



Effect of Ethrel and Glyphosate on the ripening of Sugar Cane

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Abstract: Sugarcane is under cultivation since time immemorial in the Indo-Gangetic belt of India. Sugarcane (*Saccharum officinarum*, L commercial hybrids) is an important commercial crop of the country occupying around 3.8 million hectares of land with an annual cane production of around 270 million tonnes. Sugarcane crop passes through four distinct physiological growth phases, i.e. germination (0-60 days), tillering or formative (60-150days), grand growth (150-240days) and maturity (240-360days). The optimum temperature for sugarcane growth is around 35°C. Improving sugar production in modern commercial cane varieties is essential to meet the growing sugar requirement amount the populace among the population. A field experiment was conducted during 2009–2010 crop season at Sugarcane Breeding Institute, Coimbatore with an objective of studying the influence of two promising chemical ripeners (ethrel or glyphosate) on plant characteristics, pigment composition, invertase activity, cane characteristics and juice quality of two prominent sugarcane varieties namely Co 86032 and Co 94012. The chemical ripeners were sprayed at 200ppm and 400ppm concentrations during maturity period in two rounds. In sugarcane, biological yield represent the efficiency of energy conversion and dry matter production. Sucrose, the economic end product is stored in the stem tissue, hence the stem (or) cane is considered as an essential yield attribute. Improvement in sugar productivity is an ultimate goal of a sugarcane researcher throughout the world. Although considerable advancement was achieved due to the release of high yielding cane varieties, the improvement in sucrose percentage was rather minimal.

Key Words: Sugar cane, Sucrose, *Saccharum officinarum*.

Introduction

Sugarcane (*Saccharum officinarum*, L commercial hybrids) is an important commercial crop of the country occupying around 3.8 million hectares of land with an annual cane production of around 270 million tones. The quality of sugarcane juice at harvest is determined by the concentration of sucrose, which should be high, and the

concentration of non-sucrose components such as other sugars, which should be low⁽¹⁾. Sugar begins to accumulate in the sugarcane internodes when they start elongating and continues until the elongation ceases⁽²⁾. During ripening, the sucrose concentration along the entire cane increase while the non-sucrose components such as the glucose and fructose decreases⁽³⁾. This is an evidence that the sucrose metabolism in the cane undergoes transformations during the course of development. The purpose of the present study was to understand the effect of artificial ripeners such as Ethrel or Glyphosate in the ripening or accumulation of sucrose during the harvest period of sugarcane. The chemical compounds used in the present study are sufficiently stable to provide the desired effect over period of several weeks between application and harvest, with a low degree of persistence. The knowledge of sucrose accumulation in the cane under the influence of Ethrel or Glyphosate would be vital information for the farmers in determining the right time for harvesting.

Materials and Methods

A field experiment was conducted at the Sugarcane Breeding Institute, Coimbatore, India. Experiments were conducted with the two popularity cultivated sugarcane varieties (Co 86032, Co 94012) in an open field. These sugarcane varieties are high sugar types and occupy large area under sugarcane cultivation in Tamil Nadu, India. The sugarcane germination (0-60 days), 12 during formative period (60-150 days), 12 during grand growth (150-240days), and 10 during maturity (240-360days), in addition to the normal rainfall at the experimental site⁽⁴⁾.

Ripener Treatment

Two chemical ripeners namely ethrel (Ai. 39%) or glyphosate (Ai. 41%) were applied at 200 ppm and 400 ppm concentrations on both Co 86032 and Co 94012 in two rounds, one at the commencement of maturity (240 days) and the other during maturity (300 days) period. The chemicals were diluted with water and a drop of Triton X- 100 (surfactant), to ensure the easy penetration of the applied chemicals Water spray served as a control.

Plant Characteristics And Cane Characteristics

Plant growth attributes such as plant height, tiller number, tiller height, Cane length, Number of inter nodes were measured in three randomly selected plants from each row in each replication. Measurements were recorded at monthly intervals commencing from 240 days till harvest.

Juice Quality

Qualitative parameters were measured utilizing the juice extracted from sugarcane stalks Sucrose, Purity, Brix and Commercial cane sugar⁽⁵⁾.

Statistical Analysis

The data collected were subjected to statistical analysis adopting standard procedures⁽⁶⁾.

Results

Plant Characteristics

Main shoot height

At 240 days, the main shoot height was 151.40cm under ethrel spray and 151.00 cm in glyphosate sprayed varieties in Co 86032. Ethrel (200ppm) has shown 14 cm more height as compared to the control. On the other hand, glyphosate treatment has shown slightly reduction in height. As regards variety Co 94012 the average main shoot height was 139.41 cm under ethrel treatment whereas 143.51 cm under glyphosate treatment. Ethrel has not affected the main shoot height whereas 400ppm glyphosate has reduced the height by about 11 cm in Co 94012. There was numerical variation the varieties, chemicals, levels of chemicals and there interaction was not statistically significant (Table 1a). At 360 days, the main shoot height of variety Co 86032 was identical under both ethrel and glyphosate treatment. Although Co 94012 remains unaffected due to ethrel, the glyphosate treatment reduced

progressively (i.e. 212.00 cm at 400ppm in comparison with that of control 232.33 cm). The varieties, chemicals and their interaction were not significant.

Number of tillers

During maturity month commencing from 240 days till 360 days normal plant maintained an average of two tiller (one main plant: two tillers). The tiller number was not altered due to the chemical ripener application at all stages. At harvest, an average of 1.56 tillers and 1.22 tillers was noticed in Co 86032 and Co 94012 respectively under ethrel treatment. In an identical manner, at 360 days, the average tiller number was 1.44 in Co 86032 and 1.33 in Co 94012 (**Table 1e**).

Tiller height

At 240 days, the average tiller height was 125.83 cm and 116.49 cm in varieties Co 86032 and Co 94012, respectively, under ethrel treatment. On the other hand, the average tiller height was 116.50 cm in Co 86032 and 118.04 cm in Co 94012. Variety Co 86032 has not shown significant variation with respect to ethrel treatment, glyphosate caused considerable decline in tiller height. The test chemicals have shown significant among different the varieties, chemical, levels and their interaction (Table 1a).

Number of internodes

In sugarcane the economic end product (i.e.) the cane stem is more important and the number of internodes contributes for maximum cane height. Although growth of these internodes was fast during grand growth and maturity, the cane elongation is much swifter during maturity phase. In line with this, at 240 days, the internode number was 16.33 in varieties Co 86032 and 21.00 in varieties Co 94012. 400ppm showed two units in increase internode number (18.33 in Co 86032 and 21.33 in Co 94012). Similarly, glyphosate also showed two unit improvement in Co 86032 (at 400ppm) and two unit improvement in Co 94012 at both 200ppm and 400ppm (Table 1a). At 360 days, there was a further improvement in internode number in both the varieties. Accordingly the varieties, chemicals, and there level did not show any significant difference (Table 1e).

Biomass

The total biomass content in Co 86032 at 240 days was 1961.53 g/m² which were partitioned in to leaf (360.07g), sheath (221.50g) and stem (1379.33g). 200ppm ethrel has enhanced the total biomass production by about (2245.27g/m²) and 400ppm has enhanced the total biomass content by (2243.00g/m²). Similarly, varieties Co 94012 possessed 1661.07 g/m² which was partitioned into leaf (322.27g), sheath (185.30g), and stem (1153.50g). Ethrel treatment enhanced the total biomass content by about 283.74g at 200ppm spray and by about 281.47. In both more than 70% biomass was partitioned in to stem only. In response to at 400ppm glyphosate Co 86032 has shown a drop in overall biomass production. 200ppm glyphosate reduced the total biomass content by 224.24 g, while 400ppm glyphosate has shown a drop of 297.24 g. As regards variety Co 94012 there occurred a reduction in total biomass content (433.67g at 200ppm and 141.66g) in 400ppm (Table 2a).

At 360days the total biomass content was estimated in both the varieties, there was an overall improvement in total biomass content in both the varieties Maximum amount of biomass was recorded in varieties Co 86032 under glyphosate treatment (200ppm). The total biomass of 2304.5g was distributed into leaf (201.5g), sheath (169g), and stem (1934g). Similarly 2273.99 g biomass was partitioned into leaf (269.83g), sheath (135.83g), and stem (1868.33g) (Table 2b).

Juice Quality

Juice analysis was done at monthly interval in both the varieties in response to ethrel or glyphosate treatment. The quality attributes such as brix%, sucrose%, purity%, and CCS (commercial cane sugar) were estimated through automatic Sucrolyser.

Table 1. Plant Characteristics
(a) . Plant characteristics at 240 days in response to chemical ripener application in Co 86032(V1) and Co 94012(V2)

Ripener	Level	Main shoot Length (cm)		Mean	No. of tillers		Mean	Tiller height (cm)		Mean	No. of internodes		Mean
		V1	V2		V1	V2		V1	V2		V1	V2	
Ethrel	Control	144.73	141.47	143.1	2.33	1.33	1.83	123.93	120.07	122.00	16.33	21.00	18.67
	200ppm	160.33	137.73	149.0	2.67	1.67	2.17	125.57	112.87	119.22	20.33	22.00	21.17
	400ppm	149.13	139.20	144.1	1.33	1.67	1.50	125.83	116.53	121.18	18.33	21.33	19.83
	Mean	151.40	139.41	145.43	2.11	1.56	1.83	125.11	116.49	120.80	18.33	21.44	19.89
Glyphosate	Control	156.07	144.13	150.1	2.33	1.33	1.83	125.93	117.07	121.50	18.67	18.33	18.50
	200ppm	143.73	152.87	148.3	1.33	1.33	1.33	111.30	128.90	120.10	18.33	20.33	19.33
	400ppm	153.20	133.53	143.3	1.67	2.00	1.83	112.27	108.17	110.22	20.67	20.33	20.50
	Mean	151.00	143.51	147.26	1.78	1.56	1.67	116.50	118.04	117.27	19.22	19.67	19.44
		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%	
Varieties(V)		2.95	N.S		0.10	N.S		1.18	N.S		0.48	N.S	
Chemicals(C)		3.73	N.S		0.10	N.S		3.97	11.72		0.57	N.S	
Level(L)		4.57	N.S		0.12	N.S		4.86	N.S		0.69	N.S	
V×C×L		9.15	N.S		0.25	0.74		9.73	28.71		1.39	N.S	

(b). Plant characteristics at 360 days in response to chemical ripener application in Co 86032 (V1) and Co 94012 (V2)

Ripener	Level	Main shoot Length (cm)		Mean	No. of tillers		Mean	Tiller height (cm)		Mean	No. of internodes		Mean
		V1	V2		V1	V2		V1	V2		V1	V2	
Ethrel	Control	230.67	222.00	226.33	1.67	1.33	1.50	186.00	190.17	188.08	25.33	24.67	25.00
	200ppm	242.67	220.67	231.67	1.33	1.33	1.33	193.33	197.33	195.33	24.67	24.67	24.67
	400ppm	224.00	216.00	220.00	1.67	1.00	1.33	200.77	181.00	190.88	26.00	24.67	25.17
	Mean	232.44	219.56	226.00	1.56	1.22	1.39	193.37	189.50	191.43	25.33	24.56	24.94
Glyphosate	Control	223.67	232.33	228.00	1.33	1.33	1.33	189.17	206.33	197.75	27.33	25.33	26.33
	200ppm	219.33	212.00	215.67	2.00	1.33	1.67	191.00	174.00	182.50	22.67	25.00	23.83
	400ppm	238.33	183.33	210.83	1.00	1.33	1.17	211.33	158.67	185.00	26.33	20.33	23.33
	Mean	227.11	209.22	218.17	1.44	1.33	1.39	197.17	179.67	188.42	25.44	23.56	24.50
		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%	
Varieties(V)		3.10	N.S		0.10	N.S		2.77	N.S		0.47	N.S	
Chemicals(C)		4.51	N.S		0.13	N.S		3.88	N.S		0.70	N.S	
Level(L)		5.52	N.S		0.16	N.S		4.75	N.S		0.86	N.S	
V×C×L		11.04	N.S		0.32	N.S		9.50	28.04		1.73	N.S	

Table 2. BIOMASS
(a) . Biomass at 240 days in response to chemical ripener application in Co 86032 (V1) and Co 94012 (V2)

Ripener	Levels	Leaf Biomass		Mean	Sheath Biomass		Mean	Stem Biomass		Mean	Total Biomass	
		V1	V2		V1	V2		V1	V2		V1	V2
Ethrel	Control	360.07	322.27	341.17	221.50	185.30	203.40	1379.33	1153.50	1266.42	1961.53	1661.07
	200ppm	350.43	439.67	395.27	230.37	248.53	239.45	1664.47	1562.20	1613.33	2245.27	2250.4
	400ppm	391.60	338.93	365.27	269.00	205.07	237.03	1582.40	1424.63	1503.52	2243.00	1968.63
	Mean	367.37	366.96	367.16	240.29	212.97	226.63	1542.07	1380.11	1461.09	2149.73	1960.04
Glyphosate	Control	402.87	354.93	378.90	266.33	221.50	243.92	1425.27	1236.00	1330.63	2094.47	1812.43
	200ppm	329.03	297.63	313.33	215.40	174.70	195.05	1325.80	0906.43	1116.12	1870.23	1378.76
	400ppm	314.33	325.40	319.87	188.70	228.70	208.70	1294.20	1116.67	1205.43	1797.23	1670.77
	Mean	384.74	325.99	337.37	223.48	208.30	215.89	1348.42	1086.37	1217.39	1956.64	1614.66
		SEm	CD5%		SEm	CD5%		SEm	CD 5%			
Varieties(V)		18.84	N.S		11.43	N.S		88.83	N.S			
Chemical(C)		14.64	N.S		08.48	N.S		62.10	N.S			
Level(L)		17.93	N.S		10.39	N.S		76.06	N.S			
V×C×L		35.86	N.S		20.78	N.S		152.13	N.S			

(b). Biomass at 360 days in response to chemical ripener application in Co 86032 (V1) and Co 94012 (V2)

Ripener	Levels	Leaf Biomass		Mean	Sheath Biomass		Mean	Stem		Mean	Total Biomass	
		V1	V2		V1	V2		V1	V2		V1	V2
Ethrel	Control	201.50	210.00	205.75	169.00	123.50	146.25	1934.00	2063.50	1998.75	2304.5	2397.0
	200ppm	191.33	232.00	211.67	120.25	145.50	132.88	2038.00	2462.00	2250.00	2349.5	2839.5
	400ppm	213.92	153.67	183.79	149.00	100.33	124.67	2217.00	1848.17	2032.58	2579.7	2102.1
	Mean	202.25	198.56	200.40	146.08	123.11	134.60	2063.00	2124.56	2093.78	2411.58	2446.2
Glyphosate	Control	269.83	231.33	250.58	135.83	123.00	129.42	1868.33	1730.00	1799.17	2273.9	2084.3
	200ppm	191.33	232.50	211.92	151.67	133.17	142.42	2240.00	2071.00	2155.50	2583.0	2436.6
	400ppm	149.00	175.33	162.17	103.33	117.00	110.17	2028.17	2213.33	2120.75	2280.5	2505.6
	Mean	203.39	213.06	208.22	130.28	124.39	127.33	2045.50	2004.78	2025.14	2379.1	2342.2
		SEm	CD5%		SEm	CD5%		SEm	CD 5%			
Varieties(V)		6.53	N.S		7.46	N.S		46.84	N.S			
Chemical(C)		11.63	N.S		7.67	N.S		107.64	N.S			
Level(L)		14.25	42.05		9.39	N.S		131.83	N.S			
V×C×L		28.51	N.S		18.79	N.S		263.67	N.S			

Table 3 . Juice Analysis
(a). Brix at 240-360 days in response to chemical ripener application in Co 86032 (V1) and Co 94012 (V2)

Ripener	Level	Sucrose at 240 days		Mean	Sucrose at 270 days		Mean	Sucrose at 300 days		Mean	Sucrose at 330 days		Mean	Sucrose at 360 days		Mean
		V1	V2		V1	V2		V1	V2		V1	V2		V1	V2	
Ethrel	Control	16.43	16.87	16.65	17.26	18.01	17.63	17.47	18.42	17.94	18.49	20.31	19.40	19.22	21.98	20.60
	200ppm	16.20	17.00	16.60	16.21	18.16	17.18	17.31	19.06	18.18	18.03	20.71	19.37	18.34	22.05	20.19
	400ppm	16.33	18.27	17.30	16.23	18.83	17.53	16.89	18.96	17.93	17.14	19.55	18.35	19.92	21.33	20.63
	Mean	16.32	17.38	16.85	16.56	18.33	17.45	17.22	18.81	18.02	17.88	20.19	19.04	19.16	21.79	20.47
Glyphosate	Control	15.17	17.27	16.22	17.21	15.83	16.52	18.13	19.97	19.05	17.27	20.36	18.82	19.36	22.53	20.95
	200ppm	15.87	18.20	17.03	15.83	14.51	15.18	16.93	19.39	18.16	18.49	21.43	19.96	20.04	21.54	20.79
	400ppm	15.47	17.60	16.53	17.15	18.66	17.90	18.79	19.82	19.30	19.16	21.64	20.40	19.58	21.62	20.60
	Mean	15.50	17.69	16.59	16.74	16.33	16.53	17.95	19.72	18.84	18.31	21.14	19.73	19.66	21.90	20.78
		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%	
Varieties(V)		0.20	1.23		0.82	N.S		0.19	1.18		0.29	1.82		0.39	2.41	
Chemicals(C)		0.24	N.S		0.40	N.S		0.19	0.58		0.25	N.S		0.37	N.S	
Level(L)		0.29	N.S		0.49	N.S		0.24	N.S		0.31	N.S		0.45	N.S	
V×C×L		0.59	N.S		0.98	N.S		0.48	N.S		0.63	N.S		0.91	N.S	

(b). Sucrose% at 240-360 days in response to chemical ripener application in Co 86032 (V1) and Co 94012 (V2)

Ripener	Level	Sucrose at 240 days		Mean	Sucrose at 270 days		Mean	Sucrose at 300 days		Mean	Sucrose at 330 days		Mean	Sucrose at 360 days		Mean
		V1	V2		V1	V2		V1	V2		V1	V2		V1	V2	
Ethrel	Control	16.43	16.87	16.65	17.26	18.01	17.63	17.47	18.42	17.94	18.49	20.31	19.40	19.22	21.98	20.60
	200ppm	16.20	17.00	16.60	16.21	18.16	17.18	17.31	19.06	18.18	18.03	20.71	19.37	18.34	22.05	20.19
	400ppm	16.33	18.27	17.30	16.23	18.83	17.53	16.89	18.96	17.93	17.14	19.55	18.35	19.92	21.33	20.63
	Mean	16.32	17.38	16.85	16.56	18.33	17.45	17.22	18.81	18.02	17.88	20.19	19.04	19.16	21.79	20.47
Glyphosate	Control	15.17	17.27	16.22	17.21	15.83	16.52	18.13	19.97	19.05	17.27	20.36	18.82	19.36	22.53	20.95
	200ppm	15.87	18.20	17.03	15.83	14.51	15.18	16.93	19.39	18.16	18.49	21.43	19.96	20.04	21.54	20.79
	400ppm	15.47	17.60	16.53	17.15	18.66	17.90	18.79	19.82	19.30	19.16	21.64	20.40	19.58	21.62	20.60
	Mean	15.50	17.69	16.59	16.74	16.33	16.53	17.95	19.72	18.84	18.31	21.14	19.73	19.66	21.90	20.78
		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%	
Varieties(V)		0.20	1.23		0.82	N.S		0.19	1.18		0.29	1.82		0.39	2.41	
Chemicals(C)		0.24	N.S		0.40	N.S		0.19	0.58		0.25	N.S		0.37	N.S	
Level(L)		0.29	N.S		0.49	N.S		0.24	N.S		0.31	N.S		0.45	N.S	
V×C×L		0.59	N.S		0.98	N.S		0.48	N.S		0.63	N.S		0.91	N.S	

(c). Commercial cane sugar (CCS) % at 240-360 days in response to chemical ripener application in Co 86032 (V1) and Co 94012 (V2)

Ripener	Level	CCS at 240 days		Mean	CCS at 270 days		Mean	CCS at 300 days		Mean	CCS at 330 days		Mean	CCS at 360 days		Mean
		V1	V2		V1	V2		V1	V2		V1	V2		V1	V2	
Ethrel	Control	11.13	11.57	11.35	12.02	12.51	12.27	11.92	12.56	12.24	12.93	14.34	13.64	13.37	15.75	14.56
	200ppm	11.17	11.63	11.40	11.07	12.70	11.89	11.78	13.11	12.44	11.95	15.07	13.51	11.73	15.73	13.73
	400ppm	11.33	12.55	11.94	11.35	13.25	12.30	11.49	13.03	12.26	11.02	13.41	12.22	13.00	15.10	14.05
	Mean	11.21	11.92	11.56	11.48	12.82	12.15	11.73	12.90	12.32	11.97	14.27	13.12	12.70	15.53	14.11
Glyphosate	Control	10.33	12.03	11.18	11.90	12.83	12.37	12.59	13.77	13.18	10.71	14.85	12.78	12.98	16.57	14.78
	200ppm	11.03	12.90	11.97	10.79	12.32	11.55	11.52	13.34	12.43	12.08	15.55	13.82	11.71	15.38	13.54
	400ppm	10.43	12.20	11.32	11.89	13.00	12.45	12.92	13.66	13.29	12.86	15.61	14.23	12.95	15.22	14.08
	Mean	10.60	12.36	11.49	11.53	12.72	12.12	12.35	13.59	12.97	11.88	15.34	13.61	12.55	15.72	14.13
		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%		SEm	CD 5%	
Varieties(V)		0.20	1.22		0.10	0.65		0.15	0.91		0.33	2.03		0.33	2.06	
Chemicals(C)		0.20	N.S		0.16	N.S		0.16	0.48		0.28	N.S		0.34	N.S	
Level(L)		0.24	N.S		0.20	N.S		0.20	N.S		0.34	N.S		0.42	N.S	
V×C×L		0.49	N.S		0.40	N.S		0.40	N.S		0.69	N.S		0.85	N.S	

Brix%

Brix (total solids) estimated at monthly interval have shown progressive improvement from 19.27 at 240 days to 19.21g at 270 days. Similarly, 200ppm ethrel showed improvement from 18.47 at 240 days to 24.02 at 360 days. Similarly 400ppm enhanced brix to 25.22 in variety Co 86032. In line with this, in Co 94012 ethrel treatment improved the brix% from 19.2 at 240 days to 22.82% at 360 days. Similar improvement was noticed with respected to and 400ppm ethrel treatment. As regards glyphosate the improvement was 17.70 at 240 days to 23.32 at 360 days. Considerable amount of improvement was seen at 200ppm glyphosate treatment. Although significant difference was noticed, the results were comparable at final stages of maturity (Table 3a).

Sucrose%

Sucrose percent juice increased from 16.43 at 240 days to 19.22 at 360 days in varieties Co 86032. Although 200ppm ethrel has not improved sucrose content, 400ppm has resulted in 0.7 unit improvement in sucrose% juice at harvest in variety Co 86032. Similarly, in variety Co 94012 200ppm has shown insignificant improvement in response to ethrel treatment of (Table 3b). Sucrose% gradually increased during the maturity phase in both the varieties irrespective of the chemical treatment. The varieties differed significantly at 300, 330 and 360 days and the chemical, level and their interactions were not significant.

Commercial cane sugar (CCS %)

The commercial cane sugar has also shown a similar trend of improvement (i.e.) 11.21% at 240 days to 12.70% at 360 days in Co 86032. Similarly 400ppm concentration of ethrel has retained same amount of CCS at 360 days. In varieties Co 94012, ethrel treatment has reduced the CCS by 0.6 units in Co 94012. Glyphosate has shown slightly decrease of CCS% at harvest. Variety Co 94012 has shown relatively high CCS at all stages. Here again the varieties differed significantly whereas the chemicals, levels and their interaction was not significant (Table 3c).

Conclusion

In the present experiment, the main shoot height showed some increment at the beginning of maturity while at subsequent stages the heights remained mainly stable in both the varieties. The main shoot height of variety Co 86032 was identical under both ethrel and glyphosate treatment. Although Co 94012 remained unaffected due to ethrel, the glyphosate treatment reduced the cane height. Variety Co 86032 responded better to ethrel or glyphosate treatment but Co 94012 showed some inhibitory trend towards glyphosate.. Ethrel treatment has not altered the number of internodes in Co 86032. Glyphosate (200ppm) achieved good plant stand and adequate cane formation. However, the internode number was reduced considerably at 400ppm glyphosate.

Application of the chemical ripener for improved sucrose buildup during maturity months is therefore a predominant area of research and among various chemical ripeners, ethrel and glyphosate have evolved as promising chemicals mainly because of low cost and no health hazards. It is further necessary to evaluate the response of these chemicals with promising varieties and in specific cultural conditions. The technology of identifying cane varieties and modification of them through safe and easily affordable chemical management practices would help in maximizing the sugar recovery by way of providing good quality canes. Further studies are necessary for favorable utilization of chemical ripener technology towards enhancing the sugar production in commercial cane cultivation in India.

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