
SUGARCANE

Evaluation of Early Maturing Promising Sugarcane Clones for Nutrient use Efficiency

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A field experiment was conducted to evaluate promising sugarcane clones for nutrient use efficiency. Twelve early maturing sugarcane clones including two standards were planted in a clay soil (Typic Haplustert). Dried plant materials were analysed for nitrogen, phosphorus and potassium content in dry leaves, green tops and stem. Total uptake of nutrients in above ground parts was determined. Total N uptake ranged from 66.30 kg/ha in Co 93003 to 43.30kg/ha in Co 85004 with a mean of 109.66 kg/ha. The lowest uptake of N per tonne of cane was recorded by Co 94005 (0.76 kg) and the highest was in Co 94004 (1.40 kg). Clones Co 94005, Co 93003 and Co 94008 showed better utilization of nitrogen. The lowest total uptake of phosphorus by above ground parts (24.91 kg/ha) was observed in Co 93001, while the highest was observed in CoC 671 (59.98 kg/ha). The variation of kg P per tonne of cane was from 0.285 in Co 93001 to 0.585 in Co 94002. Clones Co 93001, Co 94005, Co 93003 and Co 94003 removed relatively lower quantity of phosphorus for producing a tonne of cane. With regard to potassium, Co 85004 recorded the highest K uptake of 293.61 kg/ha and the lowest of 87.91 kg was registered in Co 94003. Clone showing the lowest K uptake to produce a tonne of cane (1.09 kg) was Co 94003 and the highest was Co 85004 (2.75 kg). Clones Co 94003, Co 93003, Co 93001 and Co 94005 removed comparatively lower amounts of potassium to produce a tonne of cane. Clones Co 93003 and Co 94005 were found to be more efficient in utilization of NPK nutrients. i.e. produce more tonnage of cane per unit quantity of nutrients taken up.

KEYWORDS : Nutrient use efficiency, early maturing sugarcane clones, NPK uptake

Application of plant nutrients in the form of organic manures and chemical fertilizers influences the output of cane and sugar. Absorption and uptake of nutrients from soil by the cane crop vary considerably. Nutrient requirements of sugarcane are being determined according to the levels of the respective nutrient in select index tissues, at specific ages of the crop (Lakshmikantham, 1983). According to Morris *et al.* (2002) P was an essential plant nutrient that contributed to optimum sugarcane yields. Bokhtiar *et al.* (2001) reported that N, P and K uptake was lower in sugarcane applied with inorganic fertilizers than the crop added with pressmud. Nasir *et al.* (2000) reported that the higher growth rate by sugarcane was mainly due to the enhanced uptake of N, P, K and Ca. According to Vijay Kumar *et al.* (1999) the application of balanced dose of N, P and K produced the maximum cane yield. Gome and Torres (1993) expressed that absorption of P and N decreased, while that of K increased under higher saline concentrations.

Thangavelu and Chiranjivi Rao (2002) reported that P uptake by dry leaves, green tops, stem and total above ground parts were associated positively and significantly with uptake of NPK, yield of cane and sugar at 10 and 12 months. In order to evaluate the early maturing sugarcane clones for nutrients use efficiency this study was taken up.

MATERIALS AND METHODS

Twelve early maturing promising sugarcane clones including two standards, were planted in RBD with three replications and a plot size of 8 rows of 6 meters length at 90 cm apart in January, 1999. The sugarcane clones tested were, Co 93001, Co 93003, Co 93020, Co 93078, Co 94002, Co 94003, Co 94004, Co 94005, Co 94008 and Co Si 94072 along with two standards (CoC 671 and Co 85004) for comparison. Normal cultural practices (seed rate: 37,500 three budded setts/ha; 65 kg P₂O₅/ha as basal and 250 kg N/ha and 120 kg K₂O/ha in two splits as top dressings at 45 and 90 days) in vogue at this Institute were followed for raising the crop in clay soil (Typic Haplustert) of the Institute Farm. At the harvest, six rows exclusively left for yield was

harvested. Simultaneously, from eight randomly harvested canes, sub samples for dry leaves, green tops and stem were collected, dried at 80°C in an electric oven and powdered in a powdering machine. Dry matter per cent of dry leaves, green tops and stem were determined. Biomass production in tonnes per ha of dry leaves, green tops and stem were determined. Powdered samples were digested with H₂SO₄ and H₂O₂ till the solution was colourless and made up to the known volume. Nitrogen in plant parts was estimated colorimetrically using Nessler's reagent for colour development (Jackson, 1967). Phosphorus was determined colorimetrically by vanadomolybdo phosphoric yellow colour method (Jackson, 1967). Potassium was determined using Flame photometer (Jackson, 1967). Nitrogen, phosphorus and potassium uptake in dry leaves, green tops and stem were computed by multiplying N, P, K per cent with biomass production of respective plant parts. Total nitrogen, phosphorus and potassium uptake in above parts were arrived by adding the respective uptake by dry leaves, green tops and stem. N, P and K uptake per tonne of cane was determined by dividing total uptake of N, P and K by yield of cane in t/ha.

RESULTS AND DISCUSSION

Uptake of nitrogen, phosphorus and potassium by dry leaves, green tops, stem and total above ground parts and kg of N, P and K removed per tonne of cane at harvest are presented in Table 1, 2 and 3 respectively.

Nitrogen uptake in above-ground parts

Significant differences between clones were observed in the nitrogen uptake by the dry leaves, green tops, stem and total above ground parts and kg nitrogen per tonne of cane. Clone mean indicated that the lowest nitrogen uptake in dry leaves was 37.16 kg/ha in Co 93078 and the highest nitrogen uptake was in Co 85004 (69.93) with the mean of 54.80 kg/ha. In green tops, the variation of nitrogen uptake was from 10.25 kg/ha in Co 94003 to 49.09 in Co 94004 with the mean of 29.80 kg. In the case of stem 16.50 kg/ha of nitrogen uptake was recorded by Co 93003 as the lowest, while 35.42 kg/ha was the highest N uptake in Co 94008 with the mean of 25.44 kg/ha. Total N uptake in kg/ha ranged from 66.30 in Co 93003 to 143.30 in Co 85004 with the mean of 109.66 kg/ha. The lowest uptake of kg N per tonne of cane was 0.76 recorded by Co 94005 and the highest was 1.40 in Co 94004 with the mean of 1.10 kg/t. Prasad *et al.* (1981) observed that the nutrient requirement of one tonne of cane was 1.71 kg N. Studies by Singh (1978) revealed that nitrogen was mobilized in the above ground parts of cane viz. stem, leaf sheath, leaf blade and dry leaves in varying proportions to unit dry weight during different phases. Clones that recorded comparatively lower quantity of N to produce a tonne of cane were Co 94005, Co 93003 and Co 94008. All the clones except Co 94002 and Co 94004 were on par with the best standard CoC 671 in N uptake per tonne of cane.

Table - 1 : Uptake of Nitrogen in above ground parts of some early maturing sugarcane clones.

Clones	N uptake (kg/ha)				N in kg per t of cane
	Dry leaves	Green Tops	Stem	Above ground parts	
Co 93001	40.40	29.85	18.48	88.73	1.01
Co 93003	39.37	10.43	16.50	66.30	0.85
Co 93020	65.89	31.13	23.44	120.46	1.24
Co 93078	37.16	48.48	25.26	110.90	1.14
Co 94002	73.88	32.99	26.09	132.96	1.39
Co 94003	56.56	10.25	29.89	97.20	1.11
Co 94004	69.69	49.09	24.52	138.72	1.40
Co 94005	49.99	14.79	24.91	89.69	0.76
Co 94008	42.14	35.97	35.42	113.53	0.98
CoSi 94072	65.57	29.78	30.85	126.00	1.07
Standards					
CoC 671	47.00	18.87	22.16	88.03	0.95
Co 85004	69.93	46.03	27.34	143.30	1.35
Mean	54.80	29.80	25.44	109.66	1.10
S.E.	1.82	1.07	0.83	2.95	0.09
C D. (P = 0.05)	5.88**	3.48**	2.71**	9.61*	0.32*

Table - 2 : Uptake of Phosphorus in above ground parts of some early maturing sugarcane clones.

Clones	P uptake (kg/ha)				P in kg per t of cane
	Dry leaves	Green tops	Stem	Total above ground parts	
Co 93001	10.01	5.54	9.41	24.91	0.285
Co 93003	15.57	1.71	9.23	26.51	0.363
Co 93020	23.29	4.79	9.49	37.32	0.425
Co 93078	20.12	6.75	8.68	35.55	0.395
Co 94002	34.63	9.22	9.02	51.89	0.585
Co 94003	16.64	1.82	10.81	29.52	0.345
Co 94004	23.96	8.77	12.94	45.66	0.460
Co 94005	22.24	2.55	10.22	34.97	0.300
Co 94008	19.01	5.16	14.13	38.39	0.380
CoSi 94072	37.20	4.55	9.85	51.60	0.445
Standards					
CoC 671	13.43	5.13	11.17	59.98	0.325
Co 85004	26.52	14.40	15.59	56.51	0.530
Mean	21.88	5.86	10.88	41.18	0.399
S.E.	0.77	0.16	0.33	0.93	0.01
C.D. (P = 0.05)	2.52**	0.52**	1.08*	3.04*	0.04**

Table - 3 : Uptake of Potassium in above ground parts of some early maturing sugarcane clones.

Clones	K uptake (kg/ha)				K in kg per t of cane
	Dry leaves	Green tops	Stem	Total above ground parts	
Co 93001	14.39	53.43	52.31	120.12	1.37
Co 93003	10.69	22.50	64.82	98.01	1.25
Co 93020	17.39	109.13	61.34	187.87	2.17
Co 93078	12.82	132.72	87.76	233.30	2.39
Co 94002	25.59	140.57	89.00	255.15	2.55
Co 94003	14.08	17.71	56.12	87.91	1.09
Co 94004	18.95	125.94	99.49	244.37	2.40
Co 94005	8.33	22.17	118.92	149.42	1.28
Co 94008	11.42	57.62	105.33	174.47	1.56
CoSi 94072	12.89	73.62	108.55	195.06	1.65
Standards					
CoC 671	12.19	86.86	64.45	163.49	1.76
Co 85004	18.42	168.88	106.34	293.64	2.78
Mean	14.76	84.26	84.53	183.56	1.84
S.E.	0.42	2.40	2.47	4.98	0.05
C.D. (P = 0.05)	1.36**	7.82**	8.03**	16.21**	0.16*

Phosphorus uptake in above ground parts

Uptake of phosphorus in dry leaves, green tops, stem and total uptake by above-ground parts and kg phosphorus per tonne of cane showed significant differences among the clones. The highest phosphorus uptake by dry leaves was 37.20 kg/ha in Co Si 94072 and the lowest was 10.01 kg/ha in Co 93001 with the mean of 21.88 kg/ha. In case of green tops, Co 93003 recorded the lowest uptake of 1.71 kg P/ha and the highest was 14.40 kg in Co 85004. With regard to stem, Co 93078 registered the lowest uptake of 8.68 kg P/ha, while the highest value was 15.59 in Co 85004. The lowest value for total uptake of phosphorus by above-ground parts was 24.91 kg/ha in Co 93001 and the highest being 59.98 kg in CoC 671 with the mean of 41.18 kg. The variation of kg phosphorus per tonne of cane was from 0.285 in Co 93001 to 0.585 in Co 94002 with a mean of 0.399. Thangavelu and Chiranjivi Rao (2002) reported that the highest P uptake by dry leaves (in kg/ha) was 22.4 in Co 997 and the lowest was 5.8 in CP 44-101. In green tops, the highest P uptake was 22.6 kg/ha in Co 7201 and the lowest was 4.6 kg/ha in CP 44-101. With regard to stem the difference between clones ranged from 12.0 kg P/ha in POJ 2878 to 49.8 kg in Co 678; the highest value for total P uptake by above ground parts was 81.9 kg/ha in Co 7201, the lowest being 24.2 in CP 44-101. Clone mean showed that P uptake per tonne of cane ranged from 0.32 kg in Co 678 to 0.59 kg in Co 7712. Clones recording lower quantity of phosphorus per tonne of cane were Co 93001, Co 94005, Co 93003 and Co 94003, besides the best standard CoC 671.

Potassium uptake in above ground parts

Significant differences among the clones were observed in the uptake of potassium in kg/ha by dry leaves, green tops, stem and above-ground parts as well as kg potassium per tonne of cane. The highest uptake of potassium (25.59 kg K/ha) was seen in Co 94002, whereas, the lowest uptake of potassium was 10.69 kg in Co 93003 for dry leaves. In respect of green tops, the highest uptake of potassium was 168.88 kg/ha in Co 85004, while the lowest was 22.17 kg/ha in Co 94005. In the case of stem, Co 94005 recorded the highest potassium uptake of 118.92 kg/ha and the lowest was 52.31 kg/ha in Co 93001. With respect to above ground parts, Co 85004 recorded the highest potassium uptake of 293.64 kg/ha and the lowest (87.91 kg) was observed in Co 94003. Likewise, the lowest potassium uptake in a tonne of cane was in Co 94003 (1.09) whereas, the highest K uptake was in Co 85004 (2.78). Kisselmann (1969) indicated that the cane crop yield 160 to 180 tonnes per ha removed 250 to 350 kg K in various growing regions. Zinde and Kibe (1983) noted that uptake of N, P and K showed significant associations among themselves. Clones recording low K uptake in kg in a tonne of cane were Co 94003, Co 93003, Co 93001 and Co 94005.

CONCLUSIONS

Significant differences between clones were observed in N, P and K nutrient uptake by above ground parts viz. dry leaves, green tops, stem and above-ground parts and nutrient to produce a tonne of cane.

Clones Co 93003 and Co 94005 were identified as best clones for efficient utilization of NPK nutrients for cane production.

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