8000 and Roundup brings about a rapid response and the optimum time to harvest is likely to be between 3 and 6 weeks after application.
3. Rates above 0,6 kg ai/ha of Mon 8000 or Roundup are likely to produce some chlorotic regrowth, a condition which is outgrown three months after harvesting. Stunting has only

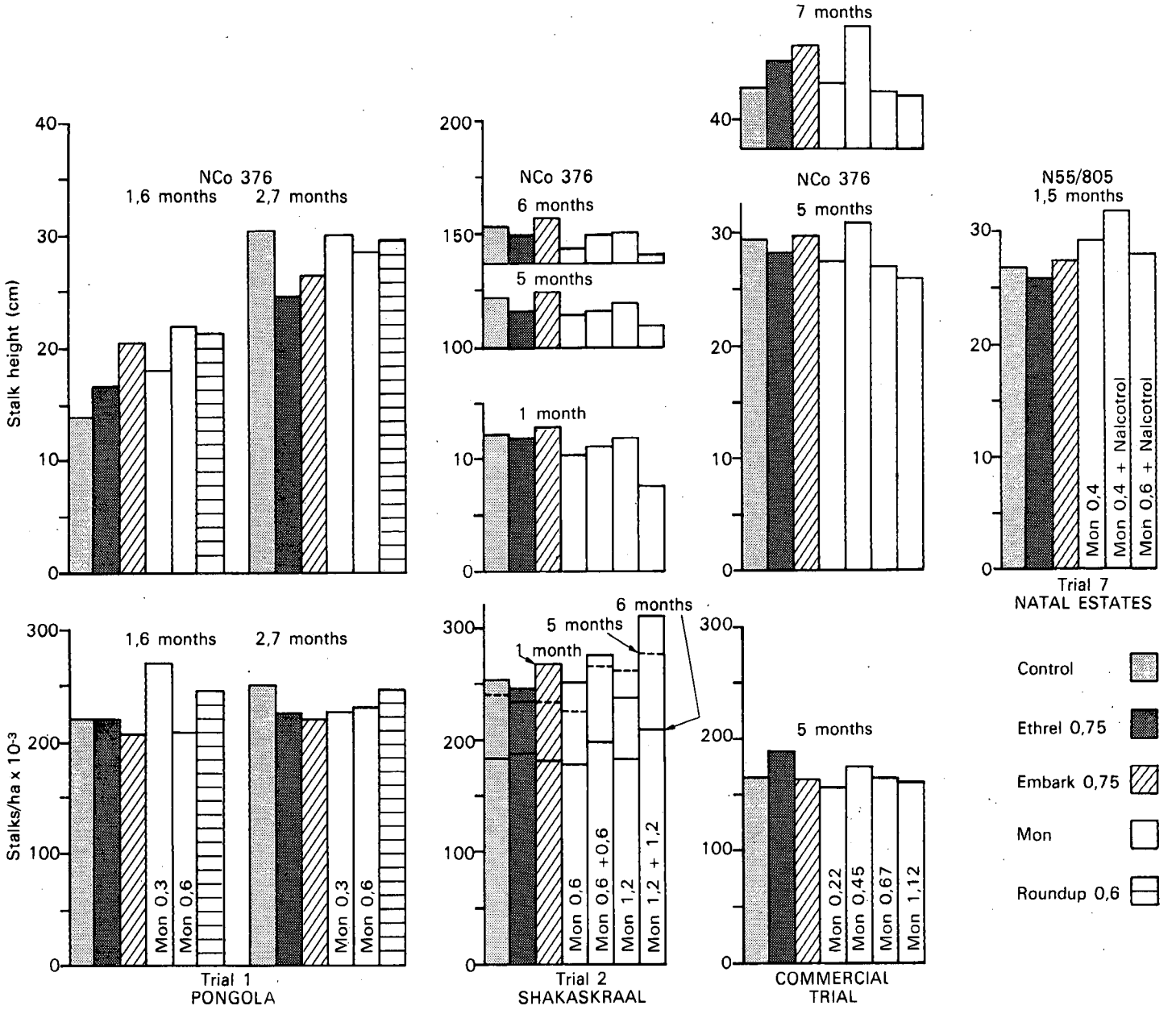

Figure 3: Stalk heights and populations of ratoon regrowth after various treatments in four trials

been observed when rates of 0,9 kg ai/ha or more have been applied. A rate between 0,3 and 0,6 kg ai/ha may produce a ripening response without affecting regrowth.

4. There is evidence that Ethrel and Embark may stimulate the growth of relatively mature sugarcane early or late in the milling season. The stimulation in growth does not appear to occur on variety NCo 376.

   There is evidence that growth of varieties N55/805, NCo 293 and N52/219 may be stimulated by Ethrel whilst Embark was only effective on N52/219.

5. Chemical ripeners can be grouped according to the process of sugar accumulation into 'ripeners' or 'loaders'. Loaders also act as 'ripeners'.

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